



The audio industry

Sound and software

Speakers and headphones may also come to be dominated by technology giants

MUSIC lovers do not typically go to the opera to buy a speaker. But at the Palais Garnier in Paris they now can: Devialet, a local maker of high-end speakers, on November 29th opened a store in the 19th-century music venue to sell its most sophisticated product, called Phantom. Looking like a dinosaur egg, this supercomputer for sound (priced at \$3,000) is considered one of the best wireless speakers available. It also comes with a dedicated streaming service for live performances, including some at the Palais Garnier.

This Phantom at the opera is the latest example of how digital technology is transforming speakers, headsets and other audio devices. Once mostly tethered to hi-fi systems, they are now wireless, increasingly intelligent and capable of supporting other services. As a result, the industry's economics are changing.

Only a few years ago the audio industry was highly fragmented, says Simon Bryant of Futuresource, a market-research firm. Hundreds of brands offered their wares, both premium and basic, often with identical components. As with other device businesses, the industry was a "vertical" one: if speakers used any software at all, it was specific to the product.

All this started to change with the advent of smartphones, which made music more portable by connecting music-streaming services such as Spotify with wireless speakers. Smartphones have also given a boost to headphones, which are becoming ever more versatile, with features now ranging from cancelling out ambient noise to real-time translation.

These new possibilities have proved hugely popular: the global market for audio devices has rocketed in recent years (see chart). According to Futuresource, only about 200,000 wireless speakers were sold in 2009; this year the number is expected to be 70m. Headphones have been on a similar tear.

Smartspeakers, which were pioneered in 2015 by Amazon with the Echo, will be even more disruptive. Nearly 24m of these devices, essentially voice-controlled remote controls for everything from music to lights, will be sold worldwide in 2017, estimates Strategy Analytics, another market researcher—a number it expects to quadruple by 2022. Once households have one, they buy more to spread them throughout their homes (apparently nearly a tenth now live in bathrooms).

Smartspeakers are pushing the audio-device industry to become “horizontal”. The voice that emanates from Amazon’s Echo or Google’s Home is not just a digital assistant, but a “platform” for all kinds of services, of which most are developed by other firms. Alexa, as Amazon’s version is called, already boasts more than 25,000 “skills”, as the firm calls such services. These range from ordering goods and finding a mobile phone to turning up the heating and (early next year) asking *The Economist* for the latest on any given topic. Similarly, wireless earbuds, such as Apple’s AirPods and The Dash by Bragi, a startup, may become so clever that more and more people will leave them in all day, for instance to monitor their health or for constant access to a digital assistant.

Conventional speaker firms are trying to catch up. In September at IFA, a trade show in Berlin, booths of various makers were adorned with logos of Amazon or Google, signalling that they already have or will integrate a digital assistant in their products. But if the history of the smartphone is any guide, such platforms will turn the hardware into a commodity, with

most of the profits going to the providers of software and services. Having sold 75% of all smartspeakers (at low prices that are thought to be close to the cost of making them), Amazon is now the world's biggest speaker brand. Incumbents will also have to contend with Apple, despite the delay of its smartspeaker until early next year.

The dominance of a few platforms is not a forgone conclusion, says Mr Bryant of Futuresource. More specialised ones are likely to thrive, too—like Microsoft's Cortana, which is good at understanding business jargon. But some audio firms feel the need to branch out. Sonos, which pioneered wireless speakers a decade ago, now wants to become an *über*-platform, integrating all voice assistants and streaming services, so consumers who like Sonos speakers have a choice. Harman, which in March was bought by Samsung Electronics, has similar plans for entertainment systems in cars.

And then there are companies which do not build their own speakers, but offer technology to enhance other products. Dolby and DTS, for instance, are busy creating software for what is called "immersive audio". Combining several speakers, Dolby's Atmos technology—first introduced in cinemas, but now available for home use—already "places" sounds in space. The next step is separate personal sound zones for each listener in a room, in effect creating invisible speakers.

So why does Devialet, which last year got €100m (\$106m) in fresh capital, think it can succeed by selling expensive high-end speakers? The answer is that it wants to be a platform, too. The speakers are mostly meant to demonstrate its technology, in the hope that other companies will integrate it into their products. The first example, launched last month, is a soundbar (a slim loudspeaker) it has developed together with Sky, a broadcaster. "If you see yourself just as an audio company," says Quentin Sannié, Devialet's chief executive, "your days are numbered." ■



音响行业

声音和软件

音箱和耳机可能也要受控于科技巨头

音乐爱好者一般不会去歌剧院买音箱。不过现在他们可以去巴黎歌剧院（Palais Garnier）买一个了——11月29日，在这座落成于19世纪的音乐殿堂里，法国本土高端音箱制造商帝瓦雷（Devialet）开设了一家店铺，销售自己最尖端的产品——Phantom（“幻影”）。这个外形像一枚恐龙蛋、用于播放声音的“超级计算机”（售价3000美元）被认为是目前最好的无线音箱之一。它同时还提供专门的演出音频流媒体服务，包括巴黎歌剧院的一些演出。

巴黎歌剧院里的这个“幻影”是运用数字技术改造音箱、耳机及其他音响设备的最新范例。过去这些设备一般通过线缆连接到高保真音响系统，而现在它们是无线的，并且越来越智能，还能支持其他服务。这个行业的局面正在因此发生变化。

市场研究公司FutureSource的西蒙·布赖恩特（Simon Bryant）指出，仅仅几年前，音响行业还高度分散。数百个品牌销售从入门级到高端的各类音箱，各家的产品经常还会使用相同的部件。与其他设备行业一样，音响行业过去是“纵向的”——如果音箱真使用了什么软件，那也是该设备的专用软件。

随着智能手机的出现，这一切开始改变。智能手机将Spotify这样的音乐流媒体服务与无线音箱相连，让音乐更加唾手可得。智能手机还推动了耳机的发展。从消除环境噪音到实时翻译，现在的耳机用途越来越广泛。

事实证明这些新功能大受欢迎：近年来音响设备的全球销量猛增（见图表）。FutureSource的数据显示，2009年无线音箱的销售量只有区区20万台，而今年这一数字有望达到7000万。耳机销量同样一路飞涨。

亚马逊于2015年推出Echo，开创了智能音箱的先河。今后，智能音箱还会更具颠覆性。另一家市场调查公司Strategy Analytics估计，2017年全球将售出将近2400万台智能音箱，预计到2022年销量还会翻两番。智能音箱本质上就是一种声控遥控器，控制从音乐到灯光的各种东西。一旦家里有了第一台智能音箱，人们就会买更多台放到家里各个角落（据说近十分之一的智能音箱是放在浴室里）。

智能音箱正推动音响行业“横向”发展。亚马逊的Echo和谷歌的Home发出的声音不仅是数字助手，还是提供各种服务的“平台”，且大多数服务都是由其他公司开发。亚马逊的语音助手Alexa已具备超过2.5万种“技能”（亚马逊用“技能”一词来指代这类服务）。这些服务五花八门——订购商品、找到手机、调高暖气，明年年初还可以就任何特定话题向《经济学人》索取最新文章。同样，苹果的AirPods以及创业公司Bragi的The Dash之类的无线耳塞式耳机或许也会变得非常智能化，越来越多的人会整天都戴着它们，监测自身健康或者随时使用数字助手等等。

传统的音箱公司也在奋起直追。在9月举办的行业展会“柏林国际电子消费品展览会”（IFA）上，各家制造商都用亚马逊或者谷歌的logo来装饰展台，表示已经或即将把某个数字助手整合到自己的产品中。但是如果以智能手机的历史为鉴，就能看到这样的平台会使硬件变成日常用品，而大部分利润则会由软件和服务的供应商收入囊中。亚马逊以被认为接近制造成本的低价销售了全世界75%的智能音箱，已成为当今世界最大的音箱品牌。传统的音箱公司还必须与苹果竞争，虽然苹果已将智能音箱的上市推迟到了明年初。

Futuresource的布赖恩特认为，结局也未必是几个平台一统天下。更专门化的平台也可能走红，比如擅长理解商业行话的微软小娜（Cortana）。但是一些音响公司觉得有必要拓展业务范围。十年前开创无线音箱先河的Sonos现在希望成为一个超级平台，将所有语音助手和流媒体服务整合在一起，供喜欢Sonos音箱的消费者选择。今年3月被三星电子收购的哈曼（Harman）在车载娱乐系统方面也有类似的计划。

还有一些公司自己不制造音箱，不过会提供技术来提升其他产品。杜比（Dolby）和DTS公司就正忙于为所谓的“沉浸式音响”开发软件。杜比的全景声技术将几个音箱结合在一起，已经可以在空间中“布置”声音。全景声技术最早应用于电影院，现在已进入家庭。下一步就是为同一个房间里的每位听众隔出个人专属声区，相当于创建了隐形音箱。

那么，去年新融资1亿欧元（1.6亿美元）的帝瓦雷为什么认为销售昂贵的高端音响可以成功？答案是它也想成为平台。它的音箱主要是用来展示其技术的——帝瓦雷希望以此吸引其他公司将该技术整合进它们的产品中。首个例子是上个月推出的一款条形音箱，与英国天空广播公司（Sky）共同研发。“如果你只把自己当成一家音响公司，” 帝瓦雷首席执行官康坦·萨尼耶（Quentin Sannié）说，“那你就时日无多了。”■



DNA sequencing

A genome in the hand

Small, portable devices take genome sequencing out of the lab

DEVICES for analysing DNA used to be big, clunky and not very good. Hundreds were required for the initial sequencing of the human genome, a project that started in the late 1990s and took over a decade to complete at a cost of at least \$500m. Since then, sequencing a human genome has become a routine process; prices have fallen to below \$1,000. Although the machines that do the job have got better and more compact, they still cost several hundred thousand dollars. Various groups are trying to make them smaller and cheaper.

The first device small enough to put in your pocket is already on the market. It comes from Oxford Nanopore, a maker of DNA-sequencing equipment based in the eponymous English city. It is about the size of a chunky mobile phone. Although the machine is swathed in patents, other miniature devices are bound to follow in time.

The MinION, as the device is called, is first plugged into a laptop. It works by sucking strands of DNA through a “flow cell”, made up of an array of tiny holes that are just a few nanometres (billions of a metre) in diameter. The way that electricity flows across the surface of such a hole changes, depending upon the shape of the molecule passing through it. As strands of DNA are composed of four types of sub-unit, called bases, which have different shapes, nanopore sequencing permits the order of these bases to be determined—and with it the message carried by a gene.

Nanopore’s device is not a direct competitor to the bigger, more complex machines able to deliver the high levels of accuracy demanded by busy

laboratories. Rather, the MinION is designed to take gene-sequencing out into the field. The device itself costs \$1,000 and the flow-cell cartridges it uses, each of which lasts a few months, cost around \$500 if purchased in bulk. So far, MinIONs have been used to sequence the DNA of microbes scraped out of the snow in Antarctica, swabbed off glaciers in Svalbard or sucked out of stagnant ponds in the bowels of disused coalmines in Wales. The technology was also employed to profile the virus behind an outbreak of Ebola in west Africa in 2015.

It is not, though, as simple as popping a sample in one end and getting the answer. To provide a truly portable gene-sequencing device, it is necessary to miniaturise and automate the preparation of samples. To extract DNA, biological samples must have their cells broken open, a process called lysing. The extracted DNA needs to be of sufficient purity that the readings are not contaminated. This is a tricky task, and one that requires some biochemical training and often the use of centrifuges and expensive reagents. Although the firm is keeping the details close to its chest, Oxford Nanopore is working on a small device called Zumbador, which it claims will be able to prep samples automatically.

For now, many users are happy to prepare samples themselves, often because by using a MinION they do not have to wait for a laboratory to send back results. Mars, a large food company, is testing the device on production lines in China, looking for particular bacterial pathogens such as *Salmonella* and *E. coli*. It already scrutinises its equipment and products closely for such contamination, but according to Robert Baker, who is in charge of food safety at the firm, the current arrangements can take days or weeks to return results. His hope is that once automated preparation is available, real-time monitoring will be able to spot problems almost instantly. It will also extend the range of bugs that can be detected; current tests are for specific pathogens, whereas sequencing can identify whatever

bug might turn up. Early results, says Mr Baker, are promising.

The provenance of food is also a good candidate for genomic investigation. Following a scandal in some British supermarkets, in which meat marked as beef was found to contain material from horses, there is demand for tests that can verify the origin and species of meat products. Cranswick, a British supplier of cooked meats, is working in partnership with the University of Warwick on the use of the hand-held sequencers to analyse samples of DNA extracted from packaged meat and confirm the species from which it hails.

The benefits of on-the-spot sequencing may be greater still in the developing world. Agricultural researchers in Tanzania and Uganda plan to use Oxford Nanopore's devices to help identify the viruses that plague cassava crops. Some 550m people, most of them African, rely on cassava as a staple, but scourges such as brown streak virus, spread by whitefly, can reduce yields by a factor of 40. Both the Mikocheni Agricultural Research Institute (MARI) in Dar es Salaam and the National Crops Resources Research Institute in Kampala already gather samples, in an effort to identify the strains of virus and to help farmers plant resistant crops. But these have to be sent abroad to laboratories in Australia, South Korea or Switzerland for sequencing—a process that can take months. In a pilot project in September, Laura Boykin, an agronomist at the University of Western Australia, and Joseph Ndunguru, MARI's director, used hand-held sequencers to return strain data to farmers within 48 hours.

As portable sequencing devices get even faster and more accurate, Clive Brown, Oxford Nanopore's chief technology officer, raises the prospect of a device that anyone can use to understand the genomic profile of the world around them. The user will merely touch the device to something, whether it is blood, spit or a supermarket chicken, and get a genomic profile in return. Gene sequencing used to be the work of years; soon enough it may be ubiquitous and quotidian. ■



DNA测序

尽在掌握的基因组

有了小型便携设备，在实验室外也可进行基因组测序

从前用来分析DNA的仪器又大又笨重，效果也不太理想。上世纪90年代末首次开展的人类基因组测序工程要用上数百台这样的设备，耗时十余年才完成，耗资至少五亿美元。自那以后，这项工作已变成常规流程，价格也降到了1000美元以下。尽管这类机器已经变得更加精良和小巧，但价格仍高达数十万美元。众多机构正在尝试开发更小、更便宜的机器。

首款小到可以放入口袋的仪器已经上市。其生产者是位于英国牛津的DNA测序设备制造商牛津纳米孔公司（Oxford Nanopore）。这台仪器的尺寸与比较厚实的手机接近，虽然有专利保护，但今后其他微型测序仪迟早也会问世。

这台测序仪名为MinION，使用时先将其接入一台笔记本电脑。它的工作方式是将DNA链吸入由大量小孔构成的“流动槽”，小孔直径仅为几纳米（一纳米相当于一米的十亿分之一）。当不同形状的分子沿孔内通过，流经小孔表面的电流就会发生变化。DNA链是由四种名为碱基的子单元构成，它们形状不同，因此可通过纳米孔测序来测定这些碱基的序列——同时获取基因携带的信息。

繁忙的实验室对测序结果的精确度要求较高，需要更大、更复杂的仪器来满足，纳米孔公司的测序仪并不是这类仪器的直接竞争对手。MinION的用处是在户外开展基因测序。仪器本身的费用为1000美元，搭配用的流动槽的使用寿命为几个月，批发价约为500美元。到目前为止，MinION已完成了多种微生物的DNA测序：有的是从南极大陆的雪上刮下来，有的是从斯瓦尔巴（Svalbard）群岛的冰川上沾取，还有的是从威尔士废弃煤矿深处的死水塘中抽吸上来。纳米孔测序技术还被用来为2015年在西非暴发的埃博拉病毒测序。

不过，这项技术并没有简单到把样本从仪器的一端放入就能得出结果的程度。要使用真正的便携式测序仪，测序样品小型化以及样品制备自动化很有必要。要提取DNA，须将生物样本的细胞打破，这一流程叫作细胞溶解。提取的DNA要达到足够的纯度，以保证读取结果不受污染。这个任务很有难度，需要操作者接受过一定的生物化学训练，通常还会用到离心机和昂贵的试剂。牛津纳米孔公司对该技术的细节守口如瓶，不过眼下该公司正在开发一个名叫Zumbador的小型仪器，并宣称该仪器将会自动完成样本制备。

目前很多用户还不排斥自己制备样本，通常是因为有了MinION就不必再等某个实验室发回结果了。大型食品公司玛氏（Mars）正在中国的生产线上测试这款仪器，检测特定种类的病原体，如沙门氏菌和大肠杆菌。该公司已经仔细检查了设备和产品，看它们是否被这些病原体污染。但玛氏食品安全中心的主任毕睿博（Robert Baker）表示，目前的系统可能需要几天或几周才能发回结果。他希望，等到自动制备样品的功能实现，就可以通过实时监控几乎即刻发现问题。玛氏还将扩展细菌检测的范围：目前的测试仅针对特定微生物，而基因组测序可以识别出任何有可能出现的细菌。毕睿博说，从初步结果来看，该技术前景看好。

基因组测序也非常适合用来调查食品的来源。若干年前，英国一些超市中被标示为牛肉的肉类商品竟含有马肉，这场丑闻过后，人们对测试核查肉类产品的产地和种类产生了需求。英国熟肉制品供应商Cranswick正与华威大学（University of Warwick）合作，利用手持测序仪分析从包装肉类中提取的DNA样本，来确认是哪种动物的肉。

在发展中国家，现场测序的好处更加显著。坦桑尼亚和乌干达的农业研究人员计划利用牛津纳米孔的测序仪来识别引起木薯病害的病毒。全球大约有5.5亿人（大多数是非洲人）以木薯为主食，但通过白粉虱传播的褐条病病毒等灾害却可能令产量减少40倍。位于达累斯萨拉姆（Dar es Salaam）的米科切尼农业研究所（Mikocheni Agricultural Research Institute，简称MARI）和位于坎帕拉（Kampala）的国家农作物资源研究

所（National Crops Resources Research Institute）已采集了样本，试图识别病毒的种类并帮助农民种植抗病性更强的作物。不过这些样本得送到澳大利亚、韩国或瑞士的实验室测序，流程可耗时数月。在9月开展的一个试点项目中，西澳大学（University of Western Australia）的农学家劳拉·博伊金（Laura Boykin）和MARI的负责人约瑟夫·登戈如（Joseph Ndunguru）使用手持测序仪，在48小时内将病毒种类的数据发送给了农民。

牛津纳米孔的首席技术官克里夫·布朗（Clive Brown）认为，随着便携测序设备变得更快速、更精确，今后将有可能出现一种测序仪，人人都可用来获知周遭事物的基因组特征。只要用这个仪器触碰一下某物，不管是血液、唾液还是超市里的鸡肉，就能获得其基因组特征。在过去，基因测序需耗时多年，但也许很快就可以随时随地开展这项工作了。■



Schumpeter

The Santa clause

A festive memo from one of America's leading chief executives to his lieutenants

DEAR Team, I trust you are looking forward to your vacations and that the spirit of love and generosity infuses your family gatherings. I also hope that this spirit will be left next to the Christmas tree when you return to work at this incredible company on January 2nd. Because 2018 is going to be the year when America Inc loses its head after a decade of iron financial self-control. And I am not going to make that mistake. Let me drop some festive wisdom: when everyone else is throwing money around like Santa, it is best to behave like Scrooge.

During my workout at 5.10am this morning my trainer played U2. I love Bono for his personal advice on charitable giving, but he is also a perceptive lyricist. “It’s a beautiful day” captures the mood in business. Third-quarter results blew the roof off. Earnings per share for the S&P 500 are 23% above the last peak in 2007. The world economy is rocking. At this week’s digital town halls our sales teams in Houston and Guangzhou reported record industrial orders. President Macron—whom I first met in 2008 when he was a junior spreadsheet guy at Rothschild—tells me that even the Europeans are doing high fives.

The triple adrenaline shot of a stockmarket boom, synchronised global growth and a worldwide passion for technology is both exciting and dangerous for corporations. Let’s not kid ourselves. People will get sloppy about allocating capital. My worst blunders were in the boom years of 1998 to 2001, when we caught the internet bug too early, and between 2006 and 2008 when we invested too much in energy. Every boss is tempted to splurge right now, cheered on by politicians, economists and investors.

I waded through Washington last week. The tax bill will boost our profits by 9%. After I got mad at Mitch McConnell, he reinserted a helpful clause that will save us money in Cayman. Our firm will pay only a small levy to repatriate cash held offshore and will benefit from accelerated depreciation. Like most companies, we've also noticed a better attitude from our regulators: unlike the Obama years, I get my calls returned. There is a price, though. Many Republicans are sincere—they believe in “trickle down” economics and expect us to invest more. A few even expect us to revive the rustbelt. When I saw the president he gave me his hardest sell yet on building a new plant in Iowa. Ivanka had to turn on Fox News to distract him.

The intellectual climate has turned pro-investment. Most economists claim firms are chronically underspending. I know that 67.384% of that is BS. Our job is not to flip-flop according to their models but to deploy capital over economic and technology cycles. Gross corporate investment, at 12.4% of GDP, is in line with the 50-year average, and we have invested a steady share of sales. Still, they are right that many big firms have the resources to let their hair down and let capex rise in line with record profits.

Investors are pivoting, too. The same Wall Street analysts that used to say the “L” in long-term stands for “loser”, and begged us to buy back more shares two years ago, now hint we should seek to grow. For the first time in years the shares of firms that invest heavily are no longer underperforming, according to Morgan Stanley. Buy-backs are out of style: just \$128bn was spent on them last quarter, 20% less than in the same quarter in 2015.

Twenty years ago CEOs would have looked at all this and asked “how much” more they should invest. But to understand investment today you have to do a deep dive and answer four other questions: who, what, where and when? Our firm used to be America’s third-biggest investor, just behind ExxonMobil. But “who” invests has changed: Alphabet has taken our place

(including research and development). Tech firms are competing with incumbents and using their dirt-cheap cost of capital to invest on their behalf. They account for 24% of investment by S&P 500 firms. My buddy Satya Nadella at Microsoft says if we shift our IT centres to his cloud division, we'll save \$700m of investment a year. If I can trust Microsoft not to steal our data, he's got a deal.

"What" we invest in has changed, too. Like most firms, a quarter of our budget goes on intangibles, including software. When I grew up AI was an acronym used in animal husbandry, but I know our firm needs to make mid-size bets on new technologies like artificial intelligence. Tech cuts both ways, though: I'm nervous about building factories that may quickly become obsolete.

As for "where", it's simple: everywhere. We're fairly typical for a big American firm, with 40% of our sales and investment abroad. Given that emerging markets will outpace America, that may rise. Other countries are being protectionist, too. President Xi's people are clear that if we want full access to China's domestic market, we have to invest more there. We have to pay to play.

Lastly, "when" should our firm invest more? Now, in the 101st month of a recovery? The longest-ever expansion, in 1991-2001, lasted 120 months. I have got to admit, it's a tough call.

Here is my prediction. Expect a surge in corporate investment in 2018, with nominal spending rising by up to 10%, equalling the boom in 2006. There's just too much pent-up energy. But it will be more skewed towards intangible assets than in the past, and while it will help the economy, it won't revive the rustbelt.

As for our firm. I get it, I know our investment committee is besieged. We

need a new campus in Austin, our software is buggy and fleet management wants Teslas. But leadership is about prioritisation, not saying “yes” to everyone. If you doubt it, repeat two words after me: Jeff Immelt. The former boss of General Electric was so soft on capital allocation the firm has turned to jelly.

So here's the deal. Santa isn't coming to this company. We'll wait as our rivals' budgets swell and the tech boom turns into a bubble. When recession strikes in 2019 our balance-sheet will be pristine and we'll expand when others are weak. In Christmas 2020 this incredible firm will enjoy the biggest stocking ever. ■



熊彼特

圣诞老人条款

美国一位知名首席执行官致部下的节日信

亲爱的团队，我相信大家都在翘首期盼假期的到来，也相信各位的家庭聚会将沉浸在爱与慷慨的氛围中。但我也希望，待1月2日大家回到我们这家卓越的公司时，就把这种氛围搁置在圣诞树旁好了。这是因为，美国商界在坚持了十年的铁腕式财务自律后，将在2018年失去理智，而我不会犯这个错误。让我给大家送去一句节日箴言：当其他所有人都像圣诞老人那样到处撒钱时，最好还是像斯克鲁奇【译注：Scrooge，狄更斯小说《圣诞欢歌》中的守财奴】那样行事。

今天早上5点10分我健身时，我的教练播放了U2的歌。我喜欢这支乐队的主唱博诺，欣赏他个人对慈善捐赠的建言，不过他也是一位感觉敏锐的词作家。《这是美丽的一天》（It's a beautiful day）这首歌捕捉到了如今商界的气氛。第三季度业绩牛气冲天。标普500指数的每股收益比2007年的上一个峰值高出23%。世界经济一片欢腾。本周的数字员工大会上，我们在休斯敦和广州的销售团队汇报了创纪录的工业订单。法国总统马克龙（2008年我第一次见他时，他还是罗斯柴尔德银行一个做报表的初级员工）告诉我，连欧洲商界也是一派击掌欢庆的气氛。

股市繁荣、全球同步增长、全世界对科技热情满腔，这三重刺激对企业来说既振奋又危险。我们还是不要自我欺骗了。人们在资本配置上会变得马虎轻率。我犯过的最大错误就是在1998年至2001年的热潮中过早追捧互联网，还有在2006年至2008年期间过度投资能源业。现在，在政客、经济学家和投资者的鼓动下，企业老板们都蠢蠢欲动，准备挥霍一番。

上周我到华盛顿走了一趟。新税改议案将使我们的利润提高9%。参议院共和党领袖麦康奈尔（Mitch McConnell）在我动怒后又加入了一个条款，能帮我们节省在开曼群岛的资金。我们公司只需要支付一小笔税款就

可以把海外资金汇回美国，美元的加速贬值也对我们有利。和大多数公司一样，我们也注意到美国监管机构的态度有所好转：与奥巴马时代不同的是，现在这些监管者会回应我的呼吁了。但这是有代价的。许多共和党人都很真诚——他们信奉“涓滴经济学”，期望我们能增加投资。他们中有些人还指望我们重振“铁锈地带”。我拜访总统时，他竭力劝说我在爱荷华州建一座新工厂。他女儿伊万卡只好打开福克斯新闻频道来分散他的注意力。

学者们也纷纷转向提倡加大投资。大多数经济学家都说企业投资支出长期低迷。我知道，这里头67.384%是胡扯。我们要做的不是跟着他们的模型来回折腾，而是按照经济和科技周期配置资本。当前，公司投资总额占GDP的12.4%，与50年来的平均水平持平，而我们也一直把销售收入的固定比例用于投资。然而，这些经济学者有一个观点是对的：许多大公司资源充足，无需捂紧钱袋子，可以在拿下创纪录利润的同时增加资本支出。

投资者也在转向。就是这一群华尔街的分析师，两年前他们说长线投资是窝囊废，恳求我们回购更多股份，现在又暗示我们应该扩大投资。摩根士丹利的数据显示，大举投资的公司一改多年的逊色表现，跑赢了大市。股份回购已变得不合时宜：上季度在回购上的支出仅为1280亿美元，比2015年同期减少了20%。

假如是在20年前，CEO们会研究这一切然后问应该增加“多少”投资。但是，要了解如今的投资，你必须深入探究并回答另外四个问题：谁在投资、投资什么、投向何处、何时投资？我们公司曾经是美国第三大投资者，紧随埃克森美孚之后。而现在“谁在投资”的答案已经不一样了：Alphabet已经取代了我们的位置（包括在研发方面）。科技公司正在与传统企业竞争，并利用成本极为低廉的资本开展自己的投资。它们占了标普500公司投资总量的24%。我在微软的好友萨蒂亚·纳德拉（Satya Nadella）说，如果我们把IT中心转移到他的云计算部门，我们将每年节省七亿美元的投资。要是我能信任微软不会窃取我们的数据，这笔交易完全可行。

至于我们要“投资什么”，答案也变了。与大多数公司一样，我们四分之一的预算都投资在包括软件在内的无形资产上。在我小时候，“AI”还是“畜牧业”一词的缩写，但我知道我们公司需要对人工智能这类新科技做中度规模的投资。然而科技是把双刃剑：我很怕建立那种可能很快就会过时的工厂。

至于投向“何处”，倒很简单：到处投。我们是一家相当典型的美国大公司，海外销售和投资占40%。鉴于新兴市场发展速度会超过美国，这一比例可能还会上升。而其他国家的保护主义倾向也在增强。中国的态度很清晰：美国公司要全面进入中国国内市场，就必须在那里加大投资。要玩游戏就得付入场费。

最后，我们公司应在“何时”加大投资？是现在，也就是经济复苏的第101个月吗？鉴于史上最长的一次扩张期从1991年到2001年持续了120个月，我得承认，这是一个艰难的决定。

我的预测是这样的。2018年企业投资将会激增，名义支出将上升10%，达到2006年繁荣时期的水平。因为资本的力量被压抑太久了。然而，投资将比过往更倾向于无形资产。另外，投资虽然有助经济发展，但无法复兴铁锈地带。

至于我们公司，我很清楚，咱们的投资委员会正对各种要求应接不暇。我们需要在奥斯汀建立新的园区，我们的软件漏洞重重，车辆管理部门希望改用特斯拉电动车。然而领导力的精髓就在于定好轻重缓急，而不是答应每个人的要求。不信的话，跟我念一个名字：杰夫·伊梅尔特（Jeff Immelt）。这位通用电气的前老板在资本配置上表现软弱，最终令公司阵脚大乱。

所以这么办吧：今年，圣诞老人不会到我们公司来。在我们的对手预算膨胀、科技热潮变为泡沫之时，我们静静等待。到2019年经济进入衰退期，我们的资产负债表将毫发无损，我们趁别人虚弱之时大举扩张。到2020年的圣诞节，我们这家非凡的公司将尽情享受有史以来最丰厚的圣诞礼物。





Medical diagnosis

Follow your nose

A new gadget that sniffs a patient's breath for diseases

HIPPOCRATES, the father of medicine, was known to have used smell as an aid to his work. Generations of doctors followed suit. Syphilis, for instance, is thought to have a characteristic odour; the smell of rotting apples suggests diabetes. Today, things are more sophisticated. All sorts of volatile organic compounds (gases, known as VOCs, that are given off by living organisms) have been identified, in laboratories, as markers of specific diseases from breast cancer to cholera. A paper reported on a “breathprint” for malaria earlier in the month. But despite all this knowledge, a “breathalyser for disease” has stubbornly failed to materialise.

The barrier, as so often with new diagnostic tools, is not whether such things are technically possible, but whether they can be proven to work reliably and usefully when used by doctors. Owlstone Medical, based in Cambridge, thinks it has developed just such a gadget. Its breath analyser is the subject of several big trials. One, called LuCID, is recruiting 4,000 patients across Europe to develop a test for the early detection of lung cancer—a disease that is often diagnosed too late to treat. Another, in collaboration with the Warwickshire NHS Trust, is attempting the detection of early-stage colorectal cancer in 1,400 people (existing screening methods are successful only 9% of the time). Cancer Research UK, a charity, is evaluating the breathalyser for early detection of a laundry list of other cancers (specifically bladder, breast, head and neck, kidney, oesophageal, pancreatic, prostate and brain).

Nor is it just cancer. Owlstone has several deals with drug firms. One, signed on November 27th with GlaxoSmithKline, aims to use the breathalyser to

see which patients are responding to treatment for chronic obstructive pulmonary disease. A smaller firm called 4D Pharma is using the device to find out more about a patient's microbiome—the legions of bacterial hangers-on which every person carries—in order to match drugs to diseases.

One reason Owlstone's device has generated such interest is that it has a documented record. The basic technology has been in use for many years, detecting chemical warfare agents for military customers. In the medical version, breath is exhaled across a sensor which ionises the VOCs, causing them to gain an electric charge. The molecules are then sorted according to how fast they move through an oscillating electric field. The result is a chemical fingerprint, or "breath biopsy", with no chemicals, needles or reagents necessary.

The details are, inevitably, trickier. For one thing, everyone's breath is different, so the device must weed out such natural variation if it is to reliably identify the telltales of sickness. But if the trials are successful, the benefits could be big. Widespread screening could help spot many diseases whose symptoms take time to develop. Doctors in Britain are experimenting with offering CT scans to supermarket shoppers with a history of smoking, who are therefore likelier than most to be harbouring undetected lung cancer. But CT scans are expensive, and deliver a substantial slug of radiation. Breath biopsies are cheap, and free of risk. If they can prove their worth, they will be a breath of fresh air for diagnostics. ■



医疗诊断

气味追踪

一种新型小工具能从病人呼出的气息中“闻”出疾病

众所周知，医学之父希波克拉底（Hippocrates）曾用气味辅助诊断。一代又一代的医生继承了这种方法。例如，他们认为人在感染梅毒后会带有特定的气味，而烂苹果味意味着糖尿病。今天，事情已经变得更加复杂。在实验室中，各种挥发性有机化合物（VOC，由生物体释放的气体）已被确定为从乳腺癌到霍乱等特定疾病的标识物。本月早些时候，一篇论文报道了疟疾的“呼吸印记”。然而，尽管人类已经掌握了这些知识，却一直未能出现一种“疾病呼吸分析仪”。

其中的障碍在推行任何新型诊断工具时都很常见——问题并不在于技术上是否可行，而在于是否能证明在医生使用时，它们能够可靠、有效地工作。总部位于英国剑桥的Owlstone Medical公司认为自己已经开发出了这样一个小工具。它的呼吸分析仪目前正在几项大型试验。其中一项名为LuCID，正在欧洲招募4000名患者来测试肺癌早期诊断——肺癌常因确诊太晚而难以治疗。另一项试验与沃里克郡NHS信托基金合作，尝试在1400人中筛查早期结直肠癌（现有筛查方法的成功率仅为9%）。慈善机构英国癌症研究中心（Cancer Research UK）正在评估这种仪器在及早发现大批其他癌症上的作用，包括膀胱癌、乳腺癌、头颈癌、肾癌、食道癌、胰腺癌、前列腺癌和脑癌。

用途并不限于癌症。Owlstone已与药品公司达成了几项协议。11月27日，它与葛兰素史克公司（GlaxoSmithKline）签约，使用它的仪器来检测哪些患者对慢性阻塞性肺病的治疗有响应。一家名为4D Pharma的小公司正使用该设备来进一步了解病人体内的微生物群——也就是每个人身上携带的细菌大军，从而能够有针对性地提供药物。

Owlstone的仪器之所以会引发那么多的兴趣，一个原因是其发展史有完备

的记载。其中涉及的基本技术已运用多年，为军事客户检测用于化学战的毒剂。在用于医疗的版本中，人呼出的气体会通过一个传感器，令VOC电离而带有电荷，而后根据分子在振荡电场中移动的速度来给它们分类，由此得到一种化学指纹，或称“呼吸活检”，过程中不必使用化学品、针头或试剂。

细节上免不了更为棘手。一方面，每个人呼出的气息都不一样，如果要可靠地识别出疾病信号，那么这种设备就必须能够克服这种天然的差异。但如果试验成功，将带来巨大的效益。广泛的筛查可以帮助发现许多种症状发展缓慢的疾病。英国的医生正在尝试向有吸烟史的超市购物者提供CT扫描，因为这些人比大多数人更可能患有未发现的肺癌。但CT扫描成本高且辐射不小。呼吸活检既便宜又无风险。如果它们能证明自己的价值，将为疾病诊断带来一股新鲜的空气。 ■



Video games

Looting the punters

Could video games fall foul of anti-gambling laws?

A DECADE ago the idea of paying real money for virtual items was strange and exotic. These days many video-game publishers build their business models around it. Some of the world's biggest games, such as "League of Legends", cost nothing to buy. Instead they rely for their revenue on players buying things for use in the game, such as new characters to play with or costumes to put them in.

A new twist on that model has been attracting the attention of regulators in recent weeks. "Loot boxes" are yet another type of "in-game" item that gamers buy with currency. Unlike the usual sort of purchase, however, players do not know in advance what they are buying, for the contents of a loot box are generated randomly. Sometimes they might be desirable, and therefore valuable; prized items include new gestures or "emotes" for a character, or a pearl handle for an automatic weapon. If less alluring, well, players can pay a bit more money to have another go.

If you think that sounds a lot like gambling, you are not alone. In November Belgium's gaming commission announced that it had opened an investigation into "Star Wars: Battlefront 2" and "Overwatch," a pair of shooters published by Electronic Arts (EA) and Activision Blizzard, respectively, that both feature loot boxes. China, where the virtual-item business model is very popular, has already passed laws restricting their sale.

Lawmakers and regulators in South Korea, Singapore, Australia and Hawaii have also made disapproving sounds. In Britain the Gambling Commission

has said that publishers of games must buy a gambling licence only if the contents of loot boxes can be converted back into money. Often they cannot, at least in theory. In practice the distinction is murkier. There are plenty of grey-market websites that allow gamers to buy and sell accounts for individual games. (On one such site, for instance, punters can buy the login details for an “Overwatch” account boasting of several rare “skins”, or costumes, for \$295.)

Not everyone is worried. The Entertainment Software Rating Board (ESRB), an American organisation that provides voluntary age ratings for games, says that loot boxes are not gambling, on the grounds that players always win something, even if it is of little value. But the controversy is unlikely to end, for loot boxes are a response to a long-standing problem within the video-games industry. The retail price of a blockbuster game has stayed at between \$40 and \$60 for over twenty years, thanks to the price-sensitivity of customers and widespread discounting of games online. Accounting for inflation, prices have fallen in real terms by a third or more at a time when production budgets have ballooned to tens or hundreds of millions of dollars for a high-quality game.

So publishers have been searching for new revenues. Many split video games into smaller chunks and charge separately for each, selling a base game for \$60, then releasing extra downloadable content a few months later. Another option is to offer expensive “collector’s edition” boxes with soundtrack CDs and the like.

Loot boxes, though, cost nothing to make. Even though most players indulge only sparingly, that makes them extremely profitable. The industry also uses psychological tricks long known to makers of gaming machines. Some games announce when a player’s friends have won big, encouraging them to think they could be next. Others tweak the algorithms in various ways, such

as making sure droughts do not last too long, which encourages players to keep buying.

The backlash against loot boxes is not coming only from regulators. Many players are unhappy, too. Pressure from customers this year persuaded EA temporarily to remove the ability to spend real money on loot boxes in “Star Wars: Battlefront 2”. In the end, that sort of bad publicity may prove a bigger stick than gambling laws. Laws, after all, can be complied with. But the video-games industry has spent decades trying to shed its image as an unwholesome pastime for oddballs. It has been succeeding, slowly. A public association with gambling will do that cause no favours. Better, perhaps, to simply raise prices and take the consequences. ■



电子游戏

洗劫赌徒

视频游戏是否会触犯反赌博法？

十年前，为虚拟物品花费真金白银的想法很奇怪也很另类。如今，许多视频游戏发行商的商业模式都建立在出售虚拟物品之上。世界上最流行的游戏中有一些是免费的，例如英雄联盟，它们的收入来自玩家购买在游戏中使用的东西，比如扮演一个新角色或者给角色购买服装。

最近几周，这种模式出现了一个新变化，引起了监管机构的注意。“战利品箱”是又一种需要玩家花钱购买的“游戏内”项目。但与通常的购买不同的是，玩家事先并不知道买到的是什么，因为战利品箱里的东西是随机产生的。有时可能是玩家想要的，就会有价值——宝贵的物品包括某个角色的新动作、新表情，或者是自动武器的珍珠手柄。如果东西不那么吸引人，玩家可以多花点钱再开一次箱。

如果你觉得这听起来很像赌博，其实不只你有这种感觉。11月，比利时游戏委员会宣布已对《星球大战：前线2》（Star Wars: Battlefront 2）和《守望先锋》（Overwatch）展开调查。这两款射击游戏分别由美国艺电公司（EA）和动视暴雪（Activision Blizzard）发布，均提供战利品箱。在虚拟道具商业模式大行其道的中国，已经通过了限制销售这类道具的法规。

韩国、新加坡、澳大利亚和夏威夷的立法者和监管机构也发声反对。英国博彩委员会（Gambling Commission）曾表示，只有当“战利品箱”里开出的东西能够兑换成法定货币时，游戏发行商才须申请博彩牌照。开箱物品一般无法兑换成钱，至少理论上如此。但实际操作中，二者的区别十分模糊。玩家可以通过许多灰市网站购买和出售各个游戏的帐号。（比如，在某个网站上，用户可以花295美元买一个《守望先锋》账号的登录信息，这个账号号称有几款罕见的“皮肤”，也就是服装。）

并不是所有人都忧心忡忡。美国的娱乐软件分级委员会（ESRB）无偿为游戏做年龄分级，它认为“战利品箱”并非赌博，因为玩家总能赢得些什么，尽管有可能没什么价值。但争议不大可能平息，因为“战利品箱”其实是对电子游戏产业中一个由来已久的问题的解决方案。由于消费者对价格的敏感以及网上销售的游戏普遍打折，过去二十多年来爆款游戏的零售价格始终保持在40到60美元之间。考虑到通货膨胀，实际价格已经下降了三分之一甚至更多，而与此同时，一款高质量游戏的制作预算已激增至数千万甚至数亿美元。

因此，发行商一直在寻找新的收入来源。许多公司将电子游戏分成几部分，分别收取费用：以60美元的价格出售基础游戏，几个月后再发布另外的可下载内容。另一种方式是提供昂贵的“典藏版”，配有背景音乐CD等物品。

不过，生产“战利品箱”没有任何成本。就算大多数玩家只是偶尔放纵一下，这些产品也利润惊人。这一行业还使用了赌博机制制造商惯用的心理技巧。一些游戏会播报玩家的朋友赢得大奖的消息，让他们觉得自己可能会成为下一个赢家。另一些游戏则以不同方式调整算法，比如确保玩家不会一直都没得赢，从而刺激他们不断购买。

抵制“战利品箱”的不仅是监管机构，许多玩家也不满意。今年，在用户施压下，EA暂时取消了在《星球大战：前线2》中花钱开箱的玩法。最终，这种负面新闻可能会是比赌博法律更有威力的大棒。毕竟，法律只要去遵守就可以了。但电子游戏一直被视为是为怪咖们准备的不健康消遣，这个行业已经花了几十年时间努力摆脱这种形象，并慢慢接近成功。公然与赌博拉上关系对实现这一目标不会有任何好处。或许更好的办法就是提高游戏售价并承担后果。 ■



America's economy

How to get it back

America's government should invest in a well-paid, qualified civil research bureaucracy

PITY the Washington wonk at this moment. America's political dysfunction looks forbiddingly irreparable, its government implacably hostile to expertise. Amid the gloom, some scholars still look to chart a course towards a healthier politics. "The Captured Economy", by Brink Lindsey and Steven Teles, sketches a plausible route out of the wilderness, albeit one that may struggle to find an audience in the corridors of power.

Their book is in part a blueprint for political realignment. For roughly a decade now Mr Lindsey, who is vice-president of the Niskanen Centre, a think-tank, and Mr Teles, a professor of political science at Johns Hopkins University, have sought to nurture understanding between conservatives of a free-market orientation and progressives. Their book is a guide for members of this "liberaltarian" tribe. Cooperation between Republicans and Democrats is frustrated by their quite different views of the role of government. The left sees the state as a means to reduce market inequities, while the right sees government redistribution as a growth-sapping anchor. Yet America's economy is now impaired by policies which both reduce growth and increase inequality. There is scope to satisfy left and right alike, if only politicians could see beyond the battle lines of partisan conflict.

The authors focus on policy failures created by rent-seeking. To an economist, a rent is excess, undeserved income resulting from barriers to competition. All too often rents are the result of successful attempts by firms to rig the rules of the marketplace in their favour. Rent-seeking seems to have grown worse in recent decades. America's economy is not just weaker and less equal than it used to be; it is also less dynamic. Profits have

grown and become more concentrated, indicating a lack of competitive vibrancy. Of the firms that enjoyed returns on invested capital of 25% or more in 2003, 85% were still earning returns that high a decade later.

The authors put forward four case studies to illustrate the choking spread of rent-seeking behaviour. Implicit and explicit government subsidies to the financial industry enrich bankers and sow the seeds of crisis, for example, but have done little to boost growth. Increasingly strong intellectual-property protections have not unleashed a torrent of new ideas, but have instead swelled the earnings of top firms, which wield their patents and copyrights menacingly at would-be innovators. The cost to negotiate reams of licence agreements, and the risk of lawsuits, can stymie the most determined of entrepreneurs. Analyses of occupational licensing and land-use rules turn up similarly skewed policies: they benefit those already on top at the expense of society as a whole.

To loosen the grip of the rent-seekers requires a more deliberative politics. Narrow interests triumph in part because the windfall they enjoy from their politicking gives them ever more incentive to organise and to press their case publicly. The costs of bad policy are, in contrast, spread across the public at large, making it harder for them to organise. As a result, leaders often hear only one side of the policy story.

Philanthropy could help fix this, Messrs Lindsey and Teles argue, as efforts to reform environmental and educational policy show: in these cases passionate campaigners made headway in the face of powerful political interests. But even better would be to “give government back its brain”. Since 1980, cost-cutting has shrunk congressional staffs and government information agencies like the Congressional Research Service. As a result, legislators have come to rely ever more heavily on research and analysis produced by interest groups. America’s government should invest in a well-paid, qualified civil-research bureaucracy, which could provide a neutral

benchmark against which industry claims could be judged.

It is an attractive, pragmatic proposal. Sadly, America's current leadership has little regard for government experts, and has indeed worked to undermine bastions of independent analysis. There is a risk that America's institutional rot is too far advanced for mere deliberation to help. ■



美国经济

如何挽回

美国政府应该投资建立一个待遇优厚、能力合格的民政研究机构

这会儿要同情一下华盛顿的学究们。美国政治运转失灵似已到了无法修补的地步，其政府又固执地敌视专家。如此阴霾之中，一些学者仍在坚持探索通往更健康政治的道路。布林克·林赛（Brink Lindsey）和史蒂夫·特莱斯（Steven Teles）合著的《受困的经济》一书从一片荒野中勾画出一条看似合理的路线，尽管这条路可能很难在权力走廊中得到认同。

二人的书在某种程度上是一幅政治重组的蓝图。林赛是智库尼斯卡南中心（Niskanen Centre）的副总裁，特莱斯是约翰霍普金斯大学（Johns Hopkins University）的政治学教授，为了促成进步派和自由市场倾向的保守派之间的相互理解，他们已探索了近十年。这本书是给这一整个“自由主义者”阵营成员的一本指南。共和党和民主党对政府角色的看法截然不同，这阻碍了双方的合作。左派认为政府干预是减少市场不平等的一种手段，而右派则认为政府的再分配是拖累增长的锚。然而现在的经济因为种种政策而受损，这些政策既减缓了增长又加剧了不平等。其实，只要政治家们能够超越党派冲突，就有机会满足两方的诉求。

两位作者着重讨论了寻租行为造成的政策失灵。在经济学家看来，租金是因竞争壁垒产生的不应得的超额收入。租金往往是公司从自身利益出发，成功操纵市场规则的结果。近几十年来，寻租活动似乎愈演愈烈。美国经济不仅比以前更疲软、更不平等，活力也有所减弱。利润增长且更为集中，表明缺乏竞争活力。在2003年投资资本回报率为25%及以上的公司中，有85%在10年后仍保持如此高的回报。

作者列举了四个案例来展现寻租行为令人窒息的扩张。例如，政府对金融业隐性和显性的补贴让银行家们致富，也播下了危机的种子，对促进经济增长却几乎毫无贡献。知识产权保护日益增强，但这并没有促使大量新想

法喷涌而出，反而令顶尖公司大赚特赚，让它们气势汹汹地对有志于创新的人挥舞专利和版权的大棒。即便是最坚定的企业家，也可能因为需要花费成本商讨大量授权协议和遭受诉讼的风险而却步。对职业注册和土地使用规则加以分析后，同样发现了一些有失公允的政策：它们让那些已经位于顶层的人受益，却牺牲了整个社会的利益。

要减轻寻租者的控制力，需要更审慎的政治举措。狭隘的利益诉求之所以能取得成功，部分是因为它们从政治活动中获得的横财让它们更有动力组织起来，公开为自己的诉求呼号。而糟糕政策的代价却会被分摊到全体公众，令他们更难组织起来。结果就是领导人往往只听到政策故事的一面。

林赛和特莱斯认为慈善事业有助于解决这个问题，就像改革环境和教育政策的努力所显示的那样：满腔热情的活动家们面对强大的政治利益迎难而上，取得进展。但更好的方案是“还智于政府”。自1980年以来，为了削减成本，国会工作人员以及像国会研究服务中心（Congressional Research Service）这样的政府信息机构被缩减，其结果是立法者越来越依赖利益集团做出的研究和分析。美国政府应该投资建立一个待遇优厚、能力合格的民政研究机构，由它提供一个中立的基准来判定各个行业的诉求。

这是一个有吸引力的、务实的提议。可悲的是，美国目前的领导层几乎完全无视政府专家，甚至还极力破坏独立分析的堡垒。有一种风险是，美国政府机制的腐坏已经太过严重，仅靠深思熟虑已无济于事。 ■



Archaeology

Capital in the 80th century BC

Wealth inequality has been increasing for millennia

THE one-percenters are now gobbling up more of the pie in America—that much is well known. This trend, though disconcerting, is not unique to the modern era. A new study, by Timothy Kohler of Washington State University and 17 others, finds that inequality may well have been rising for several thousand years, at least in some parts of the world. The scholars examined 63 archaeological sites and estimated the levels of wealth inequality in the societies whose remains were dug up, by studying the distributions of house sizes.

As a measure they used the Gini coefficient (perfectly equal society would have a Gini coefficient of zero). It rose from about 0.2 around 8000BC in Jerf el-Ahmar, on the Euphrates in modern-day Syria, to 0.5 in around 79AD in Pompeii. Data on burial goods, though sparse, point to similar trends.

The researchers suggest agriculture is to blame. The nomadic lifestyle is not conducive to wealth accumulation. Only when humans switched to farming did people truly begin to acquire material riches. Inequality rose steadily after the shift to settled agriculture, but tailed off in the Americas after around 2,500 years. In the old world, however, wealth inequality continued climbing for several millennia. That may be because Eurasia was richer in large mammals that could be domesticated. Horses and oxen greatly improved farm productivity—but livestock were mainly owned by the rich (who could also rent them out). The agricultural revolution was good for humanity but awful for egalitarians. ■



考古

公元前80世纪的资本

财富不平等加剧已经持续几千年

如今美国前1%的富人正在吞噬更多财富，这一点已经众所周知。这一趋势虽令人不安，却也非现代独有。华盛顿州立大学（Washington State University）的蒂莫西·科勒（Timothy Kohler）与另外17人开展的一项新研究发现，不平等加剧的状况很可能已持续了几千年，至少在世界的某些地区是如此。学者们调查了63处考古遗址，并通过研究房屋大小的分布，估算了有遗迹出土的社会中财富不平等的程度。

他们使用基尼系数来衡量不平等程度，一个完全平等的社会的基尼系数为零。在公元前8000年的杰夫艾哈迈尔（Jerf el-Ahmar，位于今天叙利亚的幼发拉底河流域），该系数约为0.2，到了公元79年前后的庞贝则上升至0.5。关于随葬物品的资料很稀少，但也显示出类似的趋势。

研究人员认为这要归咎于农业。游牧生活不利于财富积累。直到转向农业社会后，人们才真正开始获得物质财富。向定居农业转变后，美洲的不平等程度稳步加剧，不过约2500年后又逐步减轻。然而在旧世界，财富不平等持续上升了几千年。这可能是因为欧亚大陆有更多可驯化的大型哺乳动物。马和牛大大提升了农业生产率，但这些牲畜主要为富人所有（他们也可以将其出租）。农业革命对人类有益，但对平等主义者而言却很糟糕。





Gender in academia

Question time

Women ask fewer questions than men at seminars. There is an easy fix

ONE theory to explain the low share of women in senior academic jobs is that they have less self-confidence than men. This hypothesis is supported by data in a new working paper, by a team of researchers from five universities in America and Europe. In this study, observers counted the attendees, and the questions they asked, at 247 departmental talks and seminars in biology, psychology and philosophy that took place at 35 universities in ten countries. On average, half of each seminar's audience was female. Men, however, were over 2.5 times more likely to pose questions to the speakers—an action that may be viewed (rightly or wrongly) as a sign of greater competence.

This male skew in question-asking was observable, however, only in those seminars in which a man asked the first question. When a woman did so, the gender split in question-asking was, on average, proportional to that of the audience. Simply handing the microphone to a woman rather than a man when the floor is opened for questions may make a difference, however small, to one of academia's most intractable problems. ■



学术界的性别问题

提问时间

女性在研讨会上的提问少于男性。略施小计便可解决这个问题

从事高水平学术工作的女性比例较低，对此有一种猜想是女性不如男性自信。来自美国及欧洲五所高校的一组研究人员最近发布了一篇工作论文，其中的数据支持了这种假设。他们统计了247场学术报告和研讨会的与会人数及与会者提问。这些学术活动是在十个国家的35所高校内举行，内容涵盖生物学、心理学和哲学。平均每场研讨会有半数参会者为女性，不过男性与会者向发言人提问的可能性却是女性的2.5倍以上。而人们也许认为发问是能力更强的表现（这可能是对的也可能是错的）。

不过，只有在男性首先发问的研讨会上，才会出现男性提问者远多于女性提问者的情况。如果第一个提问的人是女性，那么平均来看，提问者的男女比例就和与会者的男女比例相当。当开放提问时，只要首先将话筒递给一位女士，也许就能为这个学术界最棘手的问题之一带来转机——无论多微小。 ■



Commercial aviation

The electric-flight plan

Electrifying aircraft is tricky. But companies are getting serious about trying

ELECTRIC cars are clean, quiet and, it seems, the way of the future. Tesla, an American firm that has done much to help electric cars shed their museli-munching image, is struggling to meet demand for its mid-market Model 3 (though that has not stopped it announcing plans to build electric lorries as well). Volvo, a Swedish carmaker, has said that, from 2019, all its cars will be at least part-electric. Volkswagen has plans to offer battery options across all of its brands; General Motors has made similar noises. Some countries, including China, Britain and France, are mooting bans on internal-combustion vehicles, to take effect within a couple of decades.

Not all forms of transport are so easy to electrify. One of the hardest is aviation, where battery power runs up against a serious problem: weight. Kilo-for-kilo, fossil fuels contain roughly 100 times as much energy as a lithium-ion battery. On the road, that is a problem which can be designed around. For a machine that must lift itself into the sky, it is much harder to solve.

But it is not impossible. Dozens of firms are working on electrically powered planes of all shapes and sizes. Some resemble flying cars, such as those which Larry Page, one of Google's founders, is backing. Others are hovering, drone-like machines that could operate as autonomous aerial taxis (Uber is keen on these). Pipistrel, a Slovenian company, already makes a two-seater electric training plane. Another two-seater, the E-fan, has been flown by Airbus, a European aviation giant, although it recently abandoned the project.

The reason for that became clear on November 28th, when Airbus announced something more ambitious. It has teamed up with Rolls-Royce, a British jet-engine producer, and Siemens, a German electricals group, to convert a small airliner into a “flying test bed” to prove the feasibility of hybrid-electric propulsion. “We are entering a new world of aviation,” said Frank Anton, head of Siemens eAircraft. Electric power, he predicted, would prove to be as significant to commercial aviation as the invention of the jet engine.

The general view in the industry is that battery technology is not yet up to building fully-electric airliners. But just as hybrid arrangements help to extend the range of some electric cars, so hybrid systems will bring electric aircraft closer to take-off.

The Airbus team plans to modify a BAE 146, which is a 100-seat regional airliner powered by four conventional jet engines (see illustration above). The first step will be to replace one of those engines with a 2MW electric unit, consisting of a fan contained in a shroud. As with a hybrid car, the fan will be powered by a combination of a battery and a range-extender, in the form of a small jet engine mounted in the rear of the fuselage and hooked up to a generator. This range extender can be switched on during parts of the flight to power the fans or to top up the battery. Because it can be run at its most efficient speed all the time, unlike a jet directly propelling a plane, it would be highly fuel-efficient.

Flight tests are due to begin in 2020. If they are successful, a second engine on the aircraft will be replaced. The results, the team hope, will provide enough data to design a full-on hybrid-electric airliner with 50-100 seats from scratch. Such a plane might enter service in 2030 or so.

Other planes could be in the air before then. Zunum Aero, a startup based near Seattle, hopes to have its 12-seat hybrid-electric airliner ready to fly

its first passengers by 2022, helped along by investment from Boeing, an American aerospace giant, and JetBlue, a successful airline.

Such aircraft will, their designers hope, serve as bridges to fully electric planes in the future. Overcoming the weight problem will be tricky. For big planes flying long-haul routes, full electrification may never happen, although hybrid systems would reduce their fuel consumption. But design changes can help. Airbus, for instance, thinks it can blend its electric motors into the aircraft's fuselage to reduce drag. And electric power offers some advantages that offset its big drawback. One is that combustion engines are not very efficient at turning the energy in their fuel into motion. Instead, a great deal of it ends up wasted as heat. A jet engine might manage around 55% efficiency during a steady cruise at the ideal altitude. But that number could fall by half or more when taking off, climbing, landing and taxiing on the ground, which is what aircraft that fly short routes spend much of their time doing.

An electric motor can do much better. The latest models are more than 95% efficient, so the batteries that power them would not need to match the energy density of jet fuel. Electric motors are also lighter than jet engines, which helps offset some of the weight disadvantage. And they contain far fewer parts, which means they require less maintenance, which is a big cost in aviation.

Those are all reasons why Zunum plans to focus, at least at first, on relatively short routes, where the efficiency gains from electric motors are most significant. The idea, says Ashish Kumar, the firm's chief executive, is to serve the hundreds of small American airports that have been left behind as flights have shifted to bigger hubs. The firm's aircraft will cruise at around 550kph (340mph) and have a range of about 1,130km (700 miles). Like the Airbus machine, it would use a single small jet engine in the rear fuselage to run a generator that could power the plane's two 500kW fans and top up the

batteries, which will be mounted in the wings and designed to be swapped in for fresh ones after landing. This way, at some airports, the turnaround time could be as low as ten minutes.

The aircraft's range, says Dr Kumar, should increase over time. For batteries have another advantage over fossil fuels: as a relatively underdeveloped technology, they still have plenty of room left for improvement. As production ramps up, led by the car and electronics industries, battery capacities are increasing and prices are falling.

In late November, for instance, Samsung Electronics, a big South Korean firm, said that by incorporating graphene—an ultra-thin form of carbon—into a lithium-ion battery, it had managed to boost its energy capacity by 45% and greatly decrease the time needed for a recharge. Many other new battery chemistries are being developed. One promising idea is a solid-state lithium battery, which replaces the liquid electrolyte of current cells with a solid substitute. Besides offering much higher energy densities, such batteries should also be cheap to mass produce. Those trends, thinks Dr Kumar, would allow his aircraft to increase its range to around 2,400km by 2035, and perhaps even ditch the on-board generator.

Combining all these benefits and drawbacks into a single figure is tricky. Paul Eremenko, Airbus's chief technology officer, says a single-aisle hybrid electric airliner would be "safe, efficient and cost-effective". Zunum's Dr Kumar is prepared to go further and talk numbers. For airlines, the important figure is the CASM—cost per available seat mile. This is obtained by dividing operating costs by capacity, measured as the number of seats in an aircraft multiplied by miles flown. Zunum claims that its plane will have a CASM of 8 cents. Oliver Wyman, a firm of aviation analysts, reckons that the average for American airlines in 2016 was 11 cents.

And like electric cars, electric aircraft would offer other benefits that are

worth having, but harder to quantify. They would be quieter than jet-powered planes, which may be attractive for airports near big cities. They would be cleaner too, and become more so as more electricity is produced from low-carbon sources. Sceptics doubt the weight problem can ever be properly overcome; cynics suspect that these projects are motivated by PR. But few people predicted the pace of electrification in other areas. If electric aircraft can offer faster door-to-door journeys avoiding crowded hub airports and provide cheaper fares at the same time, then air travellers will be happy for the sparks to fly. ■



商业航空

电动飞机计划

电动飞机挑战不小，但各家公司正在认真尝试

电动汽车清洁、安静，似乎是未来的发展方向。美国公司特斯拉在帮助电动汽车摆脱单调的环保形象方面贡献良多，不过目前却难以满足中端市场对Model 3的需求（但这并未阻止它宣布制造电动货车的计划）。瑞典汽车公司沃尔沃宣布，从2019年推出的所有新款车型都将为纯电动或混合动力车。大众汽车计划为其所有品牌的汽车都推出电动车型，通用汽车公司也公布了类似的计划。包括中国、英国和法国在内的一些国家正在研究全面禁止内燃机汽车，将在未来二三十年内生效。

不是所有的交通方式都这么容易电动化，航空就是其中最难的一种。用电池驱动飞机会遇到一个严峻的问题：重量。在同等重量下，化石燃料的能量大约是锂离子电池的100倍。在公路上，这个问题可以通过设计来解决。而对于一台必须飞上天的机器来说，事情就变得难多了。

但也不是不可能。目前有几十家公司正在研发各种形态和大小的电动飞机。其中有些像会飞的汽车，比如谷歌的创始人之一拉里·佩奇（Larry Page）投资的飞行汽车。有些则类似可悬停的无人机，可用作无人驾驶的空中的士（优步非常热衷于此）。斯洛文尼亚的Pipistrel公司已生产出双座电动教练机。欧洲航空巨头空客公司也试飞了一款双座电动飞机E-fan，不过最近放弃了这个项目。

其中的原因于11月28日揭晓：当天，空客宣布了一个更具野心的计划。它与英国喷气发动机制造商罗尔斯-罗伊斯和德国电气设备公司西门子联手，将一架小型客机改装成“飞行试验台”，以证明混合动力推进的可行性。西门子电动飞机部门eAircraft的负责人弗兰克·安东（Frank Anton）说：“我们正在进入航空业的全新领域。”他预测，对于商业航空而言，电力的应用最终将和喷气发动机的发明一样意义深远。

业界的普遍观点是电池技术还不足以制造全电动飞机。但就像混合动力延长了一些电动汽车的续航里程一样，混合动力系统也会让电动飞机更早起飞。

空客的电动飞机团队计划改装由四个常规喷气发动机驱动的100座BAE 146短程支线客机（见上图）。第一步是将其中一个发动机更换成2兆瓦的电动单元，包含一个由护罩保护的涡扇。涡扇和混合动力汽车一样，由电池和增程器共同驱动。增程器是一台小型喷气发动机，安装在机身后部，与发电机相连。它可以在飞行途中被打开，驱动涡扇或为电池充电。这台增程器不同于直接推进飞机的喷气发动机，它能在任何时间都以最有效的速度运行，因此会非常节省燃料。

飞行试验预计将在2020年启动。如果试验成功，就会用电动发动机替换掉飞机的第二个引擎。研究团队希望从试验中得到足够多的数据，有助于从零起步设计一架真正的50到100座混合动力客机。这样的飞机也许会在2030年前后投入运行。

在那之前，其他混合动力飞机可能已经升空。位于西雅图附近的创业公司Zunum Aero获得了美国航空业巨头波音和成功的航空公司捷蓝航空（JetBlue）的投资，希望其12座混合动力电动客机将在2022年准备就绪，运载第一批乘客。

这类电动客机的设计者希望他们的飞机可作为未来完全电动化飞机的过渡。克服电动机的重量问题难度很大。对于远程大型飞机而言，完全电动化可能永远不会实现，不过混合动力系统将会减少飞机的燃油消耗。然而，设计上的改变还是会有所助益。比如，空客公司认为它可以将电动机融入飞机机身以减少阻力。电力有些优点可以弥补其自身的重大缺点，其中之一就是，内燃发动机将燃料中的能量转化为动力的效率不高，很多能量最终转化成热能而白白浪费了。飞机在理想高度稳定巡航时，喷气发动机也许会实现55%左右的能量转化效率，但在起飞、爬升、降落和滑行阶段，这个数字可能会下降一半或更多，而短线飞机的大多数时间都耗费在了这些阶段上。

电动机的效率要高很多。最新款电动机的能量转化效率高达95%以上，因此，提供动力的电池无需具备和喷气式发动机的燃料相当的能量密度。电动机还比喷气发动机轻，有助于抵消电池重量的劣势。它们的零件数量也少得多，这就意味着维修需求减少，而维修在航空业中是一项很大的成本开支。

基于以上原因，Zunum计划至少在一开始先将重点放在较短线的飞机上，因为电动机带来的能效提升在短途飞行中最为显著。该公司首席执行官阿希什·库马尔（Ashish Kumar）表示，专注短线飞机是为了服务数百个小型机场。由于航班纷纷集中到更大的航空枢纽，小型机场发展滞后。该公司飞机的巡航速度大约将为550公里/小时（340英里/小时），航程约1130公里（700英里）。和空客公司的混动飞机一样，Zunum的飞机在机身后部会有一个小型喷气式发动机来驱动发电机，从而驱动两台500千瓦的涡扇并为电池充电。电池会安装在机翼中，在飞机降落后进行更换。在一些机场，这样的设计可将航班周转时间缩短至十分钟。

库马尔说，电动飞机的航程会逐渐增加。这是因为电池相对化石燃料还有另一个优势：作为一项尚未充分发展的技术，它仍有充分的改进空间。在汽车和电子行业的引领下，随着电池产量的不断增加，其容量将随之上升，价格则会下降。

例如，韩国跨国企业三星电子在11月末表示，三星将石墨烯材料（只有一个碳原子厚的超薄碳薄膜）应用在锂电池中，令电池容量提升了45%，还大幅缩短了充电时间。其他许多新的电池化学材料正在研发中。其中一个颇有前景的设想是固态锂电池，用固态物质替代当前电池中的电解液。除了可提供更高的能量密度，这种电池大规模生产的成本也很低。库马尔认为，由于这些发展趋势，他的飞机的航程在2035年之前会增加到2400公里左右，甚至还有可能不再需要机载发电机。

很难用一个指标来综合显示所有的优缺点。空客公司的首席技术官保罗·雷米恩科（Paul Eremenko）说，单通道混合动力飞机将会“安全、高效、性价比高”。Zunum的库马尔则愿意更进一步，谈一谈数据。对于航空公

司而言，每座位每英里成本（CASM）是个重要的数字，是运营成本除以运力的结果，运力则是飞机座位数与飞行里程的乘积。Zunum宣称其飞机的CASM将为8美分。据航空业分析公司奥纬咨询（Oliver Wyman）估算，2016年美国航空业的平均CASM为11美分。

电动飞机和电动汽车一样，还有其他好处，但更难量化。电动飞机比喷气式飞机噪音更低，对靠近大城市的机场来说也许有吸引力。电动飞机也更清洁，而随着低碳能源提供更多电力，它们还会变得更清洁。对电动飞机持怀疑态度的人认为，电池重量的问题可能永远也无法得到妥善解决；一些爱冷嘲热讽的人则怀疑企业的电动飞机项目都只是为了公关。然而很少有人预见到了电动化在其他领域的发展速度。如果电动飞机能让人们不必折腾到拥挤的枢纽机场就能更快捷地完成点到点的行程，同时票价还更便宜，那么航空旅客将乐见电动机上天。 ■



The Vegetarian Butcher

I can't believe it's not meat

Plant-based “meat” is prompting others to bite back

THE “kapsalon” is a healthy mix of chips, melted Gouda cheese, shawarma, lettuce and garlic sauce and is a tried and tested hangover cure in the Netherlands. So naturally, a butcher’s shop on the Spui, in The Hague, put it on its takeaway menu, alongside burgers and sausage rolls. As two young women walk out, tucking into their steaming kapsalons, an elderly gentleman asks how to prepare the steak he has just bought. The scene would have most carnivores fooled. For this butcher deals only in meatless “meat”.

“We want to become the biggest butcher in the world without ever slaughtering an animal,” says Jaap Korteweg, a ninth-generation farmer and founder of The Vegetarian Butcher. Since opening its first shop in The Hague in 2010 the company has been developing plant-based products that look, smell and taste like meat. “This shouldn’t just taste like real chorizo, it should leave the same red stains on your fingers,” says Maarten Kleizen, an employee, as he serves a slice.

The firm sells a variety of foods, ranging from minced meat to prawns, through 3,500 sales points in 15 countries (the bulk of them are in Dutch supermarkets) and has annual revenues of €12m (\$14.2m). One in five sausage rolls sold in Albert Heijn, the Netherlands’ largest supermarket chain, comes from the veggie butcher. Mr Korteweg says he wants to make factory farming obsolete by “seducing meat-lovers” without inflicting suffering on animals and damage to the environment by feeding livestock.

Not everyone welcomes this vision. Earlier this year two Dutch politicians

from the Liberal VVD party called for a ban on meat names for products that contained no animal protein. In October the country's food authority asked The Vegetarian Butcher to rename misleading products, such as its "speck" (very similar to "spek", the Dutch for bacon) because it might confuse consumers. The topic trended on Twitter for days; sales soared.

Dutch media termed the episode "Schnitzelgate" after a similar situation in Germany, whose minister for agriculture said that "meaty names" such as "schnitzel" and "wurst" should only be legal for animal-based products. That was seen as the meat lobby reacting to a country rapidly going veggie; a tenth of Germans are now vegetarians, up from 0.6% in 1983. In Brussels lobbyists want meat to get the same protection as milk did this summer (when the European Court of Justice ruled that soy-drink producers, for example, could not call their products milk). In October New Zealand's Poultry Industry Association said packaging by Sunfed Meats, a meat-substitute firm, was misleading because its "chicken-free chicken" pictures a chicken and the phrase "wild meaty chunks".

Mr Korteweg says that while his firm threatens chicken and pig farmers, meat companies and butchers are customers and partners. He co-operates with a Unilever sausage and soup brand, Unox; conventional butchers sell his products alongside animal-sourced meat. The arguments are likely to intensify as the market for alternative meat takes root. ■



素肉铺

这不是肉？我不信

植物“肉”引发反击

kapsalon在荷兰是公认的解酒菜，是用薯片、融化的高达奶酪、沙瓦玛烤肉、生菜和蒜蓉酱配成的健康食品。在海牙的斯普伊街上有一家肉铺，它的外卖餐单上除了汉堡包和香肠卷，自然还有这么一道kapsalon。两名年轻女子走出肉铺，大口吃着热气腾腾的kapsalon，这时铺子里一位老先生正在问店员，该怎样烹调刚买的这块牛排。大多数肉食者都会被这一幕欺骗。实际上，这家肉铺只卖不含肉的“肉制品”。

“我们希望成为世界上最大的肉类公司，但不用宰杀任何动物。”“素肉铺”公司（The Vegetarian Butcher）的创始人、家传第九代农场主亚普·科特维格（Jaap Korteweg）说。自2010年在海牙开设第一家店以来，该公司一直在研发色香味都像肉的植物制品。“这东西不该只是尝起来像真正的西班牙辣香肠，还得像真香肠那样在你的指头上留下红色汁液。”公司员工马尔滕·克莱岑（Maarten Kleizen）一边说着，一边给记者奉上一片“香肠”。

该公司销售肉馅、大虾等各类食品，在15个国家拥有3500个销售点（大部分在荷兰的超市内），年销售额1200万欧元（1420万美元）。荷兰最大的连锁超市Albert Heijn出售的香肠卷中有五分之一来自这家素食肉商。科特维格表示，他希望在不伤害动物或因喂养牲畜而损害环境的前提下“把肉食爱好者吸引过来”，淘汰工业化畜牧。

并非人人都欢迎这个想法。今年早前，荷兰自民党的两位政客要求禁止不含动物蛋白的产品使用肉类名称。10月，荷兰的食品监管部门要求“素肉铺”公司为误导性产品更名，例如名为“speck”的产品（与荷兰语中的“spek”即“培根”非常相像），因为这可能会令消费者混淆真肉与仿肉。这一话题在推特上流行多日，产品销量反而飙升。

德国也发生了类似的情况。该国农业部长表示，“炸猪排”（schnitzel）和“香肠”（wurst）等“肉类名称”只有用于动物类产品才算合法。这之后荷兰媒体把上述事件称为“肉排门”（Schnitzelgate）。在德国国内素食主义发展迅猛之际，这种禁令被视为肉商游说团体做出的反击。如今德国素食者的比例是十分之一，而在1983年是0.6%。在布鲁塞尔，游说者希望肉类能得到像奶制品在今年夏天获得的那种保护——当时欧洲法院裁定大豆饮料生产商不能称其产品为“奶”。10月，新西兰家禽业协会表示，肉类替代品公司Sunfed Meats的包装有误导性，因为其“不含鸡肉的鸡肉”包装上有鸡的图案和“肥美肉块”的字样。

科特维格表示，虽然他的公司威胁到了鸡农和猪农的生计，但肉类公司和肉贩其实互为顾客和合作伙伴。他和联合利华公司的香肠及汤品牌Unox合作；传统肉贩在出售动物肉类的同时也在出售他的仿肉产品。随着替代肉类市场渐渐扎根，这类争议很可能会进一步加剧。■



Free exchange

Paying no mind

Digital distractions hurt well-being, if not economic growth

FOR many it is a reflex as unconscious as breathing. Hit a stumbling-block during an important task (like, say, writing a column)? The hand reaches for the phone and opens the social network of choice. A blur of time passes, and half an hour or more of what ought to have been productive effort is gone. A feeling of regret is quickly displaced by the urge to see what has happened on Twitter in the past 15 seconds. Some time after the deadline, the editor asks when exactly to expect the promised copy. Distraction is a constant these days; supplying it is the business model of some of the world's most powerful firms. As economists search for explanations for sagging productivity, some are asking whether the inability to focus for longer than a minute is to blame.

The technological onslaught has been a long time building. Bosses no doubt found the knock of the telegraph boy or the clack of the ticker-tape machine an abominable interruption. Fixed-line desk phones were an intrusion in their day, before the mobile phone brought work interruptions into the home. But the web is different, with its unending news cycle, social networks humming with constant conversation, and news feeds algorithmically structured to keep users scrolling and sharing. The louder the din, the greater the distraction—and the harder to tune it out for fear of missing important information.

Distractions clearly affect performance on the job. In a recent essay, Dan Nixon of the Bank of England pointed to a mass of compelling evidence that they could also be eating into productivity growth. Depending on the study you pick, smartphone-users touch their device somewhere between twice

a minute to once every seven minutes. Conducting tasks while receiving e-mails and phone calls reduces a worker's IQ by about ten points relative to working in uninterrupted quiet. That is equivalent to losing a night's sleep, and twice as debilitating as using marijuana. By one estimate, it takes nearly half an hour to recover focus fully for the task at hand after an interruption. What's more, Mr Nixon notes, constant interruptions accustom workers to distraction, teaching them, in effect, to lose focus and seek diversions.

Could this explain the rich world's productivity slowdown? In a paper published in 2007, Sinan Aral and Erik Brynjolfsson, of the Massachusetts Institute of Technology, and Marshall Van Alstyne, of Boston University, analysed firms' use of information technology and its effects on labour productivity and revenue growth. They found an inverted U-shape pattern associated with multitasking and productivity. An initial increase in multitasking from the increased use of IT seems to raise productivity. But later, the accumulation of balls to be juggled reduces performance and increases the incidence of error.

IT does help workers in all sorts of ways. It speeds communication and allows documents to be shared remotely. The web makes finding information far simpler and quicker than it was in a world of paper archives. Productivity surged in the late 1990s and early 2000s as e-mail, digital databases and the web spread. The benefits technology brought, at that time, seemed to outweigh the cost of distraction. Since the mid-2000s, however, productivity growth has tumbled, perhaps because the burden of distraction has crossed some critical threshold.

But this is surely not the whole story. Performance across industries does not fit very well with the idea that distraction is the main cause of weak productivity. Over the past decade, labour-productivity growth in both manufacturing and construction has been particularly disappointing—and the problem can hardly be desk jockeys frittering away time on Pinterest.

Weak productivity is also a consequence of the reallocation of workers from industries with relatively high rates of growth to more stagnant ones. In America health care and education, where labour productivity is persistently low, account for more than half of total employment growth since 2000.

How then to reconcile evidence of the toll taken by new technologies with the difficulty in detecting a productivity cost? One possibility is that firms have not been as strenuous as might be expected in maximising output per worker. Employment does not fall much in response to minimum-wage rises because output per worker goes up. That is partly because workers try harder and partly because firms, faced with a new cost, focus more on tracking worker performance. Similarly, productivity leapt in the immediate aftermath of the financial crisis, and not because firms laid off less productive workers. Rather, workers appear to have upped their game to convince bosses not to sack them. After a decade of low wages and high profits, firms may be feeling complacent. That, and their consequent failure to invest, may be a better explanation of weak productivity than workers' distraction.

Whether or not brains fried by constant interruption are slowing growth, the digital deluge takes a toll. Mr Nixon reckons that distracted workers become less empathetic, a serious side-effect in an economy where human connections with customers are cast as a defence against automation. Distraction also appears to reduce reported happiness, and that effect may be magnified if it means that fewer tasks are completed to the workers' satisfaction—or if the source of the distraction is another distressing news alert. So this is yet another reason to yearn for a truly tight labour market: when firms cannot spare an idle moment they might get serious about trimming productivity-sapping intrusions from the workplace, to everyone's benefit. Right, time for a tweet. ■



自由交流

心不在焉

数字干扰即使不危害经济增长，也危害幸福

对很多人来说，分心就如同呼吸般不自觉。做一项重要工作时（比如写一篇专栏文章）遇到了障碍？伸手拿来手机，打开常用的社交网络。恍惚中时间流逝，本应富有成效的半小时或更长的时间就这么没了。刚涌上一丝懊悔，又迫不及待地查看刚过去的15秒里推特上发生了什么。截稿期已过，编辑询问究竟什么时候能看到承诺的稿件。现如今，干扰已是家常便饭，而一些世界上最强大的公司的商业模式正是向人们提供干扰。当经济学家们查找生产率疲软的原因时，一些人提出是否该归咎于无法集中注意力超过一分钟。

技术的狂轰滥炸由来已久。从前的老板们无疑觉得电报投递员的敲门声或自动收报机发出的哒哒声是极其讨厌的干扰。在手机将工作干扰带入家门之前，固定电话是干扰物。但是互联网不一样——新闻无休止地发布；社交网络上时时弹出对话；经过算法周密安排的新闻推送让用户没完没了地翻看和分享内容。网络世界越是喧嚣，干扰就越大，人们就越难不予理睬——生怕错过重要信息。

分心显然影响工作表现。英格兰银行的丹·尼克松（Dan Nixon）近期在一篇文章中提出大量令人信服的证据，说明分心也许还削弱了生产率增长。综合不同的研究结果，智能手机用户查看手机的频率大约在一分钟两次到每七分钟一次之间。相对于在不受干扰的安静环境中工作，员工如果边工作边收电子邮件或接电话，智商大约会降低10分。这相当于一夜失眠，致人虚弱的程度相当于吸食大麻的两倍。据估计，受干扰之后，需要将近半个小时才能再次全心投入手头的工作。尼克松指出，更重要的是，经常的干扰会让员工习惯于分心，实际上就是教唆他们不要专心，而是去找机会分心。

这会不会是富裕国家生产率增长放缓的原因？麻省理工学院的锡南·阿拉尔（Sinan Aral）、埃里克·布林于尔松（Erik Brynjolfsson）以及波士顿大学的马歇尔·范埃尔斯泰恩（Marshall Van Alstyne）在2007年发表的一篇论文中，分析了各家公司对IT技术的应用及其对劳动生产率和企业收入增长的影响。他们发现一心多用与生产率之间存在一种倒U形关系。起初，增加使用IT技术使得一心多用的情况增加，似乎提高了生产率。但之后，就像杂耍时抛接的小球多了容易失误那样，越来越多的一心多用导致业绩下降、出错增多。

IT技术确实在很多方面帮助了员工，比如加快了通讯速度，令他们得以远程分享文件。比起过去在海量纸质档案中查询信息，互联网让信息查询变得非常简单快捷。20世纪90年代末和21世纪初，随着电子邮件、数据库以及互联网的广泛应用，生产率骤增。当时，科技带来的好处似乎超过了干扰的代价。然而自2005年前后，生产率增长暴跌，或许是因为干扰的拖累超出了某个临界值。

但这一定不是全部的原因。各个行业的业绩情况并不完全符合“干扰是造成生产率疲软的主因”这一观点。过去十年间，制造业和建筑业的劳动生产率增长尤其令人失望，而出现这个问题，很难说是因为办公室员工把时间浪费在了Pinterest上。

造成生产率疲软的另一个原因是员工从增长相对较快的行业向发展停滞的行业转移。在美国，自2000年以来，在劳动生产率长期低下的医疗保健和教育行业，就业人数增长占就业总人数增长的一半多。

一边有证据显示新科技造成了负面影响，另一边雇主却没有注意到这种生产率的损失，这该如何解释？一种可能是公司在最大化每位员工的产出上不像想象的那么上心。就业率并未因最低工资增长而明显下降，因为员工的人均产出增长了。员工产出增长一方面是因为他们工作更加努力，另一方面是新增的成本促使公司更加注意跟踪员工的业绩。同样，金融危机过后生产率骤增，不是因为公司解雇了低效的员工，而是员工们似乎提升了表现，好让老板不解雇他们。经过十年的低工资和高利润，公司可能会

沾沾自喜。而这种情绪以及由此导致的投资不足，比员工的分心更能解释生产率的疲软。

无论头脑不断受干扰是否减缓了生产率增长，数字洪流确实产生了不良影响。尼克松认为心不在焉的员工会更缺乏同理心，而既然一个经济体将与客户沟通视作抵御自动化的重要手段，同理心的减少就是一种严重的副作用。干扰似乎还会减少主观幸福感。如果干扰使得员工能完成的令自己满意的任务减少了，又或者干扰来自另一则令人沮丧的新闻，这种影响可能就更大。这更让人渴望一个劳动力真正吃紧的市场：当公司没有时间可以浪费时，他们可能会认真考虑减少工作场所中种种削弱生产率的干扰，而这会让每个人获益。好了，可以发一条推文了。■



Investing in collectables

The passion index

Handsome rewards await those who can afford the finest luxuries

DIAMONDS, they say, are for ever. They can be pricey, too. On December 5th 173 lots of jewels auctioned by Sotheby's raised \$54m. They included several pieces belonging to Sean Connery, known for playing James Bond. The following day a car favoured by Bond, the Aston Martin DB5, was auctioned for \$2.7m. It was among 24 classic vehicles that together fetched \$45m. The sales in New York early last month by the world's two biggest auction houses, Sotheby's and Christie's, also involved fine wines, watches and other luxuries. Between them they sold \$200m-worth.

The Economist has compiled price indices for many of these items—diamonds, classic cars, fine wine, art, watches and other curios—and grouped them in a “passion” index. The index is weighted according to the holdings of high-net-worth individuals (HNWI)—defined as people with more than \$1m of investable assets—as reported by Barclays. Our passion index has dropped by 2% a year, on average, for the past three years. But since the beginning of 2007 it has returned 5.9% on average, outperforming the total return from the MSCI world, a global stockmarket index.

Passion investing may help hedge other bets: art tends to be inversely correlated to stockmarket indices, for example. The supply of many collectables is fixed; demand for them is growing. The number of HNWIs rose from 11m to 16.5m from 2011 to 2016 and their collective wealth grew to \$63trn, according to Capgemini, a consultancy. It forecasts that HNWI wealth will surpass \$100trn by 2025, with about 10% invested in collectables.

Caution is advised. The returns from collectables may be hard to realise. First, the indices do not reflect the true cost of investing: insurance, storage and upkeep are all costly. Second, unlike shares, items in our index are neither very liquid (except wine) nor fungible (the goods are rarely interchangeable). When a quick sale is sought—often caused by debt, death or divorce—big losses can be incurred. Finally auctions, the basis for many of our indices, may inflate the market thanks to reserve pricing. Unlike last month's glamorous showing, losses are often booked quietly in private sales. And you cannot settle in bitcoin. ■



投资收藏品

爱好指数

顶级奢侈品投资者可望获得优厚回报

人们说，钻石恒久远。而钻石也很昂贵。12月5日，苏富比拍卖了173件珠宝，总额5400万美元，其中包括因扮演邦德而为人熟知的肖恩·康纳利（Sean Connery）拥有的数件珠宝。第二天，一辆邦德钟爱的阿斯顿马丁DB5以270万美元拍出。当天共拍卖了24辆老爷车，总额4500万美元。世界最大的两家拍卖行苏富比和佳士得12月初在纽约拍卖的物品还包括优等葡萄酒、手表和其他奢侈品。两家共拍出两亿美元的藏品。

《经济学人》为许多这样的藏品（钻石、老爷车、美酒、艺术品、手表和其他古董）编制了价格指数，并将之汇集成“爱好”指数。该指数根据巴克莱银行报告的高净值人士（HNWI，可投资资产超过100万美元的个人）对这些藏品的持有情况加权。过去三年，该投资爱好指数平均每年下降2%。但自2007年初以来，其平均回报率为5.9%，超过了全球股票市场指数MSCI全球指数的总体回报。

爱好投资也许有助对冲其他投资的风险。比如，艺术品价格走势往往与股票市场指数相反。许多种类的收藏品供应量固定，而需求却不断增长。咨询公司凯捷咨询（Capgemini）的数据显示，高净值人士从2011年的1100万人上升至2016年的1650万人，其总财富增至63万亿美元。凯捷咨询预测，到2025年，高净值人士的财富总值将超过100万亿美元，其中约10%将投资于收藏品。

但投资仍需谨慎。收藏品投资的回报可能难以兑现。首先，这一指数并不反映投资的真实成本：保险、仓储及保养的费用都很高昂。其次，有别于股票，该指数中物品的流动性有限（葡萄酒倒是“流动”顺畅），也不可互换（这些物品很少相互交换）。当物主因债务、离世或离婚等原因急需出售藏品时，可能要承受巨大损失。最后，我们的许多指数是根据拍卖结果

制定的，而拍卖中保留价格的设定可能抬高了市场行情。与上月亮丽的拍卖成果不同，私人市场上，卖家往往默默承受亏损。而且你还不能用比特币来结算。 ■



Miniature robotics

Bot flies

Military robots are getting smaller and more capable

ON NOVEMBER 12th a video called “Slaughterbots” was uploaded to YouTube. It is the brainchild of Stuart Russell, a professor of artificial intelligence at the University of California, Berkeley, and was paid for by the Future of Life Institute (FLI), a group of concerned scientists and technologists that includes Elon Musk, Stephen Hawking and Martin Rees, Britain’s Astronomer Royal. It is set in a near-future in which small drones fitted with face-recognition systems and shaped explosive charges can be programmed to seek out and kill known individuals or classes of individuals (those wearing a particular uniform, for example). In one scene, the drones are shown collaborating with each other to gain entrance to a building. One acts as a petard, blasting through a wall to grant access to the others.

“Slaughterbots” is fiction. The question Dr Russell poses is, “how long will it remain so?” For military laboratories around the planet are busy developing small, autonomous robots for use in warfare, both conventional and unconventional. In America, in particular, a programme called MAST (Micro Autonomous Systems and Technology), which has been run by the US Army Research Laboratory in Maryland, wrapped up last month after ten successful years. MAST co-ordinated and paid for research by a consortium of established laboratories, notably at the University of Maryland, Texas A&M University and Berkeley (the work at Berkeley is unrelated to Dr Russell’s). Its successor, the Distributed and Collaborative Intelligent Systems and Technology (DCIST) programme, which began earlier last year, is now getting into its stride.

In 2008, when MAST began, a spy drone that you could hold in the palm of your hand was an idea from science fiction. Such drones are now commonplace. Along with flying drones, MAST's researchers have been developing pocket-sized battlefield scouts that can hop or crawl ahead of soldiers. DCIST's purpose is to take these autonomous robots and make them co-operate. The result, if the project succeeds, will be swarms of devices that can take co-ordinated action to achieve a joint goal.

At the moment, America's defence department is committed to keeping such swarms under human control, so that the decision to pull a trigger will always be taken by a person rather than a machine. The Pentagon is as alarmed by the prospect of freebooting killer robots as the FLI is. But, as someone said of nuclear weapons after the first one was detonated, the only secret worth keeping is now out: the damn things work. If swarms of small robots can be made to collaborate autonomously, someone, somewhere will do it.

Existing small drones are usually polycopters—helicopters that have a set of rotors (generally four or six) arranged at the vertices of a regular polygon, rather than a single one above their centre of gravity. Some MAST researchers, however, think they have alighted on something better.

Their proposed replacement is the cyclocopter. This resembles an airborne paddle steamer. Though the idea of cyclocopters has been around for a while, the strong, lightweight materials needed to make them have hitherto been unavailable and the computing tools needed to design them have only recently been created. Now that those materials and tools do exist, things are advancing rapidly. Over the course of the MAST project the researchers have shrunk cyclocopters from being behemoths weighing half a kilogram to svelte devices that tip the scales at less than 30 grams. Such machines can outperform polycopters.

Cyclocopter aerodynamics is more like that of insects than of conventional aircraft, in that lift is generated by stirring the air into vortices rather than relying on its flow over aerofoils. For small cyclocopters this helps. Vortex effects become proportionately more powerful as an aircraft shrinks, but, in the case of conventional craft, including polycopters, that makes things worse, by decreasing stability. Cyclocopters get better as they get smaller.

They are also quieter. As Moble Benedict of Texas A&M, one of the leaders of the cyclocopter project, observes, “aerodynamic noise is a strong function of the blade-tip speed”—hence the whup-whup-whup of helicopters. The blade-tip speeds of cyclocopters are much lower. That makes them ideal for spying. They also have better manoeuvrability, and are less disturbed by gusts of wind.

Dr Benedict reckons cyclocopters are about two years away from commercial production. Once that happens they could displace polycopters in many roles, not just military ones. But they are not the only novel technology in which MAST has been involved. The programme has also worked on robots that hop.

One of the most advanced is Salto, developed by the Biomimetic Millisystems Laboratory at the University of California, Berkeley. Salto (pictured) is a monopod weighing 98 grams that has a rotating tail and side-thrusters. These let it stabilise itself and reorient in mid-leap. That gives it the agility to bounce over uneven surfaces and also to climb staircases.

Salto’s speed (almost two metres a second) puts huge demands on its single leg. Ron Fearing, one of the electrical engineers developing it, puts things thus: “imagine a cheetah running at top speed using only one leg, and then cut the amount of time that leg spends on the ground in half.” As with cyclocopters, the materials and processing power needed to do this have

only recently come into existence.

Dr Fearing says Salto and its kin are quieter than aerial drones and can operate in confined spaces where flying robots would be disturbed by turbulence reflected from the walls. They can also travel over terrain, such as collapsed buildings, that is off-limits to wheeled vehicles. Salto still needs work. In particular, it needs to be able to cling more effectively to what it lands on. Dr Fearing uses the analogy of a squirrel leaping from branch to branch. Arriving at the next branch is only half the battle. The other half is staying there. Once that is solved, though, which it should be in the next year or two, small non-flying robots that can go where their wheeled, or even track-laying, brethren cannot should become available for practical use.

Bouncing over the rubble of a collapsed building is not the only way to explore it. Another is to weave through the spaces between the debris. Researchers at the Biomimetic Millisystems lab are working on that, too. Their solution resembles a cockroach. Its body is broad and flat, which gives it stability but also permits it to crawl through narrow spaces—if necessary by going up on one side. Should it tip over whilst attempting this, it has wing-like extensions it can use to flip itself upright again.

Getting into a building, whether collapsed or intact, is one thing. Navigating around it without human assistance is quite another. For this purpose MAST has been feeding its results to the Defence Advanced Research Projects Agency (DARPA), America's main federal military-research organisation. According to Brett Piekarski, who led MAST and is now in charge of DCIST, the Fast Lightweight Autonomy (FLA) programme at DARPA will continue MAST's work with the aim of developing small drones that can “ingress and egress into buildings and navigate within those buildings at high speeds”. Some of that has already been done. In June DARPA reported that polycopters souped up by the FLA programme were able to slalom through

woodlands, swerve around obstacles in a hangar and report back to their starting-point, all by themselves.

The next challenge—the one that people like Dr Russell particularly worry about—is getting the robots to swarm and co-ordinate their behaviour effectively. Under the aegis of MAST, a group from the General Robotics, Automation, Sensing & Perception (GRASP) laboratory at the University of Pennsylvania did indeed manage to make drones fly together in co-ordinated formations without hitting each other. They look good when doing so—but, to some extent, what is seen is an illusion. The drones are not, as members of a swarm of bees or a flock of birds would be, relying on sensory information they have gathered themselves. Instead, GRASP's drone swarms employ ground-based sensors to track individual drones around, and a central controller to stop them colliding.

That is starting to change. A farewell demonstration by MAST, in August, showed three robots (two on the ground and one in the air) keeping station with each other using only hardware that was on board the robots themselves. This opens the way for larger flocks of robots to co-ordinate without outside intervention.

Moreover, as that demonstration showed, when drones and other robots can routinely flock together in this way, they will not necessarily be birds of a feather. “Heterogeneous group control” is a new discipline that aims to tackle the thorny problem of managing units that consist of various robots—some as small as a postage stamp, others as large as a jeep—as well as human team members. Swarms will also need to be able to break up into sub-units to search a building and then recombine once they have done so, all in a hostile environment.

Such things are the goals of DCIST. The first tranche of grants to these ends, some \$27m of them, has already been awarded to the University of

Pennsylvania, the Massachusetts Institute of Technology, the Georgia Institute of Technology and the University of California, Berkeley. When DCIST itself wraps up, probably in 2022, the idea of Slaughterbots may seem a lot less fictional than it does now. ■



微型机器人技术

机器苍蝇

军用机器人个头越来越小，功能越来越强

去年11月12日，一段名为《杀戮无人机》（Slaughterbots）的视频上传到了YouTube上。这是加州大学伯克利分校人工智能教授斯图尔特·罗素（Stuart Russell）的创意，由未来生命研究院（Future of Life Institute, FLI）出资。该研究院由一群关心机器人技术发展的科学家和技术专家组成，包括伊隆·马斯克、斯蒂芬·霍金和英国天文学家马丁·里斯（Martin Rees）。视频内容设定在不久的将来，小型无人机配备了面部识别系统和聚能炸药，经过编程后可以找出并杀死指定的人或一类人（例如身穿某种制服的人）。在其中一个场景中，无人机彼此合作，攻进一座建筑，其中一架充当爆破装置，炸开一堵墙让其他无人机进入。

《杀戮无人机》的情节是虚构的。罗素通过这段视频提出的问题是，“这种虚构多久会变成现实？”全球各地的军事实验室都在忙着开发用于常规和非常规战争的小型自主机器人，特别是在美国。由位于马里兰州的美国陆军研究实验室（US Army Research Laboratory）领导的微型自主系统和技术项目（MAST）已成功开展了十年，于上月结束。MAST协调并资助多个知名实验室共同开展研究，尤其是马里兰大学、德州农工大学和加州大学伯克利分校的实验室（该项目在伯克利的研究与罗素的视频无关）。作为MAST的后续，分布式和协作式智能系统与技术（DCIST）项目在去年早些时候启动，正逐步走上正轨。

在2008年MAST项目开始的时候，可以握在手中的间谍无人机还只是科幻小说里的想象，如今却已司空见惯。除了无人机，MAST的研究人员还一直在开发能放进口袋的战场侦察机器人，可以在士兵前方跳跃或爬行前进。DCIST的目的是让这些自主机器人协同工作。项目如果成功，未来就将出现可以协调行动、实现共同目标的机器人队伍。

目前，美国的国防部门想办法保持人对机器人队伍的控制，始终让人而非机器来决定是否扣动扳机。五角大楼和FLI一样，为未来可能会出现无法无天的杀手机器人而不安。但就像第一枚核武器引爆后有人说的那样，一个唯一值得保守的秘密已经公之于众：这该死的东西真的管用。如果可以实现小型机器人的群体自主协作，那么总会有某个人在某个地方去做这件事。

现有的小型无人机通常是多旋翼式——在一个正多边形的每个角的上方设置一个旋翼（一般四到六个），而不是在机身重心的上方设置一个单旋翼。不过，一些MAST的研究人员认为他们发现了一个更好的设计。

他们提出的替代设计是滚翼式飞行器，就像一个会飞的明轮船。虽然这一设计创意已存在了一段时间，但制造这种飞行器所需的坚固而轻质的材料一直不可得，用来设计它们的计算工具也直到最近才开发出来。如今材料和工具都已齐备，研发工作进展迅速。在MAST项目进行期间，研究人员将原本重达半公斤的“庞然大物”瘦身成了体态轻盈、30克不到的微型设备。这样的机器可以完胜多旋翼无人机。

从空气动力学角度来看，滚翼式飞行器的飞行原理更接近昆虫而不是传统飞行器，因为它是将空气搅入涡旋来获得升力，而不是依靠让空气在翼面上流动。这对小型滚翼式飞行器来说是个优势。涡旋效应随着飞行器尺寸的减小而相应增强，但这会降低稳定性，因而对包括多旋翼飞机在内的常规飞行器不利。滚翼式无人机则是尺寸越小，性能越好。

它们的噪音也更小。德州农工大学滚翼式飞行器项目的负责人之一莫布·本尼迪克特（Moble Benedict）解释说，“气动噪声随翼尖转速加快而增强”，因此直升机会发出“嗡嗡”的巨大声响。滚翼式飞行器的翼尖转速要低得多，这令它成为执行侦察任务的理想设备。它的机动性也更强，受阵风的干扰更小。

本尼迪克特估计，滚翼式飞行器要实现商业生产大约还要两年时间。到那时，它可能会在军事等多种任务中取代多旋翼飞行器。但MAST项目开发

的新技术并不止这种飞行器，还有跳跃机器人。

萨尔托（Salto）是最先进的跳跃机器人之一，由加州大学伯克利分校的仿生微系统实验室（Biomimetic Millisystems Laboratory）开发。萨尔托（如图）是一台重98克的单足机器人，装有一个旋转尾翼和侧推器，让它在跳跃过程中保持稳定并调整方向。这样的设计能让它在不平坦的表面灵活地弹跳，还能爬楼梯。

萨尔托的跳跃速度为每秒近两米，这对它的这条单腿提出了极高的要求。开发它的电气工程师之一罗恩·菲林（Ron Fearing）说：“想象有一只全速奔跑的猎豹——不过它只有一条腿，然后再把它的腿接触地面的时间缩短一半。”与滚翼式飞行器一样，单腿机器人所需的材料和处理能力也是最近才问世。

菲林说，萨尔托和类似的机器人比无人机更安静，可以在狭小空间内工作，而无人机在其中会受到墙壁反射的紊流的干扰。萨尔托这样的机器人还可以在轮式设备无法进入的地形上行走，比如倒塌的建筑物。萨尔托仍需改进，尤其要提升落地时的抓力。菲林用一只在树枝间跳跃的松鼠打比方。跳到另一根树枝上只是完成了任务的一半，还有一半是在那里停留。一旦解决了这个问题（应该在一两年内就可以），在轮式机器人甚或履带式机器人无法进入的环境中也能行动自如的小型非飞行机器人应该就可以投入使用了。

在建筑物废墟上弹跳前进并不是探查这类环境的唯一方式，还有一种方法是在废墟的空间里穿行。仿生微系统实验室的研究人员也在从事这方面的研究。他们的解决方案是一款类似蟑螂的机器人，它机体扁平，稳定性强，必要时还可以用其身体的一侧行进，从而爬过狭窄的空间。如果在尝试侧身行进时翻了个四脚朝天，它可以使用翼状延伸部分翻转回来。

无论建筑物倒塌与否，进去是一回事，在没有人力协助的情况下在里头探索则完全是另一回事。为此，MAST一直在向美国主要的联邦军事研究机构国防先进研究计划局（DARPA）提供研究成果。曾领导MAST、现在负

负责DCIST项目的布雷特·皮埃卡斯基（Brett Piekarski）说，DARPA的快速轻量自主机器人（FLA）项目将继续MAST的研究，以开发可以“进出建筑物并在其中高速行进的小型无人机”。其中部分研究已取得成果。去年6月，DARPA报告称，FLA项目改进的多旋翼无人机无需人力协助就能穿越林地、在机库里绕过障碍物，并飞回起点。

下一个挑战是让机器人集体行动并有效地协调运作，罗素等人特别担心的正是这种场景。在MAST的支持下，宾夕法尼亚大学的“通用机器人、自动化、传感和感知实验室”（GRASP）的一个课题组成功实现了无人机协调列阵飞行而不会互相撞击。这种列阵飞行看起来不错，但在某种程度上只是一种假象。这些无人机并非像蜂群或鸟群的一员那样依靠自己搜集的感官信息，而是采用地面传感器跟踪周围每个无人机的位置，靠中央控制器来防止相互碰撞。

这种情况已开始改变。8月，MAST做了一次收官演示，展示了三台机器人（两台地面机器人和一台飞行器），它们只利用自身配备的硬件来相互定位。这为更大规模的机器人集群在没有外部干预的情况下展开协作开辟了道路。

而且，正如上述演示所示，等到无人机和其他机器人进行的这种集群作业成为常规，它们将未必会是同一类设备。“异构群控”这门新兴学科就是要攻克一个棘手的问题：如何管理由人类或各类机器人构成的队伍，毕竟这之中的机器人有的小如邮票，有的大如吉普车。这些队伍还要能够在恶劣环境中分组搜索建筑物，之后再重新组队。

这样的情形便是DCIST的研究目标。第一期约2700万美元的研究经费已经拨给了宾夕法尼亚大学、麻省理工学院、佐治亚理工学院和加州大学伯克利分校。DCIST项目可能在2022年结束，届时《杀戮机器人》里的情节可能就不那么像虚构的了。 ■



Economics

Capital in the 21st century

Businesses' investment decisions can have huge, unexpected consequences

RICH economies are full of puzzles. What has caused them to become so unequal? Why is their rate of business investment so low? When will real wages start growing strongly again? In “Capitalism without Capital” Jonathan Haskel of Imperial College London and Stian Westlake of Nesta, a think-tank, offer an intriguing explanation for all these problems. In the process, they introduce a phrase that readers may hear a great deal more of in the coming years: “intangible investment”.

When people think about business investment, they tend to think of spending on real things, like factories, computers and machines. Yet Messrs Haskel and Westlake point out that such investment matters less and less to modern economies. Instead, they argue, investment in intangible assets—things you cannot drop on your foot—is more important. Intangible investment can include design, research, software and branding. It is a fundamentally different sort of investment, and one that has serious consequences.

The book makes its case in a lighthearted, conversational way that will appeal to economists and non-economists alike. The authors keep jargon to a minimum. Their writing has few numbers, let alone equations. Multiple case-studies bring the arguments to life. Nonetheless, this is no beach read. The authors draw on a range of rigorous research and include their own calculations to show that intangible investment is on the increase. One study suggests that in 1948, American intangible investment accounted for about 4% of non-farm business-sector output. By 2007 this had grown to 14%. Tangible investment hovered around the 11% mark over the period.

Another estimate found that Microsoft's physical assets accounted for just 1% of its market value. The expertise of Microsoft's engineers and the code they used were far more important.

However, the significance of intangible assets is often poorly reflected by statisticians. Official economic data do include some intangible activity, such as spending on software, in measures of investment spending, but often exclude many others, such as branding. American company accounts often omit R&D from measures of their investment spending. But including intangible assets can have a big impact.

It is often said, for instance, that British businesses invest little compared with those in other countries. Yet Britain is an intangible-rich economy, full of scientific firms and design studios. Once intangibles are included, Britain looks less of a laggard. (Data still suggest that across the rich world overall investment has fallen since the financial crisis of 2008-09.)

Messrs Haskel and Westlake do not simply recommend improvements in statistics, but also explain the significance of intangibles. They argue that intangible investment has a number of special properties, which will make themselves felt as this sort of investment becomes more important. While the authors may overstate the novelty of some of their ideas, they combine them in a new way.

For one, intangible investment is "scalable". Businesses which use intangible assets can grow more rapidly, and to greater sizes, than those using tangible ones. A family-run taxi firm that owns a fleet of cars cannot easily grow; doing that requires them to expand their fleet, at great cost. By contrast Uber, a car-hailing app, which owns few of the cars that use its platform, can export its code across the world.

Intangible investment also exhibits large spillover effects, argue Messrs

Haskel and Westlake. A business investing in a factory, a form of tangible investment, can easily prevent its competitors from taking advantage of that investment (say, by putting a guard at the gate). Excluding rivals from profiting from your intangible investments is harder. Software developers use online repositories such as GitHub to share code. Steve Jobs, a former boss of Apple, was known to grouse that Google's Android operating system was hardly different from Apple's iOS.

The scalability and spillovers associated with intangible investment may help explain some of the big puzzles of advanced economies. In recent years, the gaps between the most successful firms and the weakest among them ("frontier firms" and "laggards", in the jargon) have widened in everything from wages to profits. Whereas 1% of British firms have seen annual productivity growth of 6% in recent years, a third have seen none at all since 2000.

Why is this? Frontier firms increasingly rely on intangible investment, so they easily spread their ideas across the world, reaping big rewards. But laggard firms, perhaps largely relying on tangible investment, cannot. Most of the rise in income inequality in rich countries, the authors point out, can be attributed to growing inequality between firms, rather than within them.

The rise of intangible investment may also explain why, since the financial crisis, there have been high rates of profitability and relatively low rates of business investment. If returns on investment are so high, then why is investment so weak? With the idea of spillovers in your head, it becomes easier to understand. Laggards may have little incentive to invest, since they are worried that frontier firms will gobble up their innovations. That can bring down the overall rate of investment and thus productivity (and wage) growth. The frontier firms, however, are happy to invest. They make high returns in part because they have the expertise to make the most from such investment and in part because they are less concerned about smaller

firms stealing their ideas (the local taxi firm cannot hope to copy Uber's algorithms).

At times, the reader may feel that the book oversells its case. The authors seem to believe that intangibles can explain pretty much anything, from high levels of executive pay to the election of President Donald Trump. It could also have been better edited: it offers twice in the space of three pages, for instance, Peter Thiel's observation that it is easier for Twitter to scale up than it is for a yoga studio.

Yet the book also has a deeply practical streak. It offers policymakers advice on how to help the intangible economy thrive. If not enough intangible investment is provided by the market, governments could step in. They should ensure that digital infrastructure—broadband and the like—is top-notch. Governments need to encourage people to live in cities; sensible planning regulation is thus vital. Policies such as these are all well and good, but after putting down the book the reader is left with another sobering thought. The economy is becoming winner-take-all, and will become ever more so. ■



经济学

21世纪的资本

企业的投资决策可能带来始料未及的巨大影响

富裕经济体充满了难解之谜。是什么导致它们如此不平等？为什么企业投资率如此之低？实际工资何时会再次强劲增长？伦敦帝国理工学院的乔纳森·哈斯克尔（Jonathan Haskel）以及智库Nesta的什蒂安·韦斯特莱克（Stian Westlake）在《没有资本的资本主义》（Capitalism without Capital）一书中，为所有这些问题提供了一个有趣的解释。同时，他们还引入一个读者在未来几年可能会不断听到的名词：无形投资。

提起企业投资，人们往往会展想到投资于工厂、计算机和机器这样的实物。然而哈斯克尔和韦斯特莱克指出，实物投资对现代经济体的重要性越来越弱，相反，投资于那些“不能砸到你脚上的”无形资产更加重要。设计、研究、软件以及品牌管理等都可算作无形投资。这是一种完全不同类型的投資，而且会产生重大的影响。

本书以一种轻松、闲谈的笔调阐述观点，不论是经济学家还是非经济界人士都会为之吸引。作者尽量避免使用术语，字里行间也鲜有数字，更别说公式了。多样的案例研究也让论据生动有趣。尽管如此，这可不是一本休闲读物。作者引用一系列缜密的研究，再加入自己的计算结果，证明无形投资呈增长态势。一项研究显示，1948年美国无形投资约占非农产业产值的4%，2007年这一比例增长到14%。而同期的有形投资占比则在11%左右徘徊。另一项估算发现，微软的实物资产只占它市值的1%，微软工程师的专业知识以及他们使用的代码要重要得多。

然而，统计人员的工作往往未能充分显示出无形资产的重要性。官方经济数据的确将软件开支等一些无形投资计入投资支出，但却经常将品牌管理之类的其他许多投资排除在外。美国公司账目的投资支出里就经常不包括研发。但是，将无形资产计算在内可能会产生重大影响。

比如，我们常听说，与其他国家的企业相比，英国公司很少投资。但英国有着丰富的无形资产，科技公司和设计工作室比比皆是。一旦将无形资产算进去，英国看上去就没那么落后了。（虽然仍有数据显示自2008到2009年的金融危机爆发以来，发达国家的总体投资在下降。）

哈斯克尔和韦斯特莱克不仅建议改进统计方法，还解释了无形投资的重要性。他们认为无形投资具有一些特质，随着这类投资变得愈发重要，这些特质就会显现出来。虽然作者可能夸大了自己某些观点的新颖性，不过他们融合这些观点的方式独出心裁。

举个例子，作者提出，无形投资是“可扩展的”。那些利用无形资产的企业比利用有形资产的企业发展得更快、能达到更大的规模。拥有众多车辆的家族出租车公司不容易扩张，它们要壮大就要花大价钱扩充车队。而没多少自有车辆的网约车应用优步却可以在全世界输出自己的代码。

两位作者指出，无形投资还表现出巨大的溢出效应。如果一家企业投资的是一座工厂，即有形投资，那么很容易就能防止竞争者偷师（比如在厂门口设一名保卫）。而不让对手利用你的无形投资就没那么容易了。软件开发者会使用GitHub等在线资源库分享代码。据说苹果的前老板乔布斯就抱怨谷歌的安卓操作系统和苹果的iOS系统几乎如出一辙。

无形投资的可扩展和溢出性或许有助解释发达经济体中的一些重大谜题。近年来，这些经济体中最成功与最差劲的公司（业内说法是“前沿公司”和“落伍企业”）之间从工资到利润等各方面的差距都在拉大。近年来，英国1%的公司实现了6%的年生产率增长，而三分之一的公司从2000年起毫无增长。

这是为什么呢？前沿公司越来越依托于无形投资，因此能轻易将自己的创意在全世界推行，收获丰厚的回报。但那些可能在很大程度上依赖有形投资的落伍企业就做不到这一点。作者指出，富裕国家收入不平等的状况加剧，大部分要归因于公司之间而非公司内部日益增长的差距。

无形投资的增长还可能解释为何自金融危机以来，高利润率和相对较低的

企业投资率并存。既然回报率如此之高，为什么投资却如此疲软？如果你了解“溢出”这个概念，问题就容易理解了。落伍企业担心自己的创新会被前沿公司攫取，因此可能没什么投资的动力。这会拉低整体投资率，进而拖累生产率（以及工资）的增长。但是前沿公司却乐于投资。它们之所以获得高回报，一方面是因为它们掌握从这类投资中充分获利的专业知识，另一方面是因为它们不那么担心小公司会窃取自己的创意，比如本地出租车公司就无法复制优步的算法。

读者可能偶尔会感觉本书有些夸大其词。作者似乎相信无形投资几乎可以解释从高管的高薪到特朗普当选总统的任何事情。本书在编校方面也欠佳：彼得·泰尔（Peter Thiel）关于推特比瑜伽馆更容易扩大规模的言论在三页的篇幅里出现了两次。

不过本书还是具有很强的实用性。它向政策制定者提供如何帮助无形经济繁荣的建议。如果市场不能提供足够的无形投资，政府便可以介入。政府应确保宽带之类的数字基础设施达到一流水平。政府需要鼓励人们在城市生活，合理的规划调控因而至关重要。这些政策当然很好，但读罢此书，读者会发现另一个发人深省的问题。经济正朝着“赢家通吃”的方向发展，并且会愈演愈烈。 ■



Neurotechnology

The next frontier

Brain-computer interfaces may change what it means to be human

TECHNOLOGIES are often billed as transformative. For William Kochevar, the term is justified. Mr Kochevar is paralysed below the shoulders after a cycling accident, yet has managed to feed himself by his own hand. This remarkable feat is partly thanks to electrodes, implanted in his right arm, which stimulate muscles. But the real magic lies higher up. Mr Kochevar can control his arm using the power of thought. His intention to move is reflected in neural activity in his motor cortex; these signals are detected by implants in his brain and processed into commands to activate the electrodes in his arms.

An ability to decode thought in this way may sound like science fiction. But brain-computer interfaces (BCIs) like the BrainGate system used by Mr Kochevar provide evidence that mind-control can work. Researchers are able to tell what words and images people have heard and seen from neural activity alone. Information can also be encoded and used to stimulate the brain. Over 300,000 people have cochlear implants, which help them to hear by converting sound into electrical signals and sending them into the brain. Scientists have “injected” data into monkeys’ heads, instructing them to perform actions via electrical pulses.

The pace of research into BCIs and the scale of its ambition are increasing. Both America’s armed forces and Silicon Valley are starting to focus on the brain. Facebook dreams of thought-to-text typing. Kernel, a startup, has \$100m to spend on neurotechnology. Elon Musk has formed a firm called Neuralink; he thinks that, if humanity is to survive the advent of artificial intelligence, it needs an upgrade. Entrepreneurs envisage a world in which

people can communicate telepathically, with each other and with machines, or acquire superhuman abilities, such as hearing at very high frequencies.

These powers, if they ever materialise, are decades away. But well before then, BCIs could open the door to remarkable new applications. Imagine stimulating the visual cortex to help the blind, forging new neural connections in stroke victims or monitoring the brain for signs of depression. By turning the firing of neurons into a resource to be harnessed, BCIs may change the idea of what it means to be human.

Sceptics scoff. Taking medical BCIs out of the lab into clinical practice has proved very difficult. The BrainGate system used by Mr Kochevar was developed more than ten years ago, but only a handful of people have tried it out. Turning implants into consumer products is even harder to imagine. The path to the mainstream is blocked by three formidable barriers—technological, scientific and commercial.

Start with technology. Non-invasive techniques like an electroencephalogram (EEG) struggle to pick up high-resolution brain signals through intervening layers of skin, bone and membrane. Some advances are being made—on EEG caps that can be used to play virtual-reality games or control industrial robots using thought alone. But for the time being at least, the most ambitious applications require implants that can interact directly with neurons. And existing devices have lots of drawbacks. They involve wires that pass through the skull; they provoke immune responses; they communicate with only a few hundred of the 85bn neurons in the human brain. But that could soon change. Helped by advances in miniaturisation and increased computing power, efforts are under way to make safe, wireless implants that can communicate with hundreds of thousands of neurons. Some of these interpret the brain's electrical signals; others experiment with light, magnetism and ultrasound.

Clear the technological barrier, and another one looms. The brain is still a foreign country. Scientists know little about how exactly it works, especially when it comes to complex functions like memory formation. Research is more advanced in animals, but experiments on humans are hard. Yet, even today, some parts of the brain, like the motor cortex, are better understood. Nor is complete knowledge always needed. Machine learning can recognise patterns of neural activity; the brain itself gets the hang of controlling BCIS with extraordinary ease. And neurotechnology will reveal more of the brain's secrets.

The third obstacle comprises the practical barriers to commercialisation. It takes time, money and expertise to get medical devices approved. And consumer applications will take off only if they perform a function people find useful. Some of the applications for brain-computer interfaces are unnecessary—a good voice-assistant is a simpler way to type without fingers than a brain implant, for example. The idea of consumers clamouring for craniotomies also seems far-fetched. Yet brain implants are already an established treatment for some conditions. Around 150,000 people receive deep-brain stimulation via electrodes to help them control Parkinson's disease. Elective surgery can become routine, as laser-eye procedures show.

All of which suggests that a route to the future imagined by the neurotech pioneers is arduous but achievable. When human ingenuity is applied to a problem, however hard, it is unwise to bet against it. Within a few years, improved technologies may be opening up new channels of communications with the brain. Many of the first applications hold out unambiguous promise—of movement and senses restored. But as uses move to the augmentation of abilities, whether for military purposes or among consumers, a host of concerns will arise. Privacy is an obvious one: the refuge of an inner voice may disappear. Security is another: if a brain can be reached on the internet, it can also be hacked. Inequality is a third:

access to superhuman cognitive abilities could be beyond all except a self-perpetuating elite. Ethicists are already starting to grapple with questions of identity and agency that arise when a machine is in the neural loop.

These questions are not urgent. But the bigger story is that neither are they the realm of pure fantasy. Technology changes the way people live. Beneath the skull lies the next frontier. ■



神经技术

下一个前沿

脑机接口可能会改变对人的定义

人们常用“具变革性”来宣传某种技术。对威廉·科切瓦尔（William Kochevar）来说，这个词并无夸张。一次自行车事故后，科切瓦尔自肩部以下瘫痪，但还是能自己用手吃饭。这个非凡的成就部分要归功于植入他右臂用来刺激肌肉的电极，但真正施展魔力的还在更高的部位：科切瓦尔可以用意念控制手臂。他移动手臂的意图反映在他大脑运动皮层的神经活动中，而他大脑中的植入物会探测到这些信号并将之转化成指令，激活他手臂里的电极。

用这种方式解码思想听起来可能像科幻小说。但是像科切瓦尔使用的“脑门”（BrainGate）系统之类的脑机接口证明思维控制的确可以实现。研究人员仅凭人们的神经活动就能知道他们听到了哪些词语、看到了哪些图像。信息还可以经编码用于刺激大脑。超过30万人已经植入了人工耳蜗，这种装置把声音转换成电信号，再将信号传入大脑，帮助人们听到声音。科学家还曾将数据“注射”到猴子的大脑里，通过电脉冲命令它们做出动作。

脑机接口的研究进程正在加快，并且越来越雄心勃勃。美国军方和硅谷都开始关注大脑。Facebook希望能实现“思想转文字”，让大脑直接输出文字。创业公司Kernel获得了一亿美元的融资，用于研发神经技术。伊隆·马斯克成立了一家名为Neuralink的公司，他认为人工智能出现后，人类如果还想生存下去，就需要升级。在企业家们设想的世界中，人们可以通过心灵感应与他人或机器交流，或是获得超人般的能力，比如能听到非常高频的声音。

这些能力即便真能实现，也要到几十年后。但在那之前，脑机接口或许会打开通往非凡新应用的大门。想象一下，人类或许可以通过刺激视觉皮层

来帮助盲人视物，为中风患者建立新的神经连接，或是监控大脑是否有抑郁症的迹象。脑机接口将神经元放电转化为一种可利用的资源，在此过程中或许会改变对人的定义。

持怀疑态度的人对此嗤之以鼻。事实证明，把医用脑机接口从实验室带到临床实践中就非常困难。科切瓦尔使用的“脑门”系统是十几年前开发的，但试用过的人屈指可数。将植入物变为消费品更加难以想象。脑机接口要成为主流面临三大难以逾越的障碍：技术、科学和商业。

先说技术。像脑电图（EEG）这样的非侵入性技术很难透过层层皮肤、骨骼和脑膜来提取高分辨率的大脑信号。这项技术有所改进，体现在用来玩虚拟现实游戏和仅靠思想控制工业机器人的脑电图帽上。但至少在目前，那些最具雄心的应用仍需要能与大脑神经元直接交互的植入物。现有的设备也有很多缺点，例如都有穿过头骨的电线，还会引起免疫反应，且只能与人类大脑850亿个神经元中的几百个交流。但这种情况可能很快会改变。随着微型化技术的进步以及计算能力的提高，研究人员正在努力制造安全、无线且能与几十万个神经元交流的植入物。它们当中有些解读大脑的电信号，另一些则尝试利用光、磁和超声波信号。

攻破了技术壁垒，还要面对另一个障碍。大脑仍然是个非常陌生的领域。科学家们对于它的确切工作原理知之甚少，如果涉及记忆形成这样的复杂功能就更是如此。在动物身上的研究进展更快，但在人体上试验却很困难。不过即便是目前，我们还是加深了对大脑某些部分的了解，如运动皮质。而且这方面的知识并不总要面面俱到。机器学习可以识别神经活动的模式；大脑自己也能游刃有余地控制脑机接口。神经技术还将揭示更多大脑的秘密。

第三个障碍是难以实现商业化。医疗设备获批需要时间、资金和专业知识。而消费应用只有具备对人们有用的功能时才能大行其道。有些脑机接口的应用并无必要，比如，要想不动手指就能打字，使用好的语音助手比使用大脑植入物更便捷。认为消费者会哭着喊着要做开颅手术的想法似乎也很离谱。但是在某些情况下，大脑植入物已经是一种成熟的治疗手段。

大约有15万人通过电极接受深脑刺激，帮助自己控制帕金森氏症。激光眼科手术也已证明选择性手术可以成为常规手术。

所有这些都表明，要抵达神经技术先锋们设想的未来，道路虽艰辛，但仍可实现。无论一个问题有多难，一旦人类发挥创造力，赌它无法被攻克就是不明智的。随着技术进步，也许在几年内人们就会开启与大脑沟通的新渠道。很多最先投入应用的脑机接口都是为了实现非常明确的效果：恢复运动和感知能力。但随着应用转向增强人体能力——无论是用于军事目的还是消费活动，就会产生种种担忧。隐私是一个突出的问题：内心声音的庇护所可能会消失。另一个问题是安全：如果能够通过互联网连接上大脑，那么它也可能被黑客攻击。还有第三个问题：不平等。除了自我永续的精英，也许再无人能承担得起获得超人般的认知能力。伦理学家已经开始为机器被引入神经回路所引发的身份认同和主体性问题挠头。

这些问题并不紧迫。但更重要的一点是，它们都不属于纯粹幻想。科技改变人类的生存方式。头骨之下是下一个前沿。 ■



Lifts

Higher still and higher

Lifts have shaped modern cities; with new technology they could refashion them again

THE Finnish lift's walls are bathed by a blue luminescence; music that is not quite jazz gently tootles within. The effect is comforting. But other things are odd. The lift's dozen or so buttons seem numbered at random and, one would think, unfeasibly: 45, 105, 215, 270. At level 350 the doors hiss open on a dark and dirty cavern, silent save for the sound of dripping water.

Germany's highest meeting room, 1,000km (600 miles) to the south-west of that strange Finnish lift, has its oddities, too. It looks out not at a central business district, but on the bucolic edge of the Black Forest. It sits atop a skyscraper which contains no offices but 12 lift shafts. In the lift by which you reach the penthouse an indicator tells you not just what floor you are headed for, but how fast you are getting there.

Thyssenkrupp, a German engineering conglomerate, and Kone, a Finnish liftmaker, are two of the world's big four lift-engineering companies. As such, they need places to test new designs, new patterns of operation and new technologies. Kone does this in a mineshaft in Tytyri, about 50km west of Helsinki; if you take that glowing blue lift down to the dank cavern at level 350—so called because it is 350 metres (1,150 feet) below the top of an adjacent shaft—and go through a steel door you will find yourself in the working mine which that other shaft serves.

Thyssenkrupp's facility is more flashy; a slim, 246-metre-high concrete finger clad in an elegant barley-sugar twist of fabric. Inaugurated in October, it towers above the medieval town of Rottweil, hitherto best known for its beefy guard dogs. The town welcomed it with a two-day celebration; the

view from the top—on a clear day you can see to the Alps—is expected to bring in an additional 50,000 tourists a year.

The technology being improved in these out-of-the-way places is essential to modern city life. Around 1bn people take one of the world's 14m lifts every day; they take twice as many lift journeys in a day as people take flights in a year. Cities struggle on through bus and rail strikes; life without lifts, at least in central business districts, would more or less grind to a halt.

The lift is to the vertical what the car is to the horizontal: the defining means of transport. Like cars, modern lifts are creatures of the second industrial revolution of the late 19th century. Like cars, they have transformed the way that cities look, changing how and where people live and work. And today, like the cars that are lidar-sensing their way towards an autonomous future, lifts stand ready to change the city again.

Hoisting equipment of one sort or another has been in use for millennia. The Colosseum in Rome had 24 lifts powered by slaves. For centuries arrangements of pulleys and ropes were used in mines, factories and even occasionally to move people in palaces and private homes. Erhard Weigel, a 17th-century German mathematician, used a system of pulleys to transport himself around his seven-storey home in Jena. Louis XV installed a counterweight lift to his private chambers in Versailles in 1743.

The modern lift was introduced to the public at New York's Exhibition of the Industry of All Nations in May 1854 by Elisha Otis, whose name still adorns more elevators than any other. His patented innovation added to the basic box, rope and counterweight a spring-loaded ratchet which would stop the lift falling if the main cable snapped. In front of a large audience he ascended to a height of 15 metres before an assistant with an axe severed the cable. "All safe, gentlemen. All safe" he is said to have proclaimed after the safety catch tripped. He installed his first passenger lift in E.V. Haughwout

and Company, a porcelain shop, three years later.

It was not a success. Customers would not ride in the fearful new device, and Haughwout got rid of it in 1860. Otis's eventual triumph had to wait for two other innovations: steel-frame construction, which allowed buildings to be taller, and electric motors, which allowed lifts to be faster.

Before the 1880s buildings had to support the load imposed by their upper floors with the walls of their lower ones. The taller the building, the thicker the lowest walls—and thus the less ground-floor space there was to rent. More than a dozen storeys was impractical.

Even at 12 storeys a lift comes in handy, and big new buildings in America started to boast them (in 1870 New York's Equitable Life building became the first office to do so). But for the most part they used hydraulic lifts which pushed passengers up from below. These required a piston sunk down into the ground to a depth matching the height of the liftshaft—inconvenient, but not impossible for something under 20 storeys. And they were a lot faster than Otis's steam-driven counterweight lifts.

The electric motor changed that. Otis's original steam-powered lift climbed at 0.2 meters per second (m/s). The electrified lifts in the first steel-framed building to top 50 floors, the 241-metre Woolworth Building, which opened in 1913, were more than ten times faster. Two decades later those in the 381-metre Empire State Building travelled at 6m/s, as fast as many modern lifts.

By this stage, America's cities looked like nothing the world had ever seen before. Before the lift, buildings of more than six storeys were rare; roofscapes were low and even, broken occasionally by the bulk of citadels and places of worship. There are few such cityscapes left today. Paris has mostly succeeded in keeping its roofline even (despite a towering icon that

depends on cunningly non-vertical lift technology). Kone's 16th-floor boardroom, ironically, overlooks a Helsinki kept defiantly low-rise by strict planning laws. But most cities reach for the sky, sometimes dramatically—Dubai—sometimes in a higgle-piggle—São Paulo.

In extending the human world upwards, the lift overturned previous notions of prestige. Before the 20th century people prized proximity to the pavement. The first floor, above the hubbub of the street but conveniently accessed by a single flight of stairs, was the floor most sought after—the *piano nobile* or *bel étage*. Anything above the second floor was typically reserved for servants. In hotels and tenements, standards and prices fell with altitude. As Andreas Bernard points out in “Lifted: A Cultural History of the Elevator”, top floors were considered a public-health risk. The strain of tackling so many stairs, the difficulty of getting outside in the fresh air and the trapped heat of summer played a part in this. It may be no coincidence that the garrett was home to consumptive artists.

The lift not only made much higher floors possible, it gave them a new status and glamour. Rents began to rise, not fall, with height. The penthouse—a word that took its modern meaning in the 1920s—became a status symbol. From the Equitable Life Building onwards, top executives took to the top floors. Altitude was eminence, farsightedness, elevation—power.

Lifts also made the workplace more regular. Structures built around staircases had internal arrangements much less strict than today's, with mezzanines and back-stairs that provided different points of access to the same floor. Lifts imposed a new simplicity. The lobby where lifts arrive and depart serves as a focus on each floor. Storeys are strictly and consistently set apart by number (with the occasional exception for triskaidekaphobes and their equivalents in other cultures). This repetitive stacking of space, some have argued, played a crucial role in formalising office plans and

hierarchies. There is a reason why M.C. Escher never etched any delightfully paradoxical lift shafts.

By the 1970s lift engineering was a pretty mature industry, and started to consolidate and globalise. Kone and Thyssenkrupp, along with the Swiss firm Schindler, bought up rival firms to join Otis (now a division of United Technologies) as worldwide brands. Between them the big four now account for around two-thirds of the global market; Hitachi and Mitsubishi of Japan take quite a lot of the rest. There is as yet no Chinese lift giant—perhaps because the industry relies as much on its ability to provide services on a global scale as on its mechanical engineering prowess. Half the big four's annual revenues of \$40bn (€36bn) come from that side of the business.

But if China is not a force in the industry, it has been a huge influence on it; the Chinese appetite for more, higher and faster lifts is like nothing seen since 1920s New York. In 2000 some 40,000 new lifts were installed in the country. By 2016 the number was 600,000—almost three quarters of the 825,000 sold worldwide. China not only wanted more skyscrapers; it wanted taller ones. More than 100 buildings round the world are over 300 metres; almost all of them were built this century, and nearly half of them in China. The country is home to two-thirds of the 128 buildings over 200 metres completed in 2016. Other countries may content themselves with a few show-off pinnacles. China buys them by the dozen.

Such buildings exacerbate the constraints liftmakers and the architects they work with have always faced: time and space. Kheir Al-Kodmany at the University of Illinois has found that after 28 seconds waiting, would-be passengers start to get irritated. And while lifts make rentable floor space reachable, they attract no rent themselves. At the top of the tallest buildings (which are often tapered, both because of the wind and to reduce loading on the structure below) the lift shafts may take up 40% of the floor space. The fewer the shafts, the more lucrative the building.

Increasing speed, a focus of the Japanese lift manufacturers, saves some time. Lifts typically travel at around 8-9m/s. Mitsubishi's lifts in the Shanghai Tower more than double that, reaching 20m/s (45 miles per hour). But though the users value speed, they have problems with the acceleration that provides it. Lifts accelerate at less than a tenth of the rate of an average car, because being pushed into the floor of a lift is a lot less comfortable than being pushed back in your seat. This means lifts can only reach their top speed on long uninterrupted runs. And even then, only on the upward leg; people are yet more sensitive to acceleration going down. Designers could get their lifts up to 20m/s just by letting them fall free for two seconds; but most customers wouldn't thank them for it.

Henrik Ehrnrooth, the boss of Kone, thinks the quest for further speed is now pretty much played out. The time it takes for the doors to open and close, he says, has as big an influence on the total time it takes to get to your desk—the measure which matters most. Kone, and the rest of the big four, concentrate more on the hardware and algorithms needed to prevent unnecessary stopping and empty journeys, which cuts waiting times and reduces the number of shafts needed for a given building.

Liftmakers say that “Destination control”, in which the lift system tells the user which lift to use, rather than the user telling the lift where to go, reduces door-to-desk time by 30%. Pair it with double-decker lifts, which in very tall buildings usefully serve odd and even floors simultaneously, and you increase capacity even further. (Such lifts are also spectacular, at least they are if you are in the perspex-walled observation level halfway down one of Kone’s mineshaft testbeds watching them rush past like lorries.)

Alternatively, separate the top and the bottom deck and have two independent lifts in the same shaft. This allows an express lift serving a “sky lobby” on the 25th floor to run in the same shaft as the lift that offers a stopping service to the floors above. At least one company has attempted

to put three lifts in a single shaft, but the challenges have so far proved insurmountable.

Really tall buildings pose problems of their own. Dubai's Burj Khalifa, the tallest building in the world, has 163 floors and measures 830m to its tip. But to get to the top you must change at a sky lobby; the longest ride offered by any of its 57 lifts is just 504 metres. The limiting factor is the steel lift cable. Any longer and it gets so heavy that it might snap under its own weight.

UltraRope, developed by Kone, gets around this problem by using carbon fibre. When the Jeddah Tower in Saudi Arabia, the world's first 1km building, opens in 2020 it will boast a 660-metre lift made possible by UltraRope; the company thinks doing a whole kilometre should be feasible, if anyone wants to.

UltraRope has other advantages. Tall buildings sway with the wind, an effect that Thyssenkrupp's test tower replicates with 240 jiggly-tonnes of concrete on the 21st floor. Steel amplifies the swing like a strummed guitar string, which can damage the shafts and the cables. UltraRope has a higher resonant frequency, making it less sensitive to such sway.

A development being tested at Rottweil goes even further—doing away with the cable altogether. Thyssenkrupp, which also makes railway equipment, has harnessed high-speed rail technology to create Multi, a system held in place and accelerated by electromagnetic forces like those used for magnetic-levitation trains. This is not a new idea. One of the first people to look into it was a PhD student in Manchester in the 1970s, Haider al-Abadi, who is now prime minister of Iraq. But now it seems as if its time may have come.

By eliminating the cable, Multi aims to take away all limits on height other than those imposed by a building's structure. The absence of cables will

also allow lifts to move laterally, as well as vertically, making the whole system more like a railway. Lift shafts will be able to fork and rejoin to allow overtaking; descending lifts could sidestep ascending ones.

The first building to commission such lifts, Berlin's East Side Tower, will not be able to use Multi until it has been certified by the authorities, probably around 2020. Nor can it make full use of the system's potential; while Multi could have served its needs with just six shafts, the emergency services, less trusting of the new technology, have demanded two additional old-fashioned lifts so they can reach the upper floors if something goes wrong.

Further off, though, the possibilities have lift buffs giddy with excitement. Adrian Godwin, a consultant who has advised on some of the world's tallest buildings, imagines systems like Multi making buildings of 250 storeys or more possible, with many more lift cabins circulating in cores smaller than those in use today. The number of cars in the system could be changed on the fly to reflect usage patterns, which will make things more energy-efficient.

Buildings could change shape, as well as size. Mr Godwin, along with Thomas Heatherwick, a noted British designer, has envisaged an office block that curves up elegantly from a large base using revolving lift cabins like those on a Ferris wheel. He also has a vision for a building shaped like a giant hoop; lifts freed from cables require no central core.

Perhaps most intriguing, new types of sideways-scooting lifts could link up whole clusters of buildings. Transport hubs could house lifts serving a range of local buildings, moving first horizontally, then vertically. Or the lifts could zip between their tops on skybridges. It took trees hundreds of millions of years to evolve the structural systems and internal plumbing needed for wide-spreading boughs, thus making possible the wonderfully rich ecosystems of rainforest canopies. Lateral lifts could make canopy

cities possible before Otis's patent sees its bicentenary. Having let cities climb into the sky, the lift may now help them spread across it. ■



升降电梯

上升，再上升

电梯造就了现代城市，新科技或许会让电梯再造城市新貌

这台芬兰产电梯的轿厢内壁泛着冷冷的蓝光，带点爵士乐风格的曲调轻轻回荡其中，整体环境舒心宜人。但别的地方有点怪。电梯内的十几个按钮似乎是随机编号的，让人不明所以：45、105、215、270。在350层，电梯门打开，眼前是一个黑漆漆、脏兮兮的洞穴，一片寂静中水滴声清晰可闻。

西南向距这台奇异的电梯1000公里处，矗立着德国离地最高的会议室。它也有些怪异。从其中往外看，所见并非某个中央商业区，而是黑森林林区边缘的田园风光。这间会议室位于一座摩天大楼的顶层，但楼里并没有办公室，只有12个电梯竖井。在通往顶层套房的电梯里，显示屏不仅显示你抵达的楼层，还告诉你速度有多快。

德国工程企业集团蒂森克虏伯（ThyssenKrupp）和芬兰电梯制造商通力集团（Kone）位居全球四大电梯工程公司之列。这样的公司需要场地来测试新设计、新运行模式和新技术。通力在赫尔辛基以西约50公里的蒂蒂利（Tytyri）的一个矿井内设有测试场。假如你乘坐那台蓝光映照的电梯下达位于350层（因比旁边一座矿井顶部低350米而得名）的潮湿洞穴，走出钢制电梯门，你会发现自己置身于一座开采中的矿场，上述矿井正是为此矿场服务的。

蒂森克虏伯的测试场更高调——一座246米高的混凝土塔，犹如一根纤细的手指，外部包裹着一层优美的结构，纹路如同麦芽扭扭糖。该测试塔于今年10月落成，高高耸立于中世纪古镇罗特魏尔（Rottweil）。此前，该镇最出名的是这里强壮的守卫犬。为庆祝测试塔落成，镇上举行了两天的庆祝活动。塔顶景观（晴好时可远眺阿尔卑斯山）预计会令到访当地的游客每年增加五万人。

在这些偏僻之地改进的技术对于现代城市生活至关重要。全球1400万台电梯每天约要服务十亿人；人们在一天内乘坐电梯的次数是一年内搭乘飞机次数的两倍。城市里，如果巴士和铁路罢工，人们还能挺过去，但要是没了电梯，生活差不多就要陷入瘫痪，至少在中央商务区是如此。

电梯在垂直空间里扮演的角色与汽车在水平空间中的作用相当，都是关键性的交通工具。现代电梯与汽车一样，都是19世纪末第二次工业革命的产物，也像汽车那样改变了人们生活、工作的方式和地点，从而改变了城市的面貌。今天，汽车正运用激光雷达开辟自动驾驶之路，而电梯也已准备好再次改变城市。

数千年来，人们一直在使用各式起吊升降设备。当年罗马斗兽场就有24台由奴隶人力驱动的升降机。几个世纪以来，滑轮绳索装置应用于矿井和工厂，甚至偶尔还在宫殿和私人住宅里充当运送人员的工具。17世纪的德国数学家艾哈德·魏格尔（Erhard Weigel）住在耶拿（Jena）一栋七层高的房子里，他用一套滑轮系统来运送自己上下各个楼层。1743年，路易十五在凡尔赛宫安装了一台平衡式配重升降机进出自己的密室。

现代升降机由伊莱沙·奥的斯（Elisha Otis）发明，于1854年5月在纽约举行的万国工业展览上公开亮相。时至今日，奥的斯电梯的数量仍称冠全球。在基本的轿厢、缆绳和配重装置外，奥的斯的专利创新添加了一套装有弹簧的棘轮，能防止升降机在主缆绳断裂时急坠。当着众多观众，他乘坐升降机上升至15米的高度，然后让一位助手用斧头把缆绳砍断。据说在防坠器启动后，他大声宣告“一切安全，先生们。一切安全”。三年后，他为霍沃特瓷器店（E.V. Haughwout and Company）安装了自己发明的第一台载客升降机。

但结果并不成功。顾客不敢乘坐这套吓人的新设备，霍沃特瓷器店在1860年将其拆除。奥的斯公司真正取得成功要等到另外两项创新出现之后：钢架结构和电动机，前者使建筑物变得更高，后者使电梯运行速度更快。

十九世纪80年代之前，建筑物的高层重量必须依靠低层的墙壁支撑。建筑

物越高，最底层的墙壁就越厚，可出租的底层空间就越少。所以，在过去，超过12层的建筑是不切实际的。

即使只有12层楼，有电梯也方便多了，所以美国新建的大型楼宇开始以配有电梯为豪。1870年，纽约的公平人寿大厦（Equitable Life building）成为首个安装电梯的办公楼。但这些大楼中主要使用的是把乘客从底部往上推升的液压电梯。这需要把活塞液压缸沉入地下，深度与电梯井的高度相匹配，虽然不方便，但20层以下的建筑还是可以实现的。而且它们比奥的斯的蒸汽动力配重升降机快多了。

电动机改变了这一点。奥的斯一开始发明的蒸汽动力升降机上升速度为每秒0.2米。1913年投用的伍尔沃斯大厦（Woolworth Building）是世界首栋超过50层（241米高）的钢架结构建筑，内装的电动电梯速度是前者的十倍以上。20年后，381米高的纽约帝国大厦内，电梯以每秒六米的速度运行，堪比许多现代电梯。

至此，美国城市的面貌焕然一新。在电梯出现之前，罕有六层以上的建筑，屋顶构成的天际线低矮平整，只是偶尔被城堡和教堂之类的高大建筑打破。现在，这样的城市景观已经不多了。巴黎大体上成功保持了屋顶轮廓线整齐，尽管有一座标志性铁塔高耸其中（其中的电梯采用了精巧的非垂直升降技术）。在一直以严格的规划法规限制楼宇高度的赫尔辛基，通力集团那间位于16层的会议室俯瞰着整座城市坚持低矮路线的建筑群。但大多数城市的建筑都在“力攀天际”，有时充满戏剧性，比如迪拜；有时杂乱无章，比如圣保罗。

在人类世界向上延伸的过程中，电梯颠覆了有关“尊贵”的旧有观念。20世纪以前，人们偏爱靠近人行道的生活空间。位于街道的喧嚣之上、又只要走一段楼梯便可抵达的二楼最受追捧，有贵族楼层（piano nobile）或主楼层（Bel étage）之称。三楼以上一般是仆人住的。在酒店和出租物业中，楼层越高，规格和房费就越低。正如安德烈亚斯·伯纳德（Andreas Bernard）在《上升：电梯文化史》（Lifted: A Cultural History of the

Elevator) 中指出的，顶楼曾被视为对公众健康的威胁，部分原因在于要辛苦爬多层楼梯，难以外出呼吸新鲜空气，夏天又被暑气笼罩。屋顶阁楼盛产肺痨艺术家也许并非巧合。

电梯不仅让高层楼宇成为可能，也赋予了它们新地位和光环。租金开始随着楼层的增高不降反升。“顶层公寓”（这个词的现代含义在20世纪20年代形成）成为身份的象征。公平人寿大厦建成之后，高管们变得钟情顶层办公室。高度代表杰出和远见。高度即权力。

电梯也使办公楼的设计变得更统一规范。以往围绕楼梯建造的建筑物内部布局远没有现在的严格，夹层和后楼梯提供了进入同一楼层的多个入口。电梯为楼宇新增了一份简洁。电梯到达和离开的门厅成为每一楼层的中心。现在，楼层统一而严格地以数字区隔（除了其他文化中对13或类似数字的避讳）。有人认为，如此重复的空间堆叠对固定办公室布局和等级有着至关重要的作用。荷兰版画家莫里茨·科内利斯·埃舍尔（Maurits Cornelis Escher）那些奇妙的错视作品中没有一幅画的是电梯井，也是有原因的。

到了20世纪70年代，电梯工程已是相当成熟的行业，并进入整合与全球化的阶段。通力、蒂森克虏伯及瑞士的迅达集团（Schindler）分别收购了部分对手企业，与奥的斯（现属于联合技术公司）并驾齐驱，成为全球四大电梯品牌，合共约占据了全球市场份额的三分之二。日本的日立和三菱则是余下市场中的佼佼者。目前还没有来自中国的电梯巨头企业，也许是因为该行业不仅讲求机械工程实力，还需要在全球范围提供服务的能力。上述四大电梯巨头的400亿美元（360亿欧元）年收入中，有一半来自服务业务。

但是，中国即使不是电梯业的强国，也对该行业有巨大的影响力。中国人希望拥有数量更多、攀升更高、速度更快的电梯，自20世纪20年代的纽约以来，还没有哪个地方有如此庞大的需求。2000年，中国安装了约四万台新电梯。到了2016年这个数字是60万台，几乎是当年全球电梯销量（82.5万台）的四分之三。中国不但要建更多的摩天大楼，还要建更高

的。全球有100多座建筑物高度超过300米，几乎全部建造于本世纪，而其中近半位于中国。2016年落成且高于200米的128栋高楼中三分之二是在中国。其他国家也许有一两座高耸的炫目地标就心满意足了，中国一盖就是十几座。

这类楼宇加大了电梯制造商及其合作的建筑师常面对的限制：时间和空间。伊利诺伊大学教授海尔·阿尔孔德曼尼（Kheir Al-Kodmany）发现，等电梯的时间若超过28秒，人们就会变得烦躁。尽管电梯能方便人们抵达租下的楼层，它本身却并不产生租金。在那些最高建筑物的顶层（往往因为大风和为减少下方结构负荷而收窄），电梯井可能就占了40%的楼层数量。因此，电梯井越少，楼宇的租金收入就越高。

日本电梯制造商的关注点是提高电梯的运行速度，这可以节省一些时间。通常来说，电梯的运行速度约每秒八至九米。上海中心安装的三菱电梯提速了一倍多，达到每秒20米。然而，尽管用户喜欢快，却并不喜欢加速时的感受。电梯设置的加速度还不到普通汽车的十分之一，这是因为相比汽车急速启动时的“推背感”，在电梯上升时被压向地面的感觉要难受得多。这意味着电梯只能在长时间不间断的运行中逐渐升至最高速度。即便这样，也只是在上升时适用，因为人们对于加速下降更为敏感。设计师只要让电梯自由坠落两秒，运行速度就会提高至每秒20米，但大部分用户对此是不会领情的。

通力集团的总裁韩瑞龙（Henrik Ehrnrooth）认为，如今电梯提速的空间已经不大了。他表示，电梯门开闭所需的时间在很大程度上也会影响人们到达办公桌的总耗时——而这是一个至关重要的衡量指标。通力和其余三大巨头更注重开发硬件和算法，防止电梯做不必要的停顿或空载运行。减少电梯空载运行可以缩短等待时间并减少楼宇所需的电梯井数量。

电梯制造商们表示，“目的地控制”（即电梯系统指示乘客使用哪一台电梯，而非乘客控制电梯去向）能使“从出门到抵达办公桌的耗时”减少30%。配上能在超高层楼宇同时抵达单双两个楼层的双层电梯，运送能力还可进一步提高。这类电梯非常壮观，至少站在通力矿井测试场中间的玻

璃幕墙观景台上，看着这些双层电梯像卡车般在旁边迅速上下，感觉足够震撼。

或者把上下两层分开，在同一个竖井里安装两台独立的电梯。这样，在同一井道内，可以同时存在一台直达25楼“转换层”的高速电梯和一台在25层以上楼层逐层停留的电梯。至少有一家公司已尝试把三部电梯安装在同一个竖井内，但迄今仍未能攻克其中的难题。

超高层建筑自身也给电梯带来了难题。迪拜的哈利法塔是世界上最高的建筑物，共有163层，最高点达830米。但要抵达顶层，你必须在转换层换乘另一台电梯——这里的57台电梯最高都只能爬504米。限制因素在于电梯的钢缆，若再加长就会因为不堪自身重量而断裂。

由通力集团研发的UltraRope曳引绳采用碳纤维材料，解决了这个问题。全球第一座千米高楼，沙特阿拉伯的吉达塔（Jeddah Tower）将于2020年落成，其电梯采用UltraRope碳纤维带，垂直运行距离可达660米。通力表示，如有需要，覆盖全部1000米高度也是可以的。

UltraRope碳纤维带还有其他优点。高层楼宇会随风摇摆，蒂森克虏伯的测试塔在21楼用240吨半流质混凝土模拟出这种效果。钢筋如同吉他琴弦被拨动般放大了摇晃的幅度，电梯井和钢缆可能因而受损。而UltraRope碳纤维带则因共振频率较高，不容易受这种摇晃的影响。

正在罗特魏尔测试的一项技术更是飞跃之举——完全去除钢缆。兼营铁路设备制造的蒂森克虏伯公司利用高铁技术成功打造了名为Multi的电梯系统，由电磁力驱动电梯加速及固定位置，原理类似磁悬浮列车。这并非全新创意。率先研究过这类技术的人之中，有一位是上世纪70年代曼彻斯特的博士生海德尔·阿巴迪（Haider al-Abadi），现任伊拉克总理。不过现在看来时机似乎已经成熟。

通过去除钢缆，Multi系统的目标是扫除一切高度限制，除了楼宇自身结构带来的限制。没有了钢缆，电梯除了垂直升降，还可以横向移动，使整

个系统更像铁路。电梯竖井将可以分岔，然后汇合，电梯轿厢因而可在井道内“超车”。下行轿厢可以横移闪避上行的轿厢。

订购这类电梯的首栋大楼是柏林的东城塔（East Side Tower），但要在Multi系统获得当局认证批准后才能安装，估计要在2020年左右。而且该大楼也无法充分利用Multi系统的潜力：尽管这套系统只需要用六个井道便可满足大楼的需求，但紧急服务部门不太信任这项新技术，要求大楼增设两台常规电梯。这样，万一新电梯出现问题，救援人员也可以乘老电梯到达高层。

不过，再往前看，未来的可能性还是令电梯专家兴奋不已。曾为世界一些最高建筑提供专业意见的咨询顾问阿德里安·戈德温（Adrian Godwin）认为，像Multi这样的系统令建造250层以上的楼宇成为可能，让更多电梯轿厢在占用空间比现在更小的井道内循环运行。系统运行的电梯数量可根据使用情况临时调整，更加节能高效。

除了高矮胖瘦，楼宇或许还可以改变形状。戈德温和英国著名设计师托马斯·赫斯维克（Thomas Heatherwick）一起构思设计了一栋形态奇特的办公楼，楼身从宽大的底座上以优雅的曲线向上延伸，摩天轮似的电梯轿厢旋转其中。他还设想打造一座巨圆形的大楼——电梯不需要钢缆，建筑也就不再需要有中心部分了。

也许最引人入胜的是，新型的横向穿行电梯可以将一批又一批建筑串联起来。可以设立交通枢纽站，电梯从这里始发通向一大批本地楼宇。它们先是水平移动，然后垂直升降。或者，电梯可以在楼顶的“天桥”上高速穿行。树木经过几亿年的演化才形成向繁茂枝叶输送养分的结构体系和内部管道，造就了异常丰富的热带雨林冠层生态系统。在奥的斯专利电梯面世满两百年之前，横向电梯便可能成就“天篷城市”。在让城市攀升天际之后，如今电梯也许可以让它们在云层扩张。■



Buttonwood

Out of touch

How intangible assets are changing investment

WHEN you work as an equity analyst at an investment bank, your task is clear. It is to comb all the statements made by corporate executives, to scour the industry trends and arrive at an accurate forecast of the company's profits. Achieve this and your clients will be happy and your bonus cheque will have many digits.

But is all this effort worthwhile? Not as much as it used to be, according to Feng Gu and Baruch Lev, writing in a recent issue of *Financial Analysts Journal**. The authors imagined that investors could perfectly forecast the next quarter's earnings for all companies. They then assumed that investors bought all the stocks that they expected to meet or beat the consensus of analysts' forecasts; and that investors could short (ie, bet on a declining price) the stocks of those that were predicted not to reach their estimates. They made their investment two months before the end of a quarterly reporting period and got out of their positions one month after the quarter ended (by which time the earnings have been reported).

In the late 1980s and 1990s, this would have been a highly successful strategy, achieving excess returns (over those achieved by stocks of similar size) of 4% or more every quarter. But these abnormal returns have dropped: in recent years they have been only 2% a quarter. A similar effect appeared when examining the returns that would have been achieved by perfectly predicting those companies that achieved annual earnings growth.

Although an excess return of 2% a quarter would still be highly attractive, it would require a perfect forecasting record. That suggests the number-

crunching performed by fallible analysts and investors produces much lower returns.

The intriguing question is why those returns have been falling. The authors argue that the decline is because of the rising importance of intangible investments in recent decades (in areas such as software or trademark development). Such investment may be a big driver of value growth.

Accountants have struggled to adapt. If a company buys an intangible asset, such as a patent, from another business, it is classed as an asset on the balance-sheet. But if they develop an intangible within the business, that is classed as an expense, and thus deducted from profits. As the authors note: “A company pursuing an innovation strategy based on acquisitions will appear more profitable and asset-rich than a similar enterprise developing its innovations internally.”

As a result, the authors argue, reported earnings are no longer such a good measure of a company’s profits, and thus may not be a useful guide to future share performance. To test this proposition, they divided companies into five quintiles based on their intangible investment. Sure enough, the more companies spent on intangibles, the lower the excess return available to those who correctly forecast the earnings.

The paper’s message echoes the themes of a new book** by Jonathan Haskel and Stian Westlake, which explores the impact of the growing importance of intangible assets in modern economies. The book finds a link between the poor productivity record of many leading economies since the crisis of 2008, and the sluggish rate of investment in intangible assets since then.

The problem is that intangibles have spillovers. A company may undertake expensive research and development, but the gains may be realised by other businesses. Only a few companies (the likes of Google) can achieve the scale

needed to take reliable advantage of their intangible investments. Unlike machines and equipment, intangibles may have limited resale value. So the risks of failure may put businesses off intangible investment.

This is both good news and bad news for investors. On the one hand, it may explain why profits have remained high relative to GDP. In theory, high returns should have attracted a lot more investment and the resulting competition should have driven down profits. But the difficulty in exploiting intangibles may have prevented that. On the other hand, the reluctance of many businesses to invest in intangibles may restrict their scope for growth in future. Investors looking for growth stocks will face a restricted choice and such companies will be so apparent to everyone that they will command a very high valuation. Not so much the “nifty fifty” stocks that were fashionable in the early 1970s, as the nifty five or six.

* “Time to Change Your Investment Model”, *Financial Analysts Journal*, Vol 73, number 4

** “Capitalism without Capital: The Rise of the Intangible Economy”, published by Princeton University Press ■



梧桐

失去关联

无形资产如何改变投资

如果你在一家投资银行担任股票分析师，那你的任务很明确：梳理企业管理层给出的各种财务报告，追踪行业发展趋势，最终准确预测出企业的利润水平。能做到这一点，你的客户就会满意，你的奖金支票上也将有一长串数字。

但是花这些功夫值得吗？不像过去那么值得了，顾峰（Feng Gu，音译）和巴鲁·列弗（Baruch Lev）在最近一期《金融分析师期刊》（Financial Analysts Journal）上发表文章*指出。两位作者假想投资者可以准确预测出所有公司下一季度的收益，然后假设他们购买了所有那些他们认为能达到或超出分析师普遍预期的股票，而且可能会卖空（即赌股价会跌）那些他们认为达不到分析师预期的股票。投资者在季度业绩报告期结束前两个月投入资金，在季度结束后一个月（那时收益已经公布）平仓。

换在20世纪80年代末和90年代，这会是个非常成功的策略，每季度可获得4%或以上的超额收益（超过类似规模的股票的收益）。但是这一超额收益率已经下降了：近几年来每个季度只有2%。研究发现，通过准确预测出实现年度收益增长的企业而得到的回报也有类似的变化。

虽然每季度2%的超额收益率仍然非常有吸引力，但这需要预测一贯准确。也就是说，容易犯错的分析师和投资者们在一番算计后得到的回报要低得多。

有趣的问题是为什么超额收益率一直在下降。两位作者认为是由于近几十年无形资产投资（例如在软件或品牌发展等领域）的重要性日益上升。这种投资可能是价值增长的重要推动力。

会计师们一直未能做出相应的调整。如果一个企业从另一个企业购买了某

种无形资产，例如一项专利，这在资产负债表上会被归入资产。但如果这个企业自己开发了一项无形资产，则会把它归为支出，因而要从利润中扣除。正如作者指出的那样：“相比依靠内部创新的企业，通过收购实现创新战略的企业看起来利润水平更高，资产也更雄厚。”

由此，作者认为，在衡量一家公司的利润时，企业对外公布的收益水平不再是那么可靠的指标，因而在预测未来的股票表现时可能也不再是一个有用的参考。为了检验这个观点，他们根据无形资产投资的规模将企业分成五档。果然，如他们所料，企业在无形资产上的投入越多，那些准确预测出公司收益的投资者能实现的超额收益率就越低。

这篇论文的观点与乔纳森·哈斯克尔（Jonathan Haskel）和斯蒂安·韦斯特莱克（Stian Westlake）合著的一本新书**主题不谋而合。那本书探讨了在现代经济体中无形资产的重要性日益增长所带来的影响。2008年金融危机以来，许多发达经济体生产率增长缓慢，而无形资产投资率增长疲软，该书发现二者存在关联。

无形资产有溢出效应，这是问题所在。虽然一家企业可能会将大量资金投入研发，但收益却可能被其他企业攫取。只有少数像谷歌这样的公司能达到相当的规模，从而利用无形资产投资获得切实的回报。无形资产与机器及设备不同，其转售价值可能有限。因此，失败的风险可能会让企业对无形资产投资望而却步。

这对投资者来说既是好消息也是坏消息。一方面这可以解释为什么利润占GDP的比例如此之高。从理论上讲，高回报本应吸引更多投资，由此产生的竞争又会拉低利润。但也许是难以利用无形资产来获利使得理论未能成为现实。另一方面，许多企业不愿投资于无形资产，这可能会限制它们未来增长空间。寻找成长型股票的投资者将面临有限的选择，而这样凤毛麟角的公司对谁都显而易见，因而其估值会非常高。上世纪70年代初曾有备受追捧的“漂亮50”股票【译注：“nifty fifty”，纽约证券交易所交易的50只备受追捧的大盘股】，如今有“漂亮五六”就不错了。

* 《该改变你的投资模型了》，刊于《金融分析师杂志》第73卷第四期

** 《没有资本的资本主义：无形经济的崛起》，普林斯顿大学出版社 ■



Commodities

The world in a barrel

Crude oil is the most traded commodity in the world. What is it made of and where does it go?

IN 2016 the world consumed 96m barrels of oil every day. They all started out as algae or plankton, with the odd dinosaur thrown in for good measure. Dead and buried, this ancient life was transformed into a suite of molecules made up of chains and rings of carbon with hydrogen stuck to them, and thus, prosaically known, as hydrocarbons. (They have some sulphur in them, too; it's a pain.)

Hydrocarbons, which sometimes seep to the surface unbidden, have been used for millennia. They can be set alight to frighten your enemy's cavalry, or slathered into the seams between the planks of your ship's hull. Today they power a global economy and can be used to make almost anything.

Using oxygen to burn up hydrocarbons liberates lots of energy. It also creates water, which doesn't matter much, and carbon dioxide, which does. Oil accounts for 35% of industrial CO₂ emissions.

Different hydrocarbons are used to fuel different things. The shorter the carbon chain, the more easily a fuel is vapourised, and in turn burned. A little molecule like butane—four carbons long—is good for a cigarette lighter; a ship's engine may use something 10 times longer.

Every barrel of crude oil contains a mix of all these molecules. Refineries sort them out, exploiting the fact that they vapourise at different temperatures to separate them by distillation. But even “light” crude—the short-chain-rich sort the industry likes best—contains more of the long

chains than anyone needs. So refiners use clever chemistry (“fluid catalytic cracking”) and brute-force heat (“coking”) to break some long molecules into shorter ones.

Distillation and cracking also produce plenty of small molecules containing just two or three carbons; these form the basis for the petrochemical industry, which uses them either for their own properties or as the building blocks for all manner of plastics, fibres and pharmaceuticals. The global market for these is some \$680bn: more than a third as big as the \$1.6trn oil market.

All this takes a lot of energy: most refineries use between five and ten percent of the energy in the crude that passes through them. In years to come that might change. Practitioners of “synthetic biology” are learning to genetically engineer microbes that can synthesise the building blocks of petrochemicals—and indeed the chemicals themselves. In the future, the refinery may well fall prey to the descendants of its long-dead reason for being: algae. ■



大宗商品

桶里乾坤

原油是世界上交易量最大的大宗商品。它由什么构成，又去了哪里？

在2016年，全球每天消耗9600万桶石油。石油源自藻类或浮游生物，偶尔还掺有恐龙。这些古生物死后被埋在地下，转化为一系列附有氢原子的碳链和碳环构成的分子，因此被统称为碳氢化合物。（讨厌的是，其中还含有硫。）

人类使用这些不时会自己渗出地表的碳氢化合物已有几千年的历史了。人们点燃它们来吓唬敌人的骑兵，或者将它们厚厚地涂在船体木板间的缝隙里。今天它们为世界经济提供动力，而且可用来制造几乎任何东西。

使用氧气助燃碳氢化合物会释放大量能量，过程中还产生水和二氧化碳，前者无关紧要，后者关系重大。燃油造成的二氧化碳排放占整体工业二氧化碳排放量的35%。

作为燃料，不同的碳氢化合物用途各异。碳链越短，燃料越容易蒸发，相应也就越容易燃烧。像丁烷这样只有四个碳原子的小分子适用于打火机，而轮船发动机所用燃料的碳链长度可能是丁烷的10倍。

每桶原油都是所有这些分子的混合物。炼油厂把这些化合物分类，利用它们蒸发温度不同这一点，通过蒸馏来分离不同成分。但即使是业界最青睐的富含短碳链的“轻质”原油，也包含多余的长碳链。因此炼油厂利用巧妙的化学过程（“流化床催化裂化”）和强高温（“焦化”）将一些长链分子裂化为短链分子。

蒸馏和裂化还产生大量仅包含两、三个碳原子的小分子，这些小分子奠定了石化工业的基础，它们或是直接为石化工业所用，或是用作原料，来制

造各类塑料、纤维和药物。它们的全球市场大约为6800亿美元，占整个1.6万亿石油市场的三分之一还多。

这一切消耗大量能源：大部分炼油厂消耗的能源占其所加工原油所含能源的5%至10%。这一现象未来几年可能会有改观。“合成生物学”的践行者们正在设法改造微生物的基因，让它们能够合成石化产品的基本成分——其实也就是化工品本身。亿万年前埋入地下的藻类让炼油厂得以建立，而未来，它们的后裔则可能会影响炼油厂衰败。 ■



Defending economics

The shield, not the sword

Jean Tirole could have succumbed to Nobel-prize-induced grandeur. Instead he humbly defends his discipline

“WINNING a Nobel prize changes your life,” said Jean Tirole, a French economist, from experience. When his work on competition policy and how to adapt regulation for specific industries earned him the gong in 2014, he could have succumbed to “Nobel prize syndrome”, the tendency to opine on all economic matters regardless of expertise. His book “Economics for the Common Good”, published in 2016 and just released in English, attempts something much bolder. He tries to rescue economists’ reputation.

His profession has been attacked for failing to predict the financial crisis, for pushing competition and markets above all else and for ignoring questions of morality. One academic economist will befuddle you with two contradictory opinions, while another will attack you with impenetrable algebra. No wonder technocrats are losing out to populists.

Some of this criticism is warranted, Mr Tirole accepts. Leading economists prefer to create knowledge rather than disseminate it, and they communicate with each other in a language that can be hard to understand. Although mathematical models add clarity and rigour (and Mr Tirole is a heavy user in his own research), they can constrain which questions are asked, and be mistaken as the goal of research rather than the means.

In some cases, though, critics of economists ask too much of them. Although economists did underestimate the importance of financial regulation in the run-up to the crisis, and oversold the benefits of whizzy new instruments, blaming them for failing to spot something that even financial supervisors had only partial knowledge of seems unfair. Crises

often come when an unforeseen but otherwise survivable investor panic becomes self-fulfilling. Knowing when the world will flit between states is impossible.

Mr Tirole spends much of his book reminding readers of what economics is for. It is supposed to serve society, and to offer rigour where gut instincts go wrong. Debates on whether to weaken protection for permanent employees, for example, pit managers against workers who want security. The economist is there to point out the victim hidden by this dichotomy: the person who has no job, or only a short-term contract, because companies are afraid to hire hard-to-fire staff on full contracts.

Economics is perfectly capable of incorporating questions of morality, says Mr Tirole. It simply imposes structure on debate where otherwise indignation would rule. It might make sense to ban some markets, like dwarf-tossing, he says: its existence diminishes the dignity of an entire group. But a market in organs or blood, for example, should not be rejected on the basis of instinctive moral repugnance alone. Policymakers should consider whether payment would raise the supply of donated blood or kidneys, improving or even saving lives. (It might not, if the motivation of money makes generous people afraid of looking greedy.) Whatever the answer, policymakers should make decisions from “behind the veil of ignorance”: without knowing whether any one person, including the policymakers themselves, would be a winner or loser from a particular policy, which society would they choose?

Mr Tirole applies this type of reasoning to topics ranging from carbon taxes to industrial policy, from competition to the digital economy. He presents economists as detectives, sniffing out abuse of market power and identifying trade-offs where populists make empty promises. His analysis is laden with French examples of ill-advised attempts to defy the constraints that those in his discipline delight in pointing out. When in 1996 the French

government blocked new large stores in an effort to restrain the power of supermarket chains, share prices of existing ones rose. The new laws inadvertently worsened the problem by restricting competition.

He also depicts economists as ill-equipped to deal with the dirty reality of politics. To those who might be catapulted into sudden stardom as he was, he warns that academic economists will be quickly put into political pigeonholes, and their arguments celebrated or dismissed according to whether the recipient favours that pigeonhole. Though populists revel in simplicity, his aim is to make economics context-specific and point out its complexities. This is his strength, but his discipline's limitation. He is economists' defender, but not their saviour. ■



捍卫经济学

用盾，而不是剑

让·梯若尔本可能因诺贝尔奖的光环而迷失，但他选择谦逊地捍卫自己的学科

“得了诺贝尔奖，你的生活就变了。”法国经济学家让·梯若尔（Jean Tirole）深有感触地说。2014年，他因竞争政策以及如何针对特定行业调整监管方面的成就获得了这一荣誉。他本有可能罹患“诺贝尔奖综合征”，对任何经济问题都想发表意见，不管自己是否具备相关专业知识。不过他想借2016年出版的著作《面向公共利益的经济学》（Economics for the Common Good，英文版刚刚面世）做些更大胆的尝试：挽救经济学家的名声。

没能预测到金融危机、将竞争和市场推至高于一切的位置、无视道德问题，这些都让经济学备受抨击。一位学院派经济学家会用两种相互矛盾的观点把你弄糊涂，而另一位则会用令人费解的代数运算为难你。难怪技术官僚会败给民粹主义者。

梯若尔承认，有些批评确有道理。顶尖的经济学家更喜欢创造知识而不是传播知识，彼此间还用一种非常难懂的语言来交流。尽管数学模型让研究更加清晰和严密（梯若尔在他自己的研究中大量运用数学模型），但它们会限制研究的议题，也会被误认为是研究目标本身而不是方法。

不过有些时候，批评人士对经济学家的要求太高了。尽管经济学家在危机爆发之前确实低估了金融监管的重要性，且夸大了新奇工具的好处，但指责他们未能发现连金融监管者也是只略知一二的东西，似乎并不公平。当一场不可预见但原本并不致命的投资者恐慌发展为自我应验的事实，危机就产生了。而要预知形势何时会发生变化是不可能的。

梯若尔在书中用了很大篇幅提醒读者经济学目的何在。它本应服务社会，并在直觉出错时提供严谨的分析。比如，人们争论是否要减少对正式雇员的保护，企业经营者和想要保障的员工为此针锋相对。这种情况下，经济

学家的任务就是指出这种对立所掩盖的受害者：没有工作或只有短期合同的人，因为公司不敢聘用难以解雇的正式员工。

梯若尔认为，经济学完全有能力将道德问题纳入考量。这门学科只不过是赋予争论以条理架构，以免愤怒压倒一切。他说，禁止某些市场或许有道理，比如扔侏儒表演，因为它的存在会贬损整个群体的尊严。但不应仅仅出于本能或道德上的抵触感，就反对器官或血液市场。政策制定者应该考虑的问题是，付费是否能增加捐血或捐肾从而改善治疗甚至挽救生命。

（也许并不能——如果用金钱作为动力反而让慷慨的人担心别人会觉得他们很贪婪。）无论答案是什么，政策制定者都应该在“无知之幕背后”做出决定：在不知道任何人，包括政策制定者自己，将成为某个特定政策的赢家还是输家的情况下，他们会选择怎样的社会？

梯若尔将这种思考方式应用于多个主题——从碳排放税到产业政策，从竞争到数字经济。他把经济学家描绘成侦探：他们嗅出对市场权力的滥用，识别民粹主义者做出空洞承诺时的权衡取舍。他的分析中充满了法国的例子。这个国家做出过许多不明智的尝试，试图挑战经济学家乐于指出的限制。1996年，法国政府为了抑制连锁超市的影响力，禁止新开大型商店，已有的连锁超市股价随之上涨。新法律限制了竞争，无意中反倒让问题恶化。

他还把经济学家描绘成没有能力应对肮脏的政治现实的人。他向有可能会像他一样一举成名的人发出警告，说学院派经济学家很快会被贴上政治标签；他们的观点可能会被推崇，也可能会被贬斥，全看他们是否赞同冠在自己身上的标签。民粹主义者醉心于简单，不过他的目标却是让经济学适用于具体的实际情况，并指出其复杂性。这是他的强项，却是经济学的局限之处。他是经济学家的捍卫者，却不是他们的救星。 ■



The gig economy

Shut up and play the hits

The choices musicians make about which material to play live reveal how they see their back catalogues—and what pleases their fans

The data clearly illustrate various features of Dylan's career, including the hiatus in touring after his bike crash in 1966 and the (brief) renunciation of his back catalogue after his conversion to Christianity in 1979. Since the start of his “Never-Ending Tour” in 1988, he has played more than 70 gigs a year, featuring both new songs and old but not, these days, any from the 1980s. He has always played cover versions of other people's songs, as well as songs of his own not on any of his albums (marked here as “other tracks”).

You can't always get what you want, unless it is Mick and Keith playing their golden oldies, in which case you are in luck. The balance of the Stones' setlists has barely changed in decades. New albums just fade away.

See economist.com/setlists17 for an interactive version of this Graphic Detail with even more artists, from Bowie to Beyoncé ■



演出经济

少废话！快唱老歌！

从音乐家选择的现场演出曲目能看出他们如何看待自己过去的作品，也能看出他们的粉丝最爱听哪几首

这些数据清楚地说明了迪伦演艺生涯的各种特点，包括在1966年摩托车车祸后中断巡演，以及1979年皈依基督教后（短暂）抛弃了自己之前的作品。从1988年“永不停息”巡演（Never-Ending Tour）开始，他每年都要演出70多场，既表演新歌也唱老歌，不过近些年表演的曲目没有一首来自上世纪80年代。他一直在翻唱别人的歌，还有自己创作但未收录到专辑里的歌（这里标记为“其他曲目”）。

你没法总是心想事成，除非是想听米克和基思唱他们的金曲老歌，这样的话你可走运了。几十年来，滚石演出曲目的主要构成几乎没有变化。近年新专辑干脆销声匿迹了。

想要查看更多艺人此类图表的互动版本，请参见economist.com/setlists17，从大卫·鲍伊到碧昂丝应有尽有。 ■



Economic and financial indicators

GDP forecasts

The Economist's GDP forecast



经济与金融指标

GDP预测

《经济学人》的GDP预测



Environmental economics in China

Towards a greener future

China's anti-pollution campaign may crimp growth by less than feared

LEO YAO thought he had nothing to fear from the environment ministry. Before, when its inspectors visited his cutlery factory, he says, they generated “loud thunder, little rain”. After warning him to clean up, they would, at worst, impose a negligible fine. Not so this time. In August dozens of inspectors swarmed over his workshop in Tianjin, just east of Beijing, and ordered production to be halted. His doors remain shut today. If he wants to go on making knives and forks, he has been told that he must move to more modern facilities in a less populated area.

Mr Yao’s company, which at its peak employed 80 people, is just one minor casualty in China’s sweeping campaign to reduce pollution. For years the government has vowed to go green, yet made little progress. It has flinched at reining in dirty industries, wary of the mass job losses that seemed likely to ensue. But in the past few months it has taken a harder line and pressed on with pollution controls, hitting coalminers, cement-makers, paper mills, chemical factories, textile firms and more.

Tens of thousands of companies—mostly smaller ones, like Mr Yao’s—have been forced to close, according to Chen Xingdong, an economist with BNP Paribas. In the region around Beijing this winter, the government has ordered steel mills to run at half-capacity and aluminium-makers to cut output by nearly a third. Implementation, half-hearted in the past, has if anything been heavy-handed. In Hebei, a northern province, a ban on coal heating left thousands of residents shivering because the replacement, a switch to natural gas, was not yet ready.

For the wider economy, the question is how steep the cost will be. A sharp tightening of environmental rules in the world's biggest polluter has the potential to be a shock, both to China and the global economy. Two worries are commonly heard: that it will drag down growth; and, at the same time, cause inflation as production cuts boost prices. Jiang Chao, an economist with Haitong Securities, a broker, says it could end up making for "classic stagflation". So far, though, these worries are unfounded: growth has been solid and inflation subdued. A possible explanation is that the economic impact is lagging behind the pollution controls. Another is that, contrary to received wisdom, China may be able to raise its environmental standards without paying a high price.

One thing is clear: China's shift on pollution is real. True, some extreme measures are temporary, especially those aimed at keeping Beijing's sky blue this winter. But many others will be lasting. As part of a "war on pollution" declared in 2014, China has detailed targets for cleaning up its air, water and soil. On January 1st it introduced an environmental-protection tax, replacing a patchwork of pollution fees. Last month it launched a market for trading carbon emissions, which, though scaled back from early plans, will be the world's largest. Most crucially, the environment ministry, previously a political weakling, has clout at last—as Mr Yao's cutlery business found to its chagrin. Besides fining companies, inspectors have disciplined some 18,000 officials for laxity over pollution.

The tougher tactics have already made a big dent in specific industries. Just 60% of steel blast-furnaces are now in use, down sharply since October and near a five-year low. Thermal-power output is now actually declining year by year, evidence of weakening demand. Companies are also feeling the pinch. Schaeffler Group, a German car-parts maker, warned in September that pollution controls would knock out its supplier of needle bearings. Taiwanese chipmakers in the city of Kunshan, an electronics hub not far from Shanghai, say the abrupt tightening of water-quality rules may lead

them to move.

Upward pressure on production costs has been intense. A surge in coal and steel prices has attracted most attention, as China has pushed companies to cut capacity (see chart). But similar trends affect a range of smaller industries. In July China banned imports of 24 kinds of waste such as paper and plastic; the ban came fully into effect on January 1st, but demand (and prices) for raw pulp quickly jumped. Restrictions on the chemicals industry have fuelled a 50% increase in the price of glyphosate, a popular weedkiller, over the past few months. Prices of rare-earth metals, notably two used in electric magnets, have also soared.

Yet the biggest economic surprise of China's environmental campaign so far is not that it has had an impact; it is how muted that impact has been. Yes, industrial production has recently been weaker than forecast, but it is still expanding at more than 6% year on year. And yes, some commodity prices have shot up, but this has had very little effect on general inflation.

Three factors suggest that this benign trend may endure. First, despite the common assumption that industries such as steel or coal are vast, they in fact account for a small, shrinking share of the Chinese economy. Minsheng Securities, a broker, calculates that the full complement of industries affected by the pollution measures adds up to just 7% of total national investment. China has reached a stage of development where manufacturing is fading in importance. Nearly 4m people may lose jobs as a result of cuts in industrial capacity, but strong demand for labour in the services sector, from restaurants to health care, is cushioning that blow.

Second, price increases have been concentrated and show little sign of spreading widely. Prices of coal and steel, the first to heat up, are already levelling off, making the increases seem big one-off changes rather than

the start of inflationary spirals. For the economy as a whole, it amounts to a redistribution of resources. Companies that use commodities as inputs face higher costs. But producers benefit. And since metals and mining companies are heavily indebted, the rebound in revenues is helping to fortify their balance-sheets and, in the process, easing Chinese financial risks.

Lastly, green restrictions can themselves generate growth and jobs. China's drive for cleaner energy sources has gained momentum. Estimates suggest it installed nearly 55 gigawatts of solar-power capacity in 2017, more than the existing capacity of any other country at the start of the year. China accounts for about two-fifths of global production of electric cars. And in more established industries, companies feel pressure to upgrade. To stay in business, Mr Yao says he will move his cutlery factory to a new industrial park, where waste-disposal standards are higher.

If the economic downside from China's clean-up remains relatively mild, it prompts an obvious question: why did it take the government so long to get tough on pollution? One big reason is surely the uneven distribution of pain. Smokestack industries are based in a small number of provinces such as Shandong in the east and Shanxi in the north. So long as enforcement was in local hands, officials had little incentive to act. None wanted to throttle companies in their own backyard. But from a national perspective, the economic trade-offs of greener growth ought to be easier to stomach. China will both pay a price and reap dividends. ■



中国的环境经济学

迈向更绿色的未来

中国的治污行动对经济增长的抑制可能比担心的要小

姚老板以前觉得环保部门没什么好怕的。他说，之前巡视员来检查他的金属餐具厂时都是“雷声大雨点小”，勒令他整改后，顶多也就是开一张无关痛痒的罚单。最近一次却不是这样。去年8月，几十名巡视员涌进他位于天津的车间，勒令停产。到现在工厂仍大门紧闭。他们说，他要是还想继续生产刀叉，就得搬到人少一点的地方，用更现代化的设施。

姚老板的公司在鼎盛时期雇用了80个人，它只是中国大力治污行动中一个受到冲击的小企业。多年来，政府立誓要走绿色道路，但进展甚微。它在抑制污染行业方面畏缩不前，担心引发大规模失业。但在过去几个月里，政府采取了更强硬的手段，坚定实施治污措施，煤矿、水泥厂、造纸厂、化工厂、纺织厂等都受到了冲击。

法国巴黎银行（BNP Paribas）的经济学家陈兴东称，数万家企业被迫关闭，大多是像姚经理的工厂那样的小企业。今年冬天，政府已下令北京周边地区的钢厂将开工率控制在50%，铝厂须减产近三分之一。治污在过去只是敷衍了事，如今则是重拳出击。在河北，由于煤改气工程尚未完工，成千上万居民因“禁煤令”而挨冻。

对于更广泛的经济来说，问题在于治污成本会有多高。世界上最大的污染国突然收紧环境法规，对中国和全球经济都可能产生冲击。两种常见的担忧是，治污将拖累增长，同时还会因为减产拉高价格而导致通货膨胀。证券经纪公司海通证券的经济学家蒋超说，治污最终可能会造成“经典滞涨”。但迄今为止这些担忧并无根据：经济增长保持稳定，通货膨胀也得到抑制。一种可能的解释是经济影响滞后于污染治理。还有一种解释是，与普遍共识相反，中国也许可以无需付出高昂代价就能提高环境标准。

有一点很清楚：中国在治污态度上的转变是动真格的。的确，有些极端的

措施只是暂时的，特别是那些为了让北京在今冬留住蓝天的措施，但其他许多措施将延续下去。中国在2014年“向污染宣战”，作为行动的一部分，它为治理空气、水和土壤制定了详细目标。1月1日，中国开征环保税，取代了混乱的排污费。上个月，中国还启动了一个碳排放交易市场，尽管比之前计划的规模有所缩减，但仍将是世界最大的碳市场。最重要的是，原先没什么政治实权的环保部终于有了影响力——姚老板的餐具厂就为此懊恼不已。除了对企业施以罚款之外，巡视员还问责了约1.8万名治污不力的官员。

更严格的治污措施已经让特定行业遭受重创。去年10月以来，钢厂高炉开工率大幅下滑，仅为60%，接近五年低点。火力发电量实际上正在逐年下降，这是需求减弱的证据。企业也感到了压力。德国汽车零部件制造商舍弗勒集团（Schaeffler Group）9月份警告说，治污措施将导致其中国供应商提供的滚针轴承断货。在距离上海不远的电子产业中心昆山市，台湾芯片制造商表示，由于水质要求突然收紧，它们可能会选择搬迁。

生产成本上涨的压力很大。中国已经要求煤炭和钢铁企业去产能（见图表），由此导致的煤炭和钢铁价格飙升引起了最多的关注。但类似的趋势也影响着许多较小的行业。去年7月，中国宣布禁止进口废纸、废塑料等24种废物。禁令于今年1月1日全面生效，而生纸浆的需求（和价格）迅速上涨。过去几个月里，由于化工行业受到限制，草甘膦（常见除草剂）的价格上涨了50%。稀土金属——特别是电磁铁中使用的两种稀土金属，价格也大幅上涨。

然而迄今为止，中国的环保行动在经济上给人最大的意外并不是它已经产生了影响，而是影响一直不大。诚然，近期工业生产不及预期，但同比增长仍在6%以上。一些大宗商品确实也价格猛涨，但这对总体通胀影响甚微。

有三个因素表明这种良性趋势可能会持续下去。首先，尽管人们普遍认为钢铁或煤炭等行业规模庞大，但实际上占中国经济的份额很小，而且还在

不断萎缩。证券经纪公司民生证券的数据显示，受治污措施影响的行业总体仅占国家投资总额的7%。中国已经进入新的发展阶段，制造业的重要性日益下降。工业去产能可能会造成近400万人失业，但从餐馆到医疗保健等服务行业对劳动力的强劲需求正在缓解这种冲击。

其次，价格上涨的范围比较集中，几乎没有扩大的迹象。首先升温的煤炭和钢铁价格已经趋于平稳，此番涨价因此也许只是一次性的大变，而不是螺旋式上涨的开始。对于整个经济来说，这实际上是资源的再分配。使用大宗商品作为原料的公司面临着更高的成本，不过生产者受益了。而且由于金属和矿业企业负债沉重，收入反弹有助于巩固它们的资产负债表，过程中还会缓解中国的金融风险。

最后，环保限制本身也可以带来增长和岗位。中国正大力推广清洁能源，势头强劲。据估计，2017年中国新增太阳能装机容量接近55吉瓦，超过了年初任何其他国家的已装机容量。中国的电动汽车产量约占全球的五分之二。而在更成熟的行业，企业感受到了升级的压力。姚老板说，为了继续经营，他将把餐具厂搬到一个新的工业园区，那里的废物处理标准更高。

如果中国治污相对温和的负面影响会持续下去，那就引出了一个明显的问题：政府为什么这么晚才开始大力治污？一个重要原因是疼痛分布不均。烟囱工业主要分布在华东的山东和华北的山西等少数几个省份。只要执法权是抓在地方政府手中，官员就没有动力采取行动，因为没人想要扼杀本地企业的发展。但从国家的角度来看，为实现绿色增长而付出经济代价应该就容易承受一些了。中国将付出代价，但同时也会获得回报。





MiFID 2

Day zero

Sprawling new European financial regulations enter into force at last

AFTER years of rule-drafting, industry lobbying and plenty of last-minute wrangling, Europe's massive new financial regulation, MiFID 2, was rolled out on January 3rd. Firms had spent months dreading (in some cases) or eagerly awaiting (in others) the “day of the MiFID” when the law's new reporting requirements would enter into force. One electronic-trading platform, Tradeweb, even gave its clients a “MiFID clock” to count down to it.

Apprehension was understandable. The new EU law, the second iteration of the Markets in Financial Instruments Directive (its full, unwieldy name), affects markets in everything from shares to bonds to derivatives. It seeks to open up opaque markets by forcing brokers and trading venues to report prices publicly, in close to real time for those assets deemed liquid. It also requires them to report to regulators up to 65 separate data points on every trade, with the aim of avoiding market abuse.

The changes are greatest for markets, like those in bonds and derivatives, that are now largely conducted “over the counter” (ie, not on exchanges). But the law also restricts share trading in “dark pools” closed to retail investors, provides for access to European markets for non-EU firms, and requires investment banks to start charging separately for research, among myriad other provisions. It is perhaps the biggest regulatory change to European financial markets since the financial crisis.

For all the jitters, the first hours of trading under the new regime went fairly smoothly, though trading volumes were lower than usual. Financial firms

had collectively spent \$2.1bn preparing for MiFID 2 in 2017 alone, according to one estimate by Expand, part of the Boston Consulting Group, and IHS Markit, a data provider.

Some banks had people up all the night before the 3rd. The preparations paid off. But regulatory reprieves also helped. In late December the European Securities and Markets Authority (ESMA), an EU regulator, granted a six-month reprieve from the requirement that every counterparty to a trade must have a “legal-entity identifier”, a unique number, after many firms failed to obtain these in time. It also let trading continue across the EU even though 17 of its members had not yet fully transposed the rules into national law. And ESMA clarified that trading on non-EU venues could continue while it finishes its assessment of which jurisdictions will be deemed “equivalent”. This avoided a worst-case scenario, in which European traders suddenly lost access to the New York Stock Exchange, say, or the Chicago Mercantile Exchange.

Early on January 3rd itself, Germany’s and Britain’s regulators allowed three large futures exchanges—Eurex Clearing in Frankfurt, and ICE Futures Europe and the London Metal Exchange in Britain—to delay implementation of “open access” provisions until mid-2020. These rules, divorcing the execution of futures contracts from the clearing of them (they now occur at the same exchange), were contentious when passed, with Britain reportedly a strong proponent and Germany staunchly opposed. A London lawyer thinks the long delay, to past the date in 2019 when Britain is to leave the EU, may well mean these provisions “never see the light of day”.

Significant as they may be for parts of the market, such reprieves do not amount to a delay of the overall law, says Jonathan Herbst of Norton Rose Fulbright, a law firm. Nonetheless, a disaster-free implementation day does not mean the end of the worries. As Enrico Bruni of Tradeweb points out, market participants will adjust their trading patterns over time, and

emerging problems will need to be resolved. It will take even longer to see if the structural changes the new framework is forecast to encourage—such as consolidation among brokers or asset managers—materialise. And the law may yet play a role in the Brexit negotiations. Its rules on financial-market access for third countries, after all, will apply to Britain. There are many more days of the MiFID to come. ■



《金融工具市场指令 II》

刚刚开始

覆盖广泛的欧盟新金融法规终于生效

经过多年的规则起草、行业游说以及大量最后关头的争论，欧洲庞大的金融监管新法规MiFID 2于1月3日正式实施。过去几个月里，一些企业担惊受怕，一些却翘首期盼，都是因为在“MiFID日”这一天，这套法规包含的新的报告要求将开始生效。电子交易平台Tradeweb甚至还为客户准备了一台“MiFID钟”来倒计时。

担忧是可以理解的。这套欧盟新法规是《金融工具市场指令》（即MiFID繁杂的全称）的第二版，会从股票、债券以及衍生品等方方面面影响市场。其目标是迫使经纪商及交易场所近乎实时地公布流动性资产的价格，从而提高市场透明度。为避免市场滥用，指令还要求它们就每笔交易向监管机构汇报多达65个独立的数据点。

对于债券和衍生品买卖等目前主要通过“柜台交易”（即非交易所买卖）的市场来说，变化最大。但指令的众多条款还限制了不向散户投资者开放的“暗池”股票交易，对非欧盟公司进入欧洲市场也做出了规定，还要求投资银行必须就研究服务单独收费。这可能是金融危机以来欧洲金融市场最大的监管变化。

尽管气氛紧张不安，但新规则实施后的头几个小时交易状况相当平稳，只是交易量低于通常水平。据波士顿咨询集团下属的Expand公司和数据供应商IHS Markit估计，为筹备应对MiFID 2，金融企业单单在2017年就花费了21亿美元。

有些银行让员工在1月3日前通宵达旦地做准备，功夫确实没白费。但监管法令的宽限期也有帮助。指令要求任何交易的双方都必须持有独一无二的“法人实体标识符”（legal-entity identifier），但许多公司没能及时获取这串数字。于是去年12月底，欧盟监管机构欧洲证券和市场管理局（以下简

称ESMA）就此给出了六个月的宽限期。而且，尽管有17个欧盟成员国仍未完全把这套指令转化为国内法规，ESMA依然允许各方在欧盟范围内继续交易。ESMA还澄清，在它完成司法辖区“等同”评估前，欧洲企业仍然可以在非欧盟交易场所交易。这就避免了最坏的情况发生，即欧洲交易者突然丧失了进入纽约证券交易所或芝加哥商品交易所的资格。

1月3日当天一早，德国和英国的监管机构批准三家大型期货交易所将“开放式接入”的规定推迟至2020年中实施。它们包括法兰克福的欧洲期货交易所清算公司（Eurex Clearing）、英国的欧洲洲际交易所（ICE Futures Europe）和伦敦金属交易所（London Metal Exchange）。这些规定将期货合约的执行与结算分离（目前是在同一交易所进行的），在通过时曾引起争议，据称英国强烈支持，而德国坚决反对。伦敦一位律师认为，此次推迟这么久，等到2019年英国完成脱欧了都还没开始实施，这几乎等于它们“永不见天日”了。

诺顿罗氏律师事务所（Norton Rose Fulbright）的乔纳森·赫布斯特（Jonathan Herbst）表示，这些宽限举措对部分市场意义重大，但不等于指令整体延后实施。不过，指令生效之日风平浪静不意味着从此就可安枕无忧。正如Tradeweb的恩里科·布鲁尼（Enrico Bruni）指出，市场参与者将逐步调整交易模式，而且还需要解决新出现的问题。设想中新框架将催生的结构性变化（如经纪商或资产管理机构内部的整合）是否会成真，也需要更长时间才能见分晓。该指令还可能对英国脱欧谈判有所影响。毕竟，其中有关第三国进入欧洲金融市场的规定将适用于英国。MiFID的日子还长着呢。 ■



Anti-money-laundering technology

Washing whiter

Software is patrolling the financial system, looking for crooks

KEEN, no doubt, to stay alive, drug traffickers tend to be prompter payers than most. For software firms, this is just one of many clues that may hint at the laundering of ill-gotten money. Anti-money-laundering (AML) software, as it is called, monitors financial transactions and produces lists of the people most likely to be transferring the proceeds of crime.

Spending on this software is soaring. Celent, a research company, estimates that financial firms have spent roughly \$825m on it so far this year, up from \$675m last year. Technavio, another research firm, reckons the market is even bigger and will grow at more than 11% annually in coming years. This is partly because authorities are increasingly quick to punish institutions that let down their guard. Deutsche Bank, for example, has been hit with fines worth at least \$827m this year alone. Governments, eager to appear tough on crime, are urging prosecutors to go after not just institutions, but also their employees.

The number of anti-laundering regulations is climbing yearly—by nearly 10% in America, Canada and the EU, and by roughly 15% in Australia, Hong Kong, Malaysia and Singapore, says Neil Katkov, a regulatory analyst at Celent. Even the red-tape-slashing administration of President Donald Trump is unlikely to cut regulation in this area.

David Stewart, head of anti-money-laundering systems at SAS, a software giant based in North Carolina, reckons that efforts to abide by such rules now take from a half to about 70% of most banks' entire spending on compliance. A survey this year by Duff & Phelps, an advisory group, found

that financial firms typically spend about 4% of revenue on compliance, a figure expected to reach 10% in 2022.

Many clues that lead software to block a transaction, or to flag it for a human to investigate, are straightforward. Round sums are more suspect than jagged ones. Spikes in transaction volumes and amounts are suspicious. So is cash deposited in an account via multiple branches. An area's culture also matters. Sasi Mudigonda, of Oracle, says its software considers transactions linked to eastern Ukraine riskier than the west of the country, where Russian influence is weaker. Even age counts—crooks who move money disproportionately steal the identities of old people and young adults, says Michael Kent, chief executive of Azimo, a remittances firm.

Software also hunts for clues that someone on one of hundreds of watch lists has concocted a fake identity—the giveaway could be the opening of an account with a password or phone number once used by a corrupt official. ComplyAdvantage, a firm based in London, licenses software that generates long lists of suspected criminals by sifting through hundreds of millions of articles, including those in *The Economist*, and then determines which transactions may benefit one of them.

Moving the proceeds of big-ticket crime conventionally involves disguising them as legitimate trade payments. Software from a Singaporean firm, AML360, is designed to flag instances of this. Daniel Rogers, the company's boss, says it monitors "a jigsaw puzzle" of factors such as ship itineraries, the locations of commodity producers and fluctuations in their prices. The software notices if a firm imports expensive stainless steel when a cheaper source of the material is closer at hand, say, or if an importer's spending on copper rises as its price falls.

The next step for AML software is a big leap in the amount and types of data it crunches. Last year SAS launched Visual Investigator, developed at a cost

of about \$1bn. It links financial transactions with text and even imagery in reams of social media. This could reveal, for example, that a restaurant's cash deposits appear too large for the amount of online "buzz" the business generates; or that a payment recipient skis with a kleptocrat.

With SAS software, rather more than half of flagged transactions lead to the filing of a suspicious-activity report (SAR) with authorities. Monique Melis, head of regulatory consulting at Duff & Phelps in London, argues that, to reduce "false positives" further, regulators should begin systematically to disclose the SARs that lead to a discovery of crime. Software could then be better calibrated to withstand a growing problem highlighted by Sophie Lagouanelle of FircoSoft, a Paris developer of AML technology: savvy launderers are learning how the software works to slip past it.

Should human analysts fear for their jobs? Probably not. They will still be needed to follow up on many flagged transactions. Business has not slowed for Berlin Risk, a German consultancy that discreetly investigates the nature of a person's character and earnings by talking to as many as 20 people who know him. As its senior partner, Carsten Giersch, puts it, "You will never see a robot interviewing sources." Or is that the next step? ■



反洗钱技术

洗白白

软件在金融系统中巡逻，寻找犯罪分子的踪迹

毒贩无疑觉得保命要紧，因此他们往往比大多数人付款更快。对于软件公司来说，这只是暗示可能有不法分子在洗钱的许多线索之一。顾名思义，反洗钱（AML）软件监控金融交易并生成名单，列出最有可能是在转移犯罪所得的人。

在这类软件上的花费正在飙升。研究公司Celent估计，今年迄今为止，金融公司在这方面已投入约8.25亿美元，去年为6.75亿美元。另一家研究公司Technavio认为这一市场还要更大，且未来几年将以每年11%以上的速度增长。原因之一是监管机构在惩罚放松警惕的金融机构时动作越来越快。例如，德意志银行今年一年就受到至少8.27亿美元的罚款。各国政府急于在打击犯罪方面显示强硬姿态，敦促检察官不但要追究金融机构的责任，还要追究雇员个人。

Celent的监管分析师尼尔·卡特科夫（Neil Katkov）表示，反洗钱法规的数量在逐年攀升，美国、加拿大和欧盟每年上升近10%，澳大利亚、香港、马来西亚和新加坡大约上升15%。即使是要大幅去监管的特朗普政府也不可能削弱这方面的监管。

大卫·斯图尔特（David Stewart）是北卡罗莱纳州软件巨头SAS公司的反洗钱系统主管。他认为，现在遵守这些法规的工作占到大多数银行合规总支出的一半到70%左右。咨询公司道衡（Duff & Phelps）今年的一项调查显示，金融公司通常将收入的4%用于合规，预计到2022年这一数字将达到10%。

一些线索会引导软件阻止交易，或者标记可疑之处以待人工调查。它们大多很简单：整数比有零有整的数目更可疑；交易量和金额突然增加很可疑；现金通过多个分行存入一个账户同样可疑。一个地区的文化也很重

要。甲骨文公司的萨希·穆迪岗达（Sasi Mudigonda）说，甲骨文的软件认为与乌克兰东部有关的交易风险高于该国西部，因为俄罗斯对后者的影响力较弱。就连年龄也与风险水平有关。汇款业务公司Azimo的首席执行官迈克尔·肯特（Michael Kent）说，转移钱财的犯罪分子会大量盗用老人和年轻人的身份。

软件还会寻找线索，判断数百份监控名单之一列出的某个人是否已伪造了假身份，露馅的线索可能是此人开具银行账户时用了曾属于某腐败官员的密码或电话号码。伦敦公司ComplyAdvantage授权客户使用的软件会详查包括《经济学人》文章在内的数千万篇文章，生成长长的可疑犯罪分子名单，然后判断哪些交易可能会让其中的某人受益。

把高案值犯罪所得包装成合法贸易所得进行转移是常见做法。新加坡公司AML360的软件就专门对此类交易加标注。公司老板丹尼尔·罗杰斯（Daniel Rogers）表示，该软件会监控“拼图图块”般各种因素，如船舶行程、商品生产者所在地和价格波动等。如果一家公司明明在国内就能买到比较便宜的不锈钢，却选择高价进口，或者铜价下跌时进口商的进口额反而升高，这些异常都会被软件察觉。

反洗钱软件发展的下一步是在所处理数据的数量和类型上实现重大飞跃。去年，SAS推出了“视觉侦探”（Visual Investigator）软件，开发成本约为10亿美元。这款软件能将金融交易与社交媒体中的文本甚至图像联系起来。这能揭示很多线索，例如，相对其在网络上的低“人气”而言，某家餐馆的现金存款太多；或者某笔付款的收款人和一个贪官一起滑雪。

在被SAS软件标记出来的交易中，一多半最终由工作人员向监管部门提交了可疑活动报告（SAR）。在伦敦的道衡主管监管咨询的莫妮克·梅里斯（Monique Melis）认为，为了进一步减少“误报”，监管机构应该系统地披露是哪些SAR报告帮助发现了犯罪行为。这样就可以更好地校准软件，抵御一个日益严重的问题——巴黎AML技术软件开发商FircoSoft的索菲·拉古阿奈拉（Sophie Lagouanelle）强调说，精明的洗钱者正在学习软件的工作方式，以躲避监督。

人类分析员应该担心自己的工作吗？可能不用。很多被标记的交易仍然需要人类分析员跟进。德国咨询公司Berlin Risk的业务就没有减少。该公司谨慎地调查一个人的品性和收入情况，为此会与多达20个认识他的人交谈。正如其高级合伙人卡斯丹·吉尔奇（Carsten Giersch）所说：“你永远也不会看到机器人去询问消息提供者。”或者这是下一步的发展方向？■



Fishing

The bounty below

A new survey of a pursuit fundamental to human society

THROUGHOUT history, often for religious reasons, humans have tended to believe the oceans are inexhaustible. An Egyptian pharaoh was assured by his father in about 2010BC that the gods had made fish for humans to eat. Likewise, Christianity encouraged the faithful to consider the products of both sea and land as intended by God for human use: an infinite bounty. Only with the advent of a vast, industrialised fishing industry, and the damage and depletion it has caused, has it become clear that this assumption has been a disastrous mistake.

With the advent of arable and animal agriculture, fishing alone, of the three ancient ways of obtaining food—the other two being hunting and plant foraging—has remained vital to human civilisation. It seems astonishing that a pursuit so fundamental to human society has lacked a comprehensive historian for so long. Brian Fagan's is the first general survey of its kind, and it is packed with intriguing details (like the Chinese training cormorants to catch fish for them) as well as with persuasive generalisation.

One of the barriers has been the near-invisibility of fishing's past role. Fishers have always been secretive by nature: “anonymous folk”, unlikely either to discuss profitable grounds or to leave much trace in the historical record. The perishability of most of their equipment has also left only a small archaeological mark. Complex societies and massive projects—from the Pyramids in Egypt to Angkor Wat in Cambodia—have depended upon a vast “anonymous background” of mobile food producers who foraged, hunted and fished, depending on the season and on which edible organisms were available.

Modern science has magnified the information obtainable from tiny clues, and it is often by focusing on these that Mr Fagan is able to paint a picture that is satisfying, if necessarily at times impressionistic and informed by guesswork. He describes, for instance, how the isotopic signature of fish bones reveals where the fish lived, and hence whether or not the fishing was local. He also explains how fishbone analysis, by divulging the approximate age of fish caught, has found signs of population depletion and overfishing (as older fish died off and reliance on younger, smaller, less fertile fish increased). And he shows how analysis of human bones reveals that family diets often differed; that ancient cultures, in other words, were often quite inegalitarian.

Throughout, discussion of past overfishing or earlier climate change—“palaeoclimatology”—hangs heavy with the question of the impact on human society both of overfishing and of global warming. Modern climate scientists face precisely the same limited but influential denial as did those who first argued in favour of husbanding, and trying to preserve the oceans’ fish stocks.

“Fishing” is a valuable book as well as an interesting one. It shows vividly how human civilisations have depended on harvests from the sea, just as they did on harvests from the fields. At times, it strays beyond what might appeal to the general reader: an abundance of references to “macrozooplankton”, or to a “site known as SCRI-109” made this non-specialist feel that the water was occasionally too deep. In general, though, Mr Fagan succeeds in providing an admirable primer for the enthusiast and a welcome tool for the historian—as well as a salutary reminder of the lessons of inaction. ■



捕鱼

海中恩赐

一本新书调查了一项对于人类社会至关重要的工作

纵观历史，人类往往相信海洋资源取之不尽，这通常是由宗教的原因。大约在公元前2010年，一位埃及法老的父亲向他保证，鱼是众神为人类准备的食物。同样，基督教也令信徒们把海洋和陆地的出产视作上帝特意为人类准备的馈赠，是用之不竭的恩赐。直到庞大的工业化捕鱼业出现，造成环境破坏、资源日渐枯竭，人们才明白这个想法是个灾难性的错误。

随着农耕和畜牧业的出现，狩猎、植物采集和捕鱼这三种古老的获取食物的方式中，只有捕鱼仍对人类文明至关重要。这项工作对人类社会不可或缺，长久以来却缺乏全面的历史研究，这似乎令人震惊。布莱恩·费根（Brian Fagan）的著作首次对这一活动做了综合调查。书中充满了引人入胜的细节（比如中国人训练鸬鹚来捕鱼），其中的概括也颇有说服力。

研究的障碍之一是捕鱼业在过去扮演的角色几乎无迹可寻。渔民从来都生性隐秘：身为“无名之士”的他们既不太可能讨论哪些地方生计好，也不大会在历史记录中留下太多痕迹。他们的大部分用具也都容易腐烂，因而只留下微小的印记供考古学家探究。从埃及的金字塔到柬埔寨的吴哥窟，种种庞大工程以及复杂的社会都要依赖大量“寂寂无名”的流动食品生产者，他们采集食物、狩猎、捕捞，一切行动都根据季节和能获得的可食用生物而定。

现代科学放大了微小线索透露的信息，费根往往正是通过聚焦这些信息得以绘制出一幅令人满意的图景，也因此有时难免主观，有猜测的意味。例如，他描述道，鱼骨的同位素特征会显示鱼的生存区域，因而可推导出捕鱼活动是不是在本地进行的。他还解释说，通过鱼骨分析可以确定所捕获鱼类的大致年龄，利用这一点可以捕捉到种群枯竭和过度捕捞的迹象（随着成鱼逐渐减少，人们开始更多捕捞个头更小、繁殖能力较弱的幼鱼）。

他还指出，对人类骨骼的分析揭示出家家户户的饮食常有不同，换句话说，就是古代社会往往相当不平等。

自始至终，对过去的过度捕捞或早期气候变迁（即“古气候学”）的探讨，都因为难免要探讨这两点对人类社会的影响而变得棘手。率先主张节约并试图保护海洋鱼类资源的人遭到了否定，这些否定的声音虽有限但很有影响力。现代气候科学家的境遇与之完全相同。

《捕鱼》是一本可贵而有趣的书。它生动地展示了人类文明何等依赖海洋的馈赠，正如他们依赖田间的收成。作者有时信马由缰，谈些普通读者可能不感兴趣的内容，比如屡屡提及“大型浮游动物”，或一个“名叫SCRI-109的地方”，这让没有专业知识的本文作者感觉到水有时候也太深了。不过总的来说，费根为爱好者奉上了一本非常出色的入门书，也为历史学家提供了一本有用的工具书。通过这本书，费根也提醒人们谨记无所作为带来的教训。 ■



Schumpeter

The year of the incumbent

In 2018 conventional firms will give Silicon Valley a run for its money

ACCORDING to Ginni Rometty, IBM's boss, the digital revolution has two phases. In the first, Silicon Valley firms make all the running as they create new markets and eviscerate weak firms in sleepy industries. This has been the story until now. Tech firms have captured 42% of the rise in the value of America's stockmarket since 2014 as investors forecast they will win an ever-bigger share of corporate profits. A new, terrifying phrase has entered the lexicon of business jargon: being "Amazoned".

The second phase favours the incumbents, Ms Rometty believes, and is starting about now. They summon the will to adapt, innovate to create new, digital, products and increase efficiency. The schema is plainly self-serving. IBM is itself fighting for survival against cloud-based tech rivals and most of its clients are conventional firms. Yet she is correct that incumbents in many industries are at last getting their acts together on technology.

Enough time has elapsed for even the dopiest to see the threat. It is 11 years since Netflix began streaming video and five since Tesla unveiled the Model S. The evisceration by tech firms of some mid-sized businesses, such as department-store retail, has concentrated minds. Lagging share prices have helped. In 2017 Ford fired its boss, Mark Fields, despite near-record profits. Its board concluded he was complacent about technological change.

Taking a sample of America's 20 most valuable non-tech firms, 14 now have a digital dimension to their strategies. Some blue-chip firms are mixing fashionable cocktails of e-commerce, big data and artificial-intelligence (AI) initiatives. But others are making comprehensive, multi-billion-dollar bets.

General Motors is developing a suite of electric and autonomous vehicles. Walmart is in the midst of a massive online shopping push. Investors view such initiatives as central to these firms' prospects.

A round of mergers and acquisitions has kicked off as firms respond to the threat from Silicon Valley. On December 14th Walt Disney said it would spend \$66bn buying most of 21st Century Fox. One motivation for the deal is to counter the menace of streaming video services, most notably those of Netflix and Amazon. In 2019 Disney will stop distributing new films through Netflix and launch its own streaming services. On December 12th Westfield and Unibail, a pair of huge operators of shopping malls, joined forces with two main aims: to bulk up in response to e-commerce and to build a global brand with a digital presence.

Incumbents have lots going for them. They own 80% of the commercial world's data, as Ms Rometty has noted. If AI is set to change civilisation by using data to make better decisions, most of the historical data-sets about, say, jet-engine performance or clothing supply chains belong to established firms, beyond the reach of Amazon and Facebook. Incumbents have vast resources: among S&P 500 firms, their total cashflow is four times that of tech firms' and 18 times what venture capitalists invest each year.

Established giants also enjoy barriers to entry such as strong brands and lobbying skills, the latter being especially crucial in America's money-driven political system. Also on December 14th, American regulators abolished "net neutrality" rules requiring telecoms carriers to treat all internet traffic equally—a victory for conventional telecoms and cable firms. Silicon Valley faces a global regulatory "techlash" over issues such as privacy and tax.

A typical approach by conventional firms is a blend of bolt-on acquisitions of startups and organic investment in new technologies. GM has invested

in Lyft, a ride-sharing firm, and developed electric engines. On December 13th, Target, which operates discount stores, bought Shipt, a online-delivery platform. Walmart has bought Jet.com, an e-commerce firm. Western banks have been busy buying fintech firms, although the cleverest incumbents in finance are Asian. Ping An, a Chinese insurance firm, has 265m users for its app. DBS, South-East Asia's biggest lender, has set up online banks in both India and Indonesia.

A few firms are opting for huge deals. On December 3rd CVS, a drugstore and health-care benefits manager, said it would pay \$77bn for Aetna, a health-insurance company. The idea is to bulk up and lock in customers before Amazon enters the business of selling medicines. Within the tech industry, IBM is not the only mature firm trying to adapt. In March Intel bought Mobileye for \$15bn—it specialises in chips and software for driverless cars.

Conventional wisdom says incumbent firms are timid about technological change, scared to cannibalise profits and trapped in an unimaginative mindset. In 1997 Clayton Christensen laid out this view in “The Innovator’s Dilemma”. Kodak, which folded after failing to see that camera film would become obsolete, is the classic example. Yet for every Kodak there is a Marconi, that goes too far, too fast. Formerly called GEC, it was Britain’s largest industrial firm in the 1990s but collapsed after wrecking its balance-sheet with acquisitions of fashionable but flaky tech firms in 1999.

A few firms have already been indisciplined. John Flannery, General Electric’s new boss, has axed some digital projects after judging them extravagant. But no one is yet making existential wagers. Taking a sample of eight incumbents, on average their digital initiatives are worth 14% of the size of the firm (using a range of metrics, including sales, investment and market value). So for example, e-commerce eats up only a fifth of Walmart’s investment budget. Even Disney-Fox’s existing initiatives are small. Hulu, a streaming service that it will control, makes losses equivalent to less than a

tenth of its parents' annual spending on content.

Conventional firms' digital bets will only grow larger, as more bosses note the rising share prices of pioneers such as Walmart and GM. Overall this makes sense, even if plenty of companies make an utter hash of things. For large incumbents, in 2018 digital strategy will stop being about trendy experiments and start being a matter of life and death. ■



熊彼特

老牌企业之年

2018年，传统公司和硅谷有得一拼

按照IBM老板罗睿兰（Ginni Rometty）的说法，数字革命有两个阶段。在第一个阶段，硅谷的企业一马当先，开创新市场，重挫那些因循守旧行业中的弱者。这种情形延续至今。投资者预测科技公司会抢占更大份额的企业利润，推动其股价一路上扬，自2014年以来占到美国股市价值增长的42%。商业术语词典中新增了一个骇人的词语——“被亚马逊了”（Amazoned）。

罗睿兰认为，从现在开始的第二阶段将有利于老牌企业。它们立志与时俱进，通过创新来创造新的数字化产品并提高效率。这显然是一种“自我激励”的思考模式。IBM自己正在和基于云计算的科技公司激战，这关系到它的生死存亡，而它的大部分客户也都是传统公司。不过，有一点她还是说对了：很多行业的老牌企业终于整顿旗鼓，要在科技上发力了。

经过了那么长时间，即使最迟钝的人也看清了威胁。现在距Netflix开始经营流媒体已有11年，距特斯拉发布Model S已有5年。等到百货公司这样的中型企业也被科技公司打得人仰马翻后，人们清醒了过来。落后的股价也起了作用。2017年，尽管公司利润接近历史记录，福特还是解雇了CEO马克·费尔兹（Mark Fields）。董事会认为他在科技变革方面故步自封。

看看美国20家最具价值的非科技公司，其中已有14家把数字化纳入公司战略。一些蓝筹公司多管齐下，同时涉足时兴的电子商务、大数据以及人工智能领域。而另一些公司则押下几十亿美元的赌注来发展与原业务平行的数字部门：通用汽车正在研发一系列电动和无人驾驶汽车。沃尔玛正在大举推动线上销售。投资者将这些举措视为这些公司未来成功的核心因素。

传统公司已经启动了一轮并购来应对硅谷的威胁。去年12月14日，迪士尼表示将斥资660亿美元收购21世纪福克斯的大部分资产。这起交易的一个

动机是对抗来自以Netflix和亚马逊为代表的流媒体服务的威胁。2019年迪士尼将停止通过Netflix发行电影，转而启用自己的流媒体服务。12月12日，两大购物中心运营巨头Westfield和Unibail合并，此举有两大目的，一是抱团应对电子商务的冲击，二是建立一个拥有强大数字业务的全球品牌。

老牌企业有很多优势。正如罗睿兰指出的，它们拥有商界80%的数据。如果说利用数据来优化决策的人工智能将改变人类文明，那么大部分历史数据集（比如喷气发动机的性能或服装的供应链）都属于老牌企业，而不是在亚马逊和Facebook的手中。老牌企业拥有大量资源：在标准普尔500的成分股中，它们的总现金流是科技公司的4倍、风险投资者年投资额的18倍。

老牌巨头也因为市场准入门槛而受益，比如它们强大的品牌和游说能力，后者在美国金钱驱动的政治体系中尤为关键。也是在12月14日，美国监管部门废除了要求电信运营商对所有网络流量一视同仁的“网络中立性”原则，这对传统电信和有线电视公司来说是一个胜利。硅谷则在隐私和税务等问题上面临着全球监管机构的“技术抵制”。

传统公司的典型做法是，一方面收购创业公司来补强业务，一方面在内部投资开发新技术。通用汽车投资了拼车公司Lyft，研发了电动发动机。12月13日，折扣店运营商塔吉特（Target）收购了在线送货平台Shipt。沃尔玛收购了电子商务公司Jet.com。西方的银行一直忙于收购金融科技公司，不过最精明的金融老牌企业在亚洲。中国保险公司平安的APP拥有2.65亿用户。东南亚最大的银行星展银行（DBS）在印度和印尼都开展了网上银行业务。

一些公司选择进行巨额收购。12月3日，药店及医疗保健福利管理公司CVS表示，将斥资770亿美元收购医疗保险公司Aetna，目的是在亚马逊进军药品零售业之前壮大自身并锁定顾客。在科技界，IBM不是唯一应势而动的老牌公司。去年3月，英特尔以150亿美元收购了专营无人驾驶汽车芯片和软件的公司Mobileye。

人们普遍认为老牌企业畏惧科技变革，害怕新技术冲击公司传统业务的收益，且囿于老套的思维模式。1997年，克莱顿·克里斯坦森（Clayton Christensen）在其《创新者的窘境》（The Innovator's Dilemma）一书中清楚表达了这一观点。未能预见胶卷将被淘汰而破产的柯达就是一个典型的例子。然而，每有一个反应滞后的柯达，就有一个走得太远太快的马可尼（Marconi）。马可尼的前身GEC是20世纪90年代英国最大的工业企业，却在1999年倒闭，原因是收购了一些时髦却怪异的科技公司而导致负债累累。

少数公司已经开始失控。通用电气的新老板约翰·弗兰纳里（John Flannery）就砍掉了一些他认为烧钱而不实用的数字项目。不过还没有人做出关系到公司生死存亡的赌注。以八家老牌企业为样本，平均来说，它们的数字化业务相当于公司规模的14%（基于销售额、投资额及市值等一系列指标）。例如，电子商务只占沃尔玛投资预算的五分之一。甚至迪士尼-福克斯现有的数字化业务占比也很小。即将由迪士尼控股的流媒体服务公司Hulu的亏损额还不到母公司每年在内容上花费的十分之一。

当更多传统公司的老板注意到沃尔玛和通用汽车这些先驱者的股价不断上涨，他们只会增加对数字化的赌注。总体来说这是合理的，即使很多公司会把局面搞得一团糟。但对于老牌大公司来说，2018年，数字化战略将不再只是赶时髦的尝试，而会开始成为生死攸关的要务。■



Competition and technology

Taming the titans

Google, Facebook and Amazon are increasingly dominant. How should they be controlled?

NOT long ago, being the boss of a big Western tech firm was a dream job. As the billions rolled in, so did the plaudits: Google, Facebook, Amazon and others were making the world a better place. Today these companies are accused of being BAADD—big, anti-competitive, addictive and destructive to democracy. Regulators fine them, politicians grill them and one-time backers warn of their power to cause harm.

Much of this techlash is misguided. The presumption that big businesses must necessarily be wicked is plain wrong. Apple is to be admired as the world's most valuable listed company for the simple reason that it makes things people want to buy, even while facing fierce competition. Many online services would be worse if their providers were smaller. Evidence for the link between smartphones and unhappiness is weak. Fake news is not only an online phenomenon.

But big tech platforms, particularly Facebook, Google and Amazon, do indeed raise a worry about fair competition. That is partly because they often benefit from legal exemptions. Unlike publishers, Facebook and Google are rarely held responsible for what users do on them; and for years most American buyers on Amazon did not pay sales tax. Nor do the titans simply compete in a market. Increasingly, they are the market itself, providing the infrastructure (or “platforms”) for much of the digital economy. Many of their services appear to be free, but users “pay” for them by giving away their data. Powerful though they already are, their huge stockmarket valuations suggest that investors are counting on them to

double or even triple in size in the next decade.

There is thus a justified fear that the tech titans will use their power to protect and extend their dominance, to the detriment of consumers. The tricky task for policymakers is to restrain them without unduly stifling innovation.

The platforms have become so dominant because they benefit from “network effects”. Size begets size: the more sellers Amazon, say, can attract, the more buyers will shop there, which attracts more sellers, and so on. By some estimates, Amazon captures over 40% of online shopping in America. With more than 2bn monthly users, Facebook holds sway over the media industry. Firms cannot do without Google, which in some countries processes more than 90% of web searches. Facebook and Google control two-thirds of America’s online ad revenues.

America’s trustbusters have given tech giants the benefit of the doubt. They look for consumer harm, which is hard to establish when prices are falling and services are “free”. The firms themselves stress that a giant-killing startup is just a click away and that they could be toppled by a new technology, such as the blockchain. Before Google and Facebook, Alta Vista and MySpace were the bee’s knees. Who remembers them?

However, the barriers to entry are rising. Facebook not only owns the world’s largest pool of personal data, but also its biggest “social graph”—the list of its members and how they are connected. Amazon has more pricing information than any other firm. Voice assistants, such as Amazon’s Alexa and Google’s Assistant, will give them even more control over how people experience the internet. China’s tech firms have the heft to compete, but are not about to get unfettered access to Western consumers.

If this trend runs its course, consumers will suffer as the tech industry

becomes less vibrant. Less money will go into startups, most good ideas will be bought up by the titans and, one way or another, the profits will be captured by the giants.

The early signs are already visible. The European Commission has accused Google of using control of Android, its mobile operating system, to give its own apps a leg up. Facebook keeps buying firms which could one day lure users away: first Instagram, then WhatsApp and most recently tbh, an app that lets teenagers send each other compliments anonymously. Although Amazon is still increasing competition in aggregate, as industries from groceries to television can attest, it can also spot rivals and squeeze them from the market.

What to do? In the past, societies have tackled monopolies either by breaking them up, as with Standard Oil in 1911, or by regulating them as a public utility, as with AT&T in 1913. Today both those approaches have big drawbacks. The traditional tools of utilities regulation, such as price controls and profit caps, are hard to apply, since most products are free and would come at a high price in forgone investment and innovation. Likewise, a full-scale break-up would cripple the platforms' economies of scale, worsening the service they offer consumers. And even then, in all likelihood one of the Googlettes or Facebabies would eventually sweep all before it as the inexorable logic of network effects reasserted itself.

The lack of a simple solution deprives politicians of easy slogans, but does not leave trustbusters impotent. Two broad changes of thinking would go a long way towards sensibly taming the titans. The first is to make better use of existing competition law. Trustbusters should scrutinise mergers to gauge whether a deal is likely to neutralise a potential long-term threat, even if the target is small at the time. Such scrutiny might have prevented Facebook's acquisition of Instagram and Google's of Waze, which makes navigation software. To ensure that the platforms do not favour their own

products, oversight groups could be set up to deliberate on complaints from rivals—a bit like the independent “technical committee” created by the antitrust case against Microsoft in 2001. Immunity to content liability must go, too.

Second, trustbusters need to think afresh about how tech markets work. A central insight, one increasingly discussed among economists and regulators, is that personal data are the currency in which customers actually buy services. Through that prism, the tech titans receive valuable information—on their users’ behaviour, friends and purchasing habits—in return for their products. Just as America drew up sophisticated rules about intellectual property in the 19th century, so it needs a new set of laws to govern the ownership and exchange of data, with the aim of giving solid rights to individuals.

In essence this means giving people more control over their information. If a user so desires, key data should be made available in real time to other firms—as banks in Europe are now required to do with customers’ account information. Regulators could oblige platform firms to make anonymised bulk data available to competitors, in return for a fee, a bit like the compulsory licensing of a patent. Such data-sharing requirements could be calibrated to firms’ size: the bigger platforms are, the more they have to share. These mechanisms would turn data from something titans hoard, to suppress competition, into something users share, to foster innovation.

None of this will be simple, but it would tame the titans without wrecking the gains they have brought. Users would find it easier to switch between services. Upstart competitors would have access to some of the data that larger firms hold and thus be better equipped to grow to maturity without being gobbled up. And shareholders could no longer assume monopoly profits for decades to come. ■



竞争与科技

驯服巨人

谷歌、Facebook和亚马逊的统治力越来越强。该如何控制它们？

不久前，在大型西方科技公司做老板还是一份让人梦寐以求的工作。在亿万财富滚滚而来之时，还能收获交口称赞：谷歌、Facebook、亚马逊等公司正让世界变得更加美好。而今天，这些公司备受指责——规模太大、反竞争、令人上瘾、破坏民主。监管机构对它们开出罚单，政客对它们严厉质询，曾经的支持者也发出警告，指出它们势力过大，可能造成危害。

大部分对科技企业的抵制都有失偏颇。大企业一定就邪恶这种推断完全错误。世界上市值最高的上市公司苹果广受尊重，原因很简单：即便面临激烈的竞争，苹果仍能生产出消费者愿意买单的产品。如果在线服务供应商的规模比实际上要小，很多服务的质量就要打折扣。没有强有力的证据证明智能手机与幸福感低之间有关联，假新闻也并非网络独有。

然而大型科技平台确实引发了对公平竞争的担忧，特别是Facebook、谷歌和亚马逊。原因之一是它们经常因免于承担法律责任而受益。与出版商不同，Facebook和谷歌很少为用户在其平台上的行为负责。多年来，亚马逊上的大部分美国买家都没有支付消费税。这几个超级巨头也不只是在市场上竞争，它们正日益变成市场本身，为大部分数字经济提供基础设施（即“平台”）。它们的许多服务看似免费，但用户在交出自己的数据时实际就在“付费”了。尽管它们已经实力强大，但其巨大的市值表明，投资者期待未来十年它们的规模能再增加一倍甚至两倍。

因此有理由担心，科技巨头会利用自身实力来保护和扩大它们的主导地位，进而损害消费者的利益。政策制定者面临的棘手任务是既要约束它们，又要避免过度约束而扼杀创新。

这些平台之所以能够称霸，原因在于“网络效应”。比方说，亚马逊上的卖家越多，就会吸引更多买家来购物，而这又能吸引更多的卖家。如此这

般，雪球越滚越大。据估计，亚马逊抢占了美国网购总额的40%以上。Facebook的月活跃用户超过20亿，掌控着媒体行业。企业离不开谷歌，在一些国家，90%以上的网络搜索用的都是谷歌。Facebook和谷歌这两家公司控制了美国在线广告收入的三分之二。

美国的反垄断机构对科技巨头使用了无罪推定。它们要先找到消费者受害的证据，但在价格下降、服务“免费”的情况下很难做到。这些巨头自己也强调，说不定点一下鼠标的工夫，击垮巨头的创业公司就出现了，而且它们还可能会被类似区块链的新技术所颠覆。谷歌和Facebook出现之前，Alta Vista和MySpace都是行业翘楚，如今谁还记得它们？

然而，行业门槛在不断抬高。Facebook不仅拥有世界上最丰富的个人数据，还有最大的“社交图谱”——用户名单以及用户之间的联系。亚马逊掌握的定价信息比其他任何公司都多。亚马逊的Alexa和谷歌的Assistant这些语音助手将能让它们更好地控制人们的互联网体验。中国的科技企业有竞争的实力，但还不能自由地服务西方的消费者。

如果任由这个趋势发展，科技行业会变得缺乏活力，消费者利益也会因而受损。投向创业公司的资金会减少，大多数好的创意都将被巨头买断，而且，利润总归都会被巨头收入囊中。

这种情况已初见端倪。欧盟委员会指控谷歌利用其移动操作系统安卓预装自家的应用。Facebook一直在收购那些有朝一日可能会分流其用户的公司：先是Instagram，然后是WhatsApp，最近是tbh——一个让青少年匿名赞美对方的应用。尽管亚马逊总体而言仍在促进竞争，从食品杂货到电视等行业都可以证明，但它也有可能识别出竞争对手并将其挤出市场。

该怎么办呢？过去各国处理垄断企业的办法或是将其拆分，比如1911年对标准石油公司的拆分，或是将它们当作公用事业来监管，例如1913年对AT&T采取的措施。今天，这两种方法都有很大的缺陷。价格管制和利润上限等传统的公用事业管制工具难以应用，因为大部分产品都是免费的，而且还会抑制投资和创新，代价太高。同样，完全肢解将削弱这些平台的

规模经济，导致提供给消费者的服务质量下降。而且即使拆分了谷歌、Facebook这样的企业，由于网络效应无可避免地会重新发挥作用，其中的某个“小谷歌”或“小Facebook”最终还是很可能再次横扫市场。

缺乏简单的解决办法会让政客找不出简明的口号，但不至于让反垄断机构无能为力。如果能大幅转变两种思考方式，将大大有助于巧妙地驯服这些大家伙。首先是更好地利用现有的竞争法规。反垄断机构应该仔细审查兼并案，判断某项兼并是否有可能消除潜在的长远的威胁，即使当时兼并对象的规模还很小。以前如果有这样的审查，Facebook可能就不会收购Instagram，谷歌也不会收购导航软件Waze了。要确保平台不偏袒自己的产品，可以设立监督小组来审议对手的投诉，这有点像2001年针对微软反垄断案成立的独立“技术委员会”。对内容免责的豁免也必须取消。

其次，反垄断机构需要重新思考科技市场的运作方式。经济学家和监管机构讨论的越来越多的一个重要见解是，消费者实际上是用个人数据作为货币来购买服务的。从这个角度看，科技巨头通过产品获得了关于用户行为、人际关系和购买习惯的宝贵信息。美国在19世纪制定了有关知识产权的复杂规则，同样，现在它需要一套新的法律来管理数据的所有权和交换，好让个人能切实掌握自己的权利。

这实质上是让人们更好地控制自己的信息。如果用户有需要，关键数据就应实时提供给其他公司，现在欧洲的银行在处理客户账户信息方面就被要求做到这一点。监管机构可以要求平台公司向竞争对手提供匿名的批量数据，换取一定的费用，有点像专利的强制许可。这种数据共享要求可以根据企业的规模作调整：企业越大，要共享的数据就越多。这些做法能把巨头为了抑制竞争而囤积的数据变成可供用户分享、促进创新的数据。

这些事做起来都不容易，但能让科技巨头收敛，同时又不破坏它们带来的好处。用户转换服务也会更容易。崛起的竞争对手可以获得大公司持有的部分数据，从而更有可能成长壮大而不是被吞并。股东们则再也不能指望未来几十年都获得垄断利润了。 ■



Software-as-a-service

The tower of Benioff

Salesforce has reached great heights. Can it keep climbing?

VISIBLE from nearly every corner of San Francisco and from up to 30 miles away, the new skyscraper that will be the headquarters of Salesforce, a software giant, stands 1,100 feet (326 metres) tall, making it the highest building in America west of Chicago. On January 8th, after four years of building, workers will start moving in.

Those who know Salesforce's founder, Marc Benioff, find his firm's new digs fitting. As creator of a firm that caters to salespeople, he is himself a fiercely ambitious salesman. In its 2018 fiscal year, which ends on January 31st, Salesforce is expected to reach \$10bn in annual revenue for the first time. It plans to more than double that figure over the next four years. Even that is not enough. In 20 years Mr Benioff's "dream" is \$100bn of revenue, he muses.

Can his towering expectations be met? Founded in 1999, Salesforce claims a combination of longevity and size that few tech companies have achieved; its market capitalisation is \$76bn. It is the largest tech firm with headquarters in San Francisco and the world's fourth-largest software firm, after Microsoft, Oracle and Germany's SAP, which were all founded in the 1970s.

Mr Benioff was early to spot an opportunity in delivering software as a service, meaning that software can be accessed remotely by users through the cloud, rather than being installed on firms' computers on their premises. This mode of delivery needs no upfront investment by companies for software that may go unused; instead subscribers pay a fee for

employees that access it each month. Salesforce's "customer relationship management" software, which helps companies keep track of their clients and manage prospective leads, is its main product, but it also offers tools for customer service, marketing, analytics and digital commerce.

Mr Benioff is a key element of the product too; a mix of showman, digital guru, political activist and philanthropist. Those close to him call it "marketing". Seeing firms struggling to adapt to technology trends, he puts himself forward as a digital consigliere, travelling globally to advise bosses. Each autumn Salesforce spends an estimated \$30m to put on Dreamforce, drawing some 170,000 participants to San Francisco with a promise of parties and prominent speakers.

Not everyone appreciates his salesmanship. He has taken many public positions, often through Twitter—for example, on gay rights and equal pay for women. "As political leaders become weaker, chief executives have to become stronger," says Mr Benioff. To date the firm has given \$168m in philanthropic grants. Many customers like to feel they are not only buying software but doing good for the world, says Keith Weiss of Morgan Stanley. But Salesforce's annual "10-K" securities filing lists its political positions as a risk for shareholders. According to former executives, Mr Benioff's fondness for setting policy by tweets, such as cancelling events in states that have issued anti-gay laws, can sometimes cause organisational chaos.

That is not the only drawback. Gerhard Gschwandtner, boss of a firm that publishes a magazine, *Selling Power*, calls him "a merchant of hope" but also cautions that "selling the future can attract focus away from weaknesses in the present moment". Only around a quarter of his firm's sales come from outside the Americas. Its business generates plenty of cash—in its 2017 fiscal year it produced around \$2.2bn—but its operating profits have been persistently low. That is in large part because it spends so

lavishly on sales and marketing—a total of \$10bn between 2015 and 2017.

Investors reckon Salesforce's business will keep generating lots of cash as it expands into new areas of software. But there is a risk that marketing costs stay high and that Salesforce splurges on deals in order to grow. In recent years it has diversified its business lines mainly through acquisitions. Some purchases, such as Demandware, a cloud-based provider of e-commerce services that it bought for \$2.9bn in cash in 2016, were sensible, but others, such as Buddy Media, a social-media firm it acquired for around \$750m in 2012, are viewed as expensive mistakes. Mr Benioff also flirted with buying Twitter in 2016 but backed off when shareholders protested. They also worried when Salesforce bid for LinkedIn, a professional social network; Microsoft bought it for \$26.2bn.

As for organic growth, Salesforce was later than Microsoft and some other firms to invest properly in artificial intelligence (AI), which is expected to make software more predictive and useful. In 2016 it bought an AI startup, MetaMind, for around \$33m, and is using the talent it scooped up in the deal to put together an AI offering, called Einstein, which aims to make Salesforce's software feel more personalised and insightful. Yet some wonder whether it can close the AI gap on rivals.

Salesforce may dominate sales-management software, but in newer areas of business, such as digital commerce and marketing, it faces stiff competition. Google and Amazon, for example, have an edge in the two fields, and enormous resources. Nor are Salesforce's existing competitors, Oracle, Microsoft and Adobe, showing any inclination to surrender in the battle over sales software. LinkedIn gives Microsoft access to valuable sales-lead data. Startups could yet beat Salesforce on price or innovation.

Indeed, while Mr Benioff's pitch is all about supersized future revenues,

some people wonder if Salesforce will always remain independent. Its market value means it is neither a giant like Microsoft or Oracle nor a nimble startup. It is not easy to be a midsized publicly listed software company facing competition from tech giants. In 2015 Microsoft reportedly considered buying Salesforce, but a price could not be agreed. If a potential deal were once again to present itself, who better than a master salesman to see it through? ■



软件即服务

贝尼奥夫之塔

业绩斐然的Salesforce能否继续攀升？

在旧金山，几乎从每个角落都能望见一座新建成的摩天大楼，即使30英里开外也看得到。它是软件巨头Salesforce的总部所在，高1100英尺（326米），是芝加哥以西的美国国土上最高的建筑。经过四年建设，员工们已于本月8日起入驻。

认识Salesforce创始人马克·贝尼奥夫（Marc Benioff）的人认为，公司的新楼跟这位老板很相称。贝尼奥夫创办的这家公司为销售人员提供服务，而他本人就是一个有着凌云壮志的推销员。在1月31日结束的2018财年，Salesforce预计将首次实现100亿美元的年营收。公司计划未来四年让这个数字至少翻一番。这还不够。贝尼奥夫的“梦想”是20年内让营业额达到1000亿美元，他沉思道。

这个宏伟的愿望能达成吗？Salesforce成立于1999年，综合创立时间与规模来看，很少有科技公司达到它的成就。它的市值为760亿美元，是总部在旧金山的科技公司中最大的一家。它是世界第四大软件公司，仅次于微软、甲骨文和德国的SAP，而前面这三家都是在20世纪70年代就创立的。

贝尼奥夫很早就发现将软件作为一种服务提供给客户是个商机，也就是说，用户可以通过云来远程使用软件，而不用把它们安装在自己公司的计算机上。这样一来，用户无需对可能用不上的软件做前期投资，而是作为订购用户，每月为使用该软件的员工支付费用。Salesforce的主要产品是帮助公司跟踪客户并管理潜在客户的“客户关系管理”软件，但它也提供客户服务、营销、分析和数字商务方面的工具。

贝尼奥夫自己也是产品的关键元素：他集明星、数字大师、政治活动家和慈善家的角色于一身。跟他亲近的人管他这一套叫“马氏营销”（marc-

eting）。他看到各家公司难以适应技术趋势，于是变身数字军师，周游全球向老板们进言。每年秋季，Salesforce都会花费约三千万美元举办Dreamforce大会，吸引约17万人来到旧金山。每届大会都举行各种派对，并有知名人士发表演讲。

并不是所有人都欣赏他的推销术。他经常通过推特就很多问题公开表达自己的立场，比如同性恋权利和女性同工同酬。他说：“政治领导人越来越弱，首席执行官就只能变得更强。”迄今为止，公司的慈善捐款已达1.68亿美元。摩根士丹利的基思·韦斯（Keith Weiss）表示，许多客户认为自己不仅在购买软件，还在为世界做贡献，他们喜欢这种感觉。但在每年的10-K证券报表中，Salesforce都把它的政治立场列为股东的风险之一。根据前高管们的说法，贝尼奥夫喜欢通过推特来发布决策，比如在颁布反同性恋法的州取消活动，这有时会导致组织上的混乱。

这不是唯一的缺点。《销售力》（Selling Power）杂志所属公司的老板杰哈德·葛史汪德纳（Gerhard Gschwandtner）称贝尼奥夫是“一个售卖希望的商人”，但同时也警告说，“售卖未来可能会令人们不再注意眼前的不足”。贝尼奥夫的公司只有约四分之一的销售额来自美洲以外。它的业务产生了大量现金，2017财年约有22亿美元，但营业利润一直很低。这在很大程度上是因为公司在销售和营销上花费巨大，2015年至2017年期间投入的总额达100亿美元。

投资者认为，随着Salesforce向新的软件领域扩展，其业务将继续产生大量现金。但风险在于公司营销成本居高不下，及为实现增长在并购交易上大肆挥霍。近些年，Salesforce主要是通过收购来实现业务的多元化。有些收购是明智的，比如2016年它以29亿美元现金收购了基于云的电子商务服务供应商Demandware；但其他一些则被视为代价高昂的错误，如2012年以7.5亿美元收购社交媒体公司Buddy Media。贝尼奥夫还曾在2016年动过收购推特的念头，后来因为股东抗议而作罢。当Salesforce向职业社交网络领英（LinkedIn）出价时股东们也很担忧。最后微软以262亿美元的价格收购了领英。

至于内部增长，Salesforce比微软和其他一些公司在人工智能（AI）上的投资要晚，AI技术被认为能让软件更有预测性、更好用。2016年，公司花费约3300万美元收购了AI创业公司MetaMind，凭借从这一交易中网罗的人才推出了名为Einstein的AI产品，目的是让Salesforce的软件更加个性化、更具洞察力。不过有些人怀疑它能否在AI领域缩小与竞争对手的差距。

Salesforce可能在销售管理软件上占据主导，但在电子商务和数字化营销等较新的业务领域却面临激烈的竞争。例如，谷歌和亚马逊在这两个领域既有优势也有海量资源。Salesforce一直以来的竞争对手甲骨文、微软和奥多比（Adobe）在营销软件大战中也没有任何要屈服的迹象。微软通过领英得到了宝贵的潜在客户数据。创业公司也可能在价格或创新上击败Salesforce。

的确，虽然贝尼奥夫说来说去都是未来的巨额收入，但有些人怀疑Salesforce能否永远保持独立。它的市场价值意味着它既不是微软或甲骨文这样的巨头，也不是一家灵活的创业公司。一家必须直面科技巨头对手的中型上市软件公司并不易为。据说2015年微软曾考虑收购Salesforce，但无法就价格达成一致。如果交易机会再次出现，谁能比一个销售大师看得更透彻？■



China's currency

Stable hands

How China won the battle of the yuan

“THE horse may be out of the proverbial barn.” So wrote Ben Bernanke, a former chairman of the Federal Reserve, in early 2016, arguing that capital controls might be powerless to save China from a run on its currency. He was far from alone at the time. As cash rushed out of the country, analysts debated whether the yuan would collapse, and some hedge funds bet that day was coming fast. But two years on, the horse is back in the barn: the government’s defence of the yuan has succeeded, in part through tighter capital controls.

The latest evidence was an 11th consecutive monthly increase in foreign-exchange reserves in December. During that time China’s stockpile of official reserves, the world’s biggest, climbed by \$142bn, reaching \$3.14trn, roughly double the cushion usually regarded as needed to ensure financial stability. Another sign of China’s success is the yuan itself. At the start of 2017 the consensus of forecasters was that the currency would continue to weaken; it finished the year up by 6% against the dollar.

Investors and analysts were not wrong in viewing Chinese capital controls as porous. Enterprising types had—and have—umpteen ways to sneak money out, from overpaying for imports to smuggling cash across the border in luggage. But there is a wide spectrum between a fully open and fully closed capital account, and China has showed over the past year that it can tilt towards closure, at least for a time.

Its measures were directed at actors big and small. Under more scrutiny from regulators, China’s overseas acquisitions fell by more than a third, to

\$140bn last year. Individuals were still permitted to convert up to \$50,000 a year, but they faced heavier disclosure burdens. The government is in no hurry to relax these controls: a new, lower ceiling on withdrawals from ATMs abroad went into effect on January 1st.

Also crucial to China's defence of the yuan was an economic rebound. Housing prices soared and industrial firms' profits rose by 20% last year on the back of higher commodity prices. Here, Mr Bernanke can claim some vindication: in looking at China's options in 2016, he had suggested that a fiscal boost would support growth and so help keep cash at home. An unconventional policy mix—investment in low-income housing and closure of excess industrial capacity—did the trick.

China had a stroke of good luck, too. Many had thought that Donald Trump's presidency would initially add to dollar strength, which might have pulled cash away from China. But America's political muddle instead weighed on the dollar. Not only did that boost the relative allure of Chinese assets, it also made its foreign-exchange reserves look more valuable in dollar terms, because roughly a third are held in other currencies. Over the past year, true inflows accounted for just about a third of the rise in China's reserves; valuation changes explained the rest (see chart). Other Asian economies with hefty foreign-currency reserves, from Japan to Taiwan, reaped similar gains.

As America cuts taxes and raises interest rates, the dollar may soon perk up. But China has less cause for concern than in 2016. Capital controls have reinforced the bolts on its barn door. And with growth holding up, the horse inside is well-fed. ■



中国货币

稳手驭马

中国如何打赢人民币保卫战

“马儿可能已经冲出马厩了。”2016年初，美联储前主席伯南克如此写道。他认为资本管制或许无力使人民币免遭抛售。当时持此观点的远不止他一人。随着资金快速流出中国，分析师们就人民币是否会崩盘争论不休，一些对冲基金则押注这一天会很快到来。但两年过去了，马儿又回到了马厩：中国政府打赢了人民币保卫战，某种程度上靠的正是收紧资本管制。

最新的证据是截至去年12月，中国的外汇储备已经连续11个月增长。其间，中国的官方储备（规模为全球之首）增加了1420亿美元，达到3.14万亿美元，大概是通常认为的要确保金融稳定所需缓冲的两倍。中国成功的另一个标志是人民币本身。2017年初，预测者一致认为人民币会继续走弱，但到年末，人民币兑美元汇率已经上升了6%。

投资者和分析师认为中国的资本管制存在漏洞，这没错。不管过去还是现在，敢于冒险的人都有无数种方式把钱偷偷转移出境，从以过高的价格进口，到利用行李夹带现金跨境走私，不胜枚举。然而，完全开放的和完全封闭的资本账户之间跨度很大，在过去的一年里，中国已表明它可能倾向于封闭，至少一段时间内是如此。

中国的措施针对所有的参与者，不分大小。在监管机构更严格的审查下，去年中国的海外并购下降超过三分之一，降至1400亿美元。个人每年仍有五万美元的购汇额度，但要面临更大的信息披露责任。政府并不急于放松这些管制措施：在国外ATM机上取现的上限最近下调，1月1日起生效。

中国打赢人民币保卫战的另一个重要因素是经济回暖。去年，大宗商品价格上涨，房价随之飙升，工业企业的利润也增长了20%。在这里，伯南克算是说对了：在展望中国在2016年可能采取的应对方法时，他提出财政刺激将会支持经济增长，从而让资本留在国内。确实，奏效的是一个非常规

政策组合——投资建设保障性住房和关闭过剩的工业产能。

中国的运气也不错。许多人认为特朗普上台会让美元开始走强，而这可能会导致资金流出中国。但美国的政治混乱拖累了美元。这不仅提高了中国资产的相对吸引力，还使中国外汇储备的美元价值上升，因为它大约有三分之二的外汇储备是其他货币。在过去一年里，真正的流入仅占中国外汇储备增长的三分之一左右，其余的增长则来自估值变化（见图表）。从日本到台湾，其他拥有巨额外汇储备的亚洲经济体也获得了类似的收益。

随着美国减税和加息，美元可能很快就会升值。但中国无须像2016年时那样忧虑。资本管制让马厩的门闩更加牢固。随着经济持续增长，里面的马儿会吃得饱饱的。 ■



Crypto-currencies

Beyond bitcoin

Which could be the next digital coin to rule them all?

IT STARTED as a joke. Dogecoin was launched in 2013 as a bitcoin parody, using as its mascot a Japanese *shiba inu* dog, a popular internet meme. The crypto-currency was never really used, except for tipping online, and one of its founders has called it quits. But recently its price has soared: on January 7th the dollar value of all Dogecoins in circulation reached \$2bn, a sign of how crazy crypto-currency markets have become. It is also a reminder that, for all the focus on bitcoin, it is no longer the only game in town. Its market capitalisation now amounts to only about one-third of the crypto-market (see chart).

A new crypto-currency is born almost daily, often through an “initial coin offering” (ICO), a form of online crowdfunding. CoinMarketCap, a website, lists about 1,400 digital coins or tokens, including UFO Coin, PutinCoin, Sexcoin and InsaneCoin (worth \$7m). Most are no more than curiosities, but by January 10th, around 40 had a market capitalisation of more than \$1bn.

First on the list, after bitcoin, was Ethereum, whose coin, called ether, reached a market capitalisation of \$137bn. Ethereum’s claim to fame is that it is also a platform for “smart contracts”—business rules encapsulated in software. Most ICO tokens, for instance, are issued by such contracts. Its success has attracted crypto-copycats: Cardano (\$20bn) and NEO (\$8bn), a Chinese version.

Ripple, too, is defying gravity. It is all the rage in crypto-crazy South Korea, which earlier this month roiled crypto-markets with plans to ban trading on exchanges. Ripple sells software to move money between countries; more

than 100 banks have signed up to its technology, based on a coin called XRP. Its market capitalisation jumped by more than 40,000% in 2017, reaching nearly \$149bn on January 4th, before falling back to \$78bn. That still makes Chris Larsen, a Ripple co-founder, one of the world's richest people, at least on digital paper.

Less well-known coins have also taken wing. Monero (\$6bn) and Zcash (\$2bn) focus on privacy. Stellar (\$9.8bn) has developed a system to transfer funds cheaply that is used by charities, particularly in poor countries. IOTA (\$10.1bn) allows connected machines to exchange information and payments securely. And then there is Bitcoin Cash (\$46bn), whose founders split from bitcoin in August 2017 because they were unhappy with how it was run.

Might any of these one day replace bitcoin as crypto-land reserve currency, something insiders call the “flipping”? Given bitcoin’s governance problems (another “fork”, or split, may be in the offing) and limited capacity (a transaction now costs nearly \$30, on average, in fees), this cannot be excluded. But the others have problems, too. Ethereum’s user fees have soared and the system has again hit technical snags. As for Ripple, some question the extent to which XRPs are actually used.

Come what may, the field will only get more crowded. Kodak, the archetypal victim of digital disruption, wants to jump on the crypto-wagon: on January 9th it announced that it will launch a coin to allow photographers to charge for their works. More ambitious will be the ICO of Telegram, a messaging service with 180m users: it aims to raise \$1.2bn and issue a token called Gram that can be used to pay for a range of services from online storage to virtual private networks. Even Facebook has reportedly started looking into creating a token. Should the world’s biggest social network ever make that move, bitcoin’s days as the leading crypto-currency would almost certainly be numbered. ■



加密货币

超越比特币

下一个数字货币王者会是谁？

它的诞生其实是个玩笑。狗狗币（Dogecoin）以网络上流行的日本柴犬表情包Doge为标志，2013年推出时是为了嘲弄比特币。除了在网上打赏用，这一加密货币从未被真正使用，创始人之一也已退出。但最近该币价格飙升：1月7日，流通中的狗狗币总值达到20亿美元，足见加密货币市场的疯狂程度。这同时也提醒人们，尽管比特币集万千关注于一身，但已不是市场上唯一的选择。如今比特币只占加密货币总市值的三分之一左右（见图表）。

现在几乎每天都会有一种新的加密货币诞生，通常是通过“首次代币发行”（以下简称ICO）这一网上众筹形式推出。CoinMarketCap网站上列出的数字货币或代币约有1400种，包括UFO币、普京币（PutinCoin）、性币（Sexcoin），以及市值700万美元的疯狂币（InsaneCoin）。其中的大部分都只是凑热闹，但截至1月10日，约有40种数字货币的市值超过了10亿美元。

在该网站列表上，紧跟比特币之后的是以太坊（Ethereum）发行的以太币，市值达1370亿美元。以太坊成名的原因在于它还是一个“智能合约”平台——在软件中嵌入商业规则。市面上大部分ICO代币就是通过这些合约发行的。以太坊的成功催生了不少跟风的加密交易平台，如卡尔达诺（Cardano，市值200亿美元）及中国的NEO（市值80亿美元）。

瑞波币（Ripple）也是狂飙突进。在狂热追逐加密货币的韩国，瑞波币备受追捧。本月稍早时，韩国当局计划禁止加密货币在交易所交易，导致市场一片混乱。瑞波公司销售跨国转移资金的软件，有一百多家银行采用了该公司基于瑞波币（XRP）的技术。瑞波币市值在2017年跃升超过40,000%，1月4日升至近1490亿美元。尽管之后回落至780亿美元，但仍

然令瑞波币的联合创始人克里斯·拉森（Chris Larsen）成为世界上最富有的人之一，至少在“数字”账面是这样。

不太知名的代币也趁势而起。门罗币（Monero，市值60亿美元）和Zcash（市值20亿美元）注重保护交易者隐私。恒星币（Stellar，市值98亿美元）研发出以低廉成本转移资金的系统，主要供贫穷国家的慈善机构使用。埃欧塔（IOTA，市值101亿美元）让联网机器安全地交换信息及收付款项。还有比特币现金（Bitcoin Cash，市值460亿美元），其开发者因不满比特币的运作方式，在2017年8月从比特币中分裂出来。

有朝一日，这其中的某种会不会取代比特币成为加密领域的储备货币，也就是出现圈内人所谓的“大反转”（flipping）？鉴于比特币的内部治理问题（说不定很快会再出现一次“分叉”，也就是分裂）及区块容量接近饱和（目前平均每次交易的费用接近30美元），不排除发生“大反转”的可能。但其他加密货币也有问题。以太坊的用户费用飙升，系统也又一次遭遇技术故障。至于瑞波公司，有人质疑瑞波币实际被使用的程度。

不管怎样，数字货币领域只会越来越拥挤。数字革命中的典型牺牲品柯达公司也想赶上加密货币的大潮：1月9日，柯达宣布将推出一款供摄影师收取拍摄费用的代币。拥有1.8亿用户的即时通讯应用Telegram即将发起ICO，目标更加宏伟：融资12亿美元，并发行名为Gram的代币，可用来支付从网上存储到虚拟专用网络等各类服务的费用。据说连Facebook也在研究创设代币。假如这家全球最大的社交网络公司真的采取行动，那么比特币雄霸加密货币领域的时日几乎肯定屈指可数了。■



The Big Mac index

The Mac strikes back

The dollar's decline is a small victory for burgernomics

IT IS usually considered quaint to predict foreign-exchange movements by reference to whether currencies are dear or cheap. Metrics such as *The Economist's* Big Mac index, a lighthearted guide to exchange rates, hint at how far currency values are out of whack. But they are often driven further out of kilter by capital flows, by fear and greed, by the interventions of policymakers, and so on.

Since our last look at the index in July, cheap currencies have narrowed the valuation gap against the dollar—almost completely in case of the Canadian dollar (see chart). Fundamentals, such as fair value, seem (at last) to have greater sway in the foreign-exchange market.

The index is based on the idea of purchasing-power parity, which says exchange rates should move towards the level that would make the price of a basket of goods the same in different countries. Our basket contains only one item, but it is found in around 120 countries: a Big Mac hamburger. If the local cost of a Big Mac converted into dollars is above \$5.28, the average price in four American cities, a currency is dear; if it is below that yardstick, it is cheap. The average cost of a Big Mac in the euro area (weighted by GDP) is €3.95, or \$4.84 at the current exchange rate. That implies the euro is undervalued by 8.4% against the dollar, our benchmark. The last time we looked at burgernomics, it was almost 16% undervalued. The euro surged after Mario Draghi, boss of the European Central Bank, hinted at a conference in Sintra, Portugal, that the bank's bond purchases might soon be curtailed. It was as if the foreign-exchange market suddenly woke up to how cheap it was.

Measured against a basket of currencies, the dollar still looks dear. Only in three countries (Switzerland, Norway and Sweden) do burgers cost more, based on current exchange rates. But that is not necessarily a sign that depreciation is overdue in these countries. The cost of a burger depends partly on untradable inputs, such as rent and wages, which are higher in the rich countries on the fringes of the euro zone. So the price of a meal may not be a good guide to how competitive a country is in markets for tradable goods. The Swiss and Norwegian currencies look dear, for instance, but both countries have big trade surpluses.

Among rich countries, only Britain's and Japan's currencies stand out as bargains. The pound is cheap for a reason— Brexit. But it might be harder for the yen to stay so cheap. The euro has shown that the merest hint of an end to easy monetary policy can prompt a sharp rally. The yen may have a similar “Sintra moment”, says Kit Juckes of Société Générale, a bank. For those who feel they have missed out on the euro at bargain-basement prices, there are other ways to bet on the burgeoning strength of the euro-zone economy. Poland and the Czech Republic have strong links to the euro area and robust GDP growth. The Polish zloty is undervalued by 44% against the dollar, and the Czech koruna by 28%.

The caveat that applies to Switzerland, Norway and Sweden applies in reverse to emerging markets, where rents and wages are lower than in the rich world. In general, currency gauges based on purchasing-power parity work best when comparing countries with similar income. That said, many emerging-market currencies do look cheap. The Russian rouble, for instance, is still 57% undervalued even after a big rally in the oil price. South Africa's rand is almost as cheap. Eat hamburgers with Johannesburgers. ■



巨无霸指数

巨无霸反击战

美元下挫，“汉堡经济学”迎来一次小小的胜利

人们通常会觉得，以货币昂贵还是便宜作为参照来预测外汇动向的做法有些古怪。《经济学人》的巨无霸指数是一个不那么严肃的汇率参考，通过该指数可以一瞥币值失调的程度。但资本流动、人们的担忧和贪婪、政策制定者的干预等因素往往进一步加剧这种失常。

我们于去年7月发布了上一期指数，自那以后，各种“廉价”货币与美元的估值差距已经缩小，加拿大元与美元之间的差距几乎完全弥合（见图表）。公允价值等基本面因素似乎最终得以在外汇市场中发挥更大的影响力。

巨无霸指数以购买力平价为基础。该理论认为各国汇率应该会自行调整，直至一篮子商品在不同国家的售价相同。我们的篮子里只有一件商品，不过在大约120个国家都买得到：巨无霸汉堡。巨无霸在美国四个城市的平均售价是5.28美元，如果一国的巨无霸售价换算成美元后高于这个数字，该国货币就偏贵；如果低于这个数字，该国货币就被低估。在欧元区，巨无霸的平均价格是3.95欧元（受成员国GDP加权），按当前汇率折合4.84美元。这表示欧元相对于我们的基准货币美元被低估了8.4%。而上一次我们发布“汉堡经济学”的研究结果时，欧元相对美元差不多被低估了16%。后来欧洲央行行长马里奥·德拉吉（Mario Draghi）在葡萄牙辛特拉（Sintra）的一次会议上暗示该行也许很快将缩减购债规模，欧元随之飙升——就好像外汇市场突然意识到欧元太过便宜了。

相对于一篮子货币而言，美元看起来仍然昂贵。按当前汇率计算，只有瑞士、挪威和瑞典这三个国家的巨无霸售价高于美国。但这并不一定表示这三国的货币早该贬值。汉堡的售价一定程度上取决于不可交易的投入，如租金和工资。而在欧元区边缘的富裕国家里，这类投入的代价要更高。因

此，单凭一餐饭的价格可能并不能很好地了解一个国家在贸易市场中的竞争力如何。例如，瑞士和挪威的货币虽然看起来较昂贵，但两国都享有高额贸易顺差。

富裕国家中，只有英国和日本的货币明显被低估。英镑汇率低是有原因的：英国脱欧。不过日元兑美元汇率要想保持如此低位恐怕没那么容易。欧元的经历已表明，只要稍加暗示宽松的货币政策将结束，就会促发欧元急剧反弹。法国兴业银行（Société Générale）的基特·朱克斯（Kit Juckes）表示，日元说不定也会经历类似的“辛特拉时刻”。对于那些没在欧元汇率低时抓住机会的人来说，还有其他办法把握住欧元区经济的强劲升势。波兰和捷克与欧元区联系紧密，且GDP增长强劲。波兰兹罗提相对于美元被低估44%，捷克克朗被低估28%。

上文加诸瑞士、挪威、瑞典的考虑反过来也适用于租金和工资都比富裕国家低的新兴市场。一般来说，以购买力平价为基础的币值衡量指标在对比工资水平相近的国家时效果最好。这么说来，很多新兴市场的货币看起来确实被低估了。例如，即便在油价大涨之后，俄罗斯卢布相对美元仍被低估57%。南非兰特几乎同样便宜。跟约翰内斯堡人一起大吃汉堡吧。■



Buttonwood

Analysts off the couch

New rules deal a further blow to an old profession

THEY are not extinct, nor even on the endangered-species list. But company analysts, once among the most prestigious professionals in the stockmarket, are being culled. New European rules, with the catchy name of MiFID2, have just dealt analysts another blow. A study by Greenwich Associates estimates that the budget for the research they perform may drop by 20% this year.

In their heyday in the late 1980s and early 1990s, analysts could make or break corporate reputations. A “buy” or “sell” recommendation from the leading two or three analysts in an industry could move a share price substantially. Fund managers, and many financial journalists, relied on analysts to spot those companies that were on a rising trajectory, and those where the accounts revealed signs of imminent trouble. And the best analysts were very well paid.

But that golden age was built on some rusty foundations. Analysts were well paid because they worked for the big investment banks. But those big banks made money not just by helping investors to trade but also by advising companies on new issues, and on mergers and acquisitions. In such circumstances, there was an implicit bargain that analysts would be positive about a company’s prospects. If they were not, the chief executive might take his business elsewhere. Over time, “buy” recommendations far exceeded “sell” suggestions. This looked less like dispassionate analysis than marketing.

A second problem came in the 2000s as regulators cracked down on the

way that companies released news to the market. Information could no longer be selectively released to favoured analysts. By the same token, those “Sherlock-like” analysts who liked to spot trends through independent company visits faced difficulties. Everything came to depend on the profits guidance issued by companies for the next quarter or year. And analysts dared not let their forecasts stray too far from what the companies suggested. The paradoxical result was that finance, an industry whose acolytes often trumpet the superiority of free-market economics, had created a poorly functioning market—one that was oversupplied with analysts who mostly offered the same product.

Why, then, did it survive at all? The conventional way that investors rewarded banks for good research was not to pay for it directly, but to funnel securities trades their way. This system of “soft” commissions created two conflict-of-interest questions. Were fund managers trading more than they needed to just to pay for their research? And were they getting the best terms available when they did that trade? In both cases, the client, not the fund manager, was in effect paying for the service. There was little incentive to change.

Under the new MiFID rules, banks will not be allowed to bundle research up with other products. Fund managers will have to pay for it separately. As a result, they are expected to be much more selective. This recalls Dr Johnson’s response when Boswell asked whether the Giant’s Causeway in Northern Ireland was worth seeing. The great man replied: “Worth seeing, yes; but not worth going to see.” The suspicion is that, for many fund managers, the work of analysts is “worth having, but not worth paying to have”.

The rules may technically apply only to Europe but even American investment banks are expected to adjust their business models to cope with MiFID. The employment prospects of analysts had already been hit by

index-tracking, or “passive” fund management, which simply buys all the shares in a benchmark, and by the growth of quantitative hedge funds, which use computer programs to select stocks.

But the best analysts need not despair completely. The biggest fund managers employ in-house research. Some may be willing to pay for analysis from independent boutiques (as has been the case in the world of economics).

The fear, however, is that something will be lost in the process. For all their faults, analysts acted as conduits for company information to be passed to investors who could not afford their own research (charities and small pension funds, for example) and, via the media, to the general public. A few heroic analysts (one thinks of Richard Hannah, a long-term Eurotunnel sceptic) proved adept at exposing corporate flimflam.

Alas, the industry generated far too few sceptics and far too many corporate cheerleaders. The baby is being thrown out with the bathwater—but in recent times it was a very small baby amid an awful lot of murky water. ■



梧桐

分析师风光不再

新法规令一个老行当的处境雪上加霜

他们并未绝迹，甚至不在濒危物种名单上。但是，身为股市中一度最负盛名的专业人才之一，企业分析师眼下却面临优胜劣汰。名称朗朗上口的欧洲新法规MiFID 2（《欧盟金融工具市场指令 II》）新近又给了他们一记重击。格林威治协会（Greenwich Associates）的调查估计，今年在分析师研究报告上的预算可能会下降20%。

在20世纪80年代末、90年代初，分析师如日中天，能够一手操控企业声誉。只消行业内两三个大腕分析师“买入”或“卖出”的建议，就能大幅影响股价。基金公司和很多财经记者都有赖分析师来识别哪些公司蒸蒸日上，哪些公司账目显露出困境将至。顶尖分析师的收入非常可观。

但那样的黄金时代却是建立在某些腐朽的根基之上。分析师收入丰厚，是因为他们为大投资银行工作。而这些大投行的业务不仅包括帮投资者交易，还有在新股发行以及并购上为公司提供建议。在这种情况下，分析师会心照不宣地看好公司前景，否则公司首席执行官可能会另请高明。久而久之，“买入”的建议远远超过了“卖出”。这看上去不像公正的分析，倒更像是在做市场营销。

在21世纪的头十年，监管部门严格限制公司向市场披露消息的方式，由此产生了第二个问题——公司再也不可以有选择地将消息透露给关系好的分析师。同样，那些喜欢通过私下拜访来确定公司动向的“福尔摩斯式”分析师也遇到了难题。结果，一切只能看公司对下季度或来年利润的预期，而分析师则不敢让自己的预测和公司的预计偏差太多。这就产生了一个自相矛盾的结果：这个行业的信奉者总在鼓吹自由市场机制的优越性，但该行业却造就了一个运作不良的市场，其中有过多的分析师在出产无甚区别的研究报告。

这种情形为什么竟一直存在？投资者从投行获得优质的研究报告，但一直以来他们并不直接为报告付费，而是选择研究报告做得好的投行帮他们从事证券交易挣佣金。这种“软佣金”体系产生了两个涉及利益冲突的问题：基金公司是否额外做了不必要的交易，只为了补偿研究报告的费用？交易时，基金公司是否争取了最有利的条款？不管是哪种情况，实际为服务掏腰包的都是客户，而不是基金公司。因此没什么改变的动力。

MiFID新规禁止投行将研究报告与其他产品打包在一起，基金公司将必须单独为研报付费。因此可以想见，它们会变得非常挑剔。这让人想起当年传记作家鲍斯威尔（Boswell）问塞缪尔·约翰逊北爱尔兰的巨人堤（Giant's Causeway）是否值得一看时，这位伟人回答：“是的，值得一看，但不值得专程去看。”人们怀疑，对很多基金公司而言，分析师的报告“值得拥有，但是不值得付费拥有”。

该法规严格说来只适用于欧洲，但估计连美国的投资银行也会调整经营模式以应对MiFID。分析师的职业前景早已受到指数型基金（又称“被动型”基金）和量化对冲基金增长的冲击。前者是直接买入一个基准内的所有股票，后者则是使用电脑程序来选择股票。

但顶尖分析师也不必万念俱灰。那些最大的基金公司会建立自己的研究团队。有的基金公司也许会愿意花钱请独立的专业小公司做分析（这正是经济学领域的一贯做法）。

然而，人们担心新规执行的过程中会有所损失。尽管存在问题，但分析师还是起着沟通的作用，他们将公司信息传达给那些没有财力自己做调研的投资者（比如慈善机构和小型养老基金），还通过媒体传达给公众。一些分析师的义举也显示他们擅于揭露公司的谎言，比如长期质疑欧洲隧道公司的理查德·汉拿（Richard Hannah）。

唉，这个行业里产生了太多的公司吹鼓手，却没有几个质疑者。婴儿和洗澡水被一起泼了出去——不过就近期来说，随着一大盆浑水泼出去的只是一个小小的婴儿。 ■



Economic and financial indicators

Economic outlook

The Economist's latest poll of forecasters, January



经济与金融指标

经济前景

《经济学人》1月对各家预测机构的最新调查



The oil price

Crude thinking

High oil prices are mostly a reflection of a healthy global economy, not a threat to it

PERHAPS the most vexing thing for those watching the oil industry is not the whipsawing price of a barrel. It is the constant updating of theories to explain what lies behind it. In March 2014, when the price of a barrel of Brent crude was in three figures, the then boss of Chevron, an oil giant, observed that the scarcity of cheap oil meant “\$100 per barrel is becoming the new \$20”. Two years later, when the oil price slumped below \$28, the talk was of a global oil glut caused by the furious efforts of the OPEC cartel to regain market share. Now that oil prices have tested \$70, analysts are again scratching their heads.

In “1984”, George Orwell coined the term “doublethink”, the ability to believe two contradictory things. Oil analysis seems to require similar cognitive gymnastics. Three big questions arise. First, why has the oil price more than doubled in the space of two years, against all expectation? Second, why has this surge been met with cheers from global stockmarkets and not concern for the world economy? Lastly, where might the oil price eventually settle?

Start with the journey to \$70. The slump in prices two years ago was in part a response to weak demand—with the fragility of China’s economy a big concern—and in part to abundant supply. Few believed then that OPEC would, or even could, cut output. Saudi Arabia, the world’s largest oil exporter, appeared to have every reason not to. Plentiful oil supply would check the growth of the shale-oil industry in North America. It would also stymie Iran, its bitter rival, which was back in the market following the lifting of sanctions.

Yet demand recovered quickly. China pepped up its economy with faster credit growth and other fillips to spending. Commodity prices surged. Within months clear signs of a broad-based global economic upswing were palpable. And OPEC proved better able to curb production than anyone had imagined. A deal reached in November 2016 to restrict output had little immediate effect but by late last year started to pay off. Oil stocks fell, notably in America (see left-hand chart). Demand was outstripping supply. Prices duly rose.

It is still surprising they have risen so far. Higher prices are often blamed in part on the messy politics of the Middle East. The usual worries are there but “there has been no impact on physical supply,” says Martijn Rats of Morgan Stanley. Shale was also seen as the oil industry’s flexible response to price signals. Too high, and the wildcatters in Texas would drill for fresh supply. But small producers are showing a new restraint, because their financiers want greater focus on profits and less on output. And it takes several months from drilling wells for oil to come on-stream.

The financial markets show little sign of anxiety about the oil-price surge. Stockmarkets remain buoyant, which is itself another puzzle. Since the oil shocks of the 1970s, markets have associated a sudden run-up in oil prices with economic calamity. The world is both producer and consumer of oil, so in principle the overall effect of oil-price increases is neutral. But in practice, the net impact had been to reduce global demand, because oil exporters in the Middle East tended to save a big chunk of the windfall income they gained at the expense of oil consumers in the West.

Over time, however, the rich world has become less reliant on oil. Demand in America peaked in 2005, for instance. Meanwhile, oil exporters became ever more dependent on high oil prices to pay for lavish government budgets and imported consumer goods. Most of the big oil producers in the

Middle East need an oil price above \$40 to cover their import bill (see right-hand chart).

In this new arrangement, dearer oil is both far less damaging to rich-world consumers and soothes the strained finances of the big oil exporters, not just in the Middle East but in Africa, too. For all the other trouble-spots, investors seem to find the world economy a safer place. And they have other reasons to feel cheery. The shale industry means that dearer oil is a shot in the arm for investment in America, which adds to GDP growth. And a rising oil price is taken as a sign of healthy growth in China, the world's biggest oil importer.

Beneath the dramatic ups and downs in the oil price and its changing influence on the world economy are some big themes: the rise of the shale-oil industry and how OPEC responds; the dependence of the big oil exporters in the Middle East on high oil prices; the peak in oil demand in America and eventually elsewhere. These forces will have a big say in where oil prices eventually settle.

How they will play out is the subject of a new paper by Spencer Dale, chief economist of BP, another oil giant. The critical change in the oil market, he argues, is from perceived scarcity to abundance. When oil was considered scarce and expensive to find, it seemed wise to ration it. It was more like an asset than a consumer good: oil in the ground was like money in the bank. But new sources of supply, such as shale oil, and improved recovery rates of existing reserves, along with the emergence of mass-market electric vehicles, have changed the reckoning. There is a fair chance that much of the world's recoverable oil will never be extracted, because it will not be needed. It thus makes sense for the five big producers in the Middle East (Saudi Arabia, UAE, Iran, Iraq and Kuwait), which can extract oil for less than \$10 a barrel, to undercut high-cost producers and capture market share while the demand is there. The financial logic has changed to "better to have

money in the bank than oil in the ground," notes Mr Dale.

Does that mean oil prices are poised to plummet? Probably not, unless shale producers ramp up output again. The peak in global oil demand might be decades away, argues Mr Dale, and it will not tail off sharply. And for now, the big oil exporters cannot sustain very low oil prices for long. Their "social cost" of production, taking in government spending reliant on oil revenue, is about \$60 a barrel on average. Sustaining an oil price close to the cost of extraction will require reforms, which do not usually happen quickly. Translated into doublespeak: oil prices are too high; but they may not fall, in large part because big oil producers have got used to them. ■



石油价格

原油之略见

目前的高油价大体上是全球经济健康的表现，而不是对经济的威胁

对关注石油行业的人来说，最伤脑筋的可能还不是大幅动荡的油价，而是那些层出不穷、解释油价变化背后原因的理论。2014年3月，布伦特原油每桶价格达到三位数，石油巨头雪佛龙（Chevron）的时任总裁认为，低成本原油短缺，意味着“现在的每桶100美元，就相当于以前的每桶20美元”。两年后，油价暴跌到28美元以下，有说法称这是因为欧佩克为重新赢得市场份额而采取了激烈举措，导致全球石油过剩。而今油价已经逼近70美元，分析人士又开始挠头了。

在《1984》这本书中，乔治·奥威尔创造了“双重思想”（doublethink）一词，意为明知两个事物互相矛盾却都予以相信。分析石油行情似乎也需要类似的认知灵活度。有三大问题需要思考：一，为什么油价在两年内出人意料地翻了一倍以上？二，为什么此次油价飙升引发了全球股市喝彩，而非对世界经济的担忧？三，油价最终会落到何处？

先从油价涨至70美元的历程谈起。两年前油价暴跌，部分是因为需求疲软（中国经济的稳定性因而引发深切担忧），部分是因为供给充足。当时几乎没人认为欧佩克会减产，甚至认为它没能力减产。世界最大的石油出口国沙特阿拉伯不减产的理由似乎尤其充分：充足的石油供给会抑制北美页岩油产业的发展，也会压制其死敌伊朗在制裁解除后重返市场时的竞争力。

然而需求很快回升。中国的信贷快速增长，加之其他对消费的刺激，提振了该国经济。大宗商品价格大涨。数月内，全球经济显现出明显的广泛回暖迹象。事实证明欧佩克控制产量的能力超出所有人的想象。2016年11月达成的一个限产协定在当时收效甚微，但到去年年底时效果开始显现。石油库存减少，尤其是在美国（见图表左半部分）。需求开始超过供给，油

价应声上涨。

但如此涨势还是令人惊讶。人们常认为中东的政治乱局是高油价的原因之一。尽管一贯的担忧还在，但“对实体供应没有产生影响”，摩根士丹利（Morgan Stanley）的马基恩·拉茨（Martijn Rats）表示。页岩油也被视为石油行业里能对价格信号灵活应变的部分。如果油价过高，德克萨斯那些到处打井的开采商就会钻探新油井从而增加供给。但这些小生产商倒是表现出未曾有过的克制，因为它们的出资方希望更关注利润而非产量。而且从钻井到产油也要花费数月时间。

金融市场对油价暴涨几乎没有表现出忧虑。股市仍然繁荣，这本身也是个谜。自20世纪70年代的石油危机以来，市场一直将油价骤涨与经济灾难联系在一起。世界既是石油的生产者也是消费者，所以从理论上说，油价上涨的总体影响会相互抵消。但实际上，油价上涨往往让中东的石油出口国从西方的石油消费者那里大赚一笔，并且把其中很大一部分财富存起来，所以最终都是导致全球需求下降。

然而世易时移，富裕国家已不再那么依赖石油。比如，美国的石油需求在2005年就已见顶。与此同时，石油出口国却愈发依赖高油价来为其铺张的政府预算以及进口消费品买单。中东多数产油大国需要油价高于40美元才能支付它们的进口账单（见图表右半部分）。

在这种新格局下，高油价一方面对富裕国家消费者的影响小了很多，一方面还纾解了石油出口大国的财政紧张——不光是中东，还有非洲。尽管经济领域还有很多麻烦，但投资者似乎认为世界经济已经变得更安全。他们还有其他乐观的理由。页岩油行业的存在使得高油价成了促进美国内投资的强心剂，而投资增长又会促进GDP增长。在世界最大的石油进口国中国，油价上涨也被视作经济健康的表现。

在油价剧烈波动以及它对世界经济的冲击程度发生变化的背后，是一些重大议题：页岩油产业的崛起以及欧佩克的应对；中东石油出口大国对高油价的依赖；先是在美国而最终也会在别处出现的石油需求见顶。这些因素

会对油价的最终走向产生很大的影响。

在一篇新论文中，另一石油巨头BP的首席经济学家斯宾塞·戴尔（Spencer Dale）探讨了这些因素将如何发挥作用。他指出，石油市场关键的变化是在认知上——从认为石油短缺到认为石油充裕。当石油被认为是稀缺资源且勘探成本很高时，限量供应似乎是明智之举。这时石油更像是资产而不是消费品：留在地下的石油就像存在银行里的钱。但是页岩油这样的新供应来源、现有油井采收率的提高，以及面向大众市场电动车的兴起改变了人们的认知。世界上许多可采石油很有可能因用不上而永藏地下。因此，在世界对石油的需求尚存之时，能以每桶不到10美元的低成本开采石油的中东五大产油国（沙特、阿联酋、伊朗、伊拉克和科威特）会采取以低价排挤高成本生产商并夺取市场份额的做法就合情合理了。戴尔指出，理财之道已经变成了“与其把油留在地下，不如把钱存进银行”。

这是否意味着油价随时可能暴跌？可能不会，除非页岩油生产国重新提高产量。戴尔指出，离全球石油需求见顶可能还有数十年之久，石油需求并不会骤减。而目前来说，石油出口大国难以长期维持低油价。它们生产每桶石油的“社会成本”（包括依赖石油收入的政府开支）平均约为60美元。要想油价一直贴近开采成本就需要变革，但变革通常不会很快发生。用一句“双重表述”来说就是：目前油价过高，但可能不会下降，很大程度上是因为石油生产大国已经习惯了高油价。 ■



Digital music

Float of a celestial jukebox

Spotify has changed how people listen to music. To make money it may have to upend the industry yet again

IN JUST a few short years Spotify has evolved from bête noir of some of the world's most prominent recording artists to perhaps their greatest benefactor. The Swedish company transformed the way people listen to music, and got them used to paying for it again after digital piracy had crippled sales. Global revenues from music streaming, which Spotify dominates with 70m subscribers, more than tripled in three years, to an estimated \$10.8bn last year, for the first time surpassing digital and physical sales of songs and albums.

But if it is earning billions for others, Spotify is losing money for itself—with an operating loss of nearly \$400m in 2016—because it pays out at least 70% of its revenues to the industry, mostly in royalties. As it prepares for a “direct” listing on the New York Stock Exchange (see next article) it must convince investors that it has a path to profitability. Some reckon it can find one, but only at the expense of the labels it has enriched: by paying them less in royalties; by getting them (and others) to pay for promotions and data services; and even by competing with them directly, by making its own deals with artists. In other words, Spotify may only be able to make money by reshaping the industry yet again.

The economics of recorded music had shifted twice in the internet era before streaming came along, first owing to illegal file-sharing services such as Napster, then because of iTunes from Apple, which broke up the album. Retail music sales in America plunged by almost half, from a peak of \$14.6bn in 1999 to a low of \$6.7bn in 2014 (see chart 1). Spotify, which had

launched its streaming application in 2008, was only a minor source of revenue but a major target of artists who believed they would never make money earning a fraction of a penny per song streamed.

But Daniel Ek, the founder of Spotify (pictured), has long argued that the virtues of streaming would be manifest only when it achieved scale. That has begun to happen. In addition to Spotify's subscribers who pay \$10 a month (at least 70m more use its ad-supported free service), Apple Music has 30m subscribers and other music services have at least 70m more, according to MIDiA Research, a consultancy (see chart 2). Songs from the most popular artists now routinely surpass 1bn streams on subscription services—"Shape of You" by Ed Sheeran was Spotify's top track in 2017 as of early December, with 1.4bn streams. On average a billion streams on subscription services brings in about \$7m for big labels, with perhaps \$1m of that going to the artists. Another pot of money goes to songwriters and composers.

With a big and widening lead over its competitors, Spotify has quickly become the industry's most important distributor. Redburn, a research firm, estimates that in the first quarter of 2017 Spotify accounted for 17% of the \$5bn in revenues taken by record labels, and its share is growing. That gives it several points of leverage that could help it turn around its operating losses.

Spotify's most obvious power is its ability to make stars via its playlists and recommendation algorithms, much as radio DJs used routinely to do with simple airplay. Spotify has more than 2bn playlists; most of them are made by users themselves, but Spotify's own curated lists attract millions of followers. Redburn reckons that up to 20% of streams are via one of Spotify's own playlists. AWAL, an independent label run by Kobalt, a music-services

company, says that getting on a Spotify playlist boosts a music act's streams by 50% to 100%. Spotify would have to be careful how to monetise this clout, lest it be suspected of charging for a place on its playlists. But last year it did begin testing "sponsored songs" on its free service.

Another source of power for Spotify is its granular data on listening habits, ranging from where songs are listened to most and at what times, to what other acts a certain song's listeners will also tend to like. Spotify provides a lot of data at no charge to industry players, some of which either it must do (for calculating royalty payments) or considers wise to do.

Mr Ek says making data freely available helps artists use the platform better, which in turn benefits Spotify. Its data are already used by labels, artists, promoters and ticket sellers in planning album releases, artist collaborations and concert tours. But analysts believe that, as Spotify gets bigger, it can do far more with its data and extract a good price—from promoters of live events, say, as well as ticket sellers.

The streaming service's most intriguing point of leverage is that it could use these advantages to become a recorded-music label itself, working directly with artists. Matthew Ball, an analyst, argues that Spotify is sure to start cutting deals with artists in which it pays an upfront guarantee and promises a percentage of streaming revenue that is much smaller than it pays labels, but far more than artists get now.

The maths for these sorts of deals may be simplest for established artists, for whom performance is most predictable (though many will use their clout to get better deals with their existing labels). But with its data and playlist advantages Spotify can identify, elevate and theoretically sign contracts with up-and-coming artists, too. The channels that the labels knew so well, such as radio and record stores, have diminished in importance: "Breaking artists is one of the most important things labels do but it is becoming

harder than ever," says Mark Mulligan of MIDiA.

Becoming a label will not happen soon, partly because it would infuriate the incumbents who supply most music. But the growth of Spotify's core business has come at a cost that is hard to ignore. Its royalty payments are a built-in, large expense. (Some rights-holders are clamouring for even more; in December Wixen Music Publishing sued Spotify for \$1.6bn.) Competition from other paid streaming services mean it is hard for it to raise its own prices. To fund itself Spotify raised \$1bn in debt in 2016 under terms that allowed two of the lenders, TPG, a private-equity group, and Dragoneer, a hedge fund, to convert to equity at a discount that increased with time, making an early public listing desirable. As long as its losses mount, it will seek other ways to turn a profit.

That threat gives the labels an incentive to accept lower royalty payments from Spotify. They have another reason, too: Alphabet's YouTube, a source of free listening for perhaps more than 1bn people a month, which generates far less in royalties than subscription streaming. By helping Spotify, the industry helps itself.

Spotify has indeed negotiated reductions in royalty payments in the past year, beginning with Universal Music Group, a division of Vivendi and the largest supplier of music to the service, which reportedly agreed to be paid 52% of revenues, down from 55%. Spotify struck similar deals with the other two big labels, Warner Music Group and Sony Music.

Still, big-label bosses have long been conflicted about the company that changed their industry (and in which they each have a small equity stake). Early on they were sceptical about whether Spotify would make them much money. Now they may worry they are creating a future rival, much as the Hollywood studios licensed their content to Netflix. For the first time in 20 years the music industry is growing strongly. The fight for who comes out

on top may have only just begun. ■



数字音乐

云端点唱机要上市啦

Spotify改变了人们听音乐的方式。它若想赚钱，可能得再次颠覆音乐行业

从前，一些世界上最著名的唱片艺人视Spotify为眼中钉。短短几年，它就成了他们最大的恩主。这家瑞典公司改变了人们听音乐的方式，在数字盗版重挫唱片销售之后，让人们再次习惯为听音乐掏腰包。全球各种音乐流媒体（其中Spotify以7000万付费用户的规模占据主导地位）的收入三年内增长了两倍多，去年估计达108亿美元，首次超过了单曲和专辑的数字下载及实体唱片销售额。

但是，如果说Spotify正在帮别人赚大钱，它自己实则却在亏损。2016年，它的营业亏损达近4亿美元，因为它把至少70%的收入都付给了音乐行业，主要是支付版税。Spotify正准备在纽约证券交易所“直接”上市，既如此，它必须要让投资者相信自己有办法实现盈利。有人认为Spotify还是能找到办法的，只不过得牺牲那些靠它发财的唱片公司的利益：减少支付给唱片公司的版税；让它们（和其他公司）为宣传和数据服务付费；甚至自己和艺人签约，直接与唱片公司展开竞争。换句话说，Spotify或许只能通过再次重塑行业才能实现盈利。

在流媒体出现之前，唱片业在互联网时代已经发生了两次转变，先是由于出现了Napster这样的非法文件共享服务，之后是因为苹果公司的iTunes把专辑拆分成单曲销售。美国音乐零售额从1999年146亿美元的高峰下降到2014年的67亿美元（见图表1），近乎腰斩。于2008年推出流媒体应用程序的Spotify只是音乐行业一个很小的收入来源，但却成为艺人主要的攻击目标。他们认为自己从流媒体歌曲单次点击播放获得的收入微乎其微，根本赚不到钱。

但Spotify的创始人丹尼尔·艾克（Daniel Ek，见图）一直在说流媒体的优点只有在达到足够规模时才会显现出来。如今优势已开始显现。根据咨询

公司MIDiA Research的数据，除了每月支付10美元的Spotify付费用户（至少还另有7000万用户使用其带广告的免费服务）之外，Apple Music也有3000万付费用户，其他音乐服务至少还有7000万付费用户（见图表2）。如今最受欢迎的艺人的歌曲经常有超过10亿次的付费播放。截至去年12月初，艾德·希兰（Ed Sheeran）的《你的身姿》（Shape of You）成为2017年Spotify播放量最高的单曲，达到14亿次。平均来说，10亿次付费播放能为大型唱片公司带来大约700万美元收入，艺人大概会从中分走100万美元，另有一大部分会付给歌曲的词曲作者。

凭借对竞争对手巨大且还在不断扩大的领先优势，Spotify已迅速成为音乐产业最重要的分销商。研究公司Redburn估计，2017年第一季度唱片公司收入为50亿美元，Spotify贡献了其中的17%，而且这个占比还在增长。这给了它几个借力点，或许可以助它扭亏为盈。

Spotify最明显的优势是，它能够通过播放列表和推荐算法打造巨星，很像过去电台DJ经常简单地选播歌曲那样。Spotify有超过20亿个播放列表，大部分都是由用户自己建立，但Spotify自己创建的播放列表吸引了数百万的关注者。Redburn估计，高达20%的播放量都是出自Spotify自己的某个播放列表。音乐服务公司Kobalt运营的独立唱片公司AWAL表示，登上Spotify的播放列表可以令艺人作品的点击次数提高50%至100%。在利用这一影响力来获利的问题上，Spotify必须审慎，以免让人怀疑要付费才能让作品登上播放列表。不过去年Spotify的确开始在免费服务中测试“赞助歌曲”。

Spotify的另一个优势是拥有用户听音乐习惯的精细数据，包含在哪里收听、收听时间，以及某首歌曲的听众还可能会喜欢其他哪些艺人等。Spotify为音乐从业者免费提供大量数据，其中有些是出于必须（用于计算版税），有些是因为它觉得分享出来更明智。

艾克说，免费提供数据可以帮助艺人更好地利用这个平台，这反过来也会让Spotify受益。它的数据已经被唱片公司、艺人、宣传公司和票务公司用

来策划专辑发行、艺人合作和巡回演唱会。但分析师认为，随着规模扩大，Spotify能用这些数据做的事情还有很多，也可以有很不错的分成，比如向现场演出的宣传公司和票务公司收取一个好价钱。

Spotify最具吸引力的一个发力点是，它可以利用这些优势变身唱片公司，直接与艺人合作。分析师马修·波尔（Matthew Ball）认为，Spotify一定会开始与艺人签约，向艺人预付保证金，并承诺将一定比例的流媒体播放收入分给艺人。这部分费用将远低于它分给唱片公司的收入，但大大超过艺人目前所得。

已成名艺人的成绩最可预测，因而对他们来说，这种合约的好处可能最容易算清楚（尽管他们中很多人会选择利用自己的知名度跟现在所属的唱片公司签订更有利的合约）。但是凭借其数据和播放列表的优势，Spotify还可以发现崭露头角的艺人，提携他们，理论上也可以与他们签约。电台和唱片店曾是唱片公司非常熟悉的渠道，但其重要性已经下降。MIDI的马克·马利根（Mark Mulligan）说：“捧红艺人是唱片公司最重要的任务之一，但现在越来越难了。”

Spotify不会很快发展成唱片公司，原因之一是这样会激怒目前提供了大多数音乐作品的老牌唱片公司。但Spotify为其核心业务的增长所付出的代价已经难以忽视。版税费用是一大笔固定支出。（有些版权持有者还要求提高版税：去年12月，Wixen Music Publishing起诉Spotify并索赔16亿美元）。来自其他付费流媒体服务的竞争让Spotify很难提高收费。为了融资，Spotify在2016年以可转债方式从私募股权集团TPG和对冲基金Dragoneer处筹得10亿美元，融资条款允许这两家债权人债转股，折价幅度随时间推移而增加，所以Spotify最好能尽早上市。既然Spotify的亏损越来越大，它就会寻求以其他方式扭亏为盈。

Spotify可能转身成为唱片公司的威胁会促使现有唱片公司接受较低的版税。此外还有一个原因：每月可能有超过10亿人通过Alphabet的YouTube免费收听音乐，而这个渠道带来的版税收入远低于收费流媒体。唱片业帮助Spotify，就是在帮助自己。

Spotify在过去一年中确实已经就降低版税展开谈判，先是和世界最大的音乐供应商、威望迪（Vivendi）旗下的环球音乐集团（Universal Music Group）。据报道，该公司同意把占播放收入55%的版税费用下调至52%。Spotify与另外两大唱片公司——华纳音乐集团和索尼音乐——也达成了类似的协议。

尽管如此，对于变革了行业的Spotify，大唱片公司的老板们态度一直都很矛盾（而且每家唱片公司都持有spotify的一小部分股份）。最初，它们对Spotify能否帮自己赚钱心存怀疑。现在，它们可能担心自己正在养虎为患，就像好莱坞的电影公司将内容授权给Netflix一样。音乐行业20年来头一次实现强劲增长。逐鹿之战可能才刚刚开始。■



Economic and financial indicators

New passenger-car registrations

Car sales in China saw only moderate growth, as the tax cut began to be phased out

Many of the world's big car markets grew in 2017. In Brazil and Russia, where the industries have been plagued by economic turmoil in recent years, car sales rebounded. New registrations in the European Union swelled by 3.4%. China, the world's largest car market, saw only moderate growth, as a tax cut which had boosted sales in 2016 began to be phased out. The picture was gloomier in America and Britain. Light-vehicle sales in America recorded their first annual drop since 2009, as a result of interest-rate rises and a growing inventory of secondhand vehicles. In Britain, new registrations fell by 5.7% because of weakening consumer confidence and uncertainty about potential new charges on diesel vehicles. ■



经济与金融指标

乘用车注册量

由于减税政策逐步取消，中国汽车销售只实现小幅增长

世界许多大型汽车市场在2017年实现增长。巴西和俄罗斯的汽车产业近年饱受经济动荡的打击，但汽车销量回升。欧盟的新车注册量增长了3.4%。世界最大的汽车市场中国只出现小幅增长，原因是曾在2016年提升了汽车销量的减税政策开始逐步取消。美国和英国的情况更糟糕些。在加息和二手车库存增加的影响下，美国的轻型车销量自2009年来首次下滑。在英国，由于消费者信心下降以及不确定政府是否会对柴油车收取额外费用，新车注册量下降了5.7%。 ■



Non-invasive devices

Headache

Can the brain be deciphered without opening up the skull?

PATRICK KAIFOSH'S left hand lies flat on the table in front of him. Occasionally his fingers twitch or his palm rises up slightly from the surface. There is nothing obvious to connect these movements with what is happening on the tablet in front of him, where a game of asteroids is being played. Yet he is controlling the spaceship on the screen as it spins, thrusts and fires.

What enables him to do so is a sweatband studded with small gold bars that sits halfway up his left forearm. Each bar contains a handful of electrodes designed to pick up the signals of motor units (the combination of a motor neuron, a cell that projects from the spinal cord, and the muscle fibres it controls). These data are processed by machine-learning algorithms and translated into the actions in the game. Dr Kaifosh, a co-founder of CTRL-Labs, the startup behind the device, has learned to exercise impressive control over these signals with hardly any obvious movement.

Some say that the claims of Dr Kaifosh and Thomas Reardon, his co-founder, that CTRL-Labs has created a brain-machine interface are nonsense. The sweatband is nowhere near the brain, and the signals it is picking up are generated not just by the firing of a motor neuron but by the electrical activity of muscles. "If this is a BCI, then the movement of my fingers when I type on a keyboard is also a brain output," sniffs one researcher. Krishna Shenoy, who directs the neural prosthetics systems lab at Stanford University and acts as an adviser to the firm, thinks it is on the right side of the divide. "Measuring the movement of the hand is motion capture. They are picking up neural activity amplified by the muscles."

Whatever the semantics, it is instructive to hear the logic behind the firm's decision to record the activity of the peripheral nervous system, rather than looking directly inside the head. The startup wants to create a consumer product (its potential uses include being an interface for interactions in virtual reality and augmented reality). It is not reasonable to expect consumers to undergo brain surgery, say the founders, and current non-invasive options for reading the brain provide noisy, hard-to-read signals. "For machine-learning folk, there is no question which data set—cortical neurons or motor neurons—you would prefer," says Dr Reardon.

This trade-off between the degree of invasiveness and the fidelity of brain signals is a big problem in the search for improved BCIs. But plenty of people are trying to find a better way to read neural code from outside the skull.

The simplest way to read electrical activity from outside is to conduct an electroencephalogram (EEG). And it is not all that simple. Conventionally, it has involved wearing a cap containing lots of electrodes that are pressed against the surface of the scalp. To improve the signal quality, a conductive gel is often applied. That requires a hairwash afterwards. Sometimes the skin of the scalp is roughened up to get a better connection. As a consumer experience it beats going to the dentist, but not by much.

Once on, each electrode picks up currents generated by the firing of thousands of neurons, but only in the area covered by that electrode. Neurons that fire deep in the brain are not detected either. The signal is distorted by the layers of skin, bone and membrane that separate the brain from the electrode. And muscle activity (of the sort that CTRL-Labs looks for) from eye and neck movements or clenched jaws can overwhelm the neural data.

Even so, some EEG signals are strong enough to be picked up pretty reliably.

An “event-related potential”, for example, is an electrical signal that the brain reliably gives off in response to an external stimulus of some sort. One such, called an error-related potential (Errp), occurs when a user spots a mistake. Researchers at MIT have connected a human observer wearing an EEG cap to an industrial robot called Baxter as it carried out a sorting task. If Baxter made a mistake, an Errp signal in the observer’s brain alerted the robot to its error; helpfully, if Baxter still did not react, the human brain generated an even stronger Errp signal.

Neurable, a consumer startup, has developed an EEG headset with just seven dry electrodes which uses a signal called the P300 to enable users to play a virtual-reality (VR) escape game. This signal is a marker of surprise or recognition. Think of the word “brain” and then watch a series of letters flash up randomly on a screen; when the letter “b” comes up, you will almost certainly be giving off a P300 signal. In Neurable’s game, all you have to do is concentrate on an object (a ball, say) for it to come towards you or be hurled at an object. Ramses Alcaide, Neurable’s boss, sees the potential for entertainment companies like Disney (owner of the Star Wars and Marvel franchises) to license the software in theme parks and arcade games.

Thorsten Zander of the Technische Universität in Berlin thinks that “passive” EEG signals (those that are not evoked by an external stimulus) can be put to good use too. Research has shown that brainwave activity changes depending on how alert, drowsy or focused a person is. If an EEG can reliably pick this up, perhaps surgeons, pilots or truck drivers who are becoming dangerously tired can be identified. Studies have shown strong correlations between people’s mental states as shown by an EEG and their ability to spot weapons in X-rays of luggage.

Yet the uses of EEGs remain limited. In a real-world environment like a cockpit, a car or an airport, muscle activity and ambient electricity are likely to confound any neural signals. As for Neurable’s game, it relies not solely

on brain activity but also deploys eye-tracking technology to see where a player is looking. Dr Alcaide says the system can work with brain signals alone, but it is hard for a user to disentangle the two.

Other non-invasive options also have flaws. Magnetoencephalography measures magnetic fields generated by electrical activity in the brain, but it requires a special room to shield the machinery from Earth's magnetic field. Functional magnetic resonance imaging (fMRI) can spot changes in blood oxygenation, a proxy for neural activity, and can zero in on a small area of the brain. But it involves a large, expensive machine, and there is a lag between neural activity and blood flow.

If any area is likely to yield a big breakthrough in non-invasive recording of the brain, it is a variation on fNIRS, the infrared technique used in the experiment to allow locked-in patients to communicate. In essence, light sent through the skull is either absorbed or reflected back to detectors, providing a picture of what is going on in the brain. This technique does not require bulky equipment, and unlike EEG it does not measure electrical activity, so it is not confused by muscle activity. Both Facebook and Openwater are focusing their efforts on this area.

The obstacles to a breakthrough are formidable, however. Current infrared techniques measure an epiphenomenon, blood oxygenation (the degree of which affects the absorption of light), rather than the actual firing of neurons. The light usually penetrates only a few millimetres into the cortex. And because light scatters in tissue (think of how your whole fingertip glows red when you press a pen-torch against it), the precise source of reflected signals is hard to identify.

Facebook is not saying much about what it is doing. Its efforts are being led by Mark Chevillet, who joined the social-media giant's Building 8 consumer-hardware team from Johns Hopkins University. To cope with the

problem of light scattering as it passes through the brain, the team hopes to be able to pick up on both ballistic photons, which pass through tissue in a straight line, and what it terms “quasi-ballistic photons”, which deviate slightly but can still be traced to a specific source. The clock is ticking. Dr Chevillet has about a year of a two-year programme left to demonstrate that the firm’s goal of brain-controlled typing at 100 words a minute is achievable using current invasive cell-recording techniques, and to produce a road map for replicating that level of performance non-invasively.

Openwater is much less tight-lipped. Ms Jepsen says that her San Francisco-based startup uses holography to reconstruct how light scatters in the body, so it can neutralise this effect. Openwater, she suggests, has already created technology that has a billion times the resolution of an fMRI machine, can penetrate the cortex to a depth of 10cm, and can sample data in milliseconds.

Openwater has yet to demonstrate its technology, so these claims are impossible to verify. Most BCI experts are sceptical. But Ms Jepsen has an impressive background in consumer electronics and display technologies, and breakthroughs by their nature upend conventional wisdom. Developer kits are due out in 2018.

In the meantime, other efforts to decipher the language of the brain are under way. Some involve heading downstream into the peripheral nervous system. One example of that approach is CTRL-Labs; another is provided by Qi Wang, at Columbia University, who researches the role of the *locus coeruleus*, a nucleus deep in the brain stem that plays a role in modulating anxiety and stress. Dr Wang is looking at ways of stimulating the vagus nerve, which runs from the brain into the abdomen, through the skin to see if he can affect the *locus coeruleus*.

Others are looking at invasive approaches that do not involve drilling

through the skull. One idea, from a firm called SmartStent, using technology partly developed with the University of Melbourne, is to use a stent-like device called a “stentrode” that is studded with electrodes. It is inserted via a small incision in the neck and then guided up through blood vessels to overlie the brain. Once the device is in the right location, it expands from about the size of a matchstick to the size of the vessel and tissue grows into its scaffolding, keeping it in place. Human trials of the stentrode are due to start next year.

Another approach is to put electrodes under the scalp but not under the skull. Maxime Baud, a neurologist attached to the Wyss Centre, wants to do just that in order to monitor the long-term seizure patterns of epileptics. He hopes that once these patterns are revealed, they can be used to provide accurate forecasts of when a seizure is likely to occur.

Yet others think they need to go directly to the source of action potentials. And that means heading inside the brain itself. ■



非侵入式设备

伤脑筋

能不开颅就解密大脑吗？

帕特里克·卡伊福什（Patrick Kaifosh）的左手平放在他前方的桌子上，有时他的手指会抽搐一下，有时整个手掌稍稍抬起。没有明显迹象显示这些细微的活动和他面前一台平板电脑上发生的事有关——一种小行星游戏正在进行中。但实际上，是卡伊福什在控制屏幕上的宇宙飞船做出旋转、推进和射击等动作。

个中奥秘在于他左前臂中间位置绑着的一根吸汗带。这根带子上镶嵌着细小的金条，每根金条上含有几个电极，用来采集运动单元释放的信号。运动单元由一个运动神经元（脊髓上突起的一个细胞）以及它控制的肌纤维组成。机器学习算法处理这些信号数据并将之转化为游戏中的动作。创业公司CTRL-Labs研发了这套设备，联合创始人卡伊福什已经能够很好地控制这些信号而不做出什么明显的动作。

卡伊福什和公司另一位创始人托马斯·里尔登（Thomas Reardon）称CTRL-Labs已经创造了一种脑机接口（BCI）。对此一些人嗤之以鼻：这根吸汗带离大脑这么远，它捕捉的信号不仅源自运动神经元的激活放电，也来自肌肉的电活动。“如果这也算脑机接口，那我在键盘上打字时的手指运动也是一种脑输出了。”一位研究员不屑地说。斯坦福大学神经修复植入体系统实验室主管、CTRL-Labs的顾问克里希纳·谢诺伊（Krishna Shenoy）认同这一成果。“测量手部运动是‘动作捕捉’。而他们是在识别被肌肉放大的神经活动。”

无论对术语如何理解，听一听这家公司的理由会大有裨益。为何它决定记录外周神经系统的活动，而不直接观测大脑？这是因为它想创造一种消费品，其潜在应用包括为虚拟现实和增强现实中的互动充当BCI。两位创始人说，不可能指望消费者做开颅手术，而现有的非侵入式脑部读取方式获

得的信号噪音大，难以识别。“对机器学习的研究人员来说，喜欢哪一种数据集——是大脑皮层神经元还是运动神经元——答案是毫无疑问的。”里尔登说。

在打造更先进的BCI时，在侵入程度和对大脑信号的准确还原这两者间做权衡是一个重大问题。但许多人都在寻找更好的方法从颅骨之外读取神经信号。

从大脑外部读取脑电活动的最简单方法是做脑电图。然而它也不那么便捷。通常，人们需要戴上一顶帽子，上面有许多电极压在头皮表面。为了提高信号质量，常常要涂抹一种导电胶，所以做完后就需要洗头。有时还要把头皮故意弄得粗糙些来改善连接。从用户体验来说，这要比看牙医好一点，但也好不了多少。

戴上这顶帽子后，每个电极会探测到数千个神经元被激活时产生的电流，但仅限于电极覆盖的部位。在大脑深部放电的神经元同样探测不到。隔开大脑和电极的层层皮肤、骨骼及脑膜让信号失真。而眼睛和颈部移动或咬紧牙关产生的肌肉活动（也就是CTRL-Labs探测的那一类）有可能盖过神经数据。

即便如此，一些脑电图信号足够强烈，能被较可靠地读取。比如，“事件相关电位”（Erp）是大脑在回应某种外部刺激时一定会释放的电信号。其中之一叫误差相关电位（Errp），在人们发现某个错误时产生。麻省理工学院的研究人员已经把戴脑电图帽的人类观察者和一个叫巴克斯特（Baxter）的工业机器人连接起来。巴克斯特执行某种筛选任务，当它出错时，观察者大脑中发出的Errp信号会提醒它这一错误。很有帮助的一点是，假如巴克斯特没反应，人脑还会生成更强烈的Errp信号。

消费品创业公司Neurable研发出的一种脑电图帽只有七个干电极。它利用一种叫P300的信号来玩一个虚拟现实的逃生游戏。这个信号是惊讶或识别的标志。比如，假设你想到了“brain”这个单词，然后你看着屏幕上随机闪过一串字母。当字母“b”出现时，你的大脑几乎一定会释放出一个P300信

号。在Neurable的游戏中，你要做的就是把意念集中在某个物体上，比如一个球，来让它朝你移动或被抛向某个物体。Neurable的老板拉美西斯·阿尔凯德（Ramses Alcaide）认为，这套程序日后有可能会被迪士尼（拥有星球大战和漫威漫画的专营权）等娱乐公司买下授权，用在主题公园或街机游戏中。

柏林工业大学的索斯藤·灿德尔（Thorsten Zander）认为，“非活跃”脑电图信号，即非由外部刺激唤起的信号，也可以被很好地利用起来。研究显示，一个人的脑电波活动会随其清醒、困乏和专注的程度而变化。假如脑电图能可靠地捕捉这种变化，那么就有可能识别出疲倦程度已经到达危险水平的外科医生、飞行员及卡车司机。研究发现，脑电图显示的人的精神状态和他们在行李安检中发现武器的能力之间存在强关联。

但脑电图的使用仍然有限。在现实环境中，比如驾驶舱、汽车或机场，肌肉活动和环境电流很可能会干扰神经信号。Neurable的游戏并不仅仅依赖大脑活动，也使用目光追踪定位技术来监测玩家的视线。阿尔凯德博士说，这套系统只需要大脑信号就能运作，但玩家不可能只运用大脑而不移动眼球。

其他非侵入性方式也有缺陷。脑磁图测量大脑中的电流活动产生的磁场，但它需要一个特殊的房间来让机器屏蔽地球磁场。功能性磁共振成像（fMRI）可以探测血氧浓度（神经活动的一个指示物）的变化，也能瞄准大脑中的一小块区域。但它需要一台大型而昂贵的机器，而且从神经活动到血流变化有时间上的延迟。

在探索非侵入式大脑读取技术上，假如说有什么领域很可能会有突破，那就是功能性近红外光谱技术（fNIRS）的一个变种了。这种红外技术被用于帮助闭锁综合征患者交流的实验中。简单来说，向头颅发射的光线要么被吸收，要么被反射回探测仪，从而生成一幅大脑活动的图景。这种技术不需要笨重的设备，也不像脑电图那样测量脑电活动，所以不会和肌肉活动混淆。Facebook和Openwater这两家公司都主攻这个领域。

不过，要寻求突破所面临的障碍还是令人生畏。目前的红外线技术测量的是血氧浓度（其水平会影响光线的吸收）这个附带现象，而非真正的神经激活放电。光线通常只能穿透大脑皮层几毫米。而由于光线会在细胞组织中发散（试想当你把笔灯压在手指上时，你整个指尖都泛着红光），很难识别反射信号的确切源头。

Facebook对自己的研究比较保密。该项目由马克·舍维莱（Mark Chevillet）领导，他离开约翰霍普金斯大学加入了这家社交媒体巨头的“Building 8”消费类硬件团队。为解决光穿过大脑时发散的问题，该团队希望能够利用到“直进光子”和“半直进光子”——前者在穿过细胞组织时能保持直线，后者会略微偏移但仍能追溯到某个源头。对舍维莱来说，时间很紧迫。这个两年期项目还剩一年，他要证明使用现有的入侵式细胞记录技术能够实现该公司的目标——仅靠意念控制实现每分钟打100词。此外他还要拿出一个具体方案，表明如何用非侵入式的方法达成同样的结果。

Openwater则远没那么守口如瓶。耶普森说自己这家总部位于旧金山的创业公司用全息摄影重建出了光在人体中散射的情况，从而能够克服光线发散的问题。她透露，Openwater已经创造出了一种分辨率是功能性磁共振成像机器十亿倍的技术，能穿透到大脑皮层10厘米深的地方，可以在几毫秒内采集到数据样本。

Openwater尚未展示过其技术，所以这些说法还无从确证。大部分BCI专家表示怀疑。但耶普森在消费电子产品和展示技术领域有光辉的履历，而且技术突破本来就是要颠覆传统观念。Openwater的开发套件将于今年推出。

与此同时，其他解密大脑语言的努力也在进行中。其中一些下行探索外围神经系统，比如CTRL-Labs的项目，又比如哥伦比亚大学的王奇（Qi Wang，音译）正在研究蓝斑核（locus coeruleus）的功能。这个位于脑干深处的神经核团对焦虑和压力水平有调节作用。王博士正在探索通过皮肤刺激迷走神经（该神经从大脑延至腹部）的方法，看看能否影响蓝斑核。

其他人正在研究无需在颅骨上打洞的侵入性技术。一个创意来自SmartStent公司，它所利用的技术有一部分是与墨尔本大学合作研发的。它使用一个叫作stentrode的设备，类似血管支架，上面镶嵌电极。将stentrode从颈部的小切口置入人体，经血管一路引导至大脑上方。一旦抵达正确的部位，就从火柴杆粗细扩张至血管的大小，而细胞组织会开始生长到它的支架上，从而把它固定在原位。在人体上的试验将于明年启动。

另一个方法是把电极放在头皮而非颅骨下方。瑞士韦斯中心（Wyss Center）的神经学家马克西姆·鲍德（Maxime Baud）就想用这种方法来监测癫痫病人长期的发病模式。他希望一旦这些模式被揭示出来，就可以准确预测出未来发病的时间。

但另一些人认为他们必须直接访问动作电位的源头。而这意味着长驱直入大脑内部。 ■



Brains and machines

Thought experiments

Brain-computer interfaces sound like the stuff of science fiction. Andrew Palmer sorts the reality from the hype

IN THE gleaming facilities of the Wyss Centre for Bio and Neuroengineering in Geneva, a lab technician takes a well plate out of an incubator. Each well contains a tiny piece of brain tissue derived from human stem cells and sitting on top of an array of electrodes. A screen displays what the electrodes are picking up: the characteristic peak-and-trough wave forms of firing neurons.

To see these signals emanating from disembodied tissue is weird. The firing of a neuron is the basic building block of intelligence. Aggregated and combined, such “action potentials” retrieve every memory, guide every movement and marshal every thought. As you read this sentence, neurons are firing all over your brain: to make sense of the shapes of the letters on the page; to turn those shapes into phonemes and those phonemes into words; and to confer meaning on those words.

This symphony of signals is bewilderingly complex. There are as many as 85bn neurons in an adult human brain, and a typical neuron has 10,000 connections to other such cells. The job of mapping these connections is still in its early stages. But as the brain gives up its secrets, remarkable possibilities have opened up: of decoding neural activity and using that code to control external devices.

A channel of communication of this sort requires a brain-computer interface (BCI). Such things are already in use. Since 2004, 13 paralysed people have been implanted with a system called BrainGate, first developed at Brown University (a handful of others have been given a similar device).

An array of small electrodes, called a Utah array, is implanted into the motor cortex, a strip of the brain that governs movement. These electrodes detect the neurons that fire when someone intends to move his hands and arms. These signals are sent through wires that poke out of the person's skull to a decoder, where they are translated into a variety of outputs, from moving a cursor to controlling a limb.

The system has allowed a woman paralysed by a stroke to use a robotic arm to take her first sip of coffee without help from a caregiver. It has also been used by a paralysed person to type at a rate of eight words a minute. It has even reanimated useless human limbs. In a study led by Bob Kirsch of Case Western Reserve University, published in the *Lancet* this year, BrainGate was deployed artificially to stimulate muscles in the arms of William Kochevar, who was paralysed in a cycling accident. As a result, he was able to feed himself for the first time in eight years.

Interactions between brains and machines have changed lives in other ways, too. The opening ceremony of the football World Cup in Brazil in 2014 featured a paraplegic man who used a mind-controlled robotic exoskeleton to kick a ball. A recent study by Ujwal Chaudhary of the University of Tübingen and four co-authors relied on a technique called functional near-infrared spectroscopy (fNIRS), which beams infrared light into the brain, to put yes/no questions to four locked-in patients who had been completely immobilised by Lou Gehrig's disease; the patients' mental responses showed up as identifiable patterns of blood oxygenation.

Neural activity can be stimulated as well as recorded. Cochlear implants convert sound into electrical signals and send them into the brain. Deep-brain stimulation uses electrical pulses, delivered via implanted electrodes, to help control Parkinson's disease. The technique has also been used to treat other movement disorders and mental-health conditions. NeuroPace, a Silicon Valley firm, monitors brain activity for signs of imminent epileptic

seizures and delivers electrical stimulation to stop them.

It is easy to see how brain-computer interfaces could be applied to other sensory inputs and outputs. Researchers at the University of California, Berkeley, have deconstructed electrical activity in the temporal lobe when someone is listening to conversation; these patterns can be used to predict what word someone has heard. The brain also produces similar signals when someone imagines hearing spoken words, which may open the door to a speech-processing device for people with conditions such as aphasia (the inability to understand or produce speech).

Researchers at the same university have used changes in blood oxygenation in the brain to reconstruct, fuzzily, film clips that people were watching. Now imagine a device that could work the other way, stimulating the visual cortex of blind people in order to project images into their mind's eye.

If the possibilities of BCIs are enormous, however, so are the problems. The most advanced science is being conducted in animals. Tiny silicon probes called Neuropixels have been developed by researchers at the Howard Hughes Institute, the Allen Institute and University College London to monitor cellular-level activity in multiple brain regions in mice and rats. Scientists at the University of California, San Diego, have built a BCI that can predict from prior neural activity what song a zebra finch will sing. Researchers at the California Institute of Technology have worked out how cells in the visual cortex of macaque monkeys encoded 50 different aspects of a person's face, from skin colour to eye spacing. That enabled them to predict the appearance of faces that monkeys were shown from the brain signals they detected, with a spooky degree of accuracy. But conducting scientific research on human brains is harder, for regulatory reasons and because they are larger and more complex.

Even when BCI breakthroughs are made on humans in the lab, they are

difficult to translate into clinical practice. *Wired* magazine first reported breathlessly on the then new BrainGate system back in 2005. An early attempt to commercialise the technology, by a company called Cyberkinetics, foundered. It took NeuroPace 20 years to develop its technologies and negotiate regulatory approval, and it expects that only 500 people will have its electrodes implanted this year.

Current BCI technologies often require experts to operate them. “It is not much use if you have to have someone with a masters in neural engineering standing next to the patient,” says Leigh Hochberg, a neurologist and professor at Brown University, who is one of the key figures behind BrainGate. Whenever wires pass through the skull and scalp, there is an infection risk. Implants also tend to move slightly within the brain, which can harm the cells it is recording from; and the brain’s immune response to foreign bodies can create scarring around electrodes, making them less effective.

Moreover, existing implants record only a tiny selection of the brain’s signals. The Utah arrays used by the BrainGate consortium, for example, might pick up the firing of just a couple of hundred neurons out of that 85bn total. In a paper published in 2011, Ian Stevenson and Konrad Kording of Northwestern University showed that the number of simultaneously recorded neurons had doubled every seven years since the 1950s (see chart). This falls far short of Moore’s law, which has seen computing power double every two years.

Indeed, the Wyss Centre in Geneva exists because it is so hard to get neurotechnology out of the lab and into clinical practice. John Donoghue, who heads the centre, is another of the pioneers of the BrainGate system. He says it is designed to help promising ideas cross several “valleys of death”.

One is financial: the combination of lengthy payback periods and deep technology scares off most investors. Another is the need for multidisciplinary expertise to get better interfaces built and management skills to keep complex projects on track. Yet another is the state of neuroscience itself. “At its core, this is based on understanding how the brain works, and we just don’t,” says Dr Donoghue.

This odd mixture of extraordinary achievement and halting progress now has a new ingredient: Silicon Valley. In October 2016 Bryan Johnson, an entrepreneur who had made a fortune by selling his payments company, Braintree, announced an investment of \$100m in Kernel, a firm he has founded to “read and write neural code”. Mr Johnson reckons that the rise of artificial intelligence (AI) will demand a concomitant upgrade in human capabilities. “I find it hard to imagine a world by 2050 where we have not intervened to improve ourselves,” he says, picturing an ability to acquire new skills at will or to communicate telepathically with others. Last February Kernel snapped up Kendall Research Systems, a spinoff from the Massachusetts Institute of Technology (MIT) that works on neural interfaces.

Kernel is not alone in seeing BCIs as a way for humans to co-exist with AI rather than be subjugated to it. In 2016 Elon Musk, the boss of SpaceX and Tesla, founded a new company called Neuralink, which is also working to create new forms of implants. He has gathered together an impressive group of co-founders and set a goal of developing a BCI for clinical use in people with disabilities by 2021. Devices for people without such disabilities are about eight to ten years away, by Mr Musk’s reckoning.

Neuralink is not saying what exactly it is doing, but Mr Musk’s thinking is outlined in a lengthy post on *Wait But Why*, a website. In it, he describes the need for humans to communicate far more quickly with each other, and with computers, if they are not to be left in the dust by AI. The post raises

some extraordinary possibilities: being able to access and absorb knowledge instantly from the cloud or to pump images from one person's retina straight into the visual cortex of another; creating entirely new sensory abilities, from infrared eyesight to high-frequency hearing; and ultimately, melding together human and artificial intelligence.

In April it was Facebook's turn to boggle minds as it revealed plans to create a "silent speech" interface that would allow people to type at 100 words a minute straight from their brain. A group of more than 60 researchers, some inside Facebook and some outside, are working on the project. A separate startup, Openwater, is also working on a non-invasive neural-imaging system; its founder, Mary Lou Jepsen, says that her technology will eventually allow minds to be read.

Many BCI experts react to the arrival of the Valley visionaries by rolling their eyes. Neuroscience is a work in progress, they say. An effective BCI requires the involvement of many disciplines: materials science, neuroscience, machine learning, engineering, design and others. There are no shortcuts to clinical trials and regulatory approval.

In all this, the sceptics are right. Many of the ambitions being aired look fantastical. Still, this is a critical moment for BCIs. Vast amounts of money are pouring into the field. Researchers are trying multiple approaches. Mr Musk in particular has a track record of combining grandiose aspirations (colonising Mars) and practical success (recovering and relaunching rockets via SpaceX).

To be clear, "The Matrix" is not imminent. But BCIs may be about to take a big leap forward. For that to happen, the most important thing is to find a better way of connecting with the brain. ■



大脑与机器

思想实验

脑机接口听起来像是科幻小说中的东西。在喧嚣的炒作中，安德鲁·帕尔默帮我们厘清现实状况

在日内瓦韦斯（Wyss）生物和神经工程中心那闪闪发光的大楼中，一名实验室技术人员从培养箱中取出一块多孔板。每个孔中都有小小一块来源于人类干细胞的脑组织放在一个电极阵列上。一块屏幕上显示着电极拾取的信息：神经元放电的特征峰谷波形。

看到这些脱离身体的组织会发射信号让人感到有些怪异。神经元的放电是构建智力的基本材料。这些“动作电位”汇集和组合起来，就可拾取每一个记忆，支配每一个动作，组织每一个想法。在你读这句话的时候，你整个大脑中的神经元就在不停地放电：理解页面上的字母形状，把这些形状变成音素，把音素组成单词，再赋予这些单词意义。

这曲“信号交响乐”的复杂程度令人晕眩。成年人脑中有多达850亿个神经元，而一个典型的神经元细胞会连接到10000个同类细胞。描绘这些连接的工作还处于初期阶段。但是随着大脑秘密的逐步揭示，人们已经创造出非凡的可能性：解码神经活动并用这些密码控制外部设备。

要建立这样的沟通渠道，就需要一个脑机接口（BCI）。人们已经在使用这种东西了。自2004年以来，已有13位瘫痪者被植入了一个名为BrainGate的系统，它是由布朗大学首先开发的（还有少数其他人也植入了类似的设备）。一组被称为犹他（Utah）阵列的小电极被植入到运动皮层，即大脑中管理运动的部分。如果有人想动动他的手和手臂，这些电极会检测到放电的神经元。信号通过穿出颅骨的电线传送到解码器，再转换成各种输出，如移动光标或控制肢体。

该系统让一名中风瘫痪的妇女在没有看护者帮助的情况下用机器人手臂喝到了第一口咖啡。还有一位瘫痪者能以每分钟八个字的速度打字。它甚至

让本已无用的肢体再次活动起来。由凯斯西储大学的鲍勃·基尔希（Bob Kirsch）领导的一项研究今年在《柳叶刀》上发表了论文，为在一次骑车事故中瘫痪的威廉·科切瓦（William Kochevar）人为部署了BrainGate，以刺激他手臂上的肌肉。结果八年来他第一次能够自己吃饭了。

大脑和机器之间的互动还以其他方式改变了人们的生活。2014年，在巴西举行的世界杯足球赛开幕式上，一名截瘫男子用思维控制机器人外骨骼来踢球。在最近的一项研究中，图宾根大学的乌吉瓦·乔杜里（Ujwal Chaudhary）和四位合著者使用一种可将红外光束照进大脑的“近红外光谱”（fNIRS）技术，向四名因卢·贾里格症（Lou Gehrig's disease，又称肌萎缩性脊髓侧索硬化症、渐冻症）而完全失去行动能力的闭锁综合症患者提出是非问题，患者的思维反应表现为可辨认的血氧模式。

神经活动可以被刺激，也可以被记录。人工耳蜗将声音转换为电信号并将其送入大脑。深度脑刺激通过植入电极传送电脉冲来帮助控制帕金森病，该技术也被用于治疗其他运动障碍和精神疾病。硅谷的NeuroPace公司监测大脑活动来判断癫痫即将发作的迹象，并通过电刺激来阻止它们。

我们很容易想象出脑机接口可以如何应用于其他感官的输入和输出。加州大学伯克利分校的研究人员解析了聆听对话时大脑颞叶的电活动；这些模式可以用来推测听到的单词。当人们想象听到某些单词时，大脑也会产生类似的信号，这可能为患有失语症（无法理解或产生言语）的人开启语音处理设备的大门。

这所大学的另一些研究人员利用大脑中的血氧变化来模糊地重建人们正在观看的电影片段。想想看，要是有一种设备能够反向工作，刺激盲人的视觉皮层，就可将图像投射到他们的头脑中。

不过，如果BCI有巨大的可能性，那么问题也同样巨大。最前沿的科学研究所正在动物身上进行。霍华德·休斯研究所、艾伦研究所和伦敦大学学院的研究人员开发出了一种称为神经像素（Neuropixel）的微小硅探针，用于监测小鼠和大鼠多个脑区中细胞层面的活动。加州大学圣地亚哥分校的

科学家已经造出了一个BCI，可以从先前的神经活动中预测斑马雀将会唱什么歌。加州理工学院的研究人员已经揭示了猕猴视觉皮层中的细胞如何编码人脸从肤色到眼间距的50个不同特征。这使得他们能够根据检测到的大脑信号，以让人惊恐的准确度预测猴子看到的面部外观。但是由于监管方面的原因，加上人类大脑更大、更复杂，要在人脑上进行科学研究更为困难。

即使实验室中的人类BCI获得突破，它们也很难转化为临床实践。早在2005年，《连线》(Wired)杂志就首先兴奋地报道了当时新推出的BrainGate系统。一家名为Cyberkinetics的公司初步试图将这项技术商业化，却遭到惨败。NeuroPace花费了整整20年来开发技术并与监管审批部门谈判，它预计今年只有500人将植入它的电极。

目前的BCI技术通常需要专家来操作。BrainGate的关键人物之一，布朗大学的神经学家李·霍赫贝格(Leigh Hochberg)教授说：“如果你必须让一个神经工程学硕士站在患者旁边，那它的用处就不大了。”只要是电线穿过头骨和头皮的地方就有感染的风险。植入物也可能在脑内轻微移动，这可能会伤害它正在记录的细胞；大脑对异物的免疫反应会在电极周围产生瘢痕，让它们的效果变差。

而且，现有的植入物只记录了大脑信号中很小的一部分。例如，BrainGate财团使用的犹他阵列也许仅仅拾取了几百个神经元放电的信号，而神经元总计有850亿个。在2011年发表的一篇论文中，西北大学的伊恩·史蒂文森(Ian Stevenson)和康拉德·科尔丁(Konrad Kording)提出，自20世纪50年代以来，能一次被同时记录的神经元数量每七年翻一番(见图表)。这与摩尔定律也就是计算能力每两年翻一番相差甚远。

事实上，日内瓦的韦斯中心之所以存在，恰恰是因为将神经技术从实验室带入临床实践非常困难。该中心负责人约翰·多诺霍(John Donoghue)是BrainGate系统的另一位先驱。他说中心是为了帮助有希望的想法跨越若干“死亡谷”而建立的。一个是财务问题——漫长的投资回报期与深奥前沿

科技的结合吓退了大多数投资者。另一个问题是，设计更好的界面需要多学科的专业知识，还要有管理技能来保证复杂的项目不会偏离正轨。再者是神经科学本身的现状。多诺霍说：“归根结底是要理解大脑是如何工作的，而我们根本就不知道。”

杰出的成就，停滞的进展——这个奇怪的组合如今又添上了一个成分：硅谷。2016年10月，通过出售其支付公司Braintree大赚一笔的企业家布莱恩·约翰逊（Bryan Johnson）宣布向Kernel公司投资一亿美元。他创立这家公司是为了“读写神经编码”。约翰逊认为，人工智能（AI）的兴起将要求人类的能力同步升级。他说：“我很难想象到了2050年，我们还没有出手改进自己。”他想象着能够随心所欲地获得新技能，或与其他人心灵感应。去年2月，Kernel又吞并了从麻省理工学院剥离出来，从事神经接口工作的肯德尔研究系统公司（Kendall Research Systems）。

认为BCI能让人类与AI共存而不是被其征服的不止Kernel一家。2016年，SpaceX和特斯拉的老板伊隆·马斯克创立了一家名为Neuralink的新公司，也试图创造新形式的植入体。他集结了一批星光闪耀的联合创始人，并设定了2021年将BCI投入残疾人临床使用的目标。根据马斯克的估算，开发面向非残疾人的设备还需要大概八到十年时间。

Neuralink并没有说它到底在做什么，但是网站“等待，但为什么”（Wait But Why）上的一篇长文章描述了马斯克的想法。在这篇文章中，他说人类如果不看着AI绝尘而去，就必须能够实现彼此之间、以及人机之间更快速的沟通。文章中提出了一些非凡的可能性：能够立即从云端获取和吸收知识，或者将一个人视网膜上的图像直接输入另一个人的视觉皮层；创造从红外视力到高频听力的全新感知能力；最终，让人类与人工智能融合起来。

到了今年4月份，轮到Facebook来震撼世人了：它公布了创造“静默语音”界面的计划，让人们可以直接利用大脑来每分钟输入100个单词。有60多名Facebook内部和外部的研究人员正在开发这个项目。另有一家创业公司Openwater也在开发非侵入式神经影像系统。其创始人玛丽·卢·杰普森

(Mary Lou Jepsen) 表示，她的技术最终将能够读取人们的思想。

许多BCI专家对于硅谷的这些梦想家都有些不以为然。他们说神经科学还远未成熟。高效的BCI需要许多学科的参与：材料科学、神经科学、机器学习、工程、设计等。临床试验和监管审批也没有捷径。

在这一切声音中，怀疑论者是对的。许多公开宣扬的抱负看起来都有些想入非非。尽管如此，现在是BCI的关键时刻。大量的钱涌入这一领域，研究人员也在尝试多种方法。马斯克尤其擅长将宏大的愿望（殖民火星）与实际的成功（通过SpaceX回收和再次发射火箭）结合起来。

让我把话说清楚——“黑客帝国”并非近在眼前。但BCI可能即将出现飞跃。要做到这一点，最重要的是要找到更好的方式来与大脑连接。 ■



Looking for serendipity

Grey matter, red tape

How obstacles to workable brain-computer interfaces may be overcome

NEUROTECHNOLOGY has long been a favourite of science-fiction writers. In “Neuromancer”, a wildly inventive book by William Gibson written in 1984, people can use neural implants to jack into the sensory experiences of others. The idea of a neural lace, a mesh that grows into the brain, was conceived by Iain M. Banks in his “Culture” series of novels. “The Terminal Man” by Michael Crichton, published in 1972, imagines the effects of a brain implant on someone who is convinced that machines are taking over from humans. (Spoiler: not good.)

Where the sci-fi genre led, philosophers are now starting to follow. In Howard Chizeck’s lab at the University of Washington, researchers are working on an implanted device to administer deep-brain stimulation (DBS) in order to treat a common movement disorder called essential tremor. Conventionally, DBS stimulation is always on, wasting energy and depriving the patient of a sense of control. The lab’s ethicist, Tim Brown, a doctoral student of philosophy, says that some DBS patients suffer a sense of alienation and complain of feeling like a robot.

To change that, the team at the University of Washington is using neuronal activity associated with intentional movements as a trigger for turning the device on. But the researchers also want to enable patients to use a conscious thought process to override these settings. That is more useful than it might sound: stimulation currents for essential tremor can cause side-effects like distorted speech, so someone about to give a presentation, say, might wish to shake rather than slur his words.

Giving humans more options of this sort will be essential if some of the bolder visions for brain-computer interfaces are to be realised. Hannah Maslen from the University of Oxford is another ethicist who works on a BCI project, in this case a neural speech prosthesis being developed by a consortium of European researchers. One of her jobs is to think through the distinctions between inner speech and public speech: people need a dependable mechanism for separating out what they want to say from what they think.

That is only one of many ethical questions that the sci-fi versions of brain-computer interfaces bring up. What protection will BCIs offer against neural hacking? Who owns neural data, including information that is gathered for research purposes now but may be decipherable in detail at some point in the future? Where does accountability lie if a user does something wrong? And if brain implants are performed not for therapeutic purposes but to augment people's abilities, will that make the world an even more unequal place?

For some, these sorts of questions cannot be asked too early: more than any other new technology, BCIs may redefine what it means to be human. For others, they are premature. "The societal-justice problem of who gets access to enhanced memory or vision is a question for the next decades, not years," says Thomas Cochrane, a neurologist and director of neuroethics at the Centre for Bioethics at Harvard Medical School.

In truth, both arguments are right. It is hard to find anyone who argues that visions of whole-brain implants and AI-human symbiosis are impossible to realise; but harder still to find anyone who thinks something so revolutionary will happen in the near future. This report has looked at some of the technological difficulties associated with taking BCIs out of the lab and into the mainstream. But these are not the only obstacles in the way of "brain mouses" and telekinesis.

The development path to the eventual, otherworldly destination envisaged by organisations like Neuralink and Kernel is extremely long and uncertain. The money and patience of rich individuals like Elon Musk and Bryan Johnson can help, but in reality each leg of the journey needs a commercial pathway.

Companies such as CTRL-Labs and Neurable may well open the door to consumer applications fairly quickly. But for invasive technologies, commercialisation will initially depend on therapeutic applications. That means overcoming a host of hurdles, from managing clinical trials to changing doctors' attitudes. Frank Fischer, the boss of NeuroPace, has successfully negotiated regulatory approval for his company's epilepsy treatment, but it has been a long, hard road. "If we tried to raise money today knowing the results ahead of time, it would have been impossible to get funded," he says.

Start with regulation. Neural interfaces are not drugs but medical devices, which means that clinical trials can be completed with just a handful of patients for proof-of-principle trials, and just a couple of hundred for the trials that come after that. Even so, ensuring a supply of patients for experiments with invasive interfaces presents practical difficulties. There is only one good supply of these human guinea pigs: epilepsy patients who have proved unresponsive to drugs and need surgery. These patients have already had craniotomies and electrodes implanted so that doctors can monitor them and pinpoint the focal points of their seizures; while these patients are in hospital waiting for seizures to happen, researchers swoop in with requests of their own. But the supply of volunteers is limited. Where exactly the electrodes are placed depends on clinical needs, not researchers' wishes. And because patients are often deliberately sleep-deprived in order to hasten seizures, their capacity to carry out anything but simple cognitive tasks is limited.

When it comes to safety, new technologies entail lengthier approval processes. Harvard's Dr Lieber says that his neural mesh requires a new sterilisation protocol to be agreed with America's Food and Drug Administration. Researchers have to deal with the question of how well devices will last in the brain over very long periods. The Wyss Centre has an accelerated-ageing facility that exposes electrodes to hydrogen peroxide, in a process that mimics the brain's immune response to foreign objects; seven days' exposure in the lab is equivalent to seven years in the brain.

The regulators are not the only people who have to be won over. Health insurers (or other gatekeepers in single-payer systems) need to be persuaded that the devices offer value for money. The Wyss Centre, which aims to bow out of projects before devices are certified for manufacturing, plans with this in mind. One of the applications it is working on is for tinnitus, a persistent internal noise in the ears of sufferers which is often caused by overactivity in the auditory cortex. The idea is to provide an implant which gives users feedback on their cortical activity so that they can learn to suppress any excess. Looking ahead to negotiations with insurers, the Wyss is trying to demonstrate the effectiveness of its implant by including a control group of people whose tinnitus is being treated with cognitive behavioural therapy.

That still leaves two other groups to persuade. Doctors need to be convinced that the risks of opening up the skull are justified. Mr Fischer says that educating physicians proved harder than expected. "The neurology community does not find it natural to think about device therapy," he says.

Most important, patients will have to want the devices. This is partly a question of whether they are prepared to have brain surgery. The precedents of once-rare, now-routine procedures such as laser eye and cosmetic surgery suggest that invasiveness alone need not stop brain implants from catching on. More than 150,000 people have had electrodes implanted for

deep-brain stimulation to help them control Parkinson's disease. But it is also a matter of functionality: plenty of amputees, for example, prefer simple metal hooks to prosthetic arms because they are more reliable.

These are all good reasons to be cautious about the prospects for BCIs. But there are also reasons to think that the field is poised for a great leap forward. Ed Boyden, a neuroscientist at MIT who made his name as one of the people behind optogenetics, points out that innovations are often serendipitous—from Alexander Fleming's chance discovery of penicillin to the role of yogurt-makers in the development of CRISPR, a gene-editing technique. The trick, he says, is to engineer the chances that serendipity will occur, which means pursuing lots of paths at once.

That is exactly what is now being done with BCIs. Scientific efforts to understand and map the brain are shedding ever more light on how its activity can be harnessed by a BCI and providing ever more data for algorithms to learn from. Firms like CTRL-Labs and Neurable are already listening to some of the more accessible neural signals, be it from the peripheral nervous system or from outside the skull. NeuroPace's closed-loop epilepsy system creates a regulatory precedent that others can follow.

Above all, researchers are working hard on a wide range of new implants for sending and receiving signals to and from the brain. That is where outfits like Kernel and Neuralink are focused in the short term. Mr Musk's four-year schedule for creating a BCI for clinical use is too ambitious for full clinical trials to be concluded, but it is much more realistic for pilot trials. This is also the rough timeframe to which DARPA is working with its implantables programme. With these and other efforts running concurrently, serendipity has become more likely.

Once a really good, portable, patient-friendly BCI is available, it is not hard to think of medical conditions that affect a large number of people and

could potentially justify surgery. More than 50m people worldwide suffer from epilepsy, and 40% of those do not respond to medication. Depression affects more than 300m people worldwide; many of them might benefit from a BCI that monitored the brain for biomarkers of such mental disorders and delivered appropriate stimulation. The quality of life of many older people suffering from dysphagia (difficulty in swallowing) could be improved by a device that helped them swallow whenever they wanted to. “A closed-loop system for recording from a brain and responding in a medically useful way is not a small market,” says Dr Hochberg.

That may still bring to mind the aphorism of Peter Thiel, a Silicon Valley grandee, about having been promised flying cars and getting 140 characters. There is a large gap between dreamy talk of symbiosis with AI, or infrared eyesight, and taking years to build a better brain implant for medical purposes. But if a device to deliver a real-time, high-resolution, long-lasting picture of neural activity can be engineered, that gap will shrink spectacularly. ■



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在通往实用脑机接口的路上，如何克服障碍

很久以来，神经技术都是科幻作者偏爱的题材。在威廉·吉布森（William Gibson）于1984年撰写的极具创意的《神经漫游者》（Neuromancer）一书中，人们可以使用神经植入物侵入别人的感官体验。伊恩·班克斯（Iain M. Banks）在他的《文明宇宙》（Culture）系列小说中构想了一种在人脑中生长的神经织网。迈克尔·克莱顿（Michael Crichton）在他于1972年出版的《终端人》（The Terminal Man）中，想象一种大脑植入物在一个坚信机器正在取代人类的人身上产生的影响（剧透：效果不好）。

如今，在科幻引领我们抵达之地，哲学家们开始了他们的工作。在霍华德·齐萨克（Howard Chizeck）位于华盛顿大学的实验室里，研究人员正在开发一种可实施深度脑刺激（DBS）的植入装置，用于治疗特发性震颤（essential tremor）这种常见的运动性障碍疾病。过去，DBS刺激是持续进行的，不但浪费能量，也剥夺了患者的掌控感。实验室里的伦理学家、哲学博士生蒂姆·布朗（Tim Brown）说，一些接受DBS治疗的患者感到疏离，抱怨自己活像一个机器人。

为改变这一点，华盛顿大学的这个团队正在使用与病患的意向运动相关的神经活动来启动设备。但同时，研究人员也希望患者能用清醒的思维活动来绕开这些设置。这一点实际上很有用，因为针对特发性震颤的刺激电流可能带来口音扭曲等副作用。举例来说，假如一名患者要发表演讲，那么他可能宁愿身体颤抖，也不想口齿不清。

要让更大胆的脑机接口（BCI）成为现实，那么给予人们更多这类选择将是极其关键的。牛津大学的伦理学家汉娜·马斯伦（Hannah Maslen）正在研究的BCI项目是一个欧洲研究团队研发的神经话语假体。她的工作之一是弄明白内心独白和公开讲话之间的差异——人们需要一种可靠的机制把

自己“想说的”和“在想的”内容区分开来。

这只是各种科幻BCI引发的诸多伦理问题之一。BCI对神经黑客有什么防范措施？谁拥有神经数据，包括那些目前为了研究而收集、但在未来某个时间可能被详细解码的信息？假如一名BCI用户做了错事，谁该负责？如果使用大脑植入物不是为了治病而是为了增强人的能力，那么世界是否会变得更不平等？

在一些人看来，提出这类问题根本不嫌早，因为BCI会比任何其他新技术都更可能重新定义何为“人类”。而另一些人认为还不到时候。“像谁能获得增强记忆或增强视觉这样的社会公平问题，是今后几十年而不是几年里的问题。”哈佛医学院生物伦理中心的神经学家、神经伦理学主任托马斯·科克伦（Thomas Cochrane）说。

实际上，这两种观点都是对的。眼下已经很少有人会认为全脑植入物和人机共生体这样的未来不可能成真，然而认为这样具革命性的未来已经近在眼前的人却少之又少。本次专题报道已经探讨了让BCI走出实验室、进入主流社会所面对的技术难题，但它们并不是通往“脑鼠标”和心灵感应的道路上唯一的障碍。

要通往Neuralink和Kernel这类机构设想的奇幻终点，前进的路途是极其漫长且不确定的。伊隆·马斯克和布赖恩·约翰逊（Bryan Johnson）这些富人的金钱和耐心会有所帮助，但在现实世界中，每一段旅程都需要一条可盈利的道路。

CTRL-Labs和Neurable这类公司可能很快会打开消费者应用的大门。但是，在侵入式技术方面，商业化一开始只会局限于治疗类应用。这意味着要克服一系列障碍，比如管理临床试验或改变医生的态度。NeuroPace的老板弗兰克·费希尔（Frank Fischer）已经成功说服监管部门批准了公司的癫痫治疗设备，但这一过程漫长而艰辛。“如果预先知道要花那么大力气，这个项目是拿不到融资的。”他说。

先说监管。BCI不是药物而是医疗设备，这表示在临床试验方面，只需要

一小批病患参加原理验证试验，然后有两三百人参与之后的试验。即便如此，要确保有足够的病患参加侵入式接口实验仍有实际困难。只有一类人比较可能充当小白鼠：已经证实对药物无响应而需要做手术的癫痫病人。他们已经做了开颅术，植入了电极，让医生可以监测他们并精确定位病灶。当他们在医院等待癫痫发作时，研究人员趁机前来提出自己的要求。但是，自愿参加实验的病人数量仍然有限。电极被植入什么位置也是根据临床需要而非研究人员的愿望而定。而因为这些病人常被故意剥夺睡眠以求加速发病，所以除了对他们测试一些简单的认知任务以外也做不了什么。

当涉及安全问题时，新技术往往需要更漫长的批准程序。哈佛的利伯博士说，他的神经网状组织需要美国食品和药物管理局批准通过一套新的消毒规则。研究人员需要回答一个问题：植入大脑的设备在漫长的年月里能维持得多好。韦斯中心有一台加速老化设备，把电极放在过氧化氢中，模仿大脑对外来物体的免疫反应。电极在这套设备里放七天，等同于在人脑里放七年。

监管人员并不是需要说服的唯一人群。还需要让医疗保险公司（或其他单一支付制度的把关者）相信这些设备物有所值。韦斯中心的目标是在设备获准生产前退出项目，它在试验中就考虑到了保险公司这一关。该中心正在研发的应用之一是针对耳鸣的，这种耳朵内部持续的噪音往往因听觉皮质过度活跃引发。其设想是提供一种植入物，让用户能够获得有关自己大脑皮层活动的反馈，从而能够学会抑制任何过度活动。为了准备好与保险公司谈判，该中心在试验中包含了一组控制组——一群用认知行为疗法治疗耳鸣的患者——来展示植入设备的效果。

这之后还有两类人要说服。医生需要相信冒开颅手术的风险是值得的。费希尔说，引导医生比预期要难。“神经科医生不太习惯考虑器械疗法。”

最重要的一点是，患者自身得愿意使用这种设备。他们是否准备好做脑部手术只是问题的一部分。激光眼部手术和整形美容手术曾经都很罕见，如今都已成为常规。这些先例说明，如果仅仅是侵入性，其实并不一定会妨

碍大脑植入物的流行。超过15万人已经植入实施深度脑刺激的电极来帮助控制帕金森氏症。问题的另一面是性能：比如许多截肢者宁可使用简单的金属钩子也不要义肢，因为前者更可靠。

这些都是对BCI的未来抱持审慎态度的好理由。但同样也有理由认为这个领域将发生重大的飞跃。麻省理工学院的神经学家埃德·博伊登（Ed Boyden）因和其他人一起发明了光遗传学而闻名。他指出，创新常常是撞运气，比如亚历山大·弗莱明（Alexander Fleming）偶然发现了青霉素（盘尼西林），或是酸奶制造商们在基因编辑技术CRISPR的发展中扮演的角色。他说，诀窍在于打造机会来让意外发生，这就意味着要同时探索许多条不同的道路。

这正是目前在BCI领域发生的事。科学家们努力理解和描绘大脑的运作方式，这让他们越来越多地了解到如何能用BCI来控制和利用大脑的活动，也生成日益多的数据供算法学习。CTRL-Labs和Neurable这类公司已经在倾听一些较易获得的神经信号——来自外围神经系统或颅骨以外。NeuroPace的闭合回路癫痫治疗系统则创造了说服监管部门批准的先例和模板。

最重要的是，研究人员正在尽力研发门类广泛的各种新植入物，在它们和大脑之间接收及发送信号。Kernel和Neuralink这类机构短期内就专注于此。马斯克计划在四年里打造出临床用BCI，要完成全部临床试验有点不切实际，但如果只是包含试点试验就现实多了。这也是美国国防部高级研究计划局（DARPA）对自己的植入物项目设置的粗略时间表。有了这些项目和其他项目同时开展，发生意外突破的可能性就更大了。

一旦出现了一个真正出色、便携、让病人觉得简单易用的BCI，要选择影响了一大批人、值得尝试手术的疾病并不难。全世界有超过五千万人患有癫痫，其中有四成人对药物无响应；三亿多人患有不同程度的抑郁，假如有一种BCI可以监测大脑中这类精神障碍的生物标志物并实施恰当的刺激，那么其中有许多人可能受益；许多老人患有吞咽障碍，如果有一种设备可以帮助他们想吃就吃，将会改善他们的生活质量。“一个能够读取大

脑活动并用有益于治疗的方式做出回应的闭合回路系统不会是一个小市场。”霍赫贝格说。

这可能仍然会让你想到硅谷名人彼得·泰尔（Peter Thiel）的那句名言：我们想要一辆会飞的车，得到的却是140个字符。在人机共生体、红外视觉这类梦幻般的构想和花很多年打造一个更好的医用脑植入物之间，有着巨大的差距。但是，如果我们能够设计出一套设备来描绘出一幅实时、高精度、长久持续的神经活动图像，那么这个距离将惊人地被缩短。■



Implants

Inside intelligence

The hunt for smaller, safer and smarter brain implants

TALK to neuroscientists about brain-computer interfaces (BCIs) for long enough, and the stadium analogy is almost bound to come up. This compares the neural activity of the brain to the noise made by a crowd at a football game. From outside the ground, you might hear background noise and be able to tell from the roars whether a team has scored. In a blimp above the stadium you can tell who has scored and perhaps which players were involved. Only inside it can you ask the fan in row 72 how things unfolded in detail.

Similarly, with the brain it is only by getting closer to the action that you can really understand what is going on. To get high-resolution signals, for now there is no alternative to opening up the skull. One option is to place electrodes onto the surface of the brain in what is known as electrocorticography. Another is to push them right into the tissue of the brain, for example by using a grid of microelectrodes like BrainGate's Utah array.

Just how close you have to come to individual neurons to operate BCIs is a matter of debate. In people who suffer from movement disorders such as Parkinson's disease, spaghetti-like leads and big electrodes are used to carry out deep-brain stimulation over a fairly large area of tissue. Such treatment is generally regarded as effective. Andrew Jackson of the University of Newcastle thinks that recording activity by ensembles of neurons, of the sort that gets picked up by electrocorticography arrays, can be used to decode relatively simple movement signals, like an intention to grasp something or to extend the elbow.

But to generate fine-grained control signals, such as the movement of individual fingers, more precision is needed. “These are very small signals, and there are many neurons packed closely together, all firing together,” says Andrew Schwartz of the University of Pittsburgh. Aggregating them inevitably means sacrificing detail. After all, individual cells can have very specific functions, from navigation to facial recognition. The 2014 Nobel prize for medicine was awarded for work on place and grid cells, which fire when animals reach a specific location; the idea of the “Jennifer Aniston neuron” stems from research showing that single neurons can fire in response to pictures of a specific celebrity.

Companies like Neuralink and Kernel are betting that the most ambitious visions of BCIs, in which thoughts, images and movements are seamlessly encoded and decoded, will require high-resolution implants. So, too, is America’s Defense Advanced Research Projects Agency (DARPA), an arm of the Pentagon, which this year distributed \$65m among six organisations to create a high-resolution implantable interface. BrainGate and others continue to work on systems of their own.

But the challenges that these researchers face are truly daunting. The ideal implant would be safe, small, wireless and long-lasting. It would be capable of transmitting huge amounts of data at high speed. It would interact with many more neurons than current technology allows (the DARPA programme sets its grant recipients a target of 1m neurons, along with a deadline of 2021 for a pilot trial to get under way in humans). It would also have to navigate an environment that Claude Clément of the Wyss Centre likens to a jungle by the sea: humid, hot and salty. “The brain is not the right place to do technology,” he says. As the chief technology officer, he should know.

That is not stopping people from trying. The efforts now being made to create better implants can be divided into two broad categories. The first reimagines the current technology of small wire electrodes. The second

heads off in new, non-electrical directions.

Start with ways to make electrodes smaller and better. Ken Shepard is a professor of electrical and biomedical engineering at Columbia University; his lab is a recipient of DARPA funds, and is aiming to build a device that could eventually help blind people with an intact visual cortex to see by stimulating precisely the right neurons in order to produce images inside their brains. He thinks he can do so by using state-of-the-art CMOS (complementary metal-oxide semiconductor) electronics.

Dr Shepard is aware that any kind of penetrating electrode can cause cell damage, so he wants to build “the mother of all surface recording devices” which will sit on top of the cortex and under the membranes that surround the brain. He has already created a prototype of a first-generation CMOS chip, which measures about 1cm by 1cm and contains 65,000 electrodes; a slightly larger, second-generation version will house 1m sensors. But like everyone else trying to make implants work, Dr Shepard is not just cramming sensors onto the chip. He also has to add the same number of amplifiers, a converter to turn the analogue signals of action potentials into the digital 0s and 1s of machine learning, and a wireless link to send (or receive) data to a relay station that will sit on the scalp. That, in turn, will send (or receive) the data wirelessly to external processors for decoding.

The device also has to be powered, another huge part of the implantables puzzle. No one in the field puts faith in batteries as a source of power. They are too bulky, and the risk of battery fluid leaking into the brain is too high. Like many of his peers, Dr Shepard uses inductive coupling, whereby currents passing through a coiled wire create a magnetic field that can induce a current in a second coil (the way that an electric toothbrush gets recharged). That job is done by coils on the chip and on the relay station.

Over on America's west coast, a startup called Paradromics is also using inductive coupling to power its implantable. But Matt Angle, its boss, does not think that souped-up surface recordings will deliver sufficiently high resolution. Instead, he is working on creating tiny bundles of glass and metal microwires that can be pushed into brain tissue, a bit like a Utah array but with many more sensors. To stop the wires clumping together, thereby reducing the number of neurons they engage with, the firm uses a sacrificial polymer to splay them apart; the polymer dissolves but the wires remain separated. They are then bonded onto a high-speed CMOS circuit. A version of the device, with 65,000 electrodes, will be released next year for use in animal research.

That still leaves lots to do before Paradromics can meet its DARPA-funded goal of creating a 1m wire device that can be used in people. Chief among them is coping with the amount of data coming out of the head. Dr Angle reckons that the initial device produces 24 gigabits of data every second (streaming an ultra-high-definition movie on Netflix uses up to 7GB an hour). In animals, these data can be transmitted through a cable to a bulky aluminium head-mounted processor. That is a hard look to pull off in humans; besides, such quantities of data would generate far too much heat to be handled inside the skull or transmitted wirelessly out of it.

So Paradromics, along with everyone else trying to create a high-bandwidth signal into and out of the brain, has to find a way to compress the data rate without compromising the speed and quality of information sent. Dr Angle reckons he can do this in two ways: first, by ignoring the moments of silence in between action potentials, rather than laboriously encoding them as a string of zeros; and second, by concentrating on the wave forms of specific action potentials rather than recording each point along their curves. Indeed, he sees data compression as being the company's big selling-point, and expects others that want to create specific BCI applications or prostheses simply to plug into its feed. "We see ourselves as

the neural data backbone, like a Qualcomm or Intel,” he says.

Some researchers are trying to get away from the idea of wire implants altogether. At Brown University, for example, Arto Nurmikko is leading a multidisciplinary team to create “neurograins”, each the size of a grain of sugar, that could be sprinkled on top of the cortex or implanted within it. Each grain would have to have built-in amplifiers, analogue-to-digital converters and the ability to send data to a relay station which could power the grains inductively and pass the information to an external processor. Dr Nurmikko is testing elements of the system in rodents; he hopes eventually to put tens of thousands of grains inside the head.

Meanwhile, in a lab at Harvard University, Guosong Hong is demonstrating another innovative interface. He dips a syringe into a beaker of water and injects into it a small, billowing and glinting mesh. It is strangely beautiful to watch. Dr Hong is a postdoctoral fellow in the lab of Charles Lieber, a professor of chemistry; they are both working to create a neural interface that blurs the distinction between biology and electronics. Their solution is a porous net made of a flexible polymer called SU-8, studded with sensors and conductive metal.

The mesh is designed to solve a number of problems. One has to do with the brain’s immune response to foreign bodies. By replicating the flexibility and softness of neural tissue, and allowing neurons and other types of cells to grow within it, it should avoid the scarring that stiffer, solid probes can sometimes cause. It also takes up much less space: less than 1% of the volume of a Utah array. Animal trials have gone well; the next stage will be to insert the mesh into the brains of epilepsy patients who have not responded to other forms of treatment and are waiting to have bits of tissue removed.

A mile away, at MIT, members of Polina Anikeeva’s lab are also trying to build devices that match the physical properties of neural tissue. Dr

Anikeeva is a materials scientist who first dived into neuroscience at the lab of Karl Deisseroth at Stanford University, who pioneered the use of optogenetics, a way of genetically engineering cells so that they turn on and off in response to light. Her reaction upon seeing a (mouse) brain up close for the first time was amazement at how squishy it was. “It is problematic to have something with the elastic properties of a knife inside something with the elastic properties of a chocolate pudding,” she says.

One way she is dealing with that is to borrow from the world of telecoms by creating a multichannel fibre with a width of 100 microns (one micron is a millionth of a metre), about the same as a human hair. That is denser than some of the devices being worked on elsewhere, but the main thing that distinguishes it is that it can do multiple things. “Electronics with just current and voltage is not going to do the trick,” she says, pointing out that the brain communicates not just electrically but chemically, too.

Dr Anikeeva’s sensor has one channel for recording using electrodes, but it is also able to take advantage of optogenetics. A second channel is designed to deliver channelrhodopsin, an algal protein that can be smuggled into neurons to make them sensitive to light, and a third to shine a light so that these modified neurons can be activated.

It is too early to know if optogenetics can be used safely in humans: channelrhodopsin has to be incorporated into cells using a virus, and there are question-marks about how much light can safely be shone into the brain. But human clinical trials are under way to make retinal ganglion cells light-sensitive in people whose photoreceptor cells are damaged; another of the recipients of DARPA funds, Fondation Voir et Entendre in Paris, aims to use the technique to transfer images from special goggles directly into the visual cortex of completely blind people. In principle, other senses could also be restored: optogenetic stimulation of cells in the inner ear of mice has been used to control hearing.

Dr Anikeeva is also toying with another way of stimulating the brain. She thinks that a weak magnetic field could be used to penetrate deep into neural tissue and heat up magnetic nanoparticles that have been injected into the brain. If heat-sensitive capsaicin receptors were triggered in modified neurons nearby, the increased temperature would cause the neurons to fire.

Another candidate for recording and activating neurons, beyond voltage, light and magnets, is ultrasound. Jose Carmena and Michel Maharbiz at the University of California, Berkeley, are the main proponents of this approach, which again involves the insertion of tiny particles (which they call “neural dust”) into tissue. Passing ultrasound through the body affects a crystal in these motes which vibrates like a tuning fork; that produces voltage to power a transistor. Electrical activity in adjacent tissue, whether muscles or neurons, can change the nature of the ultrasonic echo given off by the particle, so this activity can be recorded.

Many of these new efforts raise even more questions. If the ambition is to create a “whole-brain interface” that covers multiple regions of the brain, there must be a physical limit to how much additional material, be it wires, grains or motes, can be introduced into a human brain. If such particles can be made sufficiently small to mitigate that problem, another uncertainty arises: would they float around in the brain, and with what effects? And how can large numbers of implants be put into different parts of the brain in a single procedure, particularly if the use of tiny, flexible materials creates a “wet noodle” problem whereby implants are too floppy to make their way into tissue? (Rumour has it that Neuralink may be pursuing the idea of an automated “sewing machine” designed to get around this issue.)

All this underlines how hard it will be to engineer a new neural interface that works both safely and well. But the range of efforts to create such a device also prompts optimism. “We are approaching an inflection-point

that will enable at-scale recording and stimulation," says Andreas Schaefer, a neuroscientist at the Crick Institute in London.

Even so, being able to get the data out of the brain, or into it, is only the first step. The next thing is processing them. ■



植入体

内部情报

寻找更小、更安全、更智能的大脑植入体

只要与神经科学家们聊脑机接口（BCI）聊得够久，与体育馆的类比就几乎肯定会出现。大脑的神经活动就好比足球赛场上人群产生的噪音。在球场外，你可能会听到背景噪音，并从欢呼声判断是否有球队进球了。在体育场上方的飞艇上，你可以分辨出是哪一支球队进了球，甚至是有哪些球员参与了进球。但只有进入球场内部，你才能详细询问第72排的球迷到底是怎么进的球。

同样，对于大脑来说，只有接近动作发生的地方，才能真正了解发生了什么。为了获得高分辨率的信号，迄今为止除了打开颅骨之外别无选择。一种选择是将电极放置在大脑表面，也就是所谓的脑皮层电图。另一种方法是将它们直接插入大脑组织，例如使用BrainGate的犹他阵列那样的微电极网格。

到底要多靠近具体的神经元才能操作BCI是个有争议的问题。对于帕金森病等运动障碍患者，会在相当大的组织区域使用意大利细面条般的导线和大电极来进行深部脑刺激。这种治疗通常被认为是有效的。纽卡斯尔大学的安德鲁·杰克逊（Andrew Jackson）认为，记录神经元集合的活动，如脑皮层电图阵列拾取的信号，可以用于解码相对简单的运动信号，比如意图抓握某物或伸出肘部。

但要生成精细的控制信号，比如某个手指的动作，就需要更高的精度。匹兹堡大学的安德鲁·施瓦茨（Andrew Schwartz）说：“这些信号非常小，而且有许多神经元紧挨在一起同时放电。”汇总这些信号不可避免地会牺牲细节。毕竟，每个细胞都可以具有从定位到面部识别等非常特定的功能。针对位置细胞和网格细胞的工作荣获2014年诺贝尔医学奖，这些细胞在动物到达特定的地点时放电。“詹妮弗·安妮斯顿神经元”的发现源于一项研

究，该研究显示单个神经元可以对特定名人的照片作出反应而放电。

在最宏伟的BCI愿景中，思想、图像和运动都可以无缝编解码。Neuralink和Kernel等公司都认定这需要高分辨率的植入体。美国国防部高级研究计划局（DARPA）也是这么想的，它是五角大楼的一个分支机构，今年向六个组织分配了6500万美元，用于创建高分辨率植入式接口。BrainGate等公司则继续研究自己的系统。

但是这些研究人员所面临的挑战着实令人生畏。理想的植入体将是安全、小巧、无线而耐久的。它将能够高速传输大量的数据，与之相互作用的神经元数目也会远超过现有技术所能达到的（DARPA项目为其受资助方设定了100万个神经元的目标，以及2021年进行初步人类试验的最后期限）。而它要探索的环境正如韦斯中心的克劳德·克莱门特（Claude Clément）所比拟的海边丛林：潮湿、炎热、多盐。他说：“大脑不是个搞技术的好地方。”首席技术官这么说，应该不假。

但这并未阻止人们进行尝试。目前，打造更好植入体的工作可以分为两大类。第一个是重新思考目前的小型导线电极技术。第二个则是朝着新的非电气方向前进。

我们先来说说让电极变得更小、更好的方法。肯·谢帕德（Ken Shepard）是哥伦比亚大学的电气与生物医学工程教授，他的实验室接受了DARPA的资金，目标是设计一个精确地刺激正确的神经元以在脑内产生图像的装置，最终帮助视觉皮层完整的盲人重见光明。他认为他可以利用最先进的CMOS（互补金属氧化物半导体）电子技术来实现这一点。

谢帕德博士意识到，任何插入式电极都可能造成细胞损伤，所以他想要研制出一个“所有表面记录装置之母”，它将被置于皮层顶部、包覆大脑的膜之下。他已经设计了第一代CMOS芯片的原型，尺寸约1厘米见方，包含65,000个电极；一个稍大的第二代版本将容纳100万个传感器。但是，和所有试图让植入体起效的研究者一样，谢帕德博士不只是将传感器堆叠在芯片上，他还必须加上相同数量的放大器来将动作电位的模拟信号转换为

机器学习所用的数字0和1，以及一个无线链路来向头皮上的中继站发送（或接收）数据。中继站又会将数据无线发送（或接收）给外部处理器进行解码。

这个装置还需要供电，这又是植入式设备面临的另一大难题。在这个领域，没人指望利用电池供电。它们体积太大，而电池液漏入大脑的风险又太高。像许多同行一样，谢帕德博士使用电感耦合，即通过一个线圈的电流产生磁场，从而在第二个线圈中产生电流（电动牙刷的充电方式）。这项工作由芯片和中继站上的线圈完成。

在美国西海岸，一家名为Paradromics的创业公司也在使用电感耦合来为植入体供电。但是，老板马特·安格（Matt Angle）并不认为加强版的表面记录能够提供足够高的分辨率。相反，他正在研制玻璃和金属微丝束，这些微丝可以插入脑组织，有点像犹他阵列，但传感器更多。为了防止导线聚在一起，减少接触神经元的数量，该公司使用牺牲性聚合物将它们撑开；聚合物会溶解但导线会保持分离。然后它们会连到一个高速CMOS电路上。该设备明年将发布一个有65,000个电极的版本用于动物研究。

要达到DARPA设定的目标——可用于人体的100万个神经元连线装置，Paradromics还有很多工作要做。一项重要工作是要对付来自大脑的数据量。安格博士估计，最初的设备每秒产生24GB数据（Netflix上的超高清电影每小时最多可使用7GB）。在动物身上，这些数据可以通过电缆传输到一个笨重的铝制头戴式处理器上。人类身上要装这么一套也太难看了；此外，这种规模的数据量产生的热量非常高，无法在颅骨内部处理或通过无线传输出来。

因此，与其他所有试图让高带宽信号进出大脑的人一样，Paradromics必须找到一种方法来压缩数据率，而不会影响发送信息的速度和质量。安格博士认为，他可以通过两种方式做到这一点：首先是忽略动作电位之间的静默时刻，而不是费力地将它们编码为一串零；其次是专注于特定动作电位的波形，而不是记录曲线上的每个点。事实上，他认为数据压缩是公司

的一大卖点，并希望其他想要设计特定BCI应用或假肢的人只要接入信号就可以了。“我们把自己看作神经数据的支柱，就像高通或英特尔那样。”他说。

一些研究人员想整体抛弃导线植入的想法。例如在布朗大学，阿尔托·努尔米科（Arto Nurmikko）正在领导一个多学科小组来研制“神经粒”，每个如糖粒大小，可以撒在皮层顶部或植入其中。每一个神经粒中必须有内置放大器、模数转换器以及将数据发送到中继站的能力，中继站则可通过感应为颗粒供电，并将信息传输给外部处理器。努尔米科博士正在啮齿动物身上测试系统元件，他希望最终能把数以万计的颗粒撒进脑袋里。

与此同时，在哈佛大学的一个实验室里，洪国松展示了另一种创新的接口。他将一个注射器插入烧杯，向水中注入翻腾而闪闪发光的小网状组织。看起来有一种奇特的美。洪博士是化学教授查尔斯·利伯（Charles Lieber）实验室的博士后，二人都在研制一种模糊了生物学与电子学界线的神经接口。他们的解决方案是一个由称为SU-8的柔性聚合物制成的多孔网，上面镶嵌着传感器和导电金属。

这个网状组织是为了解决一系列问题。一个问题涉及大脑对异物的免疫反应。它模仿了神经组织弹性而柔软的形态，并允许神经元和其他类型的细胞在其内生长，应该可以避免更坚硬的实心探针有时可能导致的瘢痕。它占用的空间也少得多：不到犹他阵列的1%。动物试验进展顺利；下一阶段是将网状组织插入那些对其他形式的治疗无响应，正在等待去除一些组织的癫痫患者的脑中。

在距麻省理工学院一英里的地方，波林娜·安妮科娃（Polina Anikeeva）实验室的成员也在试图构建符合神经组织物理特性的设备。安妮科娃博士是一位材料科学家，最初在斯坦福大学卡尔·戴瑟罗斯（Karl Deisseroth）的实验室投身神经科学领域，后者则是利用光遗传学的先驱。光遗传学是一种对细胞进行遗传工程改造的方法，使它们能够对光线做出响应以开启和关闭。安妮科娃第一次近距离看到一个（老鼠的）大脑时，惊讶于它是那么的粘软。“把弹性特性接近刀子的东西插进弹性特性类似于巧克力布丁

的东西是有问题的。”她说。

她的应对方法之一借鉴了电信领域：使用直径100微米（一微米是百万分之一米）的多通道光纤，和人的头发差不多粗细。这比其他地方研究的设备更细密，但主要区别在于它可以让很多东西做很多事情。“只有电流和电压的电子产品搞不定。”她指出，大脑不仅仅利用电通信，还有化学通信。

安妮科娃博士的传感器有三个通道。一个利用电极进行记录，但也能够利用光遗传学。第二个用于传递通道视紫红质，这是一种藻类蛋白质，可以悄悄送入神经元使其对光敏感。还有第三个通道会发光，能够激活这些经过修饰的神经元。

判断光遗传学是否可以安全用于人体还为时尚早：通道视紫红质必须利用一种病毒掺入到细胞中，并且到底多少光可以安全照射到大脑上也有疑问。但人们正在进行人类临床试验，让光感受器细胞受损的人的视网膜神经节细胞对光敏感；另一个接受DARPA基金资助的组织巴黎视听基金会（Fondation Voir et Entender）希望利用这项技术将特制眼镜上的图像直接送入完全失明的人的视觉皮层中。原则上这也可能恢复其他感官：小鼠内耳中细胞的光遗传刺激已被用于控制听力。

安妮科娃博士也在尝试其他刺激大脑的方式。她认为，弱磁场可以用来深入穿透神经组织并加热注入大脑中的磁性纳米粒子。如果附近经修饰的神经元中的热敏辣椒素受体被触发，温度升高将导致神经元放电。

除电压、光和磁之外，另一个记录和激活神经元的选择是超声波。加州大学伯克利分校的何塞·卡梅娜（Jose Carmena）和米歇尔·马哈比兹（Michel Maharbiz）是这种方法的主要支持者。该方法也是将微小颗粒（他们称之为“神经灰尘”）注入组织。超声波穿过身体会让这些尘埃中的一个晶体像音叉一样震动，而这会产生电压给晶体管供电。邻近组织（无论是肌肉还是神经元）的电活动都可以改变粒子发出的超声回波的性质，让人们可以记录这一活动。

许多这些新的工作引发了更多的问题。如果宏伟的目标是想要研制一个涵

盖大脑多个区域的“全脑接口”，那么人脑中到底能够加入多少额外材料，不管是电线、颗粒还是灰尘，肯定有一个物理上限。如果这些粒子可以变得足够小以缓解这个问题，那么就会产生另一个不确定性：它们会不会漂浮在大脑中，而这又会产生什么影响？怎样才能通过单次手术向大脑的不同部分植入大量的植入体，特别是使用微小的柔性材料会不会造成“湿面条”的问题，即植入体过于松软而无法进入组织？（有传言称Neuralink可能正在研究一个自动化“缝纫机”的创意来克服这个问题。）

所有这些都凸显了设计一个既安全又好用的新型神经接口将会是多么困难。但是目前探索的方法之多给了我们乐观的理由。伦敦克里克研究所（Crick Institute）的神经科学家安德里亚斯·舍费尔（Andreas Schaefer）说：“我们正在接近一个实现大规模的记录和刺激的转折点。”

即便如此，能够从大脑中提取数据或向其注入数据也只是第一步。接下来就要处理它们了。 ■



The biology of inventiveness

Creative spark

Two new books probe the evolutionary roots of creativity

DOES science spoil beauty? John Keats, an English Romantic poet, thought so. When Sir Isaac Newton separated white light into its prismatic colours, the effect, Keats wrote, was to “unweave a rainbow”. By explaining how rainbows occurred, the mystery and the lustre were lost. The idea that science and the arts are distinct, incompatible cultures is an enduring one. Two new books seem to cut to the heart of the matter: human creativity.

Edward Wilson, 88 and the author of “The Origins of Creativity”, is the grand old man of Harvard biology. His speciality is myrmecology—the study of ants. For a short book, “The Origins of Creativity” is brimming with ideas, many of which wander, as Mr Wilson’s writing often does, beyond the brief of the title. Ultimately, though, everything in the book ties back to genetics and evolution—and a belief that culture and creativity have genetic roots.

Mr Wilson traces the source of creativity to human prehistory, on the African savannah. Man’s ancestors were, for a time, dull, relatively asocial vegetarians. The crucial step, Mr Wilson argues, came with the switch to eating meat. This meant having to hunt in groups, and that meant becoming more social: people had to co-operate in the foray, and share the rewards. This change put an evolutionary premium on communication and social intelligence. Eventually, by way of natural selection, it gave rise to symbolic language. And thus the birth of the humanities came about, in storytelling and the “nocturnal firelight of the earliest human encampments”.

This version of events is relatively straightforward. More controversial is where Mr Wilson tries to take the reader next. In his eyes the humanities

today are static and blinkered, hamstrung by their failure to acknowledge their evolutionary roots. The salvation of the humanities, he argues, lies in the “Big Five”: palaeontology, anthropology, psychology, evolutionary biology and neurobiology. By studying these different areas, scientists will be able to connect aesthetics and cultural evolution to the underlying genetic evolution that explains them. Thus Mr Wilson would expand the mantra of Theodosius Dobzhansky, a great geneticist: “Nothing in biology makes sense except in the light of evolution” to “Nothing in science and the humanities makes sense except in the light of evolution.”

Where Mr Wilson focuses on the origins of creativity, Anthony Brandt and David Eagleman, a composer and a neuroscientist, focus in “The Runaway Species” on the act of creation. The book makes a single argument, clearly and thoroughly: creativity is never the creation of something from nothing. Instead, consciously or not, people refashion things. They do this for the most part in three ways: by bending, breaking and blending. Bending involves taking something and altering a property. Breaking involves taking a whole apart and assembling something new from the fragments. And blending involves mixing multiple sources together in new ways.

“The Runaway Species” is not short of examples. For breaking, the authors cite Cubism, shotgun sequencing of DNA and photomontage in film. For blending, the minotaur and the mermaid, genetic splicing and creole languages. And for bending, the authors point to the artificial heart. At first, scientists copied the heart as closely as they could, beating and all. But beating led to wear and tear—and was unnecessary, as the heart simply needs to pump blood. Today transplant patients are given continuous-flow hearts. (It turns out that Dick Cheney, who had a heart transplant at the age of 71, has not had a heartbeat since 2010.)

In a way, Keats was right: applying scientific scrutiny to the arts runs the risk of feeling like an autopsy. Both these books, though, skirt around that

danger. Messrs Wilson and Eagleman themselves are both scientists and novelists—living embodiments of the fallacy that there are two distinct cultures. Both “The Origins of Creativity” and “The Runaway Species” approach creativity scientifically but sensitively, feeling its roots without pulling them out. ■



创造力生物学

创意火种

两本新书探究了创造力的进化根源

科学会毁掉美吗？英国浪漫主义诗人济慈认为会。当牛顿用三棱镜把白光分解为七彩光带时，济慈写道，这么做是“拆散了彩虹”。一旦彩虹的成因被解释清楚，它的神秘与光彩也就消失了。人们一直认为科学和艺术是两种截然不同、不可兼容的文化。两本新书似乎抓住了问题的核心：人类的创造力。

《创造力的起源》（The Origins of Creativity）一书的作者、88岁的爱德华·威尔逊（Edward Wilson）是哈佛生物系的元老。他的专长是蚁学，即研究蚂蚁的学问。《创造力的起源》篇幅不长，但观点叠出，其中不少都不囿于书名所指议题——威尔逊的著作经常如此。不过，书中讨论的一切最终都可追溯到遗传学、进化论，以及一个观点：文化和创造力有其遗传根源。

威尔逊将创造力的起源追溯到非洲大草原上的史前时期。人类的祖先曾经是无趣而比较不合群的素食者。威尔逊认为关键的一步在于开始吃肉。这意味着人们不得不成群结队去打猎，进而变得越来越习惯群居：人们必须在打猎中合作，并分享猎物。这一变化促进了交流和社交智力的进化。最终，通过自然选择，符号语言形成了。这样，人文学科滥觞于讲故事和“最早期人类营地夜间的篝火”。

这些观点还相对浅显直白。威尔逊接下来要带给读者的才更具争议性。在他看来，今天的人文学科死板且狭隘，因未能认识到自己的进化根源而受到束缚。他认为，拯救人文学科要依靠“五大领域”：古生物学、人类学、心理学、进化生物学和神经生物学。通过研究这些不同的领域，科学家们才能将美学和文化进化与能解释其原因的深层基因进化联系起来。因此，威尔逊扩展了伟大的遗传学家希尔多次雅思·多勃赞斯基（Theodosius

Dobzhansky) 的口号。多勃赞斯基说，“如果不谈进化论，生物学中的一切都无法理解。”威尔逊则说，“如果不谈进化论，科学和人文学中的一切都无法理解。”

威尔逊关注的是创造力的起源，作曲家安东尼·勃兰特（Anthony Brandt）和神经学家大卫·伊格曼（David Eagleman）在《失控的物种》（The Runaway Species）一书中关注的则是创造这种行为。这本书清晰而透彻地阐述了一个观点：创造力从来都不是凭空创造出新事物。相反，人们会有意无意地重新塑造事物。主要通过三种方式：改造、重组和混合。改造指的是拿来一样东西，改变其某个属性。重组是将整体拆解，再把碎片组合成新东西。混合则是以新的方式将多个源事物混在一起。

《失控的物种》可不缺例子。说到重组，作者列举了立体主义、DNA鸟枪法测序和电影的蒙太奇手法。说到混合，有牛头怪弥诺陶洛斯和美人鱼、基因拼接，还有克里奥尔语。说到改造，作者举了人造心脏的例子。起初科学家们竭尽所能模拟人类心脏的种种特性，包括心跳。但是跳动会导致磨损，而且它本身毫无必要，因为心脏只要能泵血就够了。今天给病人植入的是持续流动式的人造心脏。实际上，在71岁接受心脏移植手术的美国前副总统切尼从2010年起就不再有心跳了。

在某种程度上，济慈是对的：将科学调查应用到艺术上可能会让人有验尸之感。不过这两本书都避开了这种危险。威尔逊和伊格尔曼两人同样既是科学家也是小说家，他们自身就是对“科学和艺术是两种截然不同的文化”这一谬见的反驳。《创造力的起源》和《失控的物种》都以科学但又感性的方式探讨创造力，感受但并不穷究其根源。 ■



Computing geography (1)

Life on the edge

Computing is emerging from centralised clouds and moving to the “edge” of local networks and devices

CONNECTED devices now regularly double as digital hoovers: equipped with a clutch of sensors, they suck in all kinds of information and send it to their maker for analysis. Not so the wireless earbuds developed by Bragi, a startup from Munich. They keep most of what they collect, such as the wearers’ vital signs, and crunch the data locally. “The devices are getting smarter as they are used,” says Nikolaj Hviid, its chief executive.

Bragi’s earplugs are at the forefront of a big shift in the tech industry. In recent years ever more computing has been pushed into the “cloud”, meaning networks of big data centres. But the pendulum has already started to swing: computing is moving back to the “edge” of local networks and intelligent devices.

As with the rise of the cloud in the early 2010s, the shift will cause upheaval. Many startups will try to ride the trend, as will incumbents such as hardware makers. But the real fight will be over who colonises the edge and, in particular, which firms will control the “internet of things” (IoT), as connected devices are collectively called. Will Amazon Web Services (AWS), Microsoft and other large cloud providers manage to extend their reach? Or will the edge be the remit of a different set of firms, including makers of factory equipment and other sorts of gear?

Since emerging in the 1950s, commercial computing has oscillated between being more centralised and more distributed. Until the 1970s it was confined to mainframes. When smaller machines emerged in the 1980s and 1990s, it became more spread out: applications were accessed by personal

computers, but lived in souped-up PCs in corporate data centres (something called a “client-server” system). With the rise of the cloud in the 2000s, things became more centralised again. Each era saw a new group of firms rise to the top, with one leading the pack: IBM in mainframes, Microsoft in personal computers and AWS in cloud computing.

Better technology is one reason why computing is again becoming more distributed. Devices at the edge, from smartphones to machinery on the shop floor, are becoming more intelligent. Equipped with powerful processors, they can now tackle computing problems that a few years ago needed a fully loaded server. As for software, its increased flexibility means it can function well on the edge. Many applications are now “virtualised”, meaning they exist separately from any specific type of hardware: code can thus be packaged in digital “containers” and easily moved around within data centres—and, increasingly, closer to the edge.

Demand for computing at the edge is growing, too, often for non-technical reasons. Many countries have laws that require data to stay within their borders or even within the walls of a company. Firms want to use data but, worrying about leaks, often prefer to keep their own information inhouse. Consumers, for their part, care about privacy, which Bragi hopes to address with its self-sufficient earplugs.

The dominant narrative in the tech industry—that most data are best crunched centrally in the cloud—is also undermined by the fact that many new applications have to act fast. According to some estimates, self-driving cars generate as much as 25 gigabytes per hour, nearly 30 times more than a high-definition video stream. Before so many data are uploaded, and driving instructions sent back, the vehicle may well already have hit that pedestrian suddenly crossing the street.

Changing economics are another consideration. The faster adjustments can be made—for instance, to optimise the operations of a machine in a factory—the bigger revenue gains tend to be. That means data are often best analysed as they are captured, which needs to be done locally. The costs of transferring, storing and processing data in the cloud can be avoided too.

These constraints explain why services using artificial intelligence (AI) are increasingly split in two, much like client-server applications, explains Pierre Ferragu of Bernstein Research. The algorithms of autonomous cars, for instance, are first trained in the cloud with millions of miles of recorded driving data; only then are they deployed on powerful computers in the boot, where they steer the car by interpreting live data. Similarly, many video cameras used for surveillance now ship with face-recognition software trained in the cloud, as does Apple's latest iPhone model. In November, Google announced an addition to TensorFlow, its AI technology, which allows developers to deploy algorithms to mobile devices.

But in many cases even the training of algorithms must happen locally for AI applications to make commercial sense, argues Simon Crosby, chief technology officer of Swim, a startup. For instance, sending the four terabytes of data generated daily by traffic lights at intersections in Palo Alto, in Silicon Valley, to a cloud provider for processing would cost thousands of dollars a month. Swim has built a system that does the equivalent job for few hundred dollars by learning from the data on the fly as they are generated.

Although a shift to the edge is now generally acknowledged to be under way, opinions are divided over how it will change the technology industry. Nobody expects the “end of cloud computing”, to quote the provocative title of a podcast by Peter Levine of Andreessen Horowitz, a leading Silicon Valley venture-capital firm. He himself predicts that centralised clouds, in particular those of Amazon, Google and Microsoft, will continue to grow.

But smaller and more local data centres are springing up everywhere. Firms such as EdgeConneX and vXchnge have built networks of urban data centres. Vapor IO, a startup, has developed a data centre in a box that looks like a round fridge and can be quickly put in any basement. Makers of telecoms equipment, including Ericsson and Nokia, as well as network operators, talk a lot about “mobile edge computing”, which amounts to putting computers next to wireless base stations or in central switching offices. Some also speculate that one reason why Amazon last year bought Whole Foods, a chain of grocery shops, for nearly \$14bn, was to accumulate property for local data centres.

Computer makers see the shift as a chance to regain lost territory. Dell EMC and HP both want to sell more gear to firms keen to crunch data locally. But they are limited in how far they can move to the edge, says George Gilbert of Wikibon, a consultancy. These firms know how to sell commodity hardware to IT departments, but most IoT gear will be more customised, requires special software and is sold to people managing machinery. Cisco, which sells all kinds of internet equipment, seems well placed.

Big cloud-computing providers are also trying to colonise the periphery. In May Microsoft changed its slogan from “mobile first, cloud first” to “intelligent cloud and intelligent edge”. It sells services that dispatch software containers with AI algorithms to any device. AWS’s portfolio now includes a service called Greengrass, which turns clusters of IoT devices into mini-clouds. In buying the Weather Company for \$2bn in 2015, IBM wanted weather data, but also thousands of “points of presence” for edge computing.

Whoever prevails, computing will become an increasingly movable feast, bits of which can be found in even the smallest devices. Processing will occur wherever it is best placed for any given application. Data experts have already started using another term: “fog computing”. But the metaphor is

a bit, well, foggy. Better, and more poetic, would be “air computing”: it is everywhere and gives things life. ■



计算地理（1）

边缘生活

计算正在脱离中央云，向本地网络和设备所在的“边缘”转移

现在，联网设备一般还会起到数字信息收集器的作用：它们装载了一系列传感器，负责搜集各种信息并发送给它们的制造商开展分析。慕尼黑创业公司Bragi开发的无线耳塞却不同于此。这种耳塞会收集使用者的生命体征等信息，并在本地保存和处理大部分数据。首席执行官尼古拉·赫维德（Nikolaj Hviid）说：“这些设备会越用越智能。”

Bragi的耳塞处于科技行业一场重大转变的最前沿。近年来，越来越多的计算被推入“云端”，即大型数据中心构成的网络。但如今这种趋势又开始回转：计算正在回到本地网络和智能设备所在的“边缘”地带。

和2010年后云的崛起一样，这一转变也将引发动荡。许多创业公司将努力顺应这一趋势，硬件制造商等既有企业同样如此。但是真正的较量将围绕谁能占领边缘地带而展开，特别是哪些公司能够控制“物联网”（IoT，联网设备的统称）。亚马逊网络服务（AWS）、微软和其他大型云供应商是否能将触角延伸至边缘地带？还是说，这个边缘将成为另一类公司的领地，比如工业设备或其他设备的制造商？

商业计算自20世纪50年代出现以来，一直在更集中和更分散这两极之间摇摆不定。70年代以前，商业计算一直只限于在大型主机上进行。八九十年代小型计算机出现后，计算变得更加分散：用户在个人电脑上访问应用程序，但程序本身是部署在企业数据中心的加强版个人电脑即服务器里（称为“客户端-服务器”系统）。进入21世纪，随着云的兴起，计算再一次趋向集中。每个时代都有一批新企业晋身行业前列，由某家公司引领群雄：大型主机是IBM，个人电脑是微软，云计算是AWS。

技术进步是计算再次变得更分散的原因之一。从智能手机到车间机器，边缘设备变得越来越智能化。它们配有强大的处理器，可以解决几年前需要

一台全速运行的服务器才能解决的计算问题。软件的灵活性也不断提升，可以在边缘良好运行。许多应用程序现在都“虚拟化”了，也就是说它们可独立于任何特定类型的硬件：这样代码就可以被打包在数字“容器”中，在数据中心内轻松移动，并越来越靠近边缘。

对边缘计算的需求也在不断增长，这往往是出于非技术原因。许多国家的法律要求数据保存在境内，甚至不能离开公司。公司想要使用数据，但由于担心数据泄漏，往往更愿意将自己的信息保留在公司内部。消费者则关心隐私——Bragi希望通过能自行完成计算的耳塞来解决这个问题。

科技行业的主导观点认为，最好还是在云端集中处理大部分数据，但由于许多新的应用程序必须高速运行，这种说法的根基也已不再牢靠。据估计，无人驾驶汽车每小时可产生25GB的数据，比高清视频流高出近30倍。要上传完这么多数据，再等驾驶指令发回，车辆可能早已撞上了突然横穿马路的行人。

另一个原因是经济效益上的变化。做出调整的速度越快——例如优化工厂里机器的运行——获得的收益往往就越大。这意味着通常最好在捕获数据的同时进行分析，这就需要在本地完成。云端传输、存储和处理数据的成本也可以因此节省下来。

伯恩斯坦研究公司（Bernstein Research）的皮埃尔·费拉格（Pierre Ferragu）解释说，这些制约解释了为什么使用人工智能（AI）的服务越来越多地分成两部分，就像客户端-服务器应用程序一样。以无人驾驶汽车的算法为例，它首先是在云端用数百万英里的驾驶数据进行训练，然后被部署在车内强大的计算机上，通过解读实时数据来驾驶汽车。同样，很多用于监控的摄像头现在都配备了经过云端训练的面部识别软件，就像苹果最新款的iPhone那样。去年11月，谷歌公布了其人工智能技术TensorFlow的新版本，让开发人员可以将算法部署到移动设备上。

但创业公司Swim的首席技术官西蒙·克罗斯比（Simon Crosby）认为，AI应用程序要想产生商业效益，在许多情况下就连算法的训练也必须在本地

进行。例如，要把硅谷帕洛阿尔托市（Palo Alto）各个十字路口的交通信号灯每天产生的4TB数据发送给云供应商处理，每个月要花费数千美元。Swim建立的系统可以在动态数据生成的同时实时分析，仅需数百美元就能完成相同的任务。

虽然业界如今普遍认为计算正在向边缘转移，但对于这一点将如何改变科技行业却意见不一。硅谷领先的风投公司安德森·霍洛维茨（Andreessen Horowitz）的彼得·莱文（Peter Levine）发布的一期播客有个耸动的标题：《云计算的终结》，但没人认为云计算即将终结。莱文自己也预测，中央云，尤其是亚马逊、谷歌和微软的中央云将继续壮大。

但规模更小、数量更多的本地数据中心正在各地涌现。EdgeConneX和vXchnge等公司已经建立了城市数据中心网络。创业公司Vapor IO开发的数据中心看起来像一个圆形的冰箱，可以被快速放进任何地下室内。包括爱立信和诺基亚在内的电信设备制造商以及网络运营商都在大谈“移动边缘计算”，实际上就是将计算机放在无线基站或中央交换局旁边。还有人推测，亚马逊去年以近140亿美元收购连锁超市全食（Whole Foods）的一个原因就是要为本地数据中心积累场地。

计算机制造商将这一转变视为收复失地的机会。戴尔EMC和惠普都希望向那些一心想在本地处理数据的公司销售更多的设备。但咨询公司Wikibon的乔治·吉尔伯特（George Gilbert）表示，这些公司转向边缘的能力有限。它们知道如何向IT部门销售标准硬件，但大多数物联网设备将更加定制化，需要特殊的软件，销售对象是设备管理人员。销售各种互联网设备的思科似乎占据有利地位。

大型云计算提供商也在尝试占领边缘地带。去年5月，微软将“移动优先，云端至上”的口号改为“智能云端，智能边缘”。它销售的服务能将带有AI算法的软件容器部署到任意设备上。AWS的产品组合中如今有一项名为Greengrass的服务，可将物联网设备群变成微型云。IBM在2015年以20亿美元收购天气公司（Weather Company），不仅是为获取天气数据，也为获得成千上万个边缘计算的“入网点”。

无论谁占上风，计算将愈加成为一道“流动的盛宴”，即使在最小的设备上也会出现。在任何特定的应用程序中，数据处理将在对其最合理的位置上展开。数据专家已经开始使用另一个术语：“雾计算”。但是这个比喻有点云山雾罩。更贴切、更诗意的叫法还是“空气计算”：它无处不在，且赋予生命。 ■



India's economy

The missing middle class

There is a hole where India's middle class should be. That should worry the government and companies

AFTER China, where next? Over the past two decades, the world's most populous country has become the market *qua non* of just about every global company seeking growth. As its economy slows, businesses are looking for the next set of consumers to keep the tills ringing.

To many, India feels like the heir apparent. Its population will soon overtake its Asian rival's. It occasionally grows at the kind of pace that propelled China to the status of economic superpower. And its middle class is thought by many to be in the early stages of the journey to prosperity that created hundreds of millions of Chinese consumers. Exuberant management consultants speak of a 300m-400m horde of potential frapuccino-sippers, Fiesta-drivers and globe-trotters. Rare is the chief executive who, upon visiting India, does not proclaim it as central to his or her plans. Some of that may be a diplomatic dose of flattery; much of it, from firms such as IKEA, SoftBank, Amazon and Starbucks, is sincerely meant.

Hold your elephants. The Indian middle class conjured up by the marketers and consultants scarcely exists. Firms peddling anything much beyond soap, matches and phone-credit are targeting a minuscule slice of the population. The top 1% of Indian adults, a rich enclave of 8m inhabitants making at least \$20,000 a year, equates to roughly Hong Kong in terms of population and average income. The next 9% is akin to central Europe, in the middle of the global wealth pack. The next 40% of India's population neatly mirrors its combined South Asian poor neighbours, Bangladesh and Pakistan. The remaining half-billion or so are on a par with the most

destitute bits of Africa. To be sure, global companies take the markets of central Europe seriously. Plenty of fortunes have been made there. But they are no China.

Worse, the chances of India developing a middle class to match the Middle Kingdom's are being throttled by growing inequality. The top 1% of earners pocketed nearly a third of all the extra income generated by economic growth between 1980 and 2014, according to new research from economists including Thomas Piketty. The well-off are ten times richer now than in 1980; those at the median have not even doubled their income. India has done a good job at getting those earning below \$2 a day (at purchasing-power parity) to \$3, but it has not matched other countries' records in getting those on \$3 a day to earning \$5, those at \$5 a day to \$10, and so on. Middle earners in countries at India's stage of development usually take more of the gains from growth. Eight in ten Indians cite inequality as a big problem, on a par with corruption.

The reasons for this failure are not mysterious. Decades of statist intervention meant that when a measure of liberalisation came in the early 1990s, only a few were able to benefit. The workforce is woefully unproductive—no surprise given the abysmal state of India's education system, which churns out millions of adults equipped only for menial work. Its graduates go on to toil in small or micro-enterprises, operating informally; these “employ” 93% of all Indians. The great swell of middle-class jobs that China created as it became the workshop to the world is not to be found in India, because turning small businesses into productive large ones is made nigh-on impossible by bureaucracy. The fact that barely a quarter of women work—a share that has seen a precipitous decline in the past decade—only makes matters worse.

Good policy can do an enormous amount to improve prospects. However, hope should be tempered by realism. India is blessed with a deeply

entrenched democratic system, but that is no shield against poor decisions. The sudden and brutal “demonetisation” of the economy in 2016 was meant to target fat cats, but ended up hurting everybody. And the path to prosperity walked by China, where manufacturing produced the jobs that pushed up incomes, is narrowing as automation limits opportunities for factory work.

All of which means that companies need to deal with the India that exists today rather than the one they wish to emerge. A strategy of waiting for Indians to develop a taste for products that the global middle class indulges in—cars as income per head crosses one threshold, foreign holidays when it crosses the next—may lead to decades of frustration. Only 3% of Indians have ever been on an aeroplane; only one in 45 owns a car or lorry. If nearly 300m Indians count as “middle class”, as HSBC has proclaimed, some of them make around \$3 a day.

Companies would do better to “Indianise” their business by, for example, peddling wares using regional languages preferred by hundreds of millions of Indians. Pricing matters. Services proffered at the same price in India as Indiana will appeal to mere millions, not a billion. Even for someone in the top 10% of Indian earners, an annual Netflix subscription can cost over a week’s income; the equivalent in America would be around \$3,000. Apple ads may plaster Mumbai, Delhi and Bangalore, but for only one in ten Indians would the latest iPhone represent less than half a year’s salary. The biggest consumer hits in India have been goods and services that offer stonking value: scooters and mobile telephony have grown fast, but only after prices tumbled.

The sharpest businesses work out which “enablers” will allow Indians to gain access to new goods. Electrification drives demand for fridges. Cheap mobile data (India is in the midst of a data-price war that has hugely benefited consumers) are a boon to streaming services. Logistics networks put together by e-commerce giants are for the first time making it possible

for a consumer in a third-tier city to buy global fashion brands. A surge in consumer financing has put desirable baubles within reach of more Indians.

Insofar as it is the job of politicians to create a consumer class, successive Indian governments have largely failed. Businesses hoping the Indian middle class will provide their next spurt of growth should be under no illusion. Companies will have to work very hard to turn potential into profits. ■



印度经济

缺失的中产阶级

在印度，该出现中产阶级的地方却是一片空白。政府和企业应对此感到担忧

继中国之后，下一片热土在哪里？过去20年来，几乎对所有寻求增长的全球企业来说，这个全球人口最多的国家都是一个不可或缺的市场。随着中国经济放缓，企业纷纷另觅消费者大军，好让自己继续有钱可赚。

很多人觉得印度是显而易见的接班人。该国人口很快将超过它在亚洲的对手——中国。中国在高速发展下取得了经济强国的地位，而印度偶尔也能达到类似的增长速度。中国的繁荣催生出数亿消费者，很多人认为印度的中产阶级也已从通往繁荣的路上起步。欢欣鼓舞的管理顾问认为可能会出现一个喝星冰乐、开福特嘉年华、周游全球的庞大群体，人数足有三到四亿。那些踏足印度的CEO无不宣称这个国家对于自己的计划至关重要。有些也许只是在圆滑地奉承，但包括宜家、软银、亚马逊和星巴克在内的大多数公司却是发自内心地这样认为。

且先打住。令生意人和顾问们想入非非的印度中产阶级几乎并不存在。如果企业兜售的产品档次远高于肥皂、火柴、话费之类，面向的就只是全国人口中极小的一部分。印度成年人中最富有的1%人数有八百万，年收入至少为两万美元，以人口和平均收入来看，大致相当于香港。接下来的9%与欧洲中部接近，在全球财富阶梯中处于中游。再往下，占印度人口40%的群体正好相当于其贫穷的邻国孟加拉和巴基斯坦的组合。最后剩下的约五亿人处境与非洲部分最贫困的地区接近。当然，那些全球企业还是比较重视欧洲中部市场的，也从那里获得了不少财富。但那里毕竟不是中国。

更糟糕的是，由于不平等愈演愈烈，印度若要形成一个可匹敌中国中产阶级的阶层，可能性微乎其微。托马斯·皮凯蒂等经济学家开展的新研究表明，1980年至2014年印度经济增长推高了收入水平，但收入居前1%的人

几乎攫取了收入增长部分的三分之一。富裕阶层如今的富足程度是1980年时的十倍，而中等收入群体的收入甚至都没能翻番。印度成功地令一些人的日薪从不到两美元（按购买力平价计算）升至三美元，表现出色；但还是不能和其他国家的成绩相比：它们令日薪三美元的人一天赚进五美元，日薪五美元的每天赚进十美元，以此类推。当其他国家处于印度今日的发展阶段时，其中等收入人群往往是经济增长的最大受益者。八成印度人认为不平等是个大问题，严峻程度与腐败不相上下。

失败的缘由并不难理解。上世纪90年代初印度实施了一定程度的经济自由化，但由于持续数十年的国家干预，只有少数人获益。印度劳动力的生产率极其低下，考虑到该国糟糕透顶的教育体系，也就不意外了。这一教育体系培养出的数百万成年人只能胜任低技术的枯燥工作。毕业生走出校门后也是在游离于正规经济之外的小微企业里辛苦工作，这样的企业“雇用了93%的印度人口。中国成为“世界工厂”后，适合中产阶级的就业机会大增，但在印度却不会出现这种情形，原因是其官僚体制令小企业几乎不可能转变为高效的大型企业。加上只有将近四分之一的女性参与劳动——过去十年来这一比例还急剧下滑——只会使局面恶化。

要改善前景，好的政策可以发挥巨大的作用。不过怀有希望的同时也应面对现实。在印度，民主制度深入人心，但这并不能避免决策失误。2016年突然而猛烈的“纸币废止”行动本意是想打击富人和贪官，结果却伤害了所有人。而且由于自动化限制了人们进工厂做工的机会，曾引领中国走向繁荣的途径——制造业创造就业从而推高收入——也越来越难以走通。

以上种种表明，企业需要应对的是今时今日的印度，而不是它们希望出现的印度。如果它们的策略是等待印度人喜欢上全球各地中产阶级享受的事物，那它们可能要苦苦等上几十年——等印度人的人均收入跨上一个台阶后喜欢上汽车，再跨上一个台阶后喜欢上出国度假。只有3%的印度人曾经坐过飞机，每45个人中只有一人拥有一辆汽车或卡车。如果真如汇丰银行宣称的那样，将近三亿印度人都算得上是“中产阶级”，那他们当中的某些人一天大概只赚三美元。

各家公司如果能将自身业务“印度化”，会更有成效，比如在推销商品时使用几亿印度人都乐于接受的地方语言。定价也很重要。一项服务在印度的价格如果和在美国印第安纳州一样，就只能吸引几百万人，而不是十亿人。就算对一个收入位居本国前10%的印度人来说，Netflix一年的订阅费也比他一周的薪水还要高。而收入水平居本国前10%的美国人的周薪大约是3000美元。虽然孟买、德里和班加罗尔各处都张贴着苹果的广告，但对九成印度人而言，最新款iPhone的售价要超过他们半年的工资。在印度，最受消费者欢迎的还是物超所值的商品和服务：电瓶车和移动电话服务增长迅速，但都只在大幅降价后才发生。

那些最敏锐的企业会设法摸清哪些“促成因素”会让印度人去使用新产品。电气化会推高对电冰箱的需求。廉价的移动数据（印度正在开展的数字价格战令消费者大为受益）对流媒体服务来说是一大利好。电商巨头组建起的物流网络也首次让三线城市的消费者买到了国际时尚品牌。消费信贷激增让更多印度人很容易就能买到心仪的小玩意。

如果说创造出一个消费者阶层在某种程度上是政客的任务，那么一届又一届的印度政府总体上都很失败。那些希望印度中产阶级能为自己带来下一轮增长的企业应该抛弃幻想。它们需要十分努力才能把潜在可能性转化为利润。 ■



Free exchange

The digital proletariat

Economists propose a radical solution to the problems posed by artificial intelligence

YOU have multiple jobs, whether you know it or not. Most begin first thing in the morning, when you pick up your phone and begin generating the data that make up Silicon Valley's most important resource. That, at least, is how we ought to think about the role of data-creation in the economy, according to a fascinating new economics paper. We are all digital labourers, helping make possible the fortunes generated by firms like Google and Facebook, the authors argue. If the economy is to function properly in the future—and if a crisis of technological unemployment is to be avoided—we must take account of this, and change the relationship between big internet companies and their users.

Artificial intelligence (AI) is getting better all the time, and stands poised to transform a host of industries, say the authors (Imanol Arrieta Ibarra and Diego Jiménez Hernández, of Stanford University, Leonard Goff, of Columbia University, and Jaron Lanier and Glen Weyl, of Microsoft). But, in order to learn to drive a car or recognise a face, the algorithms that make clever machines tick must usually be trained on massive amounts of data. Internet firms gather these data from users every time they click on a Google search result, say, or issue a command to Alexa. They also hoover up valuable data from users through the use of tools like reCAPTCHA, which ask visitors to solve problems that are easy for humans but hard for AIs, such as deciphering text from books that machines are unable to parse. That does not just screen out malicious bots, but also helps digitise books. People “pay” for useful free services by providing firms with the data they crave.

These data become part of the firms' capital, and, as such, a fearsome source

of competitive advantage. Would-be startups that might challenge internet giants cannot train their AIs without access to the data only those giants possess. Their best hope is often to be acquired by those very same titans, adding to the problem of uncompetitive markets.

That, for now, AI's contributions to productivity growth are small, the authors say, is partly because of the free-data model, which limits the quality of data gathered. Firms trying to develop useful applications for AI must hope that the data they have are sufficient, or come up with ways to coax users into providing them with better information at no cost. For example, they must pester random people—like those blur-deciphering visitors to websites—into labelling data, and hope that in their annoyance and haste they do not make mistakes.

Even so, as AI improves, the amount of work made vulnerable to displacement by technology grows, and ever more of the value generated in the economy accrues to profitable firms rather than workers. As the authors point out, the share of GDP paid out to workers in wages and salaries—once thought to be relatively stable—has already been declining over the past few decades.

To tackle these problems, they have a radical proposal. Rather than being regarded as capital, data should be treated as labour—and, more specifically, regarded as the property of those who generate such information, unless they agree to provide it to firms in exchange for payment. In such a world, user data might be sold multiple times, to multiple firms, reducing the extent to which data sets serve as barriers to entry. Payments to users for their data would help spread the wealth generated by AI. Firms could also potentially generate better data by paying. Rather than guess what a person is up to as they wander around a shopping centre, for example, firms could ask individuals to share information on which shops were visited and which items were viewed, in exchange for payment. Perhaps most

ambitiously, the authors muse that data labour could come to be seen as useful work, conferring the same sort of dignity as paid employment: a desirable side-effect in a possible future of mass automation.

The authors' ideas need fleshing out; their paper, thought-provoking though it is, runs to only five pages. Parts of the envisioned scheme seem impractical. Would people really be interested in taking the time to describe their morning routine or office habits without a substantial monetary inducement (and would their data be valuable enough for firms to pay a substantial amount)? Might not such systems attract data mercenaries, spamming firms with useless junk data simply to make a quick buck?

Still, the paper contains essential insights which should frame discussion of data's role in the economy. One concerns the imbalance of power in the market for data. That stems partly from concentration among big internet firms. But it is also because, though data may be extremely valuable in aggregate, an individual's personal data typically are not. For one Facebook user to threaten to deprive Facebook of his data is no threat at all. So effective negotiation with internet firms might require collective action: and the formation, perhaps, of a "data-labour union".

This might have drawbacks. A union might demand too much in compensation for data, for example, impairing the development of useful AIs. It might make all user data freely available and extract compensation by demanding a share of firms' profits; that would rule out the pay-for-data labour model the authors see as vital to improving data quality. Still, a data union holds potential as a way of solidifying worker power at a time when conventional unions struggle to remain relevant.

Most important, the authors' proposal puts front and centre the collective nature of value in an AI world. Each person becomes something like an oil well, pumping out the fuel that makes the digital economy run. Both

fairness and efficiency demand that the distribution of income generated by that fuel should be shared more evenly, according to our contributions. The tricky part is working out how. ■



自由交流

数字无产阶级

经济学家们为人工智能造成的问题提出了一个激进的解决方案

你身兼数职——不论你自己是否知道。大多数人的工作从一大早就开始了：你拿起手机，开始生产数据——硅谷最重要的资源。根据一篇引人入胜的新经济学论文的说法，我们至少应该按照这种方式来思考数据创造在经济中的作用。作者们认为，我们都是数字劳动者，让谷歌、Facebook等公司得以创造财富。如果未来经济要正常运转，并避免因新技术造成的失业危机，我们就必须考虑到这一点，并据此改变大型互联网公司与用户之间的关系。

文章的作者们（包括斯坦福大学的伊玛诺·阿列塔·伊瓦拉[Imanol Arrieta Ibarra]和迪亚哥·希梅内斯·埃尔南德兹[Diego Jiménez Hernández]、哥伦比亚大学的雷纳德·哥夫[Leonard Goff]，以及微软的雅龙·拉尼埃[Jaron Lanier]和格伦·韦尔[Glen Weyl]）说，人工智能（AI）一直在不断进步，并且势必将改变一大批产业的形态。但是，为了学习驾驶汽车或识别人脸，那些让聪明的机器运转起来的算法通常必须利用大量数据进行训练。每当用户点击谷歌的搜索结果，或者向亚马逊的Alexa发出指令时，互联网公司都会从用户那里收集这些数据。它们还通过reCAPTCHA这样的工具来从用户那里攫取有价值的数据，这些工具要求访问者解决对人类很容易但对AI很难的问题，比如破译机器无法解析的典籍。这不仅屏蔽掉了恶意机器人，还帮助实现了图书数字化。人们通过为企业提供它们渴望的数据来为有用的免费服务“付款”。

这些数据成为企业资本的一部分，因此也是竞争优势的可怕来源。未来的创业公司本有机会挑战互联网巨头，但如果它们不能访问被巨头独占的数据，就无法训练自己的AI。它们最大的希望往往恰恰是被那些巨头收购，而这又让市场竞争性进一步下降。

作者说，目前人工智能对生产率增长的贡献很小，部分原因是免费数据的模式限制了所收集数据的质量。试图为AI开发有用应用程序的公司肯定希望自己拥有足够多的数据，或想出方法来诱导用户免费提供更好的信息。例如，他们必须缠着随机人选让他们标记数据（比如那些解读模糊图像的网站访问者），并且希望他们不会因为烦恼和急躁犯错误。

即使如此，随着人工智能的进步，易被技术取代的工作数量也会增加，经济中产生的价值会越来越多地归于利润丰厚的企业而非工人。正如作者所指出的那样，国内生产总值中支付给工人和工资的份额——一度被认为是相对稳定的一——在过去几十年间已经持续下降。

为了解决这些问题，他们提出了一个激进的建议。数据不应被视为资本，而应被视为劳动——更具体而言，被视为生产此类信息的人的财产，除非他们同意将其提供给企业以换取报酬。在这样的世界中，用户数据可以多次出售给多家公司，从而降低数据集在市场准入门槛中的重要性。向用户付款来获得数据将有助于分散AI产生的财富。公司也可能通过付款产生更好的数据。例如，公司无需猜测某人为何在购物中心内闲逛，而可以要求个人分享访问了哪些商店、看过哪些商品的信息以换取报酬。也许最大胆的一点是，作者们认为数据劳动可以被看作是有用的工作，并获得与有偿就业相同的尊严——可算是大规模自动化这一可能的前景中一个可喜的副作用。

作者的想法还需要充实。他们的论文虽然引人思考，却只有五页长。设想的方案中有些部分似乎不切实际。要是没有大笔金钱的诱惑，人们是否真的有兴趣花时间描述自己一上午都干些啥或是在办公室的习惯？而他们的数据又是否足够有价值，让企业愿意支付一大笔钱？这样的系统难道不会吸引数据雇佣军用大量无用的垃圾数据狂轰滥炸，只是为了快速赚上一笔？

尽管如此，这篇文章还是包含了一些关键的观点，可以引导有关数据在经济中的作用的讨论。一个是数据市场的权力不平衡。其中部分原因是大型互联网公司的集中。但另一个原因是，尽管数据汇总起来可能非常有价值

值，但一个人的个人数据通常并非如此。一个用户威胁要让Facebook失去关于自己的数据完全算不上什么威胁。因此，与互联网公司进行有效谈判可能需要集体行动，也许还需要形成“数据工会”。

这可能也有弊端。比如，工会可能会要求为数据提供太高的报酬，从而影响了有用的AI的开发。它可能免费提供所有用户的数据，但要求分割公司的部分利润作为报酬。这将排除作者认为对于提高数据质量至关重要的付费数据工作模式。但是，在传统工会日渐式微的时候，数据工会有巩固工人权力的潜力。

最重要的是，作者的建议把AI世界中价值的集体属性摆在了舞台中央。每个人都变得像一口油井，喷涌出数字经济赖以运行的燃料。无论是出于公平还是效率的需要，都要求这种燃料所产生的收入应该根据我们每个人的贡献更均匀地分配。麻烦的是要搞清楚该如何实施。■



Data processing

Translation required

Once data have been extracted from the brain, how can they be used to best effect?

FOR those who reckon that brain-computer interfaces will never catch on, there is a simple answer: they already have. Well over 300,000 people worldwide have had cochlear implants fitted in their ears. Strictly speaking, this hearing device does not interact directly with neural tissue, but the effect is not dissimilar. A processor captures sound, which is converted into electrical signals and sent to an electrode in the inner ear, stimulating the cochlear nerve so that sound is heard in the brain. Michael Merzenich, a neuroscientist who helped develop them, explains that the implants provide only a crude representation of speech, “like playing Chopin with your fist”. But given a little time, the brain works out the signals.

That offers a clue to another part of the BCI equation: what to do once you have gained access to the brain. As cochlear implants show, one option is to let the world’s most powerful learning machine do its stuff. In a famous mid-20th-century experiment, two Austrian researchers showed that the brain could quickly adapt to a pair of glasses that turned the image they projected onto the retina upside down. More recently, researchers at Colorado State University have come up with a device that converts sounds into electrical impulses. When pressed against the tongue, it produces different kinds of tingle which the brain learns to associate with specific sounds.

The brain, then, is remarkably good at working things out. Then again, so are computers. One problem with a hearing aid, for example, is that it amplifies every sound that is coming in; when you want to focus on one person in a noisy environment, such as a party, that is not much help.

Nima Mesgarani of Columbia University is working on a way to separate out the specific person you want to listen to. The idea is that an algorithm will distinguish between different voices talking at the same time, creating a spectrogram, or visual representation of sound frequencies, of each person's speech. It then looks at neural activity in the brain as the wearer of the hearing aid concentrates on a specific interlocutor. This activity can also be reconstructed into a spectrogram, and the ones that match up will get amplified (see diagram).

Algorithms have done better than brain plasticity at enabling paralysed people to send a cursor to a target using thought alone. In research published earlier this year, for example, Dr Shenoy and his collaborators at Stanford University recorded a big improvement in brain-controlled typing. This stemmed not from new signals or whizzier interfaces but from better maths.

One contribution came from Dr Shenoy's use of data generated during the testing phase of his algorithm. In the training phase a user is repeatedly told to move a cursor to a particular target; machine-learning programs identify patterns in neural activity that correlate with this movement. In the testing phase the user is shown a grid of letters and told to move the cursor wherever he wants; that tests the algorithm's ability to predict the user's wishes. The user's intention to hit a specific target also shows up in the data; by refitting the algorithm to include that information too, the cursor can be made to move to its target more quickly.

But although algorithms are getting better, there is still a lot of room for improvement, not least because data remain thin on the ground. Despite claims that smart algorithms can make up for bad signals, they can do only so much. "Machine learning does nearly magical things, but it cannot do magic," says Dr Shenoy. Consider the use of functional near-infrared

spectroscopy to identify simple yes/no answers given by locked-in patients to true-or-false statements; they were right 70% of the time, a huge advance on not being able to communicate at all, but nowhere near enough to have confidence in their responses to an end-of-life discussion, say. More and cleaner data are required to build better algorithms.

It does not help that knowledge of how the brain works is still so incomplete. Even with better interfaces, the organ's extraordinary complexities will not be quickly unravelled. The movement of a cursor has two degrees of freedom, for example; a human hand has 27. Visual-cortex researchers often work with static images, whereas humans in real life have to cope with continuously moving images. Work on the sensory feedback that humans experience when they grip an object has barely begun.

And although computational neuroscientists can piggyback on broader advances in the field of machine learning, from facial recognition to autonomous cars, the noisiness of neural data presents a particular challenge. A neuron in the motor cortex may fire at a rate of 100 action potentials a second when someone thinks about moving his right arm on one occasion, but at a rate of 115 on another. To make matters worse, neurons' jobs overlap. So if a neuron has an average firing rate of 100 to the right and 70 to the left, what does a rate of 85 signify?

At least the activities of the motor cortex have a visible output in the form of movement, showing up correlations with neural data from which predictions can be made. But other cognitive processes lack obvious outputs. Take the area that Facebook is interested in: silent, or imagined, speech. It is not certain that the brain's representation of imagined speech is similar enough to actual (spoken or heard) speech to be used as a reference point. Progress is hampered by another factor: "We have a century's worth of data on how movement is generated by neural activity," says BrainGate's Dr Hochberg dryly. "We know less about animal speech."

Higher-level functions, such as decision-making, present an even greater challenge. BCI algorithms require a model that explicitly defines the relationship between neural activity and the parameter in question. “The problem begins with defining the parameter itself,” says Dr Schwartz of Pittsburgh University. “Exactly what is cognition? How do you write an equation for it?”

Such difficulties suggest two things. One is that a set of algorithms for whole-brain activity is a very long way off. Another is that the best route forward for signal processing in a brain-computer interface is likely to be some combination of machine learning and brain plasticity. The trick will be to develop a system in which the two co-operate, not just for the sake of efficiency but also for reasons of ethics. ■



数据处理

需要翻译

一旦从大脑中提取了信号，如何能最好地利用它们？

对那些认为脑机接口（BCI）永远不会流行的人，有一个答案很简单：它们已经流行了。全世界已有30多万人在耳朵里装上了人工耳蜗。严格说来，这种听力辅助设备并不直接和神经组织互动，但结果并无多大差异。一个处理器会捕捉声响，把它们转化为电信号，传送给放置在内耳中的电极，刺激耳蜗神经从而让大脑听到声音。参与研发人工耳蜗的神经学家迈克尔·默策尼希（Michael Merzenich）解释说，这些植入设备只能粗糙再现人声。“就像用拳头演奏肖邦。”但是稍过小会儿，大脑就能识别出信号。

这让我们一窥建构BCI方程式所需的另一部分：一旦达成与大脑的连接，接下来要做什么？正如人工耳蜗所展示的，一种选择是让全世界最强大的学习机器来发挥它的功效。在上世纪中叶一个著名的实验中，两位奥地利研究员向人们展示，人脑能够迅速地适应一副将投射给视网膜的影像上下颠倒的眼镜。更近些时候，科罗拉多州立大学的研究人员发明了一种将声音转化为电脉冲的设备。把这种设备压在舌头上，它会产生不同的颤动方式，而大脑会学会把它们和特定的声音关联起来。

由此可见，大脑具有杰出的解决问题的能力。而计算机也一样。仍以助听器为例，这种装置的一个问题是它会放大所有接收到的声响，因而当你想要在派对这类的嘈杂环境中专心听一个人说话时，它就不太能帮得上忙了。哥伦比亚大学的尼马·梅斯加拉尼（Nima Mesgarani）就在研究如何分离出你想要听的那个人的声音。他的设想是用一种算法来区分同时进行的各种声音，给每种人声都创造一幅频谱图也就是对声音频率的视觉再现。然后查看戴助听器的人专注在某一个说话者时大脑的神经活动。这个活动也会被显现为一幅频谱图，而那些与之契合的声音将被加强（见图示）。

在让瘫痪者仅靠意念把光标移向目标时，算法的表现要优于大脑本身的可塑性。比如，在去年年初发布的一项研究中，斯坦福大学的谢诺伊博士及其同事在意念操控打字上取得了重大进展。这种进展并不源于新的信号或更先进的BCI，而是更优的算法。

其中一项成果源于谢诺伊利用了在算法测试阶段产生的数据。在训练阶段，研究人员反复让受试者把光标移到某个目标物上，机器学习程序识别出与这一活动相关的神经活动模式。在测试阶段，研究人员向受试者展示一个字母方阵，让他们将光标移到任何他们想让它去往的地方，这测试了算法预测受试者意愿的能力。受试者想要点击某个特定目标的意图也反映在数据中，通过调整算法来包含这一信息后，光标可以被更快速地移动到目标物上。

但是，虽然算法不断优化，但仍需要很大的提升，主要是因为实际获得的数据仍然太少。尽管人们说聪明的算法可以弥补信号不佳，但它们也是有限度的。“机器学习能做近乎魔法的事，但它不是魔法。”谢诺伊说。想想这个例子：当让闭锁综合征患者回答是非题而给出“是”或“否”的答案时，功能性近红外光谱技术（fNIRS）识别答案的准确率为70%。对于这些完全无法与人交流的病患来说，这已经是一项巨大的进展，但如果要讨论身后的，它还远远达不到可靠的程度。需要更多更明确的数据来创建更好的算法。

人类对大脑运作方式的了解还非常有限，这是又一个困难。即便有了更好的BCI，这个器官极度的复杂性不会很快解密。比如，鼠标的移动有两个自由度，而人手有27个自由度。视觉皮层研究人员常常在处理静止的图像，而真实生活中人应对的是不断运动的图像。当人们抓住一个物体时发生了什么样的感官反馈？这方面的研究基本还没有启动。

而虽然计算神经科学家可以利用更广泛的机器学习领域里取得的进展——从面部识别到自动驾驶汽车——神经数据的噪音之大是一项特别的挑战。当一个人想移动右臂时，他大脑运动皮层里的一个神经元可能以每秒100

个动作电位的速度放电，但是，当他在另一个场合想到做同样的动作时，同一个神经元却可能以每秒115个电位的速度放电。更麻烦的是，多个神经元的职能相互交叠。所以，假如一个神经元在移动右臂时的平均放电速度为100个电位而移动左臂时为70个，那么当它放电速度为85个电位时，它是想干什么？

至少运动皮层的活动还会产生“动作”这种看得见的输出，让我们可以根据动作和神经数据之间的相关性来作出预测。而另一些认知过程看不到明显的输出。比如Facebook感兴趣的领域：内心独白。尚不能确定人们在内心独白时的大脑活动和他们在真正说话或听到真正说话时的大脑活动是否足够相似，而可以将前者作为一种参考物。另一个因素也妨碍了进展：“对于神经活动如何导致动作，我们可是有一个世纪那么多的数据，”BrainGate的霍赫贝格博士不动声色地玩笑道，“而对于动物语言，我们的了解就少了。”

对于更高阶的大脑运作，比如决策，困难就更大了。BCI算法要求模型清楚定义神经活动和要研究的参数之间的关系。“问题源于如何定义参数本身，”匹兹堡大学的施瓦茨医生说，“到底什么是认知？你怎么给它写个方程式？”

这些难题表明两件事：一是要为整个大脑的活动创建出一套算法还遥遥无期。另一个是BCI信号处理的最佳发展道路很可能是机器学习和大脑可塑性的某种结合。关键将在于发展出两者可以协作的系统，这不单单是为提升效率，也是出于伦理的需要。 ■



Computing geography (2)

Great cloud of China

Chinese tech companies plan to steal American cloud giants' thunder

WHICH of the world's tech giants boasts the fastest-growing computing cloud? Many would guess either Amazon or Google, which operate the world's largest networks of data centres, but the correct answer is Alibaba. In 2016 the cloud-computing business of the Chinese e-commerce behemoth grew by 126%, to \$675m. Growth is unlikely to slow soon. Simon Hu, president of Alibaba Cloud, wants it to "match or surpass" Amazon Web Services (AWS) by 2019.

That is a stretch: AWS is estimated to have generated revenues of about \$17bn in 2017. But Alibaba's cloud (known locally as Aliyun) is one of a thriving group: China's cloud-computing industry as a whole is growing rapidly. Even more intriguing than its speedy expansion is the fact that China's cloud is different to that of Western firms in important ways.

The technology that China's cloud-computing providers use is not so dissimilar. Indeed, the fact that Western tech firms have released much of the necessary code as open-source software made it easier for them to get going. "That brought us to the same starting-line," says Xilun Chen, the chief executive of EasyStack, which builds clouds for many Chinese firms.

What varies is how the technology is used—a result of the respective roots of cloud computing. In the West the first customers were startups and only later, bigger firms. In China the cloud grew out of consumer services, including Taobao, Alibaba's e-commerce marketplace, and the online games offered by Tencent, the second-biggest online firm. As a result, many cloud services are not yet ready for complex, mainstream corporate applications,

says Evan Zeng of Gartner, a research firm.

As these services develop, however, there is huge potential. In the West almost all firms have long had sophisticated inhouse information-technology systems, which many are hesitant to abandon. In contrast, the IT of most Chinese companies is underdeveloped. “They can jump directly to the cloud,” says Ji Xinhua, the founder and chief executive of UCloud, a smaller but fast-growing cloud provider.

Another divergence stems from regulation. Whereas in the West organisations such as government agencies and financial firms often share data centres with other customers, in China there are separate “industry clouds”. Banks, for instance, are encouraged to sign up for services provided by outfits such as CIB FinTech, a spin-off from China’s Industrial Bank, because it reflects the latest regulations and makes things “more convenient” for regulators, in the words of its boss, Chong Chen.

And whereas AWS, Microsoft and Google already rule the Western roost, the eventual cloud leaders in China are as yet unknown. Alibaba, China Telecom and Tencent are ahead (see chart), but that could change, says Mr Zeng. Huawei, a maker of telecoms gear, has ambitious plans. Smaller players, such as UCloud, may catch up.

Whichever firm ends up leading, Chinese and Western cloud providers are bound to run into each other—though not so much in their home countries as in such places as Europe and India. AWS and its main rivals have been busy building data centres abroad for some time, including in China. But Alibaba and Tencent are catching up. Alibaba, for example, operates a dozen computing plants abroad and will open another one this month in India, near Mumbai. “We have taken on Amazon on all fronts,” says Alibaba’s Mr Hu.

On the face of it, Western clouds should be able to stay ahead. They are still far bigger and have a technological edge, for instance in specialised chips to crunch reams of data for artificial-intelligence services. The reluctance to use Chinese technology is growing, and not just in America. But the Chinese competitors have some advantages of their own. They can rely on a huge home market in which foreign rivals are unlikely to make much headway, not least because of regulation. Laws force foreign cloud firms to have a Chinese-owned partner to operate local data centres. This adds complexity and puts them at a disadvantage. What is more, many subsidiaries of Chinese firms in other countries are likely to opt for a Chinese cloud.

And then there is geopolitics. Alibaba, in particular, will make a special effort, because it sees its cloud as part of China's Belt and Road Initiative, President Xi Jinping's ambitious infrastructure plan to connect his country with other parts of Asia, Europe and Africa. Mr Hu recently said that it is this initiative which made him confident that his firm will be able to surpass AWS. Perhaps, one day, the plan will be renamed "One Belt, One Road, One Cloud". ■



计算地理（2）

中国大云

中国科技公司计划抢走美国云巨头的风头

全球哪家科技巨头的“计算云”扩大最快？很多人可能会猜是亚马逊或谷歌，毕竟它们运营着全球最大的数据中心网络。但正确答案是阿里巴巴。2016年这家中国电子商务巨头的云计算业务增长了126%，达到6.75亿美元。这一增长势头一时不大可能放缓。阿里云总裁胡晓明希望在2019年前公司这项业务能“赶上或超越”亚马逊网络服务（AWS）。

这可是个艰巨的任务：2017年AWS的收入估计在170亿美元左右。但是阿里巴巴的云业务（在中国被称为“阿里云”）身处于一个繁荣的群体之中——中国云计算行业整体发展迅猛。而比这种快速扩张更耐人寻味的是，中国的云服务企业在一些重要方面与西方同行有所不同。

中国的云计算提供商使用的技术倒没有多大不同。其实西方的科技公司已经以开源软件的形式发布了许多必要的代码，中国的同行因而很容易就上手了。为许多中国公司建立起云业务的EasyStack首席执行官陈喜伦表示：“这让我们站在了同一起跑线上。”

不同之处在于对技术的使用方式，而造成这种情形的原因是中西方云计算的起源不同。在西方，云计算技术的第一批用户是创业公司，直到后来才有大企业光顾。在中国，云计算产生于消费者服务，包括阿里巴巴的电子商务市场淘宝，以及第二大网络公司腾讯提供的在线游戏等。因此研究公司Gartner的曾劭清认为，中国的许多云服务还不能胜任复杂和主流的企业应用。

然而随着这些服务的发展，它们将展现出巨大的潜力。长期以来，西方几乎所有的公司都在使用复杂的内部IT系统，而且很多公司都难以割舍这些系统。而在中国，大部分公司的IT系统都不完善。“它们可以直接跃上云端。”规模较小但发展迅速的云服务提供商UCloud的创始人兼首席执行官

季昕华说。

另一个不同之处源于监管。在西方，像政府机构和金融公司这样的组织往往与其他客户共享数据中心，而中国却有相互独立的“产业云”。例如，中国鼓励各大银行使用兴业数金（从兴业银行中分拆出来独立提供云服务的公司）这样的机构提供的服务，因为它符合最新的监管精神，而且用老板陈翀的话说，它让监管变得“更加方便”。

西方市场上AWS、微软和谷歌已成三足鼎立之势，而中国市场鹿死谁手尚未可知。目前阿里巴巴、中国电信和腾讯领先（见图表），但曾劭清认为形势也可能起变化。通信设备制造商华为有着雄心勃勃的计划，而体量较小的玩家如UCloud也有可能迎头赶上。

无论最终胜出的是哪家公司，中西方云服务提供商将来必有一战，只不过主战场不在它们各自的本土市场，而在欧洲和印度等地。AWS和它的主要对手一直积极在海外建立数据中心，包括在中国。但阿里巴巴和腾讯也在紧追猛赶。例如，阿里巴巴在国外运营十几家数据中心，本月还将在印度孟买附近再开一家。阿里的胡晓明表示：“我们已向亚马逊发起全面挑战。”

表面看来，西方云应该能够保持领先。它们的规模仍旧大得多，并且有技术优势，例如在为人工智能服务处理大量数据的专用芯片方面。用户越来越不情愿使用中国的技术，而且这种情况不仅出现在美国。但中国云服务公司也有自己的优势。它们可以依托庞大的国内市场，外国竞争对手在这里难有发展，尤其是在监管的影响下。法律规定外国的云公司要想经营中国本地的数据中心，必须与一家中国公司合作。这增加了复杂性，将其置于不利境地。更重要的是，中国企业位于其他国家的很多子公司很可能会选择本国的云提供商。

还有地缘政治因素。阿里巴巴会特别努力，因为它把云业务看做“一带一路”倡议的一部分。中国国家主席习近平提出这项宏伟的基础设施计划，是想把中国同亚洲其他国家以及欧洲和非洲连接起来。胡晓明最近表示，

正是“一带一路”倡议给了他超越AWS的信心。或许有一天，这项计划会更名为“一带一路一云”。 ■



Space flight

Size matters

The biggest rocket in the world prepares for its maiden voyage

TECHNOLOGICAL progress is not always straightforward. Before Concorde's first commercial flight in 1976 supersonic passenger-travel was science fiction. Since that aircraft's last hurrah, in 2003, it has become historical fiction instead. Similarly with rockets, the most powerful built (almost five times more powerful than anything flying today) was the Saturn V, which carried human beings to the moon. It last flew in 1973.

These days, though, big rockets are coming back. On a launching pad at Cape Canaveral, Florida, sits the Falcon Heavy, the latest offering from SpaceX, a private space-flight firm. It is 70 metres tall and sports 27 engines (see picture). Collectively, these generate 22.8m newtons of thrust—about as much as eighteen 747 jetliners. That is enough oomph to put almost 64 tonnes of payload into low-Earth orbit. This is, admittedly, still less than half of what the Saturn V could once manage. But it is more than twice as much as the Delta IV Heavy, the current champion.

SpaceX's engineers carried out a successful static fire test of their machine on January 24, and planned to take the final step and actually try to launch the beast into orbit on February 6. If they succeed, the Falcon Heavy will become by far the beefiest rocket presently flying, second only to the Saturn V itself in its capacity to lift things into orbit (see chart).

A successful launch would be another vindication for SpaceX's founder, Elon Musk, who started the firm to shake up the rocketry business and to slash the cost of getting into orbit. After a rocky start, he has succeeded admirably. The launch price of the firm's existing machine, the Falcon 9, is

thought to be around half of what some of its competitors charge. That has helped SpaceX to win a big order book, launching commercial satellites for companies, secret ones for America's armed forces, and making cargo runs to the International Space Station on behalf of NASA, that country's space agency.

SpaceX's prices can go even lower if customers are willing to fly on one of its reused rockets, a technology that the firm has pioneered. It now routinely flies the first stage of a Falcon 9 back to Earth, landing it either near the original launch site or on a robotic ocean-going barge. In March one of these recovered rocket stages was relaunched for the first time, hoisting a communications satellite into orbit on behalf of Airbus, a big European firm. All this adds up to a serious squeeze on the industry's incumbents. In April 2017 United Launch Alliance (ULA), the joint venture between Lockheed Martin and Boeing that makes the Delta IV Heavy, announced that it would cut its workforce by a quarter, and the prices on a range of rockets called Atlas by a third.

Conceptually at least, the Falcon Heavy is a simple machine. It consists of three Falcon 9 rockets lashed together like a set of pan pipes. SpaceX had originally pencilled in its first launch for 2013. But Mr Musk has admitted that he had been "naive" about just how difficult things would prove. The middle of the trio needs to be fortified to deal with the stresses imposed by thrust from its neighbours. The aerodynamics of three linked rockets are different from those affecting a single one. And Mr Musk hopes to try to recover all of the Falcon Heavy's rockets at once—something that has never been tried before.

With all this in mind, Mr Musk has been careful to play down expectations. In July 2017 he told a space-flight conference in Texas that "I hope it [the Falcon Heavy] makes it far enough away from the pad that it does not cause pad damage [if it explodes]. I would consider even that a win, to be honest."

But he cannot resist having at least a bit of fun. Like all debutante rockets, the Falcon Heavy will carry a test payload rather than a paying customer's satellite. Usually, these are blocks of metal or concrete. In April Mr Musk, who is also the founder of Tesla Motors, an electric-car company, said he was looking for something more interesting. He eventually chose his own cherry-red Tesla Roadster sports car. The mission calls for the car to be blasted into orbit around the sun, where it should remain for billions of years.

Even if the first mission does end up in a fireball, though, the Falcon Heavy's extra capacity and the savings from recyclability mean that if and when it works reliably, the costs of getting big objects into space could fall by an order of magnitude from those of the Delta IV Heavy. Indeed, the new rocket already has customers lined up, including Arabsat, a satellite-communications firm, and America's air force. The most eye-catching mission is to send two paying tourists on a jaunt around the moon and back. SpaceX says the daring duo have already paid a "significant" deposit. Their trip is, perhaps ambitiously, scheduled for some time this year.

The Falcon Heavy is not the only big rocket in development. China and Russia are both working on craft—the Long March 9 and the Energiya-5V—that will rival the Saturn V's lifting prowess. Mostly, the fledgling private space industry has confined itself to smaller machines. A firm called Rocket Lab may soon become the first startup since SpaceX to reach orbit. Its diminutive Electron rocket can carry loads of 150kg. But Mr Musk has high-end competition in the form of Jeff Bezos, the founder of Amazon, who runs his own rocketry firm called Blue Origin. This company is building a lifter called the New Glenn which it hopes will take off in 2020 and will be able to carry 45 tonnes into orbit.

Mr Bezos may be pipped to the post by America's government, which is due to launch Block 1, the first version of its Space Launch System (SLS),

in 2019 or 2020. This rocket will be able to carry 70 tonnes into orbit. The final variant of the SLS, Block 2, due in 2029, should manage double that. It has been explicitly designed to enable NASA to go back to the moon and, perhaps, eventually on to Mars.

But the SLS is far from universally popular. Its critics see it as little more than a job-creation programme for established aerospace companies, which are politically powerful. Nor is it cheap. NASA has estimated it could cost \$18bn. The progress being made by America's billionaires certainly makes it harder to justify their government's attempts to duplicate their efforts. And SpaceX will probably end up taking the crown in any case. The planned sequel to the Falcon Heavy is the BFR, or "Big Fucking Rocket", whose name neatly sums up its design goals. Capable of lifting up to 250 tonnes into orbit, and intended to enable Mr Musk's oft-stated wish to colonise Mars, it would be far and away the most potent rocket ever built. SpaceX says the BFR will be ready by 2022, though few will be surprised if that date slips. Still, if it ever flies it would, after half a century, at last bring the Saturn V's reign to an end. ■



太空飞行

尺寸很关键

世界上最大的火箭准备首次发射

科技的发展并非总是一条直线。1976年协和飞机首次投入商业飞行前，超音速客机还是科幻小说里的情节；而自2003年该客机完成最后一次飞行后，它就成了历史小说的题材。火箭也一样。把人类送上月球的土星五号（Saturn V）是史上最强火箭，运载能力几乎是如今任何现役火箭的五倍。它最后一次发射是在1973年。

然而，大型火箭如今又卷土重来。在佛罗里达州卡纳维拉尔角（Cape Canaveral）的发射台上，矗立着私人航天公司SpaceX研发的最新运载火箭——重型猎鹰（Falcon Heavy）。这枚火箭高70米，配备了27台引擎（见上图）。这些引擎总共可产生2280万牛的推力，约等于18架波音747喷气客机推力的总和，足以将64吨有效载荷送到近地轨道。诚然，这样的运力还不到以前土星五号的一半，但已是当前最强火箭德尔塔IV型重型运载火箭（Delta IV Heavy）的两倍多。

SpaceX的工程师已于上月24日成功完成静态点火测试，并计划于本月6日迈出最后一步，把这个家伙真正送进轨道。如果他们成功了，重型猎鹰将成为运力最强的现役火箭，近地轨道运力仅次于当年的土星五号（见图表）。

如果发射成功，这枚火箭将是SpaceX的创始人伊隆·马斯克成就的又一明证。他创立SpaceX是为了变革火箭运输业，大大降低到达太空轨道的运输成本。尽管出师不利，但他如今的成就令人钦佩。据估计，该公司现役火箭猎鹰九号（Falcon 9）的发射价格是部分竞争对手的一半左右。SpaceX因此赢得了大量订单，既为企业发射商业卫星，也为美国军方发射间谍卫星，还为美国国家航空航天局（以下简称NASA）向国际空间站运送补给。

SpaceX开创了火箭回收再利用技术，客户如果愿意采用其回收火箭进行发射，还可以得到更低的价格。该公司目前例行回收猎鹰九号的第一级火箭至原发射点或远洋无人驳船上。去年3月，一枚经回收的一级火箭首次再度发射，替空中客车公司将一颗通信卫星送抵轨道。这一切严重打击了传统火箭企业。2017年4月，洛克希德·马丁公司（Lockheed Martin）与波音公司合资组建的联合发射联盟（ULA，德尔塔IV型重型运载火箭的制造商）宣布将裁员四分之一，并将阿特拉斯（Atlas）系列运载火箭的发射价格降低三分之一。

重型猎鹰运载火箭是一台简单的机器，至少从概念上看是这样。它由三枚猎鹰九号火箭组合而成，就像一组排箫。SpaceX最初计划在2013年首次发射，但后来马斯克承认自己“天真”地低估了其中难度。三枚火箭中间的那一枚需要加固以应付左右两枚的推力带来的压力。组合在一起的三枚火箭的空气动力特性也与单枚火箭不同。马斯克还希望能同时回收重型猎鹰的所有火箭，这是前所未有的尝试。

考虑到这一切，马斯克一直在小心翼翼地淡化人们的期望。2017年7月，他在德克萨斯州举行的一场航天会议上表示：“我希望它（重型猎鹰）能飞得离发射台远些，（万一爆炸）不至于损坏发射台。老实说，能做到这样我觉得已经是成功了。”但他还是忍不住要玩点小把戏。跟所有初次登场的火箭一样，重型猎鹰将运载升空的并非客户付费发射的卫星，而是测试用载荷，通常是金属块或混凝土块。身兼电动汽车公司特斯拉创始人的马斯克在去年4月表示，他想把更有趣的东西运送到轨道上。最终他选择了自己那辆樱桃红的特斯拉Roadster电动跑车。等到试射时，这辆电动车将被发射到围绕太阳的轨道上，应该会在那里留驻数十亿年。

即便试射失败、火箭爆炸，重型猎鹰更大的运力和因可回收而节省的成本意味着，一旦实现可靠运作，它运载大型物件进入太空的成本可能会比德尔塔IV型重型运载火箭低出一个数量级。事实上，该新型火箭已经吸引来众多顾客，包括阿拉伯卫星通信组织（Arabsat）和美国空军。最瞩目的任务当属运送两位付费游客环绕月球、再返回地球的短途旅行。SpaceX表示，这两位勇士已支付“重金”预订服务。也许有点激进，但该太空游已定

在今年年内完成。

重型猎鹰并非唯一在研的大型火箭。中国和俄罗斯均在研发运力可与土星五号媲美的火箭，前者有长征九号，后者有能源-5V（Energiya-5V）。新兴的私人航天产业大体上还是致力于开发较小型的火箭。一家名为火箭实验室（Rocket Lab）的公司可能会成为继SpaceX之后又一家发射火箭至预定轨道的创业公司。其名为电子（Electron）的小型火箭运力为150公斤。而在大运力火箭上与马斯克竞争的则是亚马逊的创始人杰夫·贝佐斯，他自己经营的火箭公司蓝色起源（Blue Origin）正在打造一款名为新格伦（New Glenn）的火箭，运力为45吨，计划在2020年发射升空。

贝佐斯可能会在最后一刻被美国政府超车。后者准备在2019年或2020年发射其太空发射系统（SLS）的第一款火箭Block 1。该火箭将可把70吨载荷送入轨道。SLS的最终型号Block 2火箭预计在2029年发射，运力将翻倍。设计该火箭明确就是为了让NASA再次踏上月球，甚至最终登陆火星。

但SLS远未获得广泛追捧。批评者认为，那不过是为政治影响力强大的传统航天公司创造就业。而且这个项目的成本也不低，据NASA估计可能要花费180亿美元。面对美国的亿万富豪们在火箭领域取得的进展，美国政府要如法炮制肯定更难以服众。再者，无论如何SpaceX都可能成为最终的王者。SpaceX计划在重型猎鹰之后推出“超级大火箭”（Big Fucking Rocket，以下简称BFR），这个名字就清楚地体现了其设计目标。该火箭除了能把250吨的载荷送入轨道，还将用来实现马斯克常常挂在嘴边的火星殖民梦，绝对会是史上最强火箭。SpaceX表示BFR将在2022年升空，但如果计划跳票，也没人会感到惊讶。不过，一旦发射成功，它将终结土星五号长达半个多世纪的霸主地位，成为新一代火箭之王。■



Digital health

Doctor You

A digital revolution in health care is coming. Welcome it

NO WONDER they are called “patients”. When people enter the health-care systems of rich countries today, they know what they will get: prodding doctors, endless tests, baffling jargon, rising costs and, above all, long waits. Some stoicism will always be needed, because health care is complex and diligence matters. But frustration is boiling over. This week three of the biggest names in American business—Amazon, Berkshire Hathaway and JPMorgan Chase—announced a new venture to provide better, cheaper health care for their employees. A fundamental problem with today’s system is that patients lack knowledge and control. Access to data can bestow both.

The internet already enables patients to seek online consultations when and where it suits them. You can take over-the-counter tests to analyse your blood, sequence your genome and check on the bacteria in your gut. Yet radical change demands a shift in emphasis, from providers to patients and from doctors to data. That shift is happening. Technologies such as the smartphone allow people to monitor their own health. The possibilities multiply when you add the crucial missing ingredients—access to your own medical records and the ability easily to share information with those you trust. That allows you to reduce inefficiencies in your own treatment and also to provide data to help train medical algorithms. You can enhance your own care and everyone else’s, too.

Medical data may not seem like the type of kindling to spark a revolution. But the flow of information is likely to bear fruit in several ways. One is better diagnosis. Someone worried about their heart can now buy a watch strap containing a medical-grade monitor that will detect arrhythmias. Apps

are vying to see if they can diagnose everything from skin cancer and concussion to Parkinson's disease. Research is under way to see whether sweat can be analysed for molecular biomarkers without the need for an invasive blood test. Some think that changes in how quickly a person swipes a phone's touchscreen might signal the onset of cognitive problems.

A second benefit lies in the management of complex diseases. Diabetes apps can change the way patients cope, by monitoring blood-glucose levels and food intake, potentially reducing long-run harm such as blindness and gangrene. Akili Interactive, a startup, plans to seek regulatory approval for a video game designed to stimulate an area of the brain implicated in attention-deficit hyperactivity disorder.

Patients can also improve the efficiency of their care. Although health records are increasingly electronic, they are often still trapped in silos. Many contain data that machines cannot read. This can lead to delays in treatment, or worse. Many of the 250,000 deaths in America attributable to medical error each year can be traced to poorly co-ordinated care. With data at their fingertips, common standards to enable sharing and a strong incentive to get things right, patients are more likely to spot errors. On January 24th Apple laid out its plans to ask organisations to let patients use their smartphones to download their own medical records.

A final benefit of putting patients in charge stems from the generation and aggregation of their data. Artificial intelligence (AI) is already being trained by a unit of Alphabet, Google's parent company, to identify cancerous tissues and retinal damage. As patients' data stream from smartphones and "wearables", they will teach AIs to do ever more. Future AIs could, for instance, provide automated medical diagnosis from a description of your symptoms, spot behavioural traits that suggest you are depressed or identify if you are at special risk of cardiac disease. The aggregation of data will also make it easier for you to find other people with similar diseases and to see

how they responded to various treatments.

As with all new technologies, pitfalls accompany the promise. Hucksters will launch apps that do not work. But with regulators demanding oversight of apps that present risks to patients, users will harm only their wallets. Not everyone will want to take active control of their own health care; plenty will want the professionals to manage everything. Fine. Data can be pored over by those who are interested, while those who are not can opt to share data automatically with trusted providers.

The benefits of new technologies often flow disproportionately to the rich. Those fears are mitigated by the incentives that employers, governments and insurers have to invest in cost-efficient preventive care for all. Alphabet has recently launched a firm called Cityblock Health, for example, which plans to trawl through patients' data to provide better care for low-income city dwellers, many of them covered by Medicaid, an insurance programme for poorer Americans.

Other risks are harder to deal with. Greater transparency may encourage the hale and hearty not to take out health insurance. They may even make it harder for the unwell to find cover. Regulations can slow that process—by requiring insurers to ignore genetic data, for example—but not stop it. Security is another worry. The more patient data are analysed in the cloud or shared with different firms, the greater the potential threat of hacking or misuse. Almost a quarter of all data breaches in America happen in health care. Health firms should face stringent penalties if they are slapdash about security, but it is naive to expect that breaches will never happen.

Will the benefits of making data more widely available outweigh such risks? The signs are that they will. Plenty of countries are now opening up their medical records, but few have gone as far as Sweden. It aims to give all its citizens electronic access to their medical records by 2020; over a third

of Swedes have already set up accounts. Studies show that patients with such access have a better understanding of their illnesses, and that their treatment is more successful. Trials in America and Canada have produced not just happier patients but lower costs, as clinicians fielded fewer inquiries. That should be no surprise. No one has a greater interest in your health than you do. Trust in Doctor You. ■



数字医疗

医生就是你

医疗保健的数字革命就要来临。迎接它吧

难怪乎英文里“患者”（patient）一词也有“耐心”之意。如今，当人们进入富裕国家的医疗体系时，他们知道自己会面对什么：不停催促的医生、无休止的检查、令人困惑的术语、不断上涨的费用，尤其还有漫长的等待。在这种情况下多少是需要忍耐的，因为医疗是一项复杂又细致的工作。然而人们已经开始忍无可忍。本周，美国三大商业巨头亚马逊、伯克希尔·哈撒韦公司和摩根大通宣布了一个新项目，要为员工提供更好、更便宜的医疗服务。现行系统的一个基本问题是病人缺乏知识和掌控。让他们自由获取数据可以解决这两点。

有了互联网，患者已经能在自己方便的时间和地点在线问诊。你可以通过非处方检测来分析血液、做基因组测序、检查肠道细菌。但要彻底变革，需要将重心从医疗保健机构转向病人，从医生转向数据。这种转变正在发生。人们可以利用智能手机等技术来监控自己的健康状况。如果你能够填补其中缺失的关键部分，即访问自己的病历并能方便地和你信任的人分享信息，那么用技术手段监控健康的可能性还会成倍增加。这让你能够减少自我治疗中低效的情况，还能提供数据来训练医疗算法。你可以改善自己和其他所有人的医疗保健。

医疗数据也许看起来并不像那种能点燃革命的导火索。但信息的流动可能会在多个方面产生效果。首先是更便捷的诊断。担心心脏问题的人现在能买到一种手环，里面装有可以检测心律失常的医用级监测器。各种应用正在争先恐后地研究如何诊断从皮肤癌、脑震荡到帕金森氏症的种种疾病。目前还有人在研究是否可以对汗液进行分子生物标记物分析，而不需要进行侵入性血液检测。有人认为，如果一个人滑动手机屏幕的速度有变，可能是出现认知问题的征兆。

第二个好处体现在对复杂疾病的管理上。糖尿病应用可以监测血糖水平和食物摄入情况，从而改变患者管理该疾病的方式，这或许能减少如失明和坏疽等长期损害。名为Akili Interactive的创业公司计划让自己设计的一款电子游戏获得监管部门批准，以刺激与注意力缺陷多动障碍有关的大脑区域。

患者还可以提高自己的治疗效率。尽管病例的电子化程度越来越高，但往往还是难以利用。许多病历包含机器无法读取的数据。这可能会延误治疗，甚至导致更糟的结果。美国每年因医疗事故死亡的人数达25万，其中许多是因为治疗协调不佳。假如病患自己的手机上就有数据，又有统一的标准来分享信息，加上他们有强大的动力来把事情做对，他们就更有可能发现错误。1月24日，苹果公司发布了一项计划，鼓励各大医疗机构允许患者使用智能手机下载自己的病历。

让患者自己来负责医疗过程的最后一个好处来自于生成和聚合数据。谷歌的母公司Alphabet旗下某部门正在训练人工智能（AI）识别癌变组织和视网膜损伤。随着智能手机和可穿戴设备不断生成关于患者的各类数据，人工智能还可以学做更多事情。比如，未来的人工智能可以根据你的症状描述自动提供诊断，还可以识别表明你处于抑郁的行为特征，或是确定你是否格外有可能罹患心脏疾病。数据的聚合也让你更容易找到其他罹患类似疾病的人，了解他们对各种治疗的反应。

和所有的新技术一样，陷阱总是与希望相伴而来。大吹大擂的商家会推出不管用的应用。但由于监管机构要求监控所有会给患者带来风险的应用，用户至多只会钱包受损。不是每个人都想主动控制自己的医疗保健——很多人希望由专业人士管理一切。没问题。感兴趣的人可以仔细研究数据，而那些不感兴趣的人则可以选择与可信赖的医疗机构自动共享数据。

新技术带来的好处常常过多地流向富人。而雇主、政府和保险公司有动力为所有人投资经济适用的预防性保健，这就缓解了这方面的担忧。例如，Alphabet最近成立了一家名为城区健康（Cityblock Health）的公司，该公司计划通过研究患者数据为低收入城市居民提供更好的医疗服务，他们中

许多人都参加了医疗补助计划（Medicaid），这是一项为贫困美国人提供的保险计划。

其他风险则更难防范。更高的透明度可能会促使身体硬朗的人不参加医疗保险，甚至可能会影响身体不好的人更难获得保险。监管可以延缓这一过程——比如要求保险公司忽略基因数据——但无法阻止它发生。安全是另一个担忧。在云端被分析或与不同公司共享的患者数据越多，被黑客攻击或滥用的风险就越大。在美国，几乎四分之一的数据泄露发生在医疗领域。如果医疗保健公司对安全敷衍了事，就应面临严厉的处罚，但指望永远不发生泄露就太天真了。

广泛分享数据的好处是否大于这些风险？种种迹象表明的确如此。许多国家现在都在开放病历信息，但很少有国家能像瑞典那样彻底。该国的目标是在2020年前让所有公民都能访问自己的电子病历，超过三分之一的瑞典人已经开设了病历账户。研究表明，有这样渠道的患者更了解自己的疾病，治疗也更成功。美国和加拿大的一些试验不但让患者更满意，成本也下降了，因为临床医生的诊疗减少了。这并不稀奇。没人比你自己更关心你的健康。相信你自己做医生的本事吧。





Trade tariffs

Duties call

The Trump administration's trade restrictions are more damaging than they appear

ON TRADE, President Donald Trump has launched lots of investigations, withdrawn from one deal (see Banyan) and started the renegotiation of another. But recently he put up a big new barrier for the first time. On January 22nd he approved broad and punitive duties, of up to 30% on imports of solar panels and up to 50% on imports of washing machines. His backers say that the measure, which affects around \$10bn of imports, will protect American workers. His critics cling to the hope that the damage will be mild. Both are wrong.

Start with the claims made by the administration. Workers are also consumers, and Mr Trump's actions will whack them. Tariffs raise prices and dull competition. Whirlpool Corporation, the washing-machine maker which asked for the duties, knows as much. When, in 2006, it merged with Maytag, a rival, it quelled concerns about its high market share by pointing to competition from abroad. One study found that clothes-dryer prices rose by 14% after the merger. For washing machines, where import competition was fiercer, prices were unchanged.

Even if American wallets are pinched, surely American jobs are safer? Whirlpool is creating 200 new posts. Samsung and LG, two South Korean washing-machine makers, are ramping up their American production. But their deals were hatched before Mr Trump came into office, spurred in part by the logic of making heavy machines close to customers.

The solar industry is a clearer case. It has about 260,000 workers, a mere 2,000 of whom were making solar cells and panels at the end of 2016. The

government reckons that the fastest-growing occupation over the next ten years will be that of solar installer. The Solar Energy Industries Association, a body that is enraged by the new tariffs, reckons that the industry will support up to 23,000 fewer jobs because of them. Meanwhile, as if to underline the irony, the two companies that asked for protection are unlikely to be saved.

And do not forget that the tariffs may harm American industry more broadly. Restricting markets for imports tends to spark retaliation that restricts markets for exports—especially when, as with these latest tariffs, they affect everyone. China, supposedly the focus of American ire, produces 60% of the world's solar cells and is responsible for 21% of America's imports. But South Korea will also be hit, and its government is poised to dispute America's action at the World Trade Organisation. Other casualties include Mexico, Canada and the European Union.

Critics of the new tariffs draw solace from the fact that Mr Trump's actions were broadly in line with the steer from the United States International Trade Commission, a quasi-judicial review body, and in both cases were weaker than the petitioners had originally requested. They point out, too, that occupants of the Oval Office have resorted to global "safeguard" tariffs on 19 previous occasions.

That Mr Trump has stayed within the rules is small comfort: they give him enormous scope to poison world trade. And it would be wrong to skate over the differences between his administration and its predecessors. The last time this particular safeguard was applied was in 2002. It is especially belligerent. Past presidents remained wary of hurting American consumers, and mindful of international repercussions. Mr Trump, by contrast, seems to hold a steadfast belief that protectionism works. His rhetoric—and now his actions—invite aggrieved petitioners to apply for help. The logic of his stance on trade is to use tariffs not sparingly, but repeatedly and

aggressively. Mr Trump is now open for business, just not the healthy sort. ■



贸易关税

关税“使命”

特朗普政府的贸易限制措施比表面上看起来为害更大

在贸易方面，特朗普已经启动了大量调查，退出了一项贸易协定，开始重新谈判另一个协定。但近日他头一次筑起了一道重大的新壁垒。1月22日，他批准征收影响广泛的惩罚性关税：美国将分别对进口太阳能电池板和洗衣机征收最高达30%和50%的关税。他的支持者认为这项影响约100亿美元进口商品的措施会保护美国工人，他的批评者则寄希望于危害不会太大。这两方都错了。

先来看看特朗普政府的说法是否站得住脚。工人本身也是消费者，特朗普的措施会对他们产生沉重打击。关税提高物价，压制竞争。要求提高关税的洗衣机制造商惠而浦公司（Whirlpool Corporation）对此心知肚明。在2006年与竞争对手美泰克（Maytag）合并时，它搬出了国外竞争这个挡箭牌，平息了外界对其高市场份额的担忧。一项研究发现，在那次合并后，干衣机的价格上涨了14%。而在进口竞争更激烈的洗衣机市场，价格没有变化。

虽然美国人的钱包缩水了，他们的工作总该更安全了吧？惠而浦正在增加200个工作岗位。韩国的两家洗衣机制造商三星和LG也在提高在美国的产量。但它们的计划是在特朗普上台之前就确定的，一定程度上是为了让大件产品的生产靠近消费者。

太阳能行业的情况就更清晰了。截至2016年底，该行业有26万名从业人员，其中只有2000人从事太阳能电池和面板制造。政府预计未来十年增长最快的行当将是太阳能设备安装。行业组织美国太阳能产业协会（Solar Energy Industries Association）对新关税政策大为恼火，它预计这会令该行业丧失多达23,000个工作岗位。而同时，两家请求关税保护的公司却不太可能因此而获救，更是加重了讽刺意味。

而且别忘了，提高关税可能会更广泛地伤害美国的产业。限制进口市场往往会使招致报复，令出口市场受限，尤其是当关税政策影响所有人时，就像本次这样。美国的怒火貌似主要针对的是中国，该国生产了全球60%的太阳能电池，占美国进口的21%。但韩国也不能幸免，该国政府已准备向世贸组织提出申诉。墨西哥、加拿大和欧盟也受到伤害。

特朗普的举措大体上与准司法审查机构美国国际贸易委员会（United States International Trade Commission）的导向一致，而且对两个行业的保护力度也都比请愿者原先要求的要弱，这令新关税的批评者好受一些。他们还指出，椭圆形办公室的历任主人曾19次诉诸“防卫性”关税。

特朗普没有逾矩，但这并没有让事情好多少：这些规则让他有很大的机会危害世界贸易。而忽略特朗普政府和往届政府的差别也是不对的。上一次运用这种防卫性关税是在2002年。而特朗普的做法尤其具有挑衅性。往届总统对于伤害美国消费者的措施总是很警觉的，也会顾忌国际影响。特朗普则不同，他似乎坚信保护主义有用。起先是他的言辞——而今则是他的行动——让愤愤不平的请愿者起而申请保护。在他的贸易立场上，运用关税政策的原则不是少用、慎用，而是反复且激进地使用。特朗普现在对商界态度开明，只是并非健康的那种。 ■



The American economy

Powell position

Could higher interest rates spoil America's economic boom?

AMENDING a famous metaphor, Janet Yellen once said that the Federal Reserve would “keep refilling the punch bowl until the guests have all arrived”. Last week investors began to wonder if Jerome Powell, who will shortly succeed Ms Yellen at the top of the Fed, might at last deem the party full. On January 29th the ten-year Treasury yield reached 2.7%, the highest since early 2014. The prospect of tighter money caused stockmarkets to sneeze. On January 30th the S&P 500 fell by 1.1%, its biggest decline since August, before recovering a tiny bit the next day. With unemployment low and tax cuts pending, investors are wondering whether inflation and interest rates might soon surge.

The economy grew by 2.5% in the year to the fourth quarter of 2017. According to Okun’s law, a rule of thumb relating unemployment to GDP, falling joblessness explains almost half of this growth. (The unemployment rate fell from 4.7% to 4.1% over the same period.) Early in the year inflation fell short, suggesting that fast growth could continue unabated. But pressure on prices has begun to build. Quarterly core inflation, which excludes volatile food and energy prices, was only just below the Fed’s 2% target at the end of 2017. Markets have recently come to believe rate-setters who say that they will tighten policy three times in 2018 (see chart), as happened in 2017.

The prospect of higher rates has bears worried, for three reasons. First, they think asset markets are not ready for higher rates. On January 29th, before the market wobble, an index of financial conditions compiled by Goldman Sachs, which falls as conditions loosen, touched an all-time low.

Postponed rate rises have propelled asset prices in recent years; surprisingly tight policy could have the reverse effect.

The second worry is that consumers are unduly exuberant. In October consumer confidence touched highs not seen in over a decade (it has since fallen back slightly). Purchases of vehicles and parts alone contributed 0.4 percentage points to growth in the fourth quarter. Yet it is not wage growth that is fuelling the spending spree, other than in a few low- and middle-income sectors of the economy. Instead, it is that consumers are saving less. In December the personal-saving rate was just 2.4%, the lowest it has been since September 2005. Were falling asset prices to puncture consumers' optimism, growth might suffer.

The final worry concerns corporate debt. Last April the IMF warned that indebted firms were exposed to higher borrowing costs. Firms accounting for 10% of corporate assets, they noted, were already struggling to service their debt.

Are these worries reasonable? Asset-price falls are fearsome when people have borrowed too much. But regulatory reforms over the past decade have deterred risky lending. Households may not be saving much, but their balance-sheets are much stronger than before the financial crisis. Corporate debt is a likelier source of trouble, but a rising oil price has eased pressure on indebted energy firms, the most likely to falter. And with bond yields rising globally, the Fed need not worry a strong dollar will destabilise the world economy.

In fact, if Mr Powell can manage the transition to higher interest rates, they will be welcome. The Fed would have more scope to loosen policy during the next recession before rates hit zero. After all, the worst thing that can happen to a party is for the punch bowl to run dry too soon. ■



美国经济

财位新官

更高的利率是否会破坏美国的经济繁荣？

珍妮特·耶伦曾经修改了一则著名的比喻，她说美联储将“不断添满酒坛，直到客人到齐”【译者注：在上世纪50至70年代担任美联储主席的威廉·马丁曾说，美联储的工作是“在派对兴致正浓时拿走酒坛”】。上周，投资者开始怀疑，不久将接替耶伦领导美联储的杰罗姆·鲍威尔（Jerome Powell）会最终认为派对已经满员。1月29日，十年期国债收益率达到2.7%，创下2014年初以来新高。银根收紧的预期让股市打了喷嚏。1月30日，标准普尔500指数下跌了1.1%，是8月以来的最大跌幅，第二天稍有反弹。失业率很低，而税收减免即将到来，投资者开始思考通胀和利率是否很快会迅速上涨。

在截至2017年第四季度的一年里，美国经济增长了2.5%。根据奥肯定律这一关于失业率与GDP关系的经验法则，失业率的下降几乎解释了这一增长的一半。（同期失业率从4.7%下降到4.1%。）去年年初，通货膨胀率未达预期，表明快速增长可能继续一路高歌。但价格压力已经开始累积。到了2017年底，将波动较大的食品和能源价格排除在外的季度核心通胀率仅略低于美联储2%的目标。利率制定者说他们将在2018年三次收紧政策（见图表），就像2017年那样。市场参与者最近开始相信他们的说法了。

利率上涨的前景让看空者担心的原因有三。首先，他们认为资产市场还没有为提高利率做好准备。1月29日，在市场震荡之前，高盛编制的财务状况指数（在银根放松时下降）触及历史低位。推迟加息推动了近几年资产价格的上涨；出乎意料的紧缩政策则可能会产生相反的影响。

第二个担心是消费者过分热情。去年10月，消费者信心触及十多年来未见的最高点（此后小幅回落）。在第四季度，仅车辆和零部件的购买就贡献了0.4个百分点的增长。然而，除了少数中低收入的经济部门之外，推动

消费热潮的因素并非工资增长，而是消费者储蓄减少。12月，个人储蓄率仅为2.4%，是2005年9月以来的最低点。如果资产价格下跌会挫伤消费者的乐观情绪，增长可能会受到影响。

最后一个担心是公司债务。去年4月，国际货币基金组织警告说，负债的公司面临更高的借贷成本。它们指出，占所有公司资产10%的公司已经在为偿还债务而挣扎。

这些担忧是否合理？当人们借贷太多时，资产价格下跌是可怕的。但过去十年的监管改革抑制了高风险贷款。家庭的储蓄可能并不多，但其资产负债表比金融危机之前要强健得多。公司债务出麻烦的可能性更大，但油价上涨已让那些负债累累而最有可能垮台的能源公司松了一口气。随着全球债券收益率的上升，美联储不必担心强势美元会破坏世界经济的稳定。

事实上，如果鲍威尔能够很好地过渡到更高的利率，它们会受到欢迎。在下一次经济衰退时，美联储在把利率降到零之前将有更多的空间来放松政策。毕竟，派对上最糟糕的事情莫过于派对还没结束，酒坛已经空了。 ■



Buttonwood

The times they aren't a-changing

Volatility has been low, and that encourages risk-taking

MAY YOU live in boring times. Financial markets have become dull, if profitable. The S&P 500 index, America's leading equity benchmark, has notched up its longest-ever streak without a 5% reversal. Bond yields may have inched up in recent months, but are still at the bottom of historical ranges. Institutions famed for their trading prowess, such as Goldman Sachs, have seen profits dented by the quiescence of the markets.

This lack of market volatility owes much to the steadiness of monetary policy since the depths of the financial crisis. Central banks have kept short-term rates low and have intervened to push down bond yields through their programmes of quantitative easing (QE). The classic method of pricing financial assets is to say they are worth the discounted value of future cashflows; since central banks have kept the discount rate steady, prices have been steady too.

The late Hyman Minsky, an economist, thought that long booms sowed the seeds of their own destruction. He argued that, when the economy was doing well, investors tended to take more risk (such as taking on more debt). These speculative positions are vulnerable to a shock, such as a sudden rise in interest rates, which can turn into a fully fledged crisis.

In these days of sophisticated markets, speculators are not restricted to their own capital or even to borrowed money to buy assets to bet on the good times continuing. They can use derivative instruments to bet on prices. Indeed, there is actually a market in volatility.

The steadiness of the S&P 500 shows that actual, or realised, volatility has

been low. But investors can also hedge against a sharp move in the stockmarket (in either direction) by taking out an option, giving them the right to buy or sell equities at a given price within a set period. The price, or premium, they pay for this option reflects a lot of factors. But one of the most important is how choppy investors expect the market to be in future. This measure is the “implied” volatility of the market and is the basis for the well-known Vix, or volatility index.

Speculators who believe markets will stay calm can sell (or “write”) options on volatility, earning premium income. The more sellers there are, the more the price, or premium, will fall (and the lower the Vix will be). The danger, then, is that a sudden pickup in volatility could result in speculators suffering losses. A linked issue is that investment banks use a measure called “value at risk” to help determine the size of their trading positions; reduced volatility will encourage them to take more risk. Since volatility tends to rise when asset prices are falling, this could be accompanied by much wider financial distress.

Two recent papers* from the New York Federal Reserve have examined this issue. The authors point out that low volatility tends to be persistent; historical data show long periods of calm interspersed with short spikes in the form of crises (see chart). So low volatility today is not necessarily a warning sign. The authors write: “On average, extremely low volatility today predicts low volatility in the future, not higher.”

However, the Vix measures the implied volatility over just a one-month horizon. It is possible to calculate implied volatility over a two-year period, creating a slope akin to the yield curve, which measures interest rates for different lending durations. Back in 2006-07 this volatility curve was very flat, suggesting that investors thought that conditions would continue to be rosy. That may explain why so many were caught out by the problems in the

subprime mortgage market.

This time, the Fed says the volatility curve is steeply upward-sloping (since 1996 the slope has been steeper only 15% of the time). This suggests that investors are not complacent at all, and think that volatility may soon return. Investors seem to think the Vix may be as high as 20% (compared with around 11% today) within the next one or two years.

The obvious catalyst for such a change is monetary policy. The Fed is pushing up interest rates and slowly unwinding QE; the European Central Bank is scaling back its bond-buying. So far, this process has occurred without any great alarms. But there may yet be a “tipping point”, when higher rates cause problems for investors and borrowers. In any cycle there is always some institution that has taken a lot more risk than the rest. If a storm comes this year, the world will discover who has gone out without a coat or umbrella.

* “The low volatility puzzle: are investors complacent?” and “Is this time different?” by David Lucca, Daniel Roberts and Peter Van Tassel ■



梧桐

不变时代

波动率一直很低，促使投资者承担风险

祝你生活在乏味的时代。金融市场虽然还有利可图，但已变得沉闷无趣。美国主要的股票基准标准普尔500指数已很久未出现5%以上的回调，时间之长，已创下历史纪录。债券收益率近几个月可能有小幅上涨，但仍处于历史低位。由于市场无波无澜，像高盛这样以交易能力闻名的机构已经出现利润下滑。

市场波动性不足，主要是因为自金融危机最深重的时期以来，货币政策一直保持稳健。各国央行一直将短期利率保持在低位，并通过量化宽松（QE）进行干预，压低债券收益率。根据经典的金融资产定价方法，资产的价值等于未来现金流的贴现值。由于央行维持了稳定的贴现率，金融资产的价格也就同样保持了稳定。

已故经济学家海曼·明斯基（Hyman Minsky）认为，长期繁荣会播下自我毁灭的种子。他指出，经济发展良好时，投资者往往会承担更多的风险（比如承担更多债务）。这些投机头寸很容易受到利率突然上涨等意外事件的影响，进而可能演变成一场全面危机。

如今，金融市场高度复杂，投机者如果看好市场持续繁荣，就不会局限于使用自有资本乃至借来的资本购买资产，他们还可以使用衍生工具来投机价格变动。实际上，还真有一个波动率的市场。

标普500指数走势稳定，表明实际（即已实现的）波动率一直很低。但投资者也可以通过买入期权来对冲股市的急剧变化（不论涨跌），期权赋予他们在规定时间内以既定价格买卖股票的权利。投资者购买期权所付的价格（即溢价）反映了很多因素。但其中最重要的一个因素就是投资者预期未来的市场有多大的不确定性。这一指标是市场的“隐含”波动率，也是著名的Vix即波动率指数的基础。

认为市场将保持平稳的投机者可以就波动率出售（也就是“写”）期权，从而获得溢价收入。市场上卖家越多，价格即溢价就越低（Vix也就越低）。其中的危险就在于波动率突然上升可能导致投机者蒙受损失。一个相关的问题是，投行采用一个叫“在险价值”的方法来帮助它们确定其交易头寸的大小；波动率降低会促使它们冒更多的风险。由于资产价格下跌时波动率趋于上升，伴随而来的可能是远为广泛的财务危机。

纽约联储在近期发表的两篇论文*中研究了这个问题。作者指出，低波动率趋于持久——历史数据表明，市场会长时间保持平静，其中穿插着以危机形式出现的短暂的剧烈波动（见图表）。因此，今天的低波动率不一定是个警示信号。作者写道：“平均而言，今天的超低波动率预示着未来波动率也会很低，而不会升高。”

但是，Vix只衡量了一个月内的隐含波动率。其实还可以计算出两年的隐含波动率，创建一个类似于收益率曲线（衡量不同贷款期限的利率）的曲线。2006年至2007年之间，这条波动率曲线非常平坦，表明投资者认为市场状况将继续向好。这也许可以解释为什么次贷市场的问题会让这么多投资者深陷危机。

而这一次，美联储表示，这条波动率曲线正急剧上升（自1996年以来，这一曲线只有15%的时间比现在更陡峭）。这表明投资者根本没出现自满情绪，而认为波动率可能很快回升。投资者似乎认为未来一两年Vix可能会高达20%（现在是11%左右）。

货币政策是这种变化的明显的催化剂。美联储正在推高利率，缓慢退出量化宽松；欧洲央行正在缩减债券购买规模。到目前为止，这个进程中没有出现任何重大警报。但当利率上升给投资者和借款人造成问题时，可能还是会有一个“临界点”。在任何周期中，总会有一些机构比其他机构承担了更多的风险。如果今年风暴来袭，就能发现谁出门的时候没带外套或雨伞了。

* 《低波动率之谜：投资者是否自满？》（The low volatility puzzle: are

investors complacent?) 及《这次会有所不同吗?》(Is this time different?)，大卫·卢卡(David Lucca)、丹尼尔·罗伯茨(Daniel Roberts)、彼得·范·塔塞尔(Peter Van Tassel)著■



Buttonwood

Buck loses its fizz

A weaker dollar has wider implications for the market

AT THE start of 2017, just before Donald Trump was inaugurated as president, a survey of fund managers by Bank of America Merrill Lynch (BAML) found they believed that being positive on the dollar was “the most crowded trade”. It turned out they were right to be cautious. On a trade-weighted basis, the currency has fallen by 9% against other major currencies in the past year.

It is not clear what the Trump administration thinks about this. At the recent World Economic Forum in Davos, Steven Mnuchin, the treasury secretary, said: “Obviously a weak dollar is good for us as it relates to trade and opportunities.” Although the rest of his statement was more nuanced, it is unusual for anyone in his position to depart from a “strong dollar” line. The greenback duly fell in price.

Mr Trump then followed up with a statement in favour of a strong dollar in the long term, which caused a rebound. Since it was only last April that the president talked about the dollar being “too strong”, the markets can be forgiven for being confused. Never mind singing from the same hymn-sheet, the American authorities are using different tonal systems.

Adding to the puzzle is the administration’s focus on eliminating the trade deficit. The recent package of tax cuts, by boosting demand, is likely to suck in imports and widen the deficit. The trade deficit tends to fall during a recession, but that is not a desirable outcome. So it may need a big decline in the value of the dollar to bring about a cut in the deficit, while keeping the economy buoyant.

If the dollar is poised to experience one of its long periods of weakness, as in the late 1980s or the early 2000s (see chart), what would that mean for the financial markets? Much may depend on the reason the dollar is weak. If the weakness is related to bad news about the American economy, then that is usually bad for equities and good for government bonds. The reverse applies if the weakness reflects a boom in emerging markets; that would be a sign of investors taking advantage of exciting opportunities elsewhere.

Current dollar weakness seems to be linked to a rebound in the global economy. That also helps explain why stockmarkets have started 2018 in a buoyant mood. A weaker dollar helps American multinationals, as Mr Mnuchin suggested. Not only does it make their exports more competitive, but their overseas earnings are also worth more in dollar terms. BAML says that, in the fourth quarter, 68% of companies with high foreign sales beat analysts' forecasts of profits and sales. Only 39% of companies with no foreign exposure managed to do so.

Although equities have been performing strongly, Treasury-bond prices have been falling (in other words, yields have been rising). This may suggest that foreign investors need a higher return to persuade them to put their money in a depreciating currency. Another explanation is that American bond investors think stronger economic growth will eventually lead to higher inflation and are demanding higher yields to compensate (see next story).

What about the rest of the world? A weak dollar means a strong euro and thus, all else being equal, tighter financial conditions in Europe. Mario Draghi, the president of the European Central Bank, made some pointed remarks on January 25th about disorderly movements in exchange rates, and their adverse implications for financial and economic stability. He took a more doveish tone on monetary policy than investors expected; the ECB

will not want the euro to rise too far. Government-bond yields in Europe have also been rising, so financial conditions are already tightening.

Life tends to be easier for economic policymakers in developing countries when the dollar is falling than when it is rising. The Asian financial crisis, for example, occurred during the dollar surge of the late 1990s. Many countries peg their currencies, formally or informally, to the greenback; if the dollar is rising, they may be forced to tighten monetary policy in order to maintain the link. A weaker dollar gives countries scope to cut interest rates, boosting growth.

Of course, all these trends may go into reverse if they go too far. If a lot of money flows into emerging markets, economies can overheat and an overvalued currency can make exporters uncompetitive, leading to an eventual crisis. If Treasury-bond yields rise far enough, that will prompt capital to flow back into the dollar. Furthermore, a sharp rise in bond yields will put the squeeze on economic growth. Investors do not mind a bit of dollar weakness; they just don't want too much of it. ■



梧桐

跑了气的美元

美元走弱对市场有广泛影响

2017年初，就在特朗普将要宣誓就任美国总统之际，美林银行对基金经理的一项调查发现，他们认为看好美元是“最过热的交易”。事实证明他们的谨慎是对的。以贸易加权汇率计算，过去一年里美元对其他主要货币已经跌去了9%。

特朗普政府对此态度如何，并不清楚。近日在达沃斯世界经济论坛上，美国财政部长斯蒂芬·努钦（Steven Mnuchin）说：“显然，美元贬值对我们有利，因为它关乎贸易和机遇。”虽然他发言的其余部分更加微妙，但以他的职位，发表偏离“强美元”的论调还是很不同寻常。美元价格应声下跌。

而后特朗普发表言论支持美元长期走强，引发美元反弹。鉴于这位总统去年4月才说过美元“太强”了，市场感到迷茫也就情有可原了。虽然手里的谱子都是同一本，但美国政府是可以换着调门唱的。

让人们愈发困惑的是美国政府正努力消除贸易赤字。近期的一揽子减税计划将提振需求，因而很可能吸引进口而进一步扩大赤字。贸易赤字在经济衰退期往往缩小，但这可不是人们想要的结果。因此，可能需要美元大幅贬值以减少贸易赤字，同时维持经济繁荣。

假如美元将经历又一轮长期疲软——就像上世纪八十年代末或本世纪初那样（见图表），这对金融市场意味着什么？答案在很大程度上取决于美元为何疲软。如果疲软是因为有关美国经济的坏消息，那么这通常不利于股市而有利于国债。如果疲软反映了新兴市场的繁荣，影响则相反——这意味着投资者正追逐美国以外其他地区令人振奋的机会。

目前美元疲软似乎和全球经济反弹有关。这有助于解释为何股市在2018年初情绪高涨。正如努钦所言，美元走弱对美国的跨国企业有利。它不但让这些企业的出口变得更有竞争力，也让其按美元计价的海外收益增加。据美林称，在第四季度，海外销售额高的企业中有68%的利润和销售额超出了分析师预期，而无海外业务的企业中只有39%做到了这一点。

虽然股市表现强劲，但国债价格已开始下跌了（换言之，收益在上涨）。这可能表示外国投资者需要更高的收益来说服他们将钱投到一种正在贬值的货币上。另一种解释是，美国债券投资者认为更强劲的经济增长最终会推高通胀率，因而要求更高的收益率作为补偿。

那世界其他地方呢？美元疲软意味着欧元走强，进而也意味着在其他因素都保持不变的情况下，欧洲的财政状况将收紧。上月25日，欧洲央行行长马里奥·德拉吉（Mario Draghi）就汇率无序波动及其对金融和经济稳定的不利影响发表了尖锐言论。在货币政策上，他的态度比投资者预期的更为温和：欧洲央行不会希望欧元过度升值。欧洲的国债收益也已开始上升，因此财政状况已经在收紧了。

对于发展中国家的经济政策制定者而言，美元贬值时他们的日子更好过些。比如，亚洲金融危机就是在上世纪90年代末美元大涨时爆发。许多国家的货币正式或非正式地盯住美元，如果美元升值，它们可能会被迫紧缩货币政策以维持这种挂钩。美元贬值则给这些国家提供了降息的空间，促进了增长。

当然，所有这些趋势一旦走过头，都可能走向反面。如果大量资金流入新兴市场，这些经济体可能会过热，货币被高估可能会令本国出口商失去竞争力，最终导致危机。一旦国债收益率升到足够高位，将促使资金回流到美元上。此外，国债收益急剧上升也将对经济增长造成压力。投资者不介意美元弱一点，只是不希望它贬值太多。 ■



Free exchange

Many happy returns

A new data trove helps reshape how the economy is understood

DATA-GATHERING is the least sexy part of economics, which is saying something. Yet it is also among the most important. The discipline is rife with elaborate theories built on assumptions that turned out to be false once someone took the time to pull together the relevant data. Accordingly, one of the most valuable papers produced in 2017 is an epic example of data-retrieval: a piece of research that spells out the rates of return on important asset classes, for 16 advanced economies, from 1870 to 2015. It is fascinating work, a rich seam for other economists to mine, and a source of insight into some of today's great economic debates.

Rates of return both influence and are influenced by the way firms and households expect the future to unfold. They therefore find their way into all sorts of economic models. Yet data on asset returns are incomplete. The new research, published as an NBER working paper in December 2017, fills in quite a few gaps. It is the work of five economists: Òscar Jordà of the San Francisco Fed, Katharina Knoll of the Bundesbank, Alan Taylor of the University of California, Davis, and Dmitry Kuvshinov and Moritz Schularick, both of the University of Bonn. (Messrs Jordà, Schularick and Taylor have spent years building a massive collection of historical macroeconomic and financial data.) For each of the 16 economies, they craft long-term series showing annual real rates of return—taking into account both investment income, such as dividends, and capital gains, all net of inflation—for government bonds and short-term bills, equities and housing. Theirs is the first such data set to gather all of that information for so many countries over so long a period.

As such, the authors establish some new basic economic facts. They conclude, for instance, that over the very long run it is housing, rather than equities, which provides the best return (see chart): both asset types have yielded about 7% a year on average over the 145 years, but equity returns are much more volatile. It is important to note that, though homeowners might cheer this news, it is not necessarily a reason to leap into the housing market. Rental yields account for about half of the long-run return on housing, and owning a diversified portfolio of rent-yielding property is not the same bet as borrowing to house the family.

Besides offering these baseline findings, the authors' work helps to answer several pressing economic questions. One example is the puzzle of declining interest rates. The falling rates of the past few decades distress some economists, who worry they betoken weak growth and complicate central bankers' ability to manage the economy. Yet the long-run data reveal that the high rates of return on government debt seen in the 1980s were an anomaly. The real return on bonds and short-term bills is normally relatively low—and can even be negative for long periods of time—as some other economists (such as Carmen Reinhart of Harvard University and Belen Sbrancia of the IMF) have also found. Recent declines therefore represent a return to more typical conditions.

That, in turn, suggests that central bankers who hope to “normalise” interest rates may be in for a rude surprise. But low rates of return also mean that government-debt burdens may prove easier to manage than thought—and perhaps that government borrowing could be used more aggressively in times of economic weakness to make up for central-bank impotence. Nor do low rates of return on government debt imply that the world is entering a period of “secular stagnation”, or chronically weak growth. Low rates have in the past been as much a feature of rip-roaring economies—eg, in the 1950s and 1960s—as of the more stagnant ones experienced recently.

More bracing still are the data's implications for debates on inequality. Karl Marx once reasoned that as capitalists piled up wealth, their investments would suffer diminishing returns and the pay-off from them would drop towards zero, eventually provoking destructive fights between industrial countries. That seems not to be true; returns on housing and equities remain high even though the stock of assets as a share of GDP has doubled since 1970. Gravity-defying returns might reflect new and productive uses for capital: firms deploying machines instead of people, for instance, or well-capitalised companies with relatively small numbers of employees taking over growing swathes of the economy. High returns on equity capital may therefore be linked to a more tenuous status for workers and to a drop in the share of GDP which is paid out as labour income.

Similarly, long-run returns provide support for the grand theory of inequality set out in 2013 by Thomas Piketty, a French economist, who suggested (based in part on his own data-gathering) that the rate of return on capital was typically higher than the growth rate of the economy. As a consequence, the stock of wealth should grow over time relative to GDP. And because wealth is less evenly distributed than income, this growth should push the economy towards ever higher levels of inequality. Mr Piketty summed up this contention in the pithy expression " $r > g$ ".

In fact, that may underestimate the case, according to the newly gathered figures. In most times and places, " r ", which the authors calculate as the average return across all assets, both safe and risky, is well above " g " or GDP growth. Since 1870, they reckon, the average real return on wealth has been about 6% a year whereas real GDP growth has been roughly 3% a year on average. Only during the first and second world wars did rates of return drop much below growth rates. And in recent decades, the "great compression" in incomes and wealth that followed the world wars has come undone, as asset returns persistently outstrip the growth of the economy.

In such ways does the painstaking collection of data fundamentally reshape understanding of the way economies work. It is a shame that data-gathering does not carry higher status within the profession. It would raise the status of economics itself. ■



自由交流

年年岁岁回报丰

一个新的数据宝藏可帮助重塑人们对经济的理解

数据收集是经济学中最乏味的部分，此言不虚。然而数据收集也是经济学中最重要的内容之一。该学科充斥各种基于假设的复杂理论，而一旦有人花时间收集了相关数据，往往就会发现这些假设并不成立。因此，2017年最具价值的论文之一是数据检索方面的一项杰出研究：该研究整理出了1870年至2015年间16个发达经济体中重要资产类别的回报率。这是个十分出色的成果，为其他经济学家提供了丰富的可供挖掘的资源，也为当今一些重大经济议题带来启发。

回报率会影响企业和家庭对未来的展望——反之亦然，因而会出现在各种经济模型中。但有关资产回报的数据并不完整。上述新研究作为美国国家经济研究局（NBER）的工作论文于2017年12月发表，填补了不少空白。这是五位经济学家的成果：旧金山联邦储备银行的奥斯卡·乔尔达（Òscar Jordà）、德国央行的卡塔琳娜·诺尔（Katharina Knoll）、加州大学戴维斯分校的艾伦·泰勒（Alan Taylor），以及波恩大学的德米特里·库夫希诺夫（Dmitry Kuvshinov）和莫里茨·舒勒里克（Moritz Schularick）。乔尔达、舒勒里克和泰勒花费多年时间收集了大量宏观经济和金融方面的历史数据。他们为16个发达经济体的每一个都建立了长期数据集，显示政府债券、短期票据、股票和房产的实际年回报率，包括扣除通胀因素后的投资收益（如股息）和资本收益。他们的研究覆盖国家之多、时间跨度之长，为同类数据集所首见。

通过这样的研究，他们确立了一些新的基本经济事实。例如他们总结道，从很长的时期来看，回报最高的资产是房产而非股票（见图表）：145年来，这两种资产的年均收益都约为7%，但股票收益的波动性更大。特别需要注意的是，这一结论也许会令房主们欢欣鼓舞，但不一定就成了投身

楼市的理由。房产的长期收益中，租金收益约占一半，而且，坐拥多个能带来租金收益的物业跟贷款购房自住是两回事。

除了点出这些基准事实外，这项研究还有助于解答几个紧迫的经济问题。一是利率下降的谜团。过去几十年来利率持续下降，经济学家们为此忧心忡忡，担心这意味着经济增长疲弱，还会削弱央行官员管控经济的能力。但长期数据显示，20世纪80年代政府债务的高回报率实为反常现象。哈佛大学教授卡门·莱因哈特（Carmen Reinhart）和国际货币基金组织的贝伦·史班西亚（Belen Sbrancia）等一些经济学家也发现，债券及短期票据的实际回报通常相对较低，甚至可能长期为负值。因此，近年利率下降是回归常态的表现。

这反过来也表明，想要利率“正常化”的央行官员可能会遭到当头一棒。但低回报率也意味着政府债务负担可能比人们以为的更容易应对，而且，或许可以在经济疲软时期更积极地利用政府举债来弥补央行的无能为力。政府债务回报率低也不意味着世界正迈入“长期停滞”即增长长期乏力的时期。过去，低利率既出现在强劲增长的经济体中——例如在20世纪五六十年代，也出现在近几十年增长相对停滞的经济体内。

这些数据对围绕不平等的争论更有启发性。马克思曾推断，随着资本家的财富积聚，其投资回报将减少并逐渐趋向于零，最终引发工业国家之间的破坏性争斗。这种说法似乎并非事实：1970年以来，尽管资产总值占GDP的比例翻了一番，但房产及股票的回报依然高企。不跌反升的收益也许表明资本找到了富有成效的新用途：例如，企业更多地部署机器而非人力；资本充足而雇员相对较少的公司在经济中的比重越来越大。因此，股权资本的高回报也许与劳动者地位日渐不稳及劳动报酬占GDP比例下降相关。

同样地，法国经济学家托马斯·皮凯蒂（Thomas Piketty）于2013年提出的有关不平等的宏大理论也可以从这些长期回报的数据中找到支撑。部分基于自己收集的数据，他认为资本收益率通常高于经济增长速度。所以随着时间推移，财富总量相对GDP的比率会增长。而由于财富分配比收入分配更为不均，这样的增长会加深经济体内的不平等。皮凯蒂将这个论点精炼

地概括为“ $r>g$ ”。

事实上，就新收集的数据来看，这可能低估了实际情况。据作者们计算，在大多数时间和地方，无论风险高低，各类资产的平均回报率“ r ”都远远高于GDP增速“ g ”。据他们估算，自1870年以来，财富的实际平均年收益率一直在6%左右，而实际GDP年均增长率约为3%。只有在两次世界大战期间，资产回报率才大大低于经济增长率。而在近几十年，世界大战造成的收入和财富“大压缩”效应已经消失，资产回报率持续超越经济增长率。

就这样，苦心收集的数据从根本上重塑了人们对经济运作方式的理解。数据收集工作在经济学界未受到足够的重视，令人遗憾。要知道，这项工作可以提高经济学自身的地位。 ■



America's economy

Running hot

The United States is taking an extraordinary economic gamble

VOLATILITY is back. A long spell of calm, in which America's stockmarket rose steadily without a big sell-off, ended abruptly this week. The catalyst was a report released on February 2nd showing that wage growth in America had accelerated. The S&P 500 fell by a bit that day, and by a lot on the next trading day. The Vix, an index that reflects how changeable investors expect equity markets to be, spiked from a sleepy 14 at the start of the month to an alarmed 37. In other parts of the world nerves frayed.

Markets later regained some of their composure. But more adrenalin-fuelled sessions lie ahead. That is because a transition is under way in which buoyant global growth causes inflation to replace stagnation as investors' biggest fear. And that long-awaited shift is being complicated by an extraordinary gamble in the world's biggest economy. Thanks to the recently enacted tax cuts, America is adding a hefty fiscal boost to juice up an expansion that is already mature. Public borrowing is set to double to \$1 trillion, or 5% of GDP, in the next fiscal year. What is more, the team that is steering this experiment, both in the White House and the Federal Reserve, is the most inexperienced in recent memory. Whether the outcome is boom or bust, it is going to be a wild ride.

The recent equity-market gyrations by themselves give little cause for concern. The world economy remains in fine fettle, buoyed by a synchronised acceleration in America, Europe and Asia. The violence of the repricing was because of newfangled vehicles that had been caught out betting on low volatility. However, even as they scrambled to react to its re-emergence, the collateral damage to other markets, such as corporate

bonds and foreign exchange, was limited. Despite the plunge, American stock prices have fallen back only to where they were at the beginning of the year.

Yet this episode does signal just what may lie ahead. After years in which investors could rely on central banks for support, the safety net of extraordinarily loose monetary policy is slowly being dismantled. America's Federal Reserve has raised interest rates five times already since late 2015 and is set to do so again next month. Ten-year Treasury-bond yields have risen from below 2.1% in September to 2.8%. Stockmarkets are in a tug-of-war between stronger profits, which warrant higher share prices, and higher bond yields, which depress the present value of those earnings and make eye-watering valuations harder to justify.

This tension is an inevitable part of the return of monetary policy to more normal conditions. What is not inevitable is the scale of America's impending fiscal bet. Economists reckon that Mr Trump's tax reform, which lowers bills for firms and wealthy Americans—and to a lesser extent for ordinary workers—will jolt consumption and investment to boost growth by around 0.3% this year. And Congress is about to boost government spending, if a budget deal announced this week holds up. Democrats are to get more funds for child care and other goodies; hawks in both parties have won more money for the defence budget. Mr Trump, meanwhile, still wants his border wall and an infrastructure plan. The mood of fiscal insouciance in Washington, DC, is troubling. Add the extra spending to rising pension and health-care costs, and America is set to run deficits above 5% of GDP for the foreseeable future. Excluding the deep recessions of the early 1980s and 2008, the United States is being more profligate than at any time since 1945.

A cocktail of expensive stockmarkets, a maturing business cycle and fiscal largesse would test the mettle of the most experienced policymakers. Instead, American fiscal policy is being run by people who have bought into

the mantra that deficits don't matter. And the central bank has a brand new boss, Jerome Powell, who, unlike his recent predecessors, has no formal expertise in monetary policy.

What will determine how this gamble turns out? In the medium term, America will have to get to grips with its fiscal deficit. Otherwise interest rates will eventually soar, much as they did in the 1980s. But in the short term most hangs on Mr Powell, who must steer between two opposite dangers. One is that he is too doveish, backing away from the gradual (and fairly modest) tightening in the Fed's current plans as a salve to jittery financial markets. In effect, he would be creating a "Powell put" which would in time lead to financial bubbles. The other danger is that the Fed tightens too much too fast because it fears the economy is overheating.

On balance, hasty tightening is the greater risk. New to his role, Mr Powell may be tempted to establish his inflation-fighting chops—and his independence from the White House—by pushing for higher rates faster. That would be a mistake, for three reasons.

First, it is far from clear that the economy is at full employment. Policymakers tend to consider those who have dropped out of the jobs market as lost to the economy for good. Yet many have been returning to work, and plenty more may yet follow. Second, the risk of a sudden burst of inflation is limited. Wage growth has picked up only gradually in America. There is little evidence of it in Germany and Japan, which also have low unemployment. The wage-bargaining arrangements behind the explosive wage-price spiral of the early 1970s are long gone. Third, there are sizeable benefits from letting the labour market tighten further. Wages are growing fastest at the bottom of the earnings scale. That not only helps the blue-collar workers who have been hit disproportionately hard by technological change and globalisation. It also prompts firms to invest more in capital equipment, giving a boost to productivity growth.

To be clear, this newspaper would not advise a fiscal stimulus of the scale that America is undertaking. It is poorly designed and recklessly large. It will add to financial-market volatility. But now that this experiment is under way, it is even more important that the Fed does not lose its head. ■



美国经济

越来越热

美国开始了一场奇异的经济豪赌

波动回来了。之前长久的一段平静期内，美国股市稳步上升，未曾大幅下跌。本周，这种平静戛然而止。催化剂是2日发布的一份报告，显示美国工资增长已加速。标准普尔500指数当天略微下跌，并在下一个交易日大幅下滑。反映投资者对股市变化预期的波动率指数Vix从本月初低迷的14点飙升至令人警觉的37点。世界其他地方的神经也紧绷起来。

之后各地市场恢复了一些平静，但更多令人心跳加速的波动还等在后头。这是因为一场转变正在进行中：全球经济的蓬勃增长令通胀取代经济停滞，成为投资者最大的担忧。而这场等待已久的转变正因为全球最大经济体一次非同寻常的赌博而变得更加复杂。美国最近实施了减税政策，以巨额财政刺激来为已经成熟的经济扩张加力。在下个财年，公共债务应该会增加一倍，达1万亿美元，相当于GDP的5%。更重要的是，在白宫和美联储主导这场实验的是近期历史上最缺乏经验的团队。无论结果是繁荣或崩盘，这都将是一次疯狂的旅程。

最近股市的波动本身并非担忧的原因。在美国、欧洲和亚洲经济增长同步加速的推动下，世界经济仍处于良好状态。价格调整如此剧烈，是因为那些新奇的工具都押注在低波动性上，它们急于对重新出现的波动做出反应。但即便如此，公司债券和外汇等其他市场受波及的程度还是有限的。而尽管发生暴跌，美国股市也只是跌回到年初的水平。

然而，这次波动确实预示了未来可能发生的事。多年来投资者一直能依赖央行的支持，而如今极度宽松货币政策所提供的安全网正在慢慢解体。自2015年底以来，美联储已经五次加息，下一次预计发生在下个月。十年期国债收益率已从去年9月的不到2.1%升至2.8%。股市陷入更高企业盈利和更高债券收益率之间的拉锯战，更高的企业盈利能保证更高的股价，而更

高的债券收益率会压低这些盈利的现值，让高得令人咂舌的估值更难令人信服。

货币政策正要回归到更正常的状态，这种紧张态势不可避免。而美国即将到来的财政赌注的规模却并非不可避免。特朗普的税改减轻了企业和美国富人的税收负担（对普通工人影响更小些），经济学家们认为它将刺激消费和投资，让今年的经济增长率提高约0.3%。而如果本周宣布的一项预算协议最后被通过，国会将增加政府开支。民主党将在儿童保育等福利上获得更多资金；两党的鹰派人物也都为国防预算争取了更多资金。与此同时，特朗普仍想修建边境墙并实施基建计划。华府对财政负担满不在乎的态度令人不安。不断增长的养老金和医疗费用之外再加上这些额外的支出，在可预见的将来美国的财政赤字应该会达到GDP的5%以上。除去上世纪80年代初和2008年的严重衰退，美国如今的挥霍程度超过自1945年以来的任何时候。

高企的股票市场、成熟中的商业周期，以及慷慨的财政政策，这三者的混合对最有经验的政策制定者来说都会是一场重大考验。然而，现在执掌美国财政政策的人却相信赤字并不重要那一套。而美联储的新掌门人杰罗姆·鲍威尔（Jerome Powell）与前几任主席不同，他在货币政策方面没有正规的专业知识。

什么将左右这场赌博的结果？就中期而言，美国将不得不应对财政赤字的问题，否则利率最终会像上世纪80年代那样飙升。但在短期，结果在很大程度上要取决于鲍威尔，他必须在两个截然相反的危险之间小心掌舵。危险之一是他会过于温和，放弃美联储当前计划中渐进（且相当温和）的紧缩政策，以慰藉紧张不安的金融市场。实际上，他将会创造一个迟早会导致金融泡沫的“鲍威尔托市”。另一个危险则是美联储因为担心经济过热而过快过多地推进紧缩。

两者相较，仓促紧缩的风险更大。新官上任的鲍威尔也许会很想通过加快加息步伐来证明自己有能力对抗通胀，且独立自主、不被白宫左右。这会是个错误，原因有三点。

首先，经济是否已达到充分就业还远未明朗。政策制定者往往认为那些退出就业市场的人是永远从经济中退出，但实际上许多人已经重返工作岗位，这样的人也许还有很多。其次，通胀突然急速上升的风险有限。在美国，工资增长只是逐渐抬头。而在失业率同样很低的德国和日本，几乎没有这样的迹象。20世纪70年代初导致工资和物价相互推动而螺旋式飙升的工资谈判早已不复存在。再则，让劳动力市场进一步收紧有相当大的好处。目前，收入最低的人群工资增长最快。这不仅有助于那些受技术变革和全球化冲击最大的蓝领工人，还会促使企业加大对资本设备的投入，从而促进生产率增长。

明确地说，本报不建议美国推行如此规模的财政刺激。它设计糟糕、规模之大不计后果。它将加剧金融市场的波动。但既然这项实验已经启动，美联储冷静行事就更重要了。 ■



Morgan Stanley v Goldman Sachs

Sorpasso on the Street

The battle of the investment banks is a parable of post-crisis finance

FOR more than a decade, equity investors have reckoned that Goldman Sachs was worth more than its Wall Street rival, Morgan Stanley. But on January 17th their opinion was turned on its head. According to Bloomberg, the last time Morgan Stanley led Goldman was back in 2006. Back then, a heedless industry-wide race to win market share and raise returns was about to end in disaster. This time the industry is transformed, and the two investment banks are on strikingly different paths.

Morgan Stanley is being rewarded, above all, for its post-crisis decision to take control of Smith Barney, Citigroup's wealth-management business. In 2012 the bank's core activity of selling and trading securities accounted for almost two-thirds of its net income, and wealth management for just over a quarter. The figures now are 55% and 40% respectively.

The mythology of Wall Street is built around big bets and contrarian calls; the business of helping the affluent manage their money lacks panache. But in post-crisis finance, glamour is out and stability is in. Wealth management offers relatively predictable returns and does not suck up too much capital. Morgan Stanley last month raised its return-on-equity targets—but only so far. On a conference call with analysts, the firm's bosses said that, if they achieved a return on equity of more than 20%, commonplace during the go-go years, they would be doing something wrong.

Goldman has changed much less since the crisis. James Gorman, Morgan Stanley's chief executive, made his way in wealth management; by contrast,

Goldman's boss, Lloyd Blankfein, cut his teeth as a trader, and it shows. Goldman's business is lumpier and more volatile. It is more dependent than Morgan Stanley on its fixed-income, currencies and commodities (FICC) franchise. For a firm that sells itself on reading markets better than anyone else, that bet has hurt its reputation as well as its bottom line. Revenue from FICC in the fourth quarter of 2017 fell more precipitously, year on year, at Goldman than at its peers; for last year as a whole, revenue was not much more than a fifth of what it was in 2009.

The fixed-income business could yet revive, especially if interest rates rise and markets become more volatile (see Buttonwood). Regulators in America are planning to streamline the Volcker rule, a post-crisis ban on banks using their own money to trade. But the chances of the trading floors recovering past glories are vanishingly thin. Because regulators will go only so far to loosen the shackles, the capital-intensity of businesses like FICC will still weigh on returns. And as bond markets gradually become electronic, banks' margins will shrink, just as they have in equity markets. Goldman itself openly acknowledges the need to change.

All of which makes Morgan Stanley's overtaking manoeuvre a parable for the industry. Lesson one is that, despite what bankers like to argue, it is possible to make a reasonable return in a more regulated environment. Lesson two is that dullness can be a selling-point. Investment banks used to promise shareholders outsize returns as the trade-off for their peculiar mixture of volatility and opacity; that bargain looks much less appetising today. Lesson three is that power on Wall Street has tilted away from traders and high-octane clients like hedge funds towards a more prosaic cast of characters: brokers, passive asset managers, corporate treasurers and well-off individuals. Investment banks can still make decent returns. But not if they play by the same old rules. ■



摩根士丹利对阵高盛

华尔街超车

这场投行间的战役是一则关于危机后金融业变迁的寓言

十多年来，股权投资者一直认为高盛比它在华尔街的竞争对手摩根士丹利更有价值。但在上月17日，他们的看法发生了180度的转变。根据彭博的数据，上一次摩根士丹利的市值领先高盛还是在2006年。当时整个金融业正不管不顾地争夺市场份额、追逐回报，再过没多久就以灾难收场了。这一次金融业已经改变，这两家投行也走上了迥然不同的道路。

摩根士丹利正在收获回报，主要得益于它在危机后决定收购花旗集团的财富管理部门美邦银行（Smith Barney）。2012年，摩根士丹利来自核心业务证券销售和交易的收益占其净收入的近三分之二，财富管理收益的占比刚过四分之一。如今这两个比例分别是55%和40%。

华尔街的神话是建立在大手笔下注和反向操作之上，帮助富人管理资金的生意则没那么风光。但在危机之后的金融界，华丽的冒险让位给了稳定。财富管理的收益相对可以预期，也不需要投入太多资本。摩根士丹利上月提高了股本回报率（ROE）目标，但并不多。在一次与分析师的电话会议上，公司高管们表示，如果他们实现了20%以上的股本回报率，那就是在犯错了。而这样的收益在股市狂飙突进的年代实在稀松平常。

高盛在危机之后的改变要小得多。摩根士丹利的首席执行官高闻（James Gorman）本人是在理财部门一路晋升，而高盛的老板劳尔德·贝兰克梵（Lloyd Blankfein）则是从交易员起步。这种差异在两家公司之间也显现出来。高盛的业务更大块，波动也更大。相比摩根士丹利，高盛更依赖固定收益、外汇和大宗商品业务（统称FICC）。对一家自诩在市场解读能力上舍我其谁的企业来说，这种依赖损害了它的声誉，也危及利润。2017年第四季度，高盛FICC业务收入的同比下跌比同行更猛烈，2017年整年的FICC收入只比2009年的五分之一多一点。

固定收益业务也许还能复苏，特别是如果遇到加息和市场波动性提高的话。美国的监管部门正计划简化沃尔克规则，这项金融危机之后出台的规则禁止银行进行自营交易。但是交易大厅重现昔日盛景的机会微乎其微。因为监管机构放松限制的程度也就仅此而已，而FICC等业务的资本密集度仍对收益造成很大压力。而且随着债券市场逐渐电子化，银行的利润将会萎缩，就像在股票市场中那样。高盛自己也坦承需要变革。

令摩根士丹利超车的种种要素为金融业提供了启示。第一，不论银行界人士如何争论，在更严格的监管下是有可能获得合理回报的。第二，沉闷可以成为一个卖点。投行过去总是向股东许以超额回报，好让他们接受自己那波动剧烈又不透明的奇特操作——这种交易如今看起来已不再诱人。第三，华尔街的权力已从交易员和对冲基金等高活力客户偏离，转移到一些更平凡的角色手中：券商、被动资产管理公司、企业司库和富裕人士。投行仍然可以获得不俗的回报，但前提是它们不再按老一套行事。 ■



Schumpeter

BlackRock v Blackstone

Mirror, mirror on the wall, who is the mightiest finance tycoon of them all?

THE two most successful entrepreneurs on Wall Street of the past two decades work on opposite sides of Park Avenue. Larry Fink, 65, is a Democrat whose hand is glued to a Starbucks cup and who runs BlackRock from 52nd Street. Stephen Schwarzman, 70, is a Republican who wears striped shirts with plain collars and runs Blackstone from between 51st and 52nd. The two are ex-colleagues, but have sharply opposing views on investment and management. Their trajectories illustrate how finance is changing. Mr Fink, once the underdog, is on top.

His firm, BlackRock, is the world's largest asset manager, with \$6trn of assets. It stands for computing power, low fees and scale, and is booming. Mr Schwarzman's firm, Blackstone, is the largest "alternative" manager, focused on private equity and property, with \$387bn of assets. It stands for a time-honoured formula of brain power, high fees and specialisation. Lately, it has trod water.

When Mr Fink was a securities trader in his 30s he joined Blackstone, co-founded by Mr Schwarzman, to set up its bond investment business. This was named BlackRock, and became a separate company in 1995. As late as 2007 the two firms had similar market values. Yet they have taken diametrically different approaches to investment and to their own control structures.

BlackRock mainly sells passive funds (including exchange-traded-funds, or ETFs) to institutions and to the masses. It has been a leader in the shift away from conventional asset managers. Its fees are wafer-thin: it makes 0.2

cents of revenue a year for every dollar it manages. Blackstone, meanwhile, uses leverage and changes the management of firms in order to try to outperform. Its fees are 1.8 cents. Its clients are institutions and the rich.

The structure of Mr Fink's firm is simple; one share, one vote. He owns only 0.66% of it (the largest shareholder is PNC, a bank, with a stake of 22%). This gave BlackRock the flexibility to issue shares to buy Barclays' fund-management arm in 2009. Mr Schwarzman, by contrast, has tightly hugged control of his partnership. Outside shareholders have no vote at Blackstone, and its accounting is as baffling as Kanye West or the works of Hegel.

Both firms pay out a handsome portion of their sales to staff—between 30% and 40%—but their cultures vary greatly. Blackstone's bill is spread over 2,240 workers, who earn on average \$1m a year, three times the average of BlackRock's 13,000 staff.

Which strategy has been the best route to world domination? Passive money run by a simple firm, or active money run by a complex one? Schumpeter has devised a five-part Wall Street “tycoon test”. It gauges the firms' size, the bosses' personal wealth, the wealth created for clients and also for shareholders, and the influence the two men wield beyond their own companies.

Mr Schwarzman wins only one of the five tests (albeit hands down). His fortune is \$13bn, according to Bloomberg; Mr Fink is worth less than \$1bn. When it comes to size, BlackRock is ahead. Its market value of \$86bn is double that of its original parent. Measured by sales, profits and cash returns to shareholders, it is, on average, 31% larger. It has raised seven times the amount of net client money cumulatively over the past decade.

There is no very satisfactory way to compare how each firms' clients have done. But an extremely crude yardstick is that BlackRock's clients have made

roughly \$2.9trn of profits over the past decade, compared with \$202bn for Blackstone's clients. For each firm the gain is equivalent to about 80% of average assets under management over the period. Both firms have benefited from soaring markets; it is not clear that Blackstone's active management and use of leverage have delivered much better results.

Both have created wealth for their shareholders, but, again, BlackRock is ahead, with a boost of \$50bn-70bn (depending on the method and including cash returned to shareholders) against \$32bn at Blackstone over the past decade. Mr Fink's achievement is in the same range as that of acclaimed entrepreneurs such as Reed Hastings at Netflix or Elon Musk at Tesla. BlackRock is valued on 25 times profits, versus 11 for Blackstone, suggesting that investors prefer its simple structure and think it will grow faster.

The final test is power. Mr Schwarzman has sway over a narrow group of businesses his firm controls, and he is a champion networker. But Mr Fink's firm probably has more overall clout: it owns 5-7% of most big listed companies in the Western world, giving it enormous influence. Mr Fink has used this platform to urge bosses to invest more. BlackRock votes against the advice of the managers of the firms it invests in about 10% of the time.

Scoring three or four out of five, Mr Fink comes out on top. And yet BlackRock has lots to worry about. A stockmarket dip might sour the public's love affair with passive funds, whose value would slump. A crash might destabilise the inner workings of ETFs, which operate a bit like giant derivatives. Fierce competition could push down fees. And the more BlackRock uses its power to influence other firms, the more regulators will scrutinise it.

Mr Schwarzman's firm, meanwhile, has a hidden strength: \$92bn of "dry powder", or unspent funds. But it will struggle to catch up. Although its funds have made internal rates of return (a performance measure) of about

15% since the 1990s, asset prices are high, making it hard to crank out good returns on new money invested. The best way for Mr Schwarzman to serve his shareholders would be to convert Blackstone from a fiddly partnership to a normal firm, which would command a higher valuation.

Great fortunes on Wall Street are the result of technology waves and investment trends as well as personal drive and charisma. Mr Fink has played a good hand very well. Yet the rise of both men is also evidence that Wall Street's pecking order is never stable. If Mr Schwarzman passes Mr Fink on Park Avenue he should congratulate his former colleague—and remind him that somewhere, someone young and hungry is plotting his downfall. ■



熊彼特

贝莱德对阵黑石

魔镜魔镜请告诉我，谁是世上最强大的金融大亨？

华尔街过去20年最成功的两位企业家在帕克大道的左右两旁拉开阵势。拉里·芬克（Larry Fink），65岁，民主党人，永远捧着一杯星巴克，在52街经营他的贝莱德集团（BlackRock）。苏世民（Stephen Schwarzman），70岁，共和党人，穿纯色领子的条纹衬衫，在51街和52街之间执掌黑石（Blackstone）。两人曾是同事，但对投资和管理的观点截然不同。他们的轨迹显示了金融行业正在发生的变化。曾处于下风的芬克已经后来居上。

芬克的贝莱德是全球最大的资产管理公司，资产总额达6万亿美元。它是计算能力、低收费和规模的代表，正在急速发展。苏世民的黑石是全球最大的“另类”资产管理公司，专注于私募和房地产，资产总额达3870亿美元。它是脑力、高收费、专业化这一经典配方的典范。但这家公司最近停滞不前。

芬克30多岁时是一名证券交易员，他加入由苏世民等人创办的黑石并建立了债券投资业务部门。该部门命名为贝莱德，在1995年变成一家独立的公司。直到2007年两家公司的市值还不相上下。但它们在投资和各自的控制架构上都采用了完全不同的方式。

贝莱德主要向机构和大众销售被动型基金（包括交易所交易基金即ETF）。它在脱离传统资产管理模式的转变中一直在扮演领头羊的角色。它收费很低，每年从管理的每一美元赚取0.2美分。黑石使用杠杆，换掉控股企业的管理层，以求跑赢大市。它收费为每一美元1.8美分，客户是机构和富人。

芬克的公司结构很简单：一股一票。他本人只拥有0.66%的股权（最大的股东是PNC金融服务集团，持股22%）。这给予了贝莱德灵活度，可在

2009年增发股票买下巴克莱银行的基金管理部门。与之不同的是，苏世民牢牢控制黑石。外部股东在黑石没有投票权，而这家公司在财务审计上的复杂度堪比坎耶·韦斯特的饶舌歌曲和黑格尔的著作。

两家公司向员工支付的报酬都占了销售额很可观的比例——约为30%到40%。但它们的企业文化大相径庭。黑石有2240名员工，平均年薪为一百万美元，是贝莱德1.3万名员工平均年薪的三倍。

哪种战略是通向全球老大的最佳路径？由一家结构简单的公司经营被动型基金，还是由一家复杂的企业管理主动型资产？本专栏设计了一个包含五部分的华尔街“巨头测试”。它衡量企业规模、老板个人财富、为其客户创造的财富、为股东创造的财富，以及两位老板对各自公司以外的企业的影响力。

苏世民只赢得了五项测试中的一项（虽然这一项他赢得非常轻松）。据彭博统计，他的个人资产为130亿美元，而芬克不到10亿美元。在企业规模方面，贝莱德领先，市值为860亿美元，是它最初的母公司黑石的两倍。若以销售额、利润和给予股东的现金回报来衡量，贝莱德平均要高31%。过去十年里，它新增管理的客户净资产额为黑石的七倍。

我们没有非常完善的手段来比较两家公司客户的获利状况。但有一个极其粗略的衡量标准：过去十年里贝莱德为其客户赚得约2.9万亿美元的利润，黑石为2020亿美元。对两家公司而言，该数字都相当于这段时期内所管理平均资产额度的约80%。两家公司都从猛涨的股市中获益，并没有明显的证据显示黑石的主动型管理和使用杠杆带来了好得多的效益。

两家公司都为股东创造了财富，但在这方面贝莱德再次领先。它在过去十年里为其股东新增了500亿至700亿美元（根据不同的计算方法而结果不同，其中包括给予股东的现金回报）的财富，而黑石为320亿美元。芬克的成就可与网飞的里德·哈斯廷斯（Reed Hastings）及特斯拉的伊隆·马斯克等杰出创业家比肩。贝莱德的市盈率为25倍，黑石为11倍，由此可见投资者更喜欢前者简单的架构，并认为它会发展得更快。

最后一项测试是影响力。苏世民能够左右由黑石控股的一小批企业，他是一流的交际人才。但芬克的公司总体势力可能更大：它对西方国家大部分上市大企业都持股5%到7%，这给了它极大的影响力。芬克已经使用这一平台来敦促企业老板们做更多投资。贝莱德在它所投资的企业中投票时与企业管理者意见相左的几率约为10%。

芬克在五项测试中拿下三项或四项，他已经胜出。但贝莱德有很多问题叫人担心。股价下挫可能会令公众对被动型基金兴趣减少，从而令这些基金的价值暴跌。这样的崩溃可能会动摇ETF的内部机制，因为它的运作有点像巨型金融衍生品。激烈的竞争可能会压低收费。而贝莱德越多使用其实力来影响其他企业，就越容易引来监管部门的审查。

与此同时，苏世民的公司倒有一个隐藏的优势：920亿美元的“干火药”——也就是还没花出去的资金。但它很难赶上贝莱德。尽管自上世纪90年代以来其资金取得了约15%的内部收益率（一个业绩指标），但如今资产价格高企，让它很难在新投资的资金上取得很好的回报。苏世民服务其股东的最好方法将是把黑石从一个复杂繁琐的合伙公司变成一家正常的企业，这会让它的估值升高。

华尔街上的巨额财富是技术浪潮和投资趋势导向的结果，也是个人努力和魅力创造的成就。芬克干得非常漂亮。但两人的崛起之路也证明了一件事：华尔街上的强弱排名从不会固定不变。如果苏世民在帕克大道上和芬克擦肩而过，他应该祝贺这位前同事，但也不忘提醒他：在某个地方，某个渴望胜利的年轻人正在悄悄策划他垮台的那一天。 ■



A new way to float

Direct flight to NYSE

Spotify opts for an unusual way of going public. Can it be a model for others?

FOR seasoned bankers and starry-eyed entrepreneurs alike, doing an IPO, or initial public offering, is synonymous with the very idea of taking a firm public. No wonder, then, that the decision by Spotify, a music-streaming service, to opt for an unconventional alternative called a “direct listing” has prompted debate. Instead of paying investment banks hefty fees to arrange an IPO, Spotify plans to have existing shares simply switch one day to being tradable on the New York Stock Exchange (NYSE).

IPOs themselves have become rarer, as startups such as Uber and Airbnb have chosen to raise money through private markets instead. Although there was an uptick in the number of IPOs in America in 2017—108, compared with 74 in 2016—the average number of IPOs has remained at around 100 annually since 2000, compared with over 300 in the course of the two previous decades. But until now no big company had contemplated direct listing as an alternative. The structure has been seldom used: in America, examples include a few vehicles for investing in property and a handful of small biotech firms. Among American exchanges, only NASDAQ has so far allowed such listings; the NYSE has proposed a change to its own rules that would allow them (it is still to be approved by regulators).

An IPO contains many elements: investment banks drum up investor interest through a roadshow, sign up new investors, set a target price, line up blocks of shares from existing shareholders, underwrite new share issuance and smooth trading on the first day by guaranteeing a floor for the share price. A direct listing comes with no such luxuries. With no new share issuance, all shares that come to market must come from existing

shareholders. But with no special provisions for large blocks of trades, they will only be able to sell what the market will bear; a large sell-off would cause the price to plummet. And if too few shareholders sell, the first days may see thin and volatile trading, resulting in strange pricing for the shares.

Why would Spotify go for the direct option? The savings on underwriting fees are not trivial. Perhaps more important is that without the 3-6 month lockup period typically seen in IPOs (presold blocks aside), existing holders will be free to sell shares when they like. In the meantime, they need not fear their holdings being diluted. Spotify may think its well-known brand does not need a full roadshow. The onerous terms of a \$1bn loan Spotify took from TPG and Dragoneer, two investment firms, may have also played a part. The loan not only became dearer the longer Spotify stayed private; it also included an exchange of debt into equity at a level tied to an IPO price.

Others may follow in Spotify's path. The publicity around direct listing has prompted "intense interest", says Anna Pinedo of Morrison Foerster, a law firm. A senior IPO banker insists that direct listing is a "niche" suitable only for the small subset of private companies that already have a large number of shareholders. But some privately held tech companies do indeed have big shareholder bases and brands as well-known as Spotify's; if they decided they did not need new capital as part of listing, the direct option could fit the bill. If Spotify's listing goes smoothly, IPOs may no longer be the only game in town. ■



上市新途径

直达纽交所

Spotify选择了一种不寻常的上市方式。这会成为其他公司的模板吗？

对于经验丰富的银行家和满怀抱负的企业家来说，IPO（首次公开募股）就是公司上市的代名词。因此，当音乐流媒体服务公司Spotify决定选择一种名为“直接上市”（direct listing）的非常规方式时，引发争议也就不足为奇了。Spotify并没有向投资银行支付一大笔钱来安排IPO，而是计划在某一天让现有股票在纽约证券交易所直接转成可交易股票。

优步和爱彼迎等创业公司如今都选择通过私人市场融资，IPO本身已经变少。尽管2017年美国IPO数量增至108个（2016年为74个），但自2000年以来IPO的平均数量一直保持在每年100个左右；而再往前的20年里，年均IPO数量超过300个。不过到目前为止，还没有哪家大公司考虑过直接上市。企业很少采用这种上市结构，在美国，只有几个投资房地产的实体和少数几家小型生物技术公司使用过这种方法。在美国的交易所中，迄今为止只有纳斯达克允许直接上市；纽交所已经提出调整自身规则的计划，允许直接上市，但仍需要监管机构批准。

IPO包含很多内容：投资银行通过路演勾起投资者的兴趣，签约新投资者，设定目标股价，为现有股东手中存量股票的交易做好安排，承销新股发行，在上市首日为股价保底以保证交易顺利进行。直接上市可没有这么奢侈。没有新股发行，上市的股票只能来自现有股东手里的存量股票。但由于对大宗交易没有特别的应对措施，因此只能出售市场能承受的股票数——大量抛售会导致股价暴跌。而如果出售股票的股东太少，头几日可能会出现交易清淡且股价波动的情况，造成股票定价异常。

Spotify为什么要选择直接上市呢？由此节省下来的承销费用绝非小数目。也许更重要的是，直接上市没有IPO通常三至六个月的锁定期（预售大宗持股除外），现有的持股人可以随意出售股票。与此同时，持股人不必担

心自己的股份被稀释。Spotify可能认为以自己品牌的知名度不需要全面路演。为从TPG和Dragoneer这两家投资公司获得10亿美元债务融资而签订的苛刻条款可能也是原因。根据这些条款，Spotify上市越晚，贷款负担就越重，而且债转股的价格也与IPO价格挂钩。

其他公司也许会仿效Spotify的做法。美富律师事务所（Morrison Foerster）的安娜·皮内多（Anna Pinedo）表示，关于直接上市的报道引发了人们“强烈的兴趣”。一位资深IPO银行家坚称，直接上市是一种“小众”做法，只适合小部分已经拥有大量股东的私人企业。但一些私人控股的科技公司确实有大量股东，而且品牌知名度与Spotify相当，如果它们认为自己并不需要上市带来的新资本，那么直接上市就能满足它们的需要。如果Spotify的上市进展顺利，IPO可能就不再是上市的唯一选择了。■



Schumpeter

Mad men

Warning: counting on too many advertisements may be bad for your health

IMAGINE a world in which you are manipulated by intelligent advertisements from dusk until dawn. Your phone and TV screens flash constantly with commercials that know your desires before you imagine them. Driverless cars bombard you with personalised ads once their doors lock and if you try to escape by putting on a virtual-reality headset, all you see are synthetic billboards. Your digital assistant chirps away non-stop, systematically distorting the information it gives you in order to direct you towards products that advertisers have paid it to promote.

Jaron Lanier, a Silicon Valley thinker who was an adviser on “Minority Report”, a bleak sci-fi film, worries that this could be the future. He calls it a world of ubiquitous “digital spying”. A few platform firms, he fears, will control what consumers see and hear and other companies will have to bid away their profits (by buying ads) to gain access to them. Advertising will be a tax that strangles the rest of the economy, like medieval levies on land.

It may sound outlandish, but this dystopia is increasingly what stockmarket investors are banking on. The total market value of a basket of a dozen American firms that depend on ad revenue, or are devising their strategies around it, has risen by 126% to \$2.1trn over the past five years. The part of America’s economy that is ad-centric has become systemically important, with a market value that is larger than the banking industry.

The biggest firms are Facebook and Alphabet (Google’s parent), which rely on advertising for, respectively, 97% and 88% of their sales. But the chunky valuations of America’s giant TV broadcasters imply that their ad revenues

will fall very slowly, or not at all. Startups that rely on advertising, such as Snap, are floating their shares at prices that suggest huge growth. Large deals, too, are being justified by potential ad revenues. Microsoft's \$26bn acquisition of LinkedIn in 2016 was partly premised on "monetising" its user base through adverts. The main reason AT&T says it wants to buy Time Warner for \$109bn is to create a digital ad platform linking AT&T's data to Time Warner's TV content.

The immense sums being bet on advertising raise a question: how much of it can America take? A back-of-the-envelope calculation by Schumpeter suggests that stock prices currently imply that American advertising revenues will rise from 1% of GDP today, to as much as 1.8% of GDP by 2027—a massive jump. Since 1980 the average has been 1.3%, according to Jonathan Barnard of Zenith, a media agency, and in the past few years the advertising market relative to GDP has been shrinking.

There are reasons why it might go on a tear, points out Rob Norman of GroupM, another media agency. In the old days adverts in *Time* magazine or on billboards in Times Square were big-ticket items that only giant firms could afford. But tech platforms have done a brilliant job of persuading smaller companies to spend money targeting customers. Facebook has 6m advertisers, equivalent to a fifth of all American small firms.

Adverts could become even more effective at identifying customers and enticing them to spend money, using troves of data that have been gathered to anticipate their needs. As commerce shifts online, firms will cut back on conventional marketing (for example, the fees that consumer goods and food firms pay to Walmart to ensure products are displayed prominently on its shelves), freeing up budgets to spend more on digital ads.

Yet there are two logical limits to the size of the advertising market. First, the irritation factor, or how much consumers can absorb without being put

off. In the analogue era the rule of thumb was that ads could comprise no more than 33-50% of TV or radio programming, or of a magazine's pages, says Rishad Tobaccowala, of Publicis, an advertising firm. The digital world is already showing signs of saturation.

More people are using ad-blocking software. Tech brands that eschew bombarding customers with ads, such as Apple and Netflix, are wildly popular. The drive to lift user "engagement" on social-media platforms by showing sensational content, in turn boosting the number of ads that can be sold, has prompted a backlash. On January 11th Facebook said it would show users fewer posts from "businesses, brands and media". Time spent online by the typical American is growing at about 10% a year, less than the 15-20% ad-sales growth that many digital firms expect.

The second limit on the size of the advertising market is how much cash all other firms, in aggregate, have at their disposal to spend on ads. In theory they could spend more and more until their overall returns on capital drop below the cost of capital, compromising their financial viability. Remarkably, expectations for ad revenues are now so bullish that they imply that this boundary will indeed be tested.

Imagine if advertising spending really did rise to 1.8% of GDP in America by 2027. Most firms' costs would have to rise, cutting total corporate profits (excluding those of ad platforms) from about 6.5% to 5.7% of GDP, the kind of drop normally associated with a recession. Alternatively, imagine if the firms in the S&P 500 index (excluding ad platforms) bore all the additional cost of the advertising boom. Their combined return on capital would drop from the present 10% to 8%, at or just below their cost of capital. America Inc would go from being the world's greatest profit machine to flirting with Japanese-style financial-zombie status.

That does not seem realistic. More probably, hopes for a new age of

advertising nirvana are too optimistic. Perhaps the ad sales of conventional media firms (which are about half of the total, with TV dominating) will drop fast rather than merely stagnate. Or perhaps digital firms will struggle to increase ad sales at compound annual rates of 15-20% or a decade, as their valuations imply. Expectations for both groups are surely too high. In the advertising world, and on Wall Street, something does not add up. ■



熊彼特

广告狂人

警告：仰仗过量广告恐不利健康

想象你身处这样一个世界：从黄昏到黎明，你一直都被智能广告操纵。你的手机和电视屏幕不断播放着广告，它们比你自己更先一步知道你的欲望。你钻进无人驾驶汽车，车门一关上，专门为你定制的广告就开始对你狂轰滥炸。为了躲避，你戴上了虚拟现实头罩，结果扑面而来的全是数字广告牌。你的数字助理喋喋不休，系统性地扭曲它给你的信息，好让你注意到广告商付了钱让它促销的产品。

硅谷思想家、曾为暗黑科幻电影《少数派报告》（*Minority Report*）担任顾问的雅龙·拉尼耶（Jaron Lanier）担心这可能就是我们的未来。他称之为一个“数字间谍”无处不在的世界。他担忧少数几家平台公司将控制消费者的所见所闻，而其他企业得把自己的利润都拿来竞争广告位才能接触到消费者。广告将变成扼杀其他经济成分的税赋，就像中世纪的土地税那样。

这听来也许难以接受，但这种暗黑前景正日益成为股市投资者押注的未来。过去五年里，十几家依赖广告收入或围绕广告建构发展战略的企业总市值上升了126%，达2.1万亿美元。美国经济中以广告为核心的行业已变得具有系统重要性，市值超过了银行业。

其中最大的企业是Facebook和谷歌母公司Alphabet，它们的销售额中分别有97%和88%倚赖广告收入。但从美国电视大鳄的巨额估值看，投资者认为它们的广告收入未来会下跌得非常缓慢，甚至根本不跌。从Snap这类依赖广告收入的创业公司的股价看，投资者认为它们有巨大的增长机会。大型并购协议的达成也有赖于潜在广告收入的支撑。微软在2016年以260亿美元收购LinkedIn，部分假设是能通过广告将其用户群“变现”。美国电话电报公司（AT&T）称，其欲以1090亿美元并购时代华纳的主要原因是

创建一个数字广告平台，将自己的数据和时代华纳的电视内容连接起来。

人们对广告收入的巨额押注引发了一个问题：美国能承受多少？本专栏的粗略计算显示，目前的股价意味着投资者认为美国的广告收入将从今天占GDP的1%上升到2027年的占1.8%——一个巨大的飞跃。媒体代理公司Zenith的乔纳森·巴纳尔（Jonathan Barnard）称，自1980年以来这个数字平均为1.3%。在过去几年里，广告市场的GDP占比实际收缩了。

另一家媒体代理机构群邑媒介集团（GroupM）的罗布·诺曼（Rob Norman）指出，广告收入可能狂飙猛进的背后有几个原因。过去，《时代》杂志上的广告和纽约时报广场上的广告牌都是唯有巨头企业才买得起的大手笔开销。但技术平台在说服小企业花钱发布定向广告方面干得漂亮。Facebook拥有六百万广告客户，占全美所有小企业的五分之一。

通过使用收集到的海量数据预测人们的需求，广告在识别顾客和引诱他们消费上还将变得更富成效。随着商业向网络转移，企业会收缩花在传统营销手段上的费用（比如消费品和食品公司向沃尔玛付费，确保自家产品被摆放在货架上最显眼的位置），从而腾出更多预算来购买数字广告。

不过，广告市场的规模仍存在两大合理限制。首先是心理刺激因素，即消费者能吸纳多少广告而不至于被激怒。在模拟电视的时代，经验法则是广告最多只能占到电视和广播内容或杂志页面的33%到50%，广告公司Publicis的里萨德·托巴科瓦拉（Rishad Tobaccowala）说。数字世界已经开始显露饱和的迹象。

越来越多的人开始使用广告屏蔽软件。像苹果和Netflix这样摒弃了广告轰炸模式的科技品牌目前极受欢迎。社交媒体平台上一度流行用耸动的内容提升用户“参与度”以促进广告销量，这种做法也已引发了抵制。上月11日，Facebook称它将减少向用户推送来自“企业、品牌和媒体”的内容。目前普通美国人花在网上的时间年增10%，低于许多数字公司预期的15%到20%的广告销售增速。

广告市场规模的第二道限制是其他企业总共能拿出多少现金花在广告上。

理论上它们可以花得越来越多，直到自己的总体资本回报跌至资本成本以下，危及自己的财务可行性。不可思议的是，目前对广告收入的预期之乐观，显示投资者认为这些企业真的会挑战这道边界。

假设广告支出到2027年真的上升到了GDP的1.8%，那么大部分企业的成本都将增加，使得企业总利润(不包括那些广告平台)从占GDP的约6.5%降至5.7%，而这样的跌幅通常都和经济衰退相关联。或者，想象一下如果标普500指数企业（不包括广告平台）承担了广告增长的所有额外成本。它们的合并资本回报率将从目前的10%下跌至8%，与资本成本持平甚至略低。“美国公司”这一全球最大的利润机器有可能陷入日本式的金融僵尸状态。

这看起来不大现实。对“广告极乐”新时代的预期应该是太过乐观了。或许传统媒体公司的广告销售额（占总额约一半，由电视广告主导）将快速下跌而非仅仅停滞。又或许，数字企业无法令其广告销售额在未来十年达到其估值所预测的15%到20%的复合年增长率。对这两批企业的预期无疑都过高了。在广告界，以及在华尔街上，有些东西说不通。■



History of physics

Clever calculator

Enrico Fermi, champion nuclear researcher, mathematician and educator

JUST before daybreak on July 16th 1945 Enrico Fermi lay down in the open desert of New Mexico. At 05:30, the world's first nuclear explosion took place ten miles (16km) away. He counted off the seconds after the flash, anticipating the arrival of the blast-wave. With preternatural calm, Fermi stood up and let some strips of paper flutter away as the wave passed. They flew about eight feet. The Trinity nuclear test, he pronounced after making some quick calculations, had released the equivalent of about 10 kilotonnes of TNT.

Fermi was, by that stage, already a celebrity among physicists. An obvious mathematics prodigy as a child in Italy, he had devoured texts written for adults. Throughout his life he kept few books, preferring to derive conclusions from first principles whenever he felt the need.

As he took up different posts in academic research in Italy and abroad, Fermi showed himself to be not only a theorist with unparalleled insight but also adept as an experimentalist (a rare combination) across every kind of physics. He had an uncanny knack for rough-and-ready calculations to obtain approximate answers for damnably difficult questions (the Trinity bomb, later analysis revealed, released 18 kilotonnes of TNT, which was surprisingly close to Fermi's desert estimation).

He eschewed complexity, preferring to tackle only a problem's essentials, discard any distracting elements and ruthlessly squeeze what remained. Such back-of-the-envelope calculations, which became known as "Fermi problems", were such good examples of critical thinking that recruiters

nowadays test applicants' mettle by setting them as interview questions. Fermi's solutions were so often right that his colleagues in Rome called him "the pope". His boss recognised that he could help raise the reputation of Italian science.

Fermi's discovery of how slow-moving neutrons helped to make some atoms radioactive won him the Nobel prize in 1938. He used the trip to Stockholm to abscond with his family from his increasingly fascist homeland. Once in America he became involved in the Manhattan Project, which led to the first nuclear bomb, bringing him renown well beyond the physics community.

Fermi was an inveterate showman. In Chicago, on the day he demonstrated the world's first controlled nuclear chain reaction—a prerequisite for the uncontrolled kind in a nuclear weapon—he ran the show like a circus ringmaster, ramping up the tension by calling for lunch just as things literally heated up.

David Schwartz, the author of "The Last Man Who Knew Everything", is the son of another Nobel-winning physicist. His father left some intriguing correspondence on Fermi, which inspired Mr Schwartz to learn more. He interviewed many of Fermi's students and colleagues, shedding light also on Fermi the educator (his lectures were so renowned that even notes taken by his assistants were a bestseller).

Mr Schwartz deftly conveys the aesthetic beauty of Fermi's insights without getting mired in their minutiae. His book includes only enough scientific detail to explain each discovery as it happened. Fermi is depicted as a natural leader—in the laboratory, on hiking trails near his workplaces in Rome and New Mexico, and in the square-dances he came to love in America. Yet for all his gregariousness Fermi tended to reveal little of his emotions in conversations or correspondence, even as he worked on the

team to develop humanity's most terrible weapons. Laura, his wife, did not know until after the bombs fell just what her husband had really been up to in his laboratory.

As a result, Mr Schwartz tussles with many of the same questions that have dogged previous Fermi biographers. Did he stay so long in Italy, joining Benito Mussolini's vaunted Accademia d'Italia, just for the funds and freedom to pursue his precious research? Did he participate in the Manhattan Project out of patriotism for his adopted country, or was he dragged along because of his expertise in nuclear physics? Or was he just insatiably curious about whether the bomb could indeed be made?

It would be easy to depict Fermi as a standard reticent genius who solved every problem as if he had, as one student put it, "an inside track to God". But Mr Schwartz's sleuthing also reveals how science works in its proper context: how each finding builds on the last; how identical ideas can occur to more than one person when the intellectual conditions are right; how an insight into nature arises not from a vacuum but from hard-won experience and, usually, some clever calculating.

Fermi was once described by a student as the last man who knew everything. He went on to make important discoveries in particle physics, geophysics and even the science of the stars. And he never stopped calculating. Even on his deathbed, he used a stopwatch to determine exactly how much fluid he was receiving from his intravenous drip. It was a simple problem, really, if you focused on the essentials. ■



物理学史

计算高手

恩里科·费米：卓越的核研究者、数学家和教育家

一九四五年7月16日，天还没亮，恩里科·费米（Enrico Fermi）在新墨西哥州空旷的沙漠中躺下来。5点30分，世界首颗原子弹在16公里外引爆。见到火光后他开始数秒，等待爆震波到来。气浪经过时他异乎寻常地镇定，起身并松手任纸片飘到大约2.4米之外。他快速地计算了一番，判断这场“三位一体”核试验的当量大约为一万吨TNT炸药。

费米那时已经是物理学家中的名人。他成长在意大利，孩提时如饥似渴地阅读为成年人编写的教材，无疑是个数学神童。他一生只收藏少量书籍，更喜欢随时依据基本原理推出结论。

费米在意大利和国外担任过各种学术研究职务，在物理学的每个分支里都展现出理论物理学家无与伦比的洞察力和实验物理学家的不凡身手——很少有人能同时扮演这两种角色。他天赋异禀，面对特别伤脑筋的问题能通过估算得出大致的答案。（之后的分析显示，三位一体核试验释放的能量相当于1.8万吨TNT炸药爆炸，与费米在沙漠中估算的结果惊人地接近。）

他绕开问题的复杂之处，力图解决其关键所在，摒弃任何分散注意力的因素，然后大刀阔斧地压缩剩余的部分。这种粗略的计算后来得名“费米问题”，成了批判性思维的生动体现，连如今的招聘人员都在面试时采用这种问题来检验应聘者的魄力。费米估算出的答案经常都是正确的，他在罗马的同事因此叫他“教皇”。他的上司意识到，他能够帮助提升整个意大利科学界的声誉。

费米发现慢速中子能让部分原子产生放射性，这令他在1938年获得诺贝尔奖。他利用前往斯德哥尔摩的机会携家人逃离法西斯主义日盛的祖国。到美国后，他旋即加入了最终研制出世界首颗原子弹的曼哈顿计划，在物理学界之外也收获了声誉。

费米一贯热衷出风头。他在芝加哥演示世界首个受控连锁核反应（实现不受控连锁反应即核武器概念的先决条件）时，就像马戏团领班那样掌控全场。当现场气氛刚热烈起来，他又戛然而止，提议吃午饭，增加悬念吊足胃口。

《最后一个无所不知的人》的作者大卫·施瓦茨（David Schwartz）的父亲也是一位获得诺贝尔奖的物理学家。施瓦茨的父亲留下的一些有趣信件提到了费米，这引起了施瓦茨的兴趣，促使他去了解更多。他采访了费米的许多学生和同事，让人们了解到费米作为教育工作者的一面（他的课十分出名，连助手记的笔记都成了畅销书。）

施瓦茨驾轻就熟地传达出费米的洞见所蕴含的美感，同时又不纠结于其中的细枝末节。他在描述科学细节时很节制，分量恰好足够向读者解释每个科学发现如何发生。作者将费米刻画成一个天生的领导者：在实验室中是这样，在罗马和新墨西哥州的工作地点附近徒步时是这样，后来爱上美国的方块舞时也是如此。然而，费米虽然乐于融入人群，却几乎从未在谈话或信件中流露过情感，即便他加入的团队正在研发人类史上最可怕的武器。他的妻子劳拉直到原子弹爆炸后才知道丈夫之前在实验室里做什么。

因此，之前让那些为费米立传的作者大为挠头的种种疑问，施瓦茨同样难以给出完满的解答。比如，他在意大利待了那么久，还加入了墨索里尼那个被大肆吹捧的意大利学院（Accademia d'Italia），仅仅是为了获得资金和自由，好继续自己珍视的研究工作吗？他参加曼哈顿计划是出于对移居国的爱国热情，还是身不由己，只因具备核物理专长就被硬拖进来？还是他只是极度好奇是不是真的能造出原子弹来？

如果把费米描述成一位典型的隐藏自我的天才就容易了：他仿佛（用他学生的话说）“独享上帝恩泽”，能攻克所有难题。但施瓦茨的调查也揭示了科学如何在适当的条件下发展：每一项发现都要以之前的发现为基础；如果知识环境合适，同样的灵感会在不止一个人的脑海中产生；对自然的深刻理解也不是凭空产生的，而是源自来之不易的经验，而且通常还要依赖一些高明的计算。

费米的一名学生曾将他描述为“最后一个无所不知的人”。他脚步不停，在粒子物理学、地球物理学甚至天文学领域都做出了重大发现。他也从未停止过计算。即使在临终前输液时，他还在用秒表测算到底有多少药液进入了自己体内。如果你把注意力集中在关键点上，这确实是个简单的问题。





Economic and financial indicators

Real wages

Growth in real wages has fallen across the developed world in recent years.

Growth in real (inflation-adjusted) wages has fallen across the developed world in recent years. Labour markets have been tightening, but inflation has also risen from the lows caused by the oil price crash in late-2014. In Britain prices are growing faster than wages. The vote in 2016 to leave the European Union is partly to blame: the pound's subsequent tumble has made imports dearer, pushing up inflation. Rising prices also constrained real-wage growth in America, despite a plummeting unemployment rate that has sparked large pay rises in some bits of the economy. Elsewhere, only modest growth is expected. The OECD reckons that real-wage growth will average 0.6% over the next few years. ■



经济与金融指标

实际工资

近年来，发达国家的实际工资增速普遍放缓

近年来，发达国家经通胀调整的实际工资的增速普遍放缓。劳动力市场持续收紧，不过通胀也已摆脱了2014年年末油价暴跌造成的低迷状态。在英国，价格增速超过了工资增速，一定程度上要归咎于2016年的脱欧公投：公投后英镑猛跌，进口价格提升，进而推高了通胀水平。价格上涨也限制了美国的实际工资增长水平，尽管失业率直线下降，大幅拉高了部分经济部门的工资水平。世界其他地方预计只会有小幅增长。经合组织估算未来几年实际工资增长率平均为0.6%。 ■



Schumpeter

The fog of war

If they are to save the firm, General Electric's bosses and board need far better information

IN THEIR documentary “The Vietnam War”, Ken Burns and Lynn Novick, the directors, dwell on the flawed information that American politicians got from Indo-China. The generals on the ground focused on the “kill ratio”, or the number of enemies killed per American or South Vietnamese soldiers killed. That bore no relationship to victory—North Vietnam quickly replaced its dead soldiers. And it corrupted behaviour, leading American troops to embellish numbers and count dead civilians as “wins”.

The curse of rotten information can strike companies, too. That seems to be the case with General Electric (GE), which has had a vertiginous fall. Its shares, cashflow and forecast profits have dropped by about 50% since 2015. On January 16th it disclosed a huge, \$15bn capital shortfall at its financial arm due to a revision in insurance reserves. And on January 24th it revealed a \$10bn loss for the fourth quarter. In its core industrial arm, returns on capital have sunk from 20% in 2007 to a puny 5% in 2017.

GE’s boss, John Flannery, an insider who took office in August, must clear up the mess made by his predecessor, Jeff Immelt. He seems to recognise the gravity of the situation. In November he gave a frank presentation to investors. Last month he suggested that GE might be broken up. Yet an unnerving sense lingers that no one fully understands what has gone wrong.

Is the conglomerate formerly known as the world’s best-run firm a victim of weak demand for gas turbines, a low oil price, lavish digital initiatives, timing lags in client payments, morbidity rates, bad deals, cost overruns

or a 20-year squeeze in industrial-equipment margins because of Chinese competition? You can imagine GE's 12-man board blinking at this list, like Pentagon generals huddled around maps of the Gulf of Tonkin which they are too embarrassed to admit they do not understand.

Schumpeter's theory is that GE's flow of financial information has become fantastically muddled. There is lots of it about (some 200 pages are released each quarter) and it is audited by KPMG. But it offers volume and ambiguity instead of brevity and clarity. It is impossible—certainly for outsiders, probably for the board, and possibly for Mr Flannery—to answer central questions. How much cashflow does GE sustainably make and where? How much capital does it employ and where? What liabilities must be serviced before shareholders get their profits?

Perhaps GE has a better, parallel accounting system that it keeps under wraps. But the public one reveals eight problems. First, it has no consistent measure of performance. This year it has used 18 definitions of group profits and cashflow. As of September 2017, the highest number was double the average one. There is a large gap between most measures of profits and free cashflow.

Second, GE's seven operating divisions (power, for example, or aviation) are allowed to use a flattering definition of profit that excludes billions of dollars of supposedly one-off costs. Their total profits are almost twice as big as the firm's. It is the corporate equivalent of China's GDP accounting, where the claimed outputs of each province add up to more than the national figure.

Third, GE does not assess itself on a geographical basis. Does China yield solid returns on capital? Has Saudi Arabia been a good bet? No one seems to know. This is unhelpful, given that the firm does half its business abroad and that the long-term decline in returns has taken place as the firm has

become more global.

Fourth, GE pays little attention to the total capital it employs, which has ballooned by about 50% over the past decade (excluding its financial arm). Its managers rarely talk about it and have set no targets. It is unclear which parts of the firm soak up disproportionate resources relative to profits, diluting returns.

Fifth, it is hard to know if GE's leverage is sustainable. Its net debts are 2.6 times its gross operating profits, again excluding its financial arm. That is high relative to its peers—for Siemens and Honeywell the ratio is about one. Some of those profits are paper gains. And the average level of debt during the year is much higher than the figures reported at the end of each quarter.

Sixth, the strength of GE's financial arm is unclear. The new insurance loss will lower its tangible equity to 8% of assets. This is well below the comfort level, although regulators seem to have granted it forbearance in order gradually to rebuild its capital.

Seventh, it is hard to calibrate the risk this poses to GE shareholders. GE likes to hint that its industrial and financial arms are run separately. But they are umbilically connected by a mesh of cross-guarantees, factoring arrangements and other transactions.

Eighth, is GE sure that its industrial balance-sheet accurately measures its capital employed and its liabilities? Some 46% of assets are intangible, which are hard to pin down financially: for example, goodwill and "contract" assets where GE has booked profits but not been paid yet. Hefty liabilities, including pensions and tax, are also tricky to calculate. Based on GE's poor record of forecasting, it seems that large write-downs are possible. On January 24th GE said that regulators were looking into its accounting.

GE's situation is like that of the global bank conglomerates after the

financial crisis. Citigroup, JPMorgan Chase and HSBC did not entirely trust their own numbers and lacked a framework for assessing which bits of their sprawl created value for shareholders. Today, after much toil, the people running these firms know whether, say, loans in California or trading in India make sense.

This does not happen naturally. If neglected, financial reporting becomes a hostage to internal politics, with different constituencies claiming they bring in sales, while arguing that costs and capital are someone else's problem. Mr Flannery is a numbers guy who wants to slim GE to its profitable essence. But he is trapped in a financial construct that makes it hard to pursue that mission intelligently. Until he re-engineers how GE measures itself, he will be stumbling about in the murk. ■



熊彼特

战争迷雾

通用电气的高管和董事会若想拯救这家公司，需要大大提高信息的质量

肯·伯恩斯（Ken Burns）和林恩·诺维克（Lynn Novick）在他们执导的纪录片《越南战争》（The Vietnam War）中详述了美国政客从印度支那获取的情报有多不可靠。前线的美军将领一味强调“杀敌比率”，即每个美国士兵的杀敌数量，或南越士兵的杀敌数量。这与胜利并无关联——北越很快就补充了士兵。这也将人们引入歧途，美军开始美化数字，将死亡的平民也算作“胜利”。

糟糕的情报这一祸根也会在企业中埋下。惨遭重大滑坡的通用电气（GE）似乎便属于这种情况。自2015年以来，其股价、现金流和利润预期已下跌了约50%。上月16日，GE透露其金融部门因保险业务储备金方面的调整而出现150亿美元的巨大资本缺口。24日，公司公布第四季度亏损100亿美元。其核心工业部门的资本回报率从2007年的20%缩水至2017年惨淡的5%。

GE的老板约翰·弗兰纳里（John Flannery）从公司内部一路成长起来，于去年8月走马上任。他必须清理前任掌门人杰夫·伊梅尔特（Jeff Immelt）留下的烂摊子。他似乎也认识到了局势的严峻。11月，他向投资者做了坦诚的报告。上月，他暗示GE也许会分拆。不过，一种让人不踏实的感觉仍挥之不去：恐怕没人完全明白GE到底是哪里出了问题。

这家曾列全球运营最佳的企业集团何以落入困境？是因为燃气轮机需求疲软吗？油价低？数字项目烧钱？客户延迟付款？患病率影响？糟糕的并购交易？成本超支？还是因为来自中国的竞争在过去20年里持续挤压工业设备利润？想象得出GE的12人董事会正盯着这些选项茫然地眨着眼睛，就像五角大楼里的将军们聚集在北部湾地图的周围，人人都不好意思承认自己其实一头雾水。

本专栏认为，GE的财务信息已变得极其混乱。GE披露了大量财务信息（每个季度公布的信息多达二百来页），又有毕马威来做审计，但这些信息庞杂而含混，欠缺简洁和明晰。靠这些信息无法回答那些关键问题：GE持续获得的自由现金流有多少，来自哪里？它动用了多少资本，资本流向了哪里？在股东们获得收益之前，GE须先偿还哪些债务？公司以外的人士肯定无法回答，董事会很可能也一样，弗兰纳里说不定也是如此。

也许GE有一个更好的、未公之于众的平行会计系统，但其公开的系统暴露出八个问题。首先，GE缺少衡量绩效的一致标准。今年，它采用了18个定义来衡量集团的利润和现金流。截至2017年9月，最高数字比平均数字高出一倍。大部分利润及自由现金流衡量结果之间都存在巨大差异。

第二，GE的七大业务部门（例如电力或航空）被容许使用一个会让结果比较好看的利润定义，将数十亿美元的所谓一次性成本刨除在外。这些部门的总利润几乎是公司利润的两倍。这相当于将中国的GDP统计方法运用在了企业上：中国各省声称的产值相加后高于全国数字。

第三，GE没有按照区域来评估自身。公司是否从中国获得了丰厚的资本回报？对沙特阿拉伯的押注对不对？答案似乎无人知晓。公司一半的业务都是在海外开展，然而随着公司全球化程度加深，回报率却长期下滑，有鉴于此，这种无知对公司实在无益。

第四，GE几乎不关心自己投入的资本总量。过去十年间，这些资本已激增约50%（不包括其金融部门）。其管理者很少谈论资本问题，也未为之设立目标。无法确知公司的哪些部门耗费了与其收益不相称的资源，导致收益被稀释。

第五，很难说GE的杠杆水平是否可持续。其净债务是其经营毛利的2.6倍——同样不包括它的金融部门。这个比率相对同类企业来说较高：西门子和霍尼韦尔的数字大约是1。GE的部分经营毛利是账面收益。而且，这一年间的平均债务水平比每季度末公布的数字高出许多。

第六，GE的金融部门实力如何也无从知晓。由于新近保险业务的亏损，

GE的有形股本将降至其资产的8%。这远远低于令人安心的水平，不过监管部门似乎给予了GE一些宽限，好让它逐渐重建资本。

第七，很难评估这对GE的股东构成了怎样的风险。GE很喜欢暗示其工业和金融部门的运营彼此独立。但一系列交叉担保、应收账款保理协议以及其他交易将它们紧密联系在一起。

第八，GE是否能肯定其工业资产负债表精确记录了公司投入的资本及承担的债务？GE无形资产的占比约为46%，很难确定这类资产的价值——公司商誉及“合约资产”（GE将之登记为利润，但尚未收到付款）便属于此类。包含养老金及税在内的高昂债务同样难以估算。GE的预测水准历来欠佳，就这一点来看，有可能发生大规模的资产减记。上月24日GE表示正在接受监管部门对其财报的调查。

GE的情形与金融危机后那些全球银行集团的境况相似。花旗、摩根大通和汇丰并不完全相信自己的数字，也缺乏一个框架来评估自己庞杂的业务中有哪些为股东创造了价值。下了一番苦功后，如今这些银行集团的高管们已经清楚在加州放贷或在印度开展业务的做法是否明智。

这一切并不是自然而然发生的。如果不加重视，财务报表就会受制于内部纷争，局面就是各方纷纷声称是自己贡献了销售额，同时辩称成本和资本是别人的问题。弗兰纳里是一个注重数字的人，他想令GE瘦身，只保留能够盈利的业务。但由于GE财务体系的牵绊，他要巧妙地完成这一任务困难重重。他需要改造GE衡量自身业绩的方法，否则他只能在黑暗中踉跄前行。 ■



Genomics

Sequencing the world

An ambitious effort to map, store and disseminate genetic information about much of life on Earth gets under way

IN NOVEMBER 2015, 23 of biology's bigwigs met up at the Smithsonian Institution, in Washington, DC, to plot a grandiose scheme. It had been 12 years since the publication of the complete genetic sequence of *Homo sapiens*. Other organisms' genomes had been deciphered in the intervening period but the projects doing so had a piecemeal feel to them. Some were predictable one-offs, such as chickens, honey bees and rice. Some were more ambitious, such as attempts to sample vertebrate, insect and arachnid biodiversity by looking at representatives of several thousand genera within these groups, but were advancing only slowly. What was needed, the committee concluded, was a project with the scale and sweep of the original Human Genome Project. Its goal, they decided, should be to gather DNA sequences from specimens of all complex life on Earth. They decided to call it the Earth BioGenome Project (EBP).

At around the same time as this meeting, a Peruvian entrepreneur living in São Paulo, Brazil, was formulating an audacious plan of his own. Juan Carlos Castilla Rubio wanted to shift the economy of the Amazon basin away from industries such as mining, logging and ranching, and towards one based on exploiting the region's living organisms and the biological information they embody. At least twice in the past—with the businesses of rubber-tree plantations, and of blood-pressure drugs called ACE inhibitors, which are derived from snake venom—Amazonian organisms have helped create industries worth billions of dollars. Today's explosion of biological knowledge, Mr Castilla felt, portended many more such opportunities.

For the shift he had in mind to happen, though, he reasoned that both those who live in the Amazon basin and those who govern it would have to share in the profits of this putative new economy. And one part of ensuring this happened would be to devise a way to stop a repetition of what occurred with rubber and ACE inhibitors—namely, their appropriation by foreign firms, without royalties or tax revenues accruing to the locals.

Such thinking is not unique to Mr Castilla. An international agreement called the Nagoya protocol already gives legal rights to the country of origin of exploited biological material. What is unique, or at least unusual, about Mr Castilla's approach, though, is that he also understands how regulations intended to enforce such rights can get in the way of the research needed to turn knowledge into profit. To that end he has been putting his mind to the question of how to create an open library of the Amazon's biological data (particularly DNA sequences) in a way that can also track who does what with those data, and automatically distribute part of any commercial value that results from such activities to the country of origin. He calls his idea the Amazon Bank of Codes.

Now, under the auspices of the World Economic Forum's annual meeting at Davos, a Swiss ski resort, these two ideas have come together. On January 23rd it was announced that the EBP will help collect the data to be stored in the code bank. The forum, for its part, will drum up support for the venture among the world's panjandrums—and with luck some dosh as well.

The EBP's stated goal is to sequence, within a decade, the genomes of all 1.5m known species of eukaryotes. These are organisms that have proper nuclei in their cells—namely plants, animals, fungi and a range of single-celled organisms called protists. (It will leave it to others to sequence bacteria and archaea, the groups of organisms without proper nuclei.) The plan is to use the first three years to decipher, in detail, the DNA of a member of each eukaryotic family. Families are the taxonomic group above the

genus level (foxes, for example, belong to the genus *Vulpes* in the family Canidae) and the eukaryotes comprise roughly 9,300 of them. The subsequent three years would be devoted to creating rougher sequences of one species from each of the 150,000 or so eukaryotic genera. The remaining species would be sequenced, in less detail still, over the final four years of the project.

That is an ambitious timetable. The first part would require deciphering more than eight genomes a day; the second almost 140; the third, about 1,000. For comparison, the number of eukaryotic genomes sequenced so far is about 2,500. It is not, though, the amount of sequencing involved that is the daunting part of the task. That is simply a question of buying enough sequencing machines and hiring enough technicians to run them. Rather, what is likely to slow things down is the gathering of the samples to be sequenced.

For the sequencing, Harris Lewin, a genomicist at the University of California, Davis, who was one of the EBP's founding spirits, estimates that extracting decent-quality genetic data from a previously unexamined species will require between \$40,000 and \$60,000 for labour, reagents and amortised machine costs. The high-grade family-level part of the project will thus clock in at about \$500m.

Big sequencing centres like BGI in China, the Rockefeller University's Genomic Resource Centre in America, and the Sanger Institute in Britain, as well as a host of smaller operations, are all eager for their share of this pot. For the later, cruder, stages of the project Complete Genomics, a Californian startup bought by BGI, thinks it can bring the cost of a rough-and-ready sequence down to \$100. A hand-held sequencer made by Oxford Nanopore, a British company, may be able to match that and also make the technology portable.

The truly daunting part of the project is the task of assembling the necessary specimens. Some of them, perhaps 500,000 species, may come from botanical gardens, zoos or places like the Smithsonian (the herbarium of which boasts 5m items, representing around 300,000 species). The rest must be collected from the field. Dr Lewin hopes the project will spur innovation in collection and processing. This could involve technology both high (autonomous drones) and low (enlisting legions of sample-hunting citizen scientists). It does, though, sound like a multi-decade effort.

It is also an effort in danger of running into the Nagoya protocol. Permission will have to be sought from every government whose territory is sampled. That will be a bureaucratic nightmare. Indeed, John Kress of the Smithsonian, another of the EBP's founders, says many previous sequencing ventures have foundered on the rock of such permission. And that is why those running the EBP are so keen to recruit Mr Castilla and his code bank.

The idea of the code bank is to build a database of biological information using a blockchain. Though blockchains are best known as the technology that underpins bitcoin and other crypto-currencies, they have other uses. In particular, they can be employed to create "smart contracts" that monitor and execute themselves. To obtain access to Mr Castilla's code bank would mean entering into such a contract, which would track how the knowledge thus tapped was subsequently used. If such use was commercial, a payment would be transferred automatically to the designated owners of the downloaded data. Mr Castilla hopes for a proof-of-principle demonstration of his platform to be ready within a few months.

In theory, smart contracts of this sort would give governments wary of biopiracy peace of mind, while also encouraging people to experiment with the data. And genomic data are, in Mr Castilla's vision, just the start. He sees the Amazon Bank of Codes eventually encompassing all manner of biological compounds—snake venoms of the sort used to create ACE

inhibitors, for example—or even behavioural characteristics like the congestion-free movement of army-ant colonies, which has inspired algorithms for co-ordinating fleets of self-driving cars. His eventual goal is to venture beyond the Amazon itself, and combine his planned repository with similar ones in other parts of the world, creating an Earth Bank of Codes.

Plenty needs to go right for this endeavour to succeed, concedes Dominic Waughray, who oversees public-private partnerships at the World Economic Forum. Those working on different species must agree common genome-quality standards. People need to be enticed to study hitherto neglected organisms. Countries which share biological resources (the Amazon basin, for example, is split between nine states) should ideally co-operate on common repositories. And governments must resist lobbying from vested interests in the extractive industries, keen to preserve access to land, minerals or timber, which Mr Castilla's scheme aims ultimately to curtail.

As to the money, that is the reason for the announcement at Davos. By splashing the tie-up between the EBP and the code bank in front of many of the world's richest people, those behind the two enterprises are not so discreetly waving their collecting tins. The EBP has already been promised \$100m of the \$500m required for its first phase. The code bank, meanwhile, has piqued the interest of the Brazilian and Peruvian governments.

For the participants, the rewards of success would differ. Dr Lewin, Dr Kress and their compadres would, if the EBP succeeds, be able to use the evolutionary connections between genomes to devise a definitive version of the tree of eukaryotic life. That would offer biologists what the periodic table offers chemists, namely a clear framework within which to operate. Mr Castilla, for his part, would have rewritten the rules of international trade by bringing the raw material of biotechnology into an orderly pattern of ownership. If, as many suspect, biology proves to be to future industries

what physics and chemistry have been to industries past, that would be a feat of lasting value. ■



基因组学

测序全世界

一项绘制、存储和传播地球上大部分生命遗传信息的宏伟计划启动

二零一五年11月，23位生物学权威齐聚华盛顿特区的史密森学会（Smithsonian Institution），制定了一项宏伟计划。当时距离人类基因组序列图完成已有12年。在此期间其他一些生物体的基因组已被破译，但这些项目有种不成体系的感觉。有些不出所料就是一次性项目，如对鸡、蜜蜂和大米基因组的研究。有些更为雄心勃勃，例如尝试对脊椎动物、昆虫和蜘蛛纲动物的生物多样性取样，方法是研究这些动物几千个属中的代表物种，但进展缓慢。史密森学会的项目委员会得出结论称，现在需要开展一个规模和范围堪比当初的人类基因组计划的项目。委员们认为项目的目标应该是从地球上所有复杂生物的标本中收集DNA序列，并决定将该项目命名为地球生物基因组计划（EBP）。

大约在举行这次会议的同一时间，一位居住在巴西圣保罗的秘鲁企业家正在制定他自己的大胆计划。胡安·卡洛斯·卡斯蒂利亚·卢比奥（Juan Carlos Castilla Rubio）希望将亚马逊流域的经济从采矿、伐木和畜牧等行业转向利用该地区生物体及其所包含的生物信息。亚马逊的生物曾至少两次帮助创造了价值数十亿美元的产业，一是橡胶树种植业，二是利用蛇毒开发的名为ACE抑制剂的降压药。卡斯蒂利亚认为，如今生物学知识的爆炸式增长预示着还有大量这样的机会。

然而，要实现他构想中的这一转变，他认为亚马逊河流域的居民和治理者必须也能分享到这个设想中的新经济带来的利益。要确保这一点，其中一个任务就是要设法阻止重蹈橡胶园和ACE抑制剂发展的覆辙，即被外国公司独占好处，当地人得不到任何使用费或税收。

有这种想法的不止卡斯蒂利亚一人。名为《名古屋议定书》的国际协定已将合法权利赋予所开发生物材料的原产国。卡斯蒂利亚的做法的独特之处

(或者至少是不寻常之处) 在于他同时也明白, 实施这些权利的监管部门也会干扰为把知识转化为利润而进行的研究。为此, 他一直在努力思考一个问题, 即如何创建一个开放的亚马逊生物数据库(特别是DNA序列数据), 好用它来跟踪谁在利用这些数据做什么, 并将利用这些数据所产生的任何商业价值中的一部分自动分配给原产国。他把这一想法称为亚马逊代码库(Amazon Bank of Codes)。

现在, 在瑞士滑雪胜地达沃斯召开的世界经济论坛年会的主持下, EBP计划和亚马逊代码库结合在了一起。上月23日发布的消息称, 前者将帮助后者收集数据。世界经济论坛则会为此项目争取全球领袖的支持, 运气好的话还能争取到一些资金。

EBP明确表述的目标是在十年内对全部150万种已知真核生物的基因组测序。真核生物是细胞中具有完整细胞核的生物体, 即植物、动物、真菌以及各种被称为原生生物的单细胞生物。(细菌和古细菌这些没有完整细胞核的生物群的测序不在此计划范围之内)。计划分三个阶段, 先是用三年时间在每个真核生物科中选一个代表物种进行详细的DNA测序。“科”在生物分类中的等级高于“属”(例如, 狐狸属于犬科狐属), 真核生物共有约9300个科、大概15万个属。接着再花三年对每一个属中的一个物种进行较粗略的测序。在计划的最后四年, 将完成对剩余物种更粗略的测序。

这是一个雄心勃勃的时间表。第一阶段需要每天测序八个以上的基因组, 第二阶段每天差不多要测序140个, 第三阶段约为每天1000个。目前已测序的真核生物基因组约有2500个, 该计划的艰巨性可想而知。不过, 最大的难度不在于待测序基因组数量庞大——只要购买足够的测序仪器、雇用足够的技术人员来操作就能解决这个问题。可能会拖慢进度的其实是测序样本的收集工作。

EBP的创始人之一、加州大学戴维斯分校的基因组学家哈里斯·列文(Harris Lewin)估计, 要从之前未经测序的物种中提取高质量的基因数据, 成本在四到六万美元之间, 包括人工、试剂和机器摊余成本。项目中较高一级的“科”测序就将需要约5亿美元。

中国的华大基因、美国洛克菲勒大学的基因组资源中心（Genomic Resource Centre）和英国的桑格研究所（Sanger Institute）等大型测序中心以及一些较小的测序机构都渴望从中分一杯羹。对于项目后期的粗略测序，华大基因收购的加州创业公司完整基因组（Complete Genomics）认为它可以将成本降低到100美元。英国公司牛津纳米孔（Oxford Nanopore）制造的手持式测序仪也可能把成本控制在同等水平，而且还具备便携的优点。

该计划真正困难的部分是收集所需的标本。其中一些（可能有50万个物种）可以取自植物园、动物园，或史密森学会（其植物标本馆拥有500万件标本，涵盖约30万个物种）这样的机构，其余的必须从野外收集。列文希望该计划能够促进标本收集和加工的创新。尖端科技（自主无人机）和技术含量不高的方法（征募大批民间科学家收集样本）都可以加以运用。不过，听起来这项工作得花几十年才能完成。

这个部分也可能因《名古屋议定书》而遭遇困难。议定书规定在各国境内取样必须获得该国政府许可，其中涉及的官僚政治将如同噩梦。实际上，另一位EBP创始人、史密森学会的约翰·克雷斯（John Kress）表示，以前许多测序项目正是在尝试获得政府许可时碰了壁。正因为如此，EBP的管理者非常想与卡斯蒂利亚和他的代码库合作。

该代码库的理念是用区块链建立一个生物信息数据库。尽管区块链最广为人知的应用是作为比特币和其他加密货币的底层技术，但它们还有其他用途，特别是可以用来创建能够自动监控和执行的“智能合约”。访问卡斯蒂利亚的代码库就意味着订立了这样的合约，合约将自动跟踪这些数据的后续使用情况。如果数据被用于商业目的，所下载数据的指定所有者就会自动收到一笔费用。卡斯蒂利亚希望能在几个月内为他的平台做一个原理验证的演示。

从理论上讲，这类智能合约可以让警惕生物剽窃的政府安心，同时也鼓励人们利用这些数据开展试验。按照卡斯蒂利亚的构想，基因组数据只是一个开始。他的愿景是亚马逊代码库最终将包含所有的生物化合物信息，例

如用来制造ACE抑制剂的那种蛇毒，甚至还会包含行为特征信息，如行军蚁群的无拥堵行进方式——这为协调无人驾驶汽车的算法提供了灵感。卡斯蒂利亚的最终目标是超越亚马逊流域，将他计划中的代码库与世界其他地区的类似数据库相结合，创建一个“地球代码库”。

世界经济论坛的公私合作总监多米尼克·沃雷（Dominic Waughray）承认，项目要取得成功，需要具备多种条件。研究不同物种样本的人必须就基因组的共同质量标准达成一致。需要吸引人们去研究迄今一直被忽视的生物体。理想情况下，共享生物资源的国家（例如亚马逊河流域分属九个国家）应就公共数据库展开合作。各国政府还必须抵制采掘行业既得利益集团的游说，这些集团渴望能继续利用土地、矿产或木材资源，而卡斯蒂利亚的计划是要最终限制这种行为。

之所以要在达沃斯宣布两个计划的合并，是为了获取资金。通过在许多世界上最富有的人面前高调宣传EBP和代码库的合作关系，主导这两个计划的人在筹集资金时也可以大张旗鼓了。EBP的第一步需要五亿美元，目前已获得一亿美元资金的承诺。与此同时，代码库也已激起了巴西和秘鲁政府的兴趣。

参与计划的人将会得到不同的成功回报。如果EBP取得成功，列文、克雷斯和他们的同僚们将能够利用基因组之间的进化关系绘制出最终版本的真核生物演化树。这将为生物学家提供清晰的操作框架，就像化学家有了化学周期表一样。而在卡斯蒂利亚这里，他将明晰生物技术原材料的所有权，进而改写国际贸易的规则。如果像许多人猜想的那样，生物学将对未来的产业产生重要影响，就像物理和化学过去的作用那样，那么这将是一个意义深远的壮举。 ■



Free exchange

Jam tomorrow

Driverless cars will not save cities from either traffic or infrastructure expense

THE most distractingly unrealistic feature of most science fiction—by some margin—is how the great soaring cities of the future never seem to struggle with traffic. Whatever dystopias lie ahead, futurists seem confident we can sort out congestion. If hope that technology will fix traffic springs eternal, history suggests something different. Transport innovation, from railways to cars, reshaped cities and drove economic advance. But it also brought crowded commutes. Now, as tech firms and carmakers aim to roll out fleets of driverless cars, it is worth asking: might this time be different? Alas, artificial intelligence (AI) is unlikely to succeed where steel rails and internal-combustion engines failed.

More's the pity. In America alone, traffic congestion brings economic losses estimated in the hundreds of billions of dollars each year. Such costs will rise unless existing transport systems receive badly needed investment. For example, fixing New York's beleaguered, overcrowded subway will take at least \$100bn, according to one recent estimate. A driverless *deus ex machina* might seem to spare governments some difficult decisions.

But congestion is a near-inevitable side-effect of urban growth. Cities exist because being near to other people brings enormous advantages. Proximity allows people to find friends, mates and business partners, to discuss ideas and generate new ones, and to trade (and so to capture the benefits of specialisation). Regrettably, clumping leads to crowding: the more people an area houses, the greater the competition for its scarce resources, from seats at a hot new restaurant to space on public roadways. Each new arrival enhances a city's magic but also adds to congestion. Cities grow until costs

outstrip benefits.

New transport technologies are not useless. Mass-transit railways and highways allowed big cities to get bigger. But their congestion-easing benefits inevitably proved temporary. When the New York subway extended into northern Manhattan, it became practical to live far from the dirty, expensive, crowded downtown area, while still enjoying access to the city's social and economic benefits. So the city's population rose—a lot—leaving New Yorkers once more cheek by jowl. A post-war highway-building boom in America yielded explosive growth in city suburbs. Cities once again found their equilibrium, however, as the suburban land-rush led to road congestion, raising the cost of living far from employment centres. In a paper published in 2011, Gilles Duranton, of the University of Pennsylvania, and Matthew Turner, of Brown University, identified a “fundamental law of road congestion”: namely, that building more highways does not alleviate congestion. Rather, it attracts more residents, leads to more driving by existing residents and boosts transport-intensive economic activity, until roads are once again crammed.

Driverless cars should cut traffic, other things being equal. Lower accident rates will mean fewer crash-related hold-ups, while AIs that can pilot cars more closely together will boost road capacity. But reductions in traffic will make living in currently congested areas more attractive and hence more populous. Miles travelled per person might also rise, since self-driving technology frees passengers to use travel time for work or sleep. And just as new highways prompt a rise in transport-intensive business, driverless vehicles could generate lots of new road-using activity. Where now a worker might pop into the coffee shop before going to work, for example, a latte might soon be delivered in a driverless vehicle. The technology of driverless cars may make us safer and more productive, but not necessarily less traffic-bound.

It might, however, improve traffic by making it easier, politically, to impose tolls on roads. Jams occur because a scarce resource, the road, is underpriced, so more people drive than it can accommodate. But tolls could favour use of the roadway by those who value it most. Some places already use such charges—London and Singapore are examples—but they are rarely popular. Some drivers balk at paying for what they once got for nothing, and others are uneasy about the tracking of private vehicles that efficient pricing requires. People seem not to object to paying by the mile when they are being driven—by taxis and services like Uber and Lyft—and the driverless programmes now being tested by Waymo and GM follow this model. If a driverless world is one in which people generally buy rides rather than cars, then not only might fewer unnecessary journeys be made, but also political resistance to road-pricing could ease, and congestion with it.

That might lead to a different kind of dystopia (also with historical antecedents): one in which fast, functional transport is available only to those who can pay. Luckily, history also suggests a solution: mass transit. Ride-hailing services might introduce multi-passenger vehicles and split travel costs across riders (they could call them “buses”). Or, as Daniel Rauch and David Schleicher of Yale University argue, governments might instead co-opt the new transport ecosystem for their own purposes. They might subsidise the travel of low-income workers, or take over such systems entirely (a common fate for mass-transit systems which begin life as private enterprises, including the New York subway). Municipal networks of driverless cars might prove less efficient than private ones, particularly if cars are rationed on a first-come-first-served basis rather than by price. But in the past city governments have felt that providing equal-opportunity access to centres of economic activity was worth the cost.

Should congestion prove ineradicable in a driverless world, people will continue to hope for technological solutions, like the long-promised flying cars. While we wait for that—and the clotted skyways that would soon

follow—governments would be wise to keep their underground systems in good working order. ■



自由交流

拥堵的明天

无人驾驶汽车无法让城市免于拥堵或节省基础设施开支

在大多数科幻小说中，最不切实际乃至让人出戏的一个特征，无疑就是未来那些宏伟高耸的城市似乎从来不用为堵车操心。不管人类面临着什么样的灾难，未来派似乎都对消除拥堵信心满满。如果说对技术能够解决交通问题的希望永不熄灭，历史经验却并不乐观。从铁路到汽车，交通创新重塑了城市，带动了经济发展，但也带来了拥挤的通勤。如今，既然科技公司和汽车制造商希望推出无人驾驶车队，那就值得问一问：这次会不同吗？唉，可惜在钢轨和内燃引擎战败之地，人工智能（AI）也不太可能成功。

这可真不幸。仅在美国，交通堵塞每年就会带来数千亿美元的经济损失。除非现有运输系统获得急需的投资，这种成本还会上升。例如，根据最近的一项估计，要修理纽约那问题重重而过度拥挤的地铁至少需要1000亿美元。无人驾驶这个救星看起来好像可以让政府少做几个困难的决定。

但拥堵是城市发展一个近乎不可避免的副作用。城市之所以存在，是因为人们相互接近带来巨大的好处。这种接近性让人们找到朋友、伴侣和商业伙伴，讨论并创造新想法，并相互交易（以获得专业分工的好处）。令人遗憾的是，聚集会导致拥挤：在一个地区居住的人越多，对稀缺资源的竞争就越大——无论是热门新餐厅的座位还是公共道路上的空间。每个新到来的人都让城市更加迷人，但也让拥堵更甚。城市会一直增长，直到代价超过收益。

新的运输技术并非一无是处。地铁和高速公路让大城市变得更大。但到头来，它们对缓解拥挤的好处无一例外都是短暂的。当纽约的地铁延伸到北曼哈顿时，人们可以远离肮脏、昂贵、拥挤的下城区，却仍然享受城市的社会和经济效益。所以这个城市的人口增加了一—很多，让纽约客们再次

摩肩接踵。美国战后的公路建设热潮让城市郊区人口爆发式增长。然而，城市再次找到了平衡点，因为郊区的拓荒热潮导致道路拥堵，使得远离就业中心的生活成本提高。宾夕法尼亚大学的吉勒斯·杜兰顿（Gilles Duranton）和布朗大学的马修·特纳（Matthew Turner）在2011年发表的一篇论文中指出了“道路拥堵的基本规律”，即建造更多的公路并不能缓解拥堵。相反，它吸引了更多的居民，导致现有居民开车更多，并促进了运输密集型的经济活动，直到道路再次变得拥挤不堪。

如果其他的一切都保持不变，无人驾驶汽车应该会减少交通量。较低的事故率意味着因撞车导致的耽搁更少，而AI能够调控车队更密集地行驶，从而提高道路容量。但交通减少会使在目前拥挤的地区生活变得更具吸引力，人也会更多。由于自动驾驶技术使乘客能够利用通行时间工作或睡眠，每个人乘坐的里程数也可能会增加。正如新高速公路会推动运输密集型业务，无人驾驶车辆可能会产生大量新的道路使用活动。例如，现在的员工可能会在上班前去咖啡店，也许很快就会有无人车来送拿铁了。无人驾驶汽车技术可能让我们更安全、更高效，但对交通的依赖未必会减少。

不过，从政治角度看，它可能会让对道路收费更容易，从而改善交通。拥挤是因为道路这种稀缺资源价格过低，所以开车的人超出了它的容量。但通行费会有利于那些最看重道路的人使用它。有些地方已经开始征收此类费用——伦敦和新加坡就是例子，但这件事总归不怎么受欢迎。一些司机不愿意为一度免费获得的东西付钱，另一些司机则对有效定价需要追踪私人车辆感到不安。而由别人开车的时候，比如使用出租车或是优步和Lyft等服务时，人们似乎并不反对按距离付钱——Waymo和通用汽车现在测试的无人驾驶方案就遵循这个模式。如果在无人驾驶的世界里，人们通常买的是搭载服务而非汽车，那么不仅可以减少不必要的通行，对道路收费的政治阻力也会更小，由此减少拥堵。

这可能会导致另一种糟糕的境地（历史上也有前车之鉴）：只有能付得起钱的人能获得快速、高效的交通。幸运的是，历史也提供了一个解决方案：公共交通。叫车服务可能会引入多乘客车辆，并在乘客之间分摊费用（可以称之为“巴士”）。或者，正如耶鲁大学的丹尼尔·劳什（Daniel

Rauch) 和大卫·施耐德 (David Schleicher) 所说，政府可能会出于自己的考虑而接手新的交通生态系统。它们可能会资助低收入工作者的通勤，或者完全接管这些系统（以民营企业开端的公交系统的常见命运，包括纽约地铁在内）。由市政府运营的无人驾驶汽车网络可能比民营网络效率低，特别是如果汽车是先到先得而非按价格分配的话。但在过去，市政府认为，为了提供进入经济活动中心的平等机会而付出这种代价是值得的。

如果无人驾驶的世界也无法根除拥堵，那么人们将会继续盼望新的技术解决方案，比如他们期盼已久的飞行汽车。当我们还在等待这一天——以及之后很快又会拥堵不堪的空中道路的时候，政府还是把自己的地下交通系统修修好吧。 ■



Medicine

External organs

Livers for transplant can now be kept alive at body temperature

WHEN Constantin Coussios, a biomedical engineer at Oxford University, arrived one day in 2013 at the transplant centre of King's College Hospital, in London, with a liver for their use, he triggered a brief flurry of panic. Two other livers had arrived at the same time. The hospital had only one operating theatre in which liver transplants could be carried out—and because livers intended for transplant can be kept in cold storage for no longer than 12 hours, the situation looked serious.

What saved the day, and possibly a patient's life, was that Dr Coussios was bringing not a cold liver, stored on ice, but a warm one. Instead of having had its metabolism slowed, it was fully functional. This was because it was connected to a supply of blood and nutrients inside a special box known as a metra (a Greek word meaning "womb"), invented by Dr Coussios and his colleague Peter Friend. The metra even had a graphical interface to show, moment by moment, how well its cargo was faring. Dr Coussios told the surgeon to transplant the cold-stored livers first. The one he had brought would keep.

That was in the early days of metras. Now, the devices are starting to spread. So far 25 have been deployed around the world and others are about to be. There are also plans, by Dr Coussios and others, to extend the idea behind the metra to the preservation of other vital organs. If that works, it would change the transplant business by improving both the supply and the health of such organs.

A metra is designed to keep the organ it is nurturing supplied with the

correct amount of blood—an amount which varies from one instant to the next. It detects the organ's demand for blood by monitoring pressure in the arteries and veins going into and out of the liver. It then adjusts the power of its pump in response.

The blood in question has been tinkered with to make it more effective. It has had its white cells and platelets removed to avoid inflammation, clotting and the transfer of disease. For the further prevention of clotting, it has had anticoagulants added. And it has been boosted with special chemicals that the liver needs in order to produce bile; with insulin to regulate the organ's metabolism; and with nutrition in the form of glucose and amino acids.

Once a liver is hooked up inside a metra, its health can be tracked by monitoring things like blood flow, bile production and acidity levels. All these data permit a transplant team to see how the organ is faring. Moreover, a metra not only keeps a liver healthy but can, in some circumstances, actually improve its health. Putting a liver that has been cooled for storage into a metra can reverse damage it has sustained when cold by providing an environment in which its natural propensity to rejuvenate can come to the fore. More remarkably, metras may even be able to recondition livers that are sickly because they contain too much fat, and are thus untransplantable. Once a liver has been removed from the body that was making it fat, it will recover surprisingly quickly. A mere two days in a metra "liver spa" is enough to have a palpable positive effect on the health of such an organ.

At the moment, this last benefit is of only theoretical value, because regulations mean livers for transplant can be stored in a metra for a maximum of 24 hours. That, though, is twice the maximum a liver ought to be kept chilled for transplant, and almost three times the nine-hour limit generally preferred—hence Dr Coussios's insouciance at the hospital back in 2013. Research on metras suggests that the 24-hour limit could safely be

raised to three days, and possibly longer than that.

Twenty-four hours is, though, still long enough to conduct tests on the quality of livers that might otherwise be rejected. The existing assessment of a liver for transplant is necessarily subjective, because there is no sure way to tell if a cooled organ will work normally when it is warmed up and reconnected. Many surgeons therefore err on the side of caution, knowing that if they put a defective liver into a patient, it will probably kill him.

All this means that using metras should increase the availability of livers for transplant. Dr Coussios reckons that reducing the rate of rejection by surgeons could, by itself, double the number which can be used in Britain. Metras could also make it easier to perform the tricky operation of splitting livers in two, which is sometimes done to create a child-sized organ while still leaving enough over to transplant into an adult. The use of a metra is likely to permit these divisions to be carried out more slowly and carefully.

The metra is being commercialised by OrganOx, a firm based in Oxford. Dr Coussios estimates that the world's hospitals have need for about 300 of the machines, but the firm says it will have reliable repeat business from furnishing the metras it has sold with the disposable plastic connectors that hook machine and organ up together—for a replacement set of these is required with each new liver stored.

In the future, OrganOx hopes to expand its activities by building a metra for kidneys, and perhaps also one for pancreases. Meanwhile, the firm has competition in the form of TransMedics, of Andover, Massachusetts. This company is developing similar devices for livers, hearts and lungs.

Besides increasing the supply of organs, and improving patient outcomes, metras and their competitors can also help ease the psychological burden on surgeons. One such, of some 30 years' experience, still admits to having

sleepless nights after performing a liver transplant. Even if he has done the surgery perfectly, he cannot be sure that the liver he has transplanted will actually work. Metra-storage makes it quite likely that it will. ■



医学

外来器官

用于移植的肝脏现在能够在体温下保存

二零一三年的一天，牛津大学生物医学工程师康斯坦丁·库西奥斯（Constantin Coussios）来到伦敦国王学院医院（King's College Hospital）的移植中心，带来了一副医院等着用的肝脏。这引起了一阵短暂的恐慌。因为另有两副肝脏也已同时到达，而医院只有一个手术室能做肝移植。用于移植的肝脏被冷藏保存不能超过12个小时，形势看起来非常严峻。

幸而有一件事解救了局面，或许也挽救了一位患者的生命：库西奥斯带来的并非用冰块冷藏的低温肝脏，而是一副温暖的肝脏。它的新陈代谢并未减缓，而是在完全正常地工作。这是因为它在一个叫作“metra”（希腊语，意为“子宫”）的特殊的盒子里接受着血液和养分的供应，这是库西奥斯和他的同事彼得·弗兰德（Peter Friend）的发明。这个“子宫”甚至还带有图形界面，每时每刻显示着所装器官的状态。库西奥斯让外科医生先移植冷藏的肝脏，他带来的可以等一等。

那还是“子宫”问世的初期。现在这种设备已经开始推广。目前全球已有25套投入使用，未来还会有更多。库西奥斯等人还计划将“子宫”背后的理念推广用于保存其他的重要器官。如果可行，这些器官的供应和健康状况均会得到改善，器官移植行业也将因此改变。

“子宫”能够向它供养的器官持续提供适量的血液——器官所需血量是时刻变化的。它监测进出肝脏的动脉和静脉的压力，从而判断器官对血液的需求，然后相应地调整泵的功率。

“子宫”里的血液也经过处理，以便更高效地发挥作用。为了防止炎症、凝血和疾病转移，血液中的白细胞和血小板被移除了。为了进一步防止凝血

还添加了抗凝剂。此外，血液中还添加了肝脏分泌胆汁所需的特殊化学物质、调节器官新陈代谢的胰岛素、提供营养的葡萄糖和氨基酸。

一旦放入“子宫”的肝脏与整套系统连接起来，它的健康状况就可以通过监测血液流动、胆汁分泌和酸度水平等指标来追踪。这些数据能让移植团队了解器官的现状。此外，“子宫”不仅能保持肝脏健康，在某些情况下还能改善肝脏状况。将一个经过冷藏保存的肝脏放入“子宫”中，可以逆转它在低温下受到的损伤，因为“子宫”提供的环境能够激发肝脏恢复活力的天然能力。更令人称奇的是，“子宫”甚至可能改善因脂肪太多而不适于移植的不良肝脏。一旦把肝脏从让它增脂的身体里移除，肝脏会以惊人的速度恢复。只要在“子宫”里做上两天的“水疗”，就足以对肝脏的健康产生明显的积极影响。

目前，这最后一项优势的价值还只停留在理论上，因为按照法规，用于移植的肝脏在“子宫”内最多只能保存24小时。尽管如此，这已经是移植肝脏冷藏时限的两倍，是人们普遍接受的9小时时限的近三倍。所以2013年库西奥斯在那家医院里镇定自若。对“子宫”的研究表明，24小时的时限可以安全延长至三天，甚至可能更长。

不过，24小时的时间已经足够对那些本可能被弃之不用的肝脏做质量测试。目前对移植肝脏的评估难免主观，因为没有万无一失的方法来判断一个经冷藏的器官回暖并重新连接人体后能否正常工作。因此，许多外科医生会一味求稳，因为他们知道如果把一个有缺陷的肝脏植入病人体内，很可能害死人。

上述种种都意味着使用“子宫”能够增加可移植肝脏的数量。库西奥斯认为，单是降低被外科医生拒用的比例就能让英国可用肝脏的数量翻倍。把肝脏一分为二的手术也会变得容易些。医生有时会做这种棘手的手术来切分出一块大小适用于儿童的器官，剩下的还足够移植给一个成人。使用“子宫”应该能更从容、仔细地做这种切分。

总部位于牛津的OrganOx公司正在将“子宫”商业化。库西奥斯估算全球的

医院大约需要300台此类设备，但该公司表示自己会通过为已售出的“子宫”提供配件来获得可靠的回头生意。“子宫”里将机器和器官连接在一起的装置是一次性塑料连接器，每存储一个新的肝脏就要换一套。

未来OrganOx公司希望拓展业务，为肾脏也打造一个“子宫”，甚至还可以为胰腺也造一个。另一方面，公司也遇到了竞争对手——来自马萨诸塞州安多弗市（Andover）的TransMedics公司。后者正在研发针对肝脏、心脏和肺的类似设备。

除了增加器官的供应，改善治疗结果，“子宫”及其竞争产品还能帮助外科医生减轻心理负担。有位外科医生已有30年的工作经验，但仍坦陈自己在做了肝移植手术后会数夜无眠。即使他的手术做得很完美，他也无法确保移植的肝脏能有效工作。“子宫”式存储设备让成功的可能性大大提高。■



A generation's mood

Teens and screens

Cutting adolescents' use of smartphones and social media is a poor solution to their problems

FIRST they went for tobacco, coal and sugar. Now they are targeting smartphones and social media. On January 6th two large investors in Apple demanded that the technology company must help parents curtail their children's iPhone use, citing research into the links between adolescent social-media habits and risk factors for suicide, such as depression. Old and new media abound with reports about phones' addictive, mind-warping properties. On the school run, parents compare tactics for limiting screen time.

Something has made today's teenagers different from teenagers in the past. As well as being far more temperate and better-behaved, they seem more anxious and unhappy. School surveys by the OECD, a club of mostly rich countries, suggest that 15-year-olds find it harder to make friends. In America—though, phone-bashers should note, not in the rich world as a whole—suicides of young people are up.

Before stampeding for the off switch, parents and others should ask two questions. First, are iPhones, Instagram and so on actually to blame for adolescents' problems? Second, will curtailing their use do much good? On the available evidence, the answers are, respectively, maybe and no.

Some studies of Britain and America, which conduct large surveys of young people, have found correlations between heavy technology use and unhappiness. Correlation is not causation, however: it could be that unhappy people seek refuge online. And the correlations are very weak. Only about 1% of the variability in young people's mental wellbeing can be

explained by social-media or smartphone use. One British study suggests that eating breakfast regularly is more than three times as important.

Perhaps technology has messed up all young people, even those who abstain from it. Maybe it makes everyone feel left out, or thwarts all intimate connections: if your friend is always looking at her phone, it may not matter much whether you are. But if the effects are so amorphous it is hard to know what to do. Should parents gang up on teenagers as a group and enforce a universal crackdown? Should they deal with the inevitable charge of unfairness by applying the same restrictions to themselves? Good luck with that.

Parents who worry about their teenage offspring (which is to say, all parents) can do something, however. Prod them out of the house, and worry a bit less about what they get up to. There is plenty of evidence for the cheering effects of hanging out with friends. Yet youngsters are doing less of this. Over-protective parents are probably one reason.

Social pressure is another. It is revealing of broader attitudes that, in Britain, “teenagers hanging out on the streets” is a standard measure of anti-social behaviour. The authoritative Crime Survey of England and Wales asks people whether it is a problem where they live, alongside things such as drug dealing and burnt-out cars. That the rate of adolescent hanging-out has dropped from 33% to 16% in ten years may please criminologists, but is unlikely to signal happier teenagers.

A last cause of teenage angst could be the economy and the job market. The great recession hit young people harder than others. Some teenagers believe they face crushing competition, not only from their peers but from foreigners and robots. All the more reason for governments to work on improving schools and to get rid of job protection for older workers. Teenagers, for their part, could probably handle a bit more work. Even

though homework is associated with higher test scores, it declined by an hour a week across the OECD between 2003 and 2012, from six hours to five. Some put in that much time on their phones in a single day. ■



一代人的精神状态

少年与屏幕

要解决青少年问题，减少他们使用智能手机和社交媒体的时间是下策

他们先是抨击烟草、煤炭和糖，现在又盯上了智能手机和社交媒体。1月6日，苹果公司的两大投资者敦促这家科技公司帮助家长控制孩子使用iPhone的时间。他们援引的相关研究指出，青少年使用社交媒体的习惯和抑郁等自杀风险因素存在关联。新旧媒体上满是使用手机成瘾、扭曲心智的报道。家长们也会在接送孩子上下学时交流限制孩子“屏幕时间”的办法。

世易时移，如今的青少年与以往世代的同龄人有所不同。一方面他们温和规矩得多，另一方面似乎也更焦虑和不快乐。经合组织（OECD，成员主要为富裕国家）开展的学校调查表明，现在15岁的青少年觉得更难交到朋友。在美国，年轻人的自杀率在上升——但抨击手机的人要知道，富裕国家整体上并非如此。

在慌忙给孩子们断网前，家长和其他人应该先弄清两个问题。第一，青少年问题的罪魁祸首真的是iPhone和Instagram这些东西吗？第二，强行减少他们使用这些东西的时间会有很大的益处吗？根据现有证据，这两个问题的答案分别为：也许是和不会。

英美一些针对年轻人的大规模调查发现，重度使用科技产品与抑郁寡欢之间存在关联。然而，相关性不等于因果关系：也可能是不快乐的人在网上寻求逃避。而且这一关联性很微弱。使用社交媒体或手机只能解释年轻人约1%的心理健康变化。英国一项研究表明，按时吃早餐与心理健康的关联性要高出两倍以上。

科技或许已经影响到了所有年轻人的精神健康，连那些并未沉溺其中的人也未能幸免。它也许让所有人都感到被冷落，或者说妨碍了所有的亲密关系：如果你的朋友总是在看手机，那么你自己看不看手机结果都一样。但

这种影响如此难以捉摸，令人们无所适从。父母们是否该联起手来，全面逼迫青少年减少使用科技产品？他们是不是应该在这方面以身作则，以免被指责不公平？祝他们能做到吧。

然而，那些为青春期子女忧心的父母（基本上就等于说所有父母了）还是可以有所作为的。把孩子赶出门，别太操心他们会做出什么事来。有充分证据表明，跟朋友一起玩能让人快乐。但年轻人越来越少这么做。父母的过度保护可能是原因之一。

社会压力是另一个原因。在英国，“青少年三五成群流连街头”被视为反社会行为的典型表现，这就表明了大众的普遍态度。权威的“英格兰和威尔士犯罪调查”（Crime Survey of England and Wales）除了向大众了解所住区域的毒品交易和焚烧汽车等情况，还询问是否存在青少年游荡街头的现象。十年间，青少年结伴出门玩的比率从33%下降至16%，犯罪学家们也许会为此高兴，但这不大可能表示青少年变得更快乐了。

青少年焦虑的最后一个原因可能是经济和就业市场状况。经济大衰退对年轻人的冲击最为严重。一些青少年认为自己面临严酷的竞争：他们不止要迎战同龄人，还有外国人和机器人。政府因而更应该努力改善学校教育，并废除保护年长者岗位的政策。而就青少年而言，他们也许可以多做点功课。尽管多做作业能够提高考试分数，但2003到2012年间，经合组织成员国的青少年每周做作业的时间平均减少了一个小时，从六小时减至五小时。一些孩子一天里头玩手机的时间就有这么长。 ■



Economic and financial indicators

Open budget index

Progress towards greater financial transparency has stalled

Progress towards greater financial transparency has stalled, according to the latest “open budget index” from the International Budget Partnership, an advocacy group. The index measures the amount, level of detail and timeliness of budget information that is publicly available in 115 countries. The average score fell by two points between 2015 and 2017, to 43 out of 100. Sub-Saharan Africa is to blame: the continent’s average score fell by 11 points (in part because countries published fewer documents). Global budget transparency is still greater than it was a decade ago. Georgia is a bright spot: its score has risen by 48 points over the past decade, supported by reforms that began with the revolution in 2003. ■



经济与金融指标

公开预算指数

提高财政透明度的进程陷入停滞

倡议组织国际预算促进会（International Budget Partnership）最新的“公开预算指数”显示，提高财政透明度的进程陷入停滞。该指数衡量了115个国家披露预算信息的数量、详细程度和及时性。2017年各国平均得分为43分（总分为100），较2015年下降两分。撒哈拉以南非洲地区拖了后腿：非洲大陆的平均分下降了11分（一定程度上是因为各国公开的文件数量下降）。不过全球预算透明度仍比十年前要高。格鲁吉亚表现突出：在2003年发生的革命及后续各项改革的助力下，过去十年间该国分数提升了48分。 ■



The car industry

General Uber-Motors

The carmaker takes an unexpected lead in the race to develop autonomous vehicles

GENERAL MOTORS reveals barn-sized truck at Detroit motor show. What else is new, you might now ask. But the launch on January 20th of the Chevrolet Silverado, a pickup that will go on sale at the end of the year, highlights a surprising turnaround for America's largest carmaker.

The good news is not just the Silverado's outsized margins, which are important for a firm that relies heavily on trucks—after Mary Barra, GM's boss, gave an ebullient performance at an investors' conference that coincided with the motor show, the release of GM's quarterly results on February 6th are likely to include record profits. It is also that the money thrown off by vehicles such as the Silverado will help the firm navigate the tricky terrain that lies ahead of all the world's big carmakers.

One task is to ensure that their current business of selling vehicles with internal-combustion engines stays healthy. At the same time, they must prepare for a future of electric and autonomous cars (EVs and AVs), which threaten to up-end business models that have endured for a century.

Not so long ago, GM and its peers seemed to be on a path to extinction. Technology firms such as Alphabet, Uber and other pushy newcomers had started a race to develop software that would control driverless cars and to offer ride-hailing and ride-sharing services that are expected to thrive at the expense of car ownership. In April 2017 GM's market value was overhauled by Tesla's, a firm that makes just tens of thousands of flashy EVs a year, compared with the millions of vehicles rolling off GM's production lines.

Sentiment has changed dramatically. Since April GM's share price has

surged by 28%, giving the firm back the lead. By contrast, Tesla has struggled with the nuts-and-bolts of carmaking. Production-line problems have hampered a big roll out of its mass-market Model 3. Analysts at Barclays, a bank, say that GM is more “evolving mammal than...dying dinosaur”.

One reason for the reversal of fortunes is that GM has convinced investors that its current business is in fine fettle. The cash generated by the Silverado and a range of new pickups will help pay for big investments in EVs and AVs. It does not hurt GM’s case that Ford, its main rival in Detroit, is struggling (see chart). Jim Hackett, a new boss brought in because of his technology know-how, oversaw a lacklustre relaunch in October that was sketchy on Ford’s vision for the future of transport services. On January 24th the firm reported disappointing quarterly results, dashing hopes for quick improvement.

In contrast, GM is already well on the way to reshaping itself. For starters, it has diverted resources to where it is a market leader. It has got rid of unprofitable businesses around the world, a process that culminated in a decision last March to sell Opel, its loss-making European carmaker, to France’s PSA. At the same time, GM has invested heavily in new pickups, such as the Silverado.

Cadillac, GM’s premium brand, may look like an exception to this happy rule. Sales of just 350,000 cars in 2017 puts it far behind its German rivals. Yet sales have doubled since 2010 and it has grown faster than any of them in recent years. Although the firm does not disclose the information, analysts at Morgan Stanley reckon that Cadillac could be worth \$13bn, around 20% of GM’s current value. Johan de Nysschen, Cadillac’s boss, admits he runs a “challenger brand”, but sniffs an opportunity. The upheaval created as carmakers grapple with new business models means that “everyone has to start again”.

The most important reason for GM's comeback, though, is its success in convincing investors that it is a leader not just among established carmakers, but among tech firms, too. It has rapidly accelerated from the position of an also-ran in the field of autonomous vehicles to apparent leader. A scorecard issued annually by Navigant, a consultancy, puts GM ahead of the AV pack of carmakers and tech firms, with Alphabet's Waymo in second place.

That GM is ahead of Silicon Valley's risk-takers may seem surprising. But earlier investments, which were once looked on with scepticism, seem to be paying off. Alan Batey, GM's president for North America, points to the manufacturing of mass-market long-range EVs, where the firm has a lead. The Chevy Bolt, the world's first such vehicle, has been on sale for over a year, beating Tesla's Model 3 and the new Nissan LEAF to market.

The Bolt is supposed to be the basis for an ambitious autonomous ride-sharing business. On January 12th GM announced the latest version of its Cruise AV, a Bolt-based robotaxi without a steering wheel or pedals. GM plans to use it to launch a commercial scheme in several cities, starting next year. Rival tech firms and carmakers are only running, or are planning to launch, small test projects.

When GM paid \$1bn in 2016 for Cruise, an artificial-intelligence startup, many analysts wondered whether it was throwing away money. But the marriage of cutting-edge technology and large-scale manufacturing seems to be paying off. The carmaker has learned to be more nimble; Cruise has picked up how to make its fiddly technology robust enough for the open road. As a result, GM can now mass-produce self-driving cars, says Dan Ammann, second-in-command to Ms Barra. Scale will help steeply to reduce the cost of sensors, which are the key components of an AV.

The firm is being rewarded because, unlike other carmakers, it has

assembled all the parts of the puzzle you need to build new transport services, says Stephanie Brinley of IHS Markit, a consultancy. But even if GM is no longer a dinosaur, risks remain. In particular, it may be too bullish in its estimate of the market for robotaxis and it may be placing too much faith in the benefits of being the first to market.

The company expects demand to expand quickly. Costs of ride-hailing services, it predicts, will fall from \$2.50 a mile now to about \$1 as the main expense—the driver—is eliminated. In America alone it would be able to tap a market worth around \$1.6trn a year (representing three-quarters of all miles travelled) as drivers are lured from their cars to robotaxis. But what Mr Ammann calls this “very big business opportunity” comes with an inconvenient corollary. As car buyers become car users, GM’s legacy business supplying vehicles to drive will decline accordingly.

Critics think that GM may have accelerated too swiftly and that it will have to endure years of losses before robotaxis take off. Even if things move fast, points out Berenberg, another bank, GM may not be the one to benefit. The main constraint in growing a ride-hailing business now is acquiring drivers. But when these are eliminated, capital will be the only limit. And that could mean huge fleets of robotaxis chasing passengers, forcing prices down. Riders may then choose a brand they recognise, such as Uber and Lyft, rather than Maven, GM’s ride-hailing business.

If so, being first would confer little advantage. And yet, if carmakers do not want to accept their fate passively, they have little choice but to remodel themselves. The outsized Silverado and the sensor-packed Cruise AV show that GM has the present in hand—and that it is at least doing its best to safeguard its future. ■



汽车产业

超级通用汽车

通用在自动驾驶汽车研发的比拼中意外领先

在上月20日的底特律车展上，通用汽车展示了它的大块头皮卡。你可能会问，这有什么稀奇的？但是，这款将于年底上市的雪佛兰索罗德的此番亮相凸显出美国最大的汽车厂商迎来意外的转机。

好消息还不止是索罗德的巨大利润（这对严重依赖皮卡的通用来说意义重大）。在与车展同期举行的投资者会议上，通用汽车总裁玛丽·博拉（Mary Barra）表现得兴高采烈，将于2月6日发布的季报很可能会显示创记录的利润【译注：结果确实如此】。除此之外，靠索罗德这类车赚到的钱会帮助公司应对摆在世界所有大型汽车厂商面前的严峻形势。

通用要确保目前内燃机汽车的生意持续健康发展。同时它还必须做足准备，应对电动车和自动驾驶汽车的未来——这两种车可能会颠覆持续了一个世纪之久的经营模式。

就在不久前，通用及其业界同行似乎已穷途末路。Alphabet、优步等科技公司以及其他干劲十足的新来者已经在两个方面展开竞赛——开发操控无人驾驶汽车的软件和提供召车与拼车服务。后者的兴盛意味着人们不必再拥有汽车。去年4月，通用市值被特斯拉赶超。通用每年生产数百万辆汽车，而特斯拉一年只生产几万辆炫目的电动汽车。

此后市场情绪有了极大转变。4月以来，通用股价暴涨28%，重回行业领先地位。而特斯拉则苦于应对汽车制造中的基本问题。生产线问题已经妨碍了其大众车型Model 3的大规模市场投放。巴克莱银行的分析师表示，通用更像是“进化中的哺乳动物，而不是垂死的恐龙”。

通用运势逆转的一个原因是它说服了投资者相信它当前的业务状况良好。索罗德和一系列新型皮卡带来的现金将帮助支撑它对电动车及自动驾驶汽

车领域的巨额投入。通用在底特律的主要对手福特处境艰难，但这并未削弱通用的说服力（见图表）。吉姆·哈克特（Jim Hackett）凭借技术专长成为福特新CEO，去年10月他主持发布了无生气的新战略规划，其中关于福特在未来交通服务上的构想也很粗略。福特于上月24日公布的季报令人失望，公司快速提升业绩的希望落空。

相比之下，通用已经顺利走上了转型之路。首先，它将资源转移到自己占据领先地位的市场上。它在世界各地剥离了不赢利的部门。去年3月，它决定将亏损的欧洲汽车厂商欧宝出售给法国的PSA，至此，这一进程画上句号。同时，通用还在索罗德这类新型皮卡上投入巨资。

通用的高端品牌凯迪拉克似乎是这一进程中的例外。2017年凯迪拉克仅售出35万辆，远远落后于它的德国对手。然而凯迪拉克的销量与2010年相比已经翻倍，近年的增速快于任何德国对手。虽然公司未作披露，但摩根士丹利的分析师估计凯迪拉克价值可达130亿美元，约为通用目前市值的20%。凯迪拉克总裁约翰·德·尼琛（Johan de Nysschen）承认自己经营的是“挑战者品牌”，但嗅到了机会。汽车厂商努力应对新的经营模式，由此引发的剧变让“每个人都必须重新站到起跑线上”。

然而，通用得以翻盘，最重要的原因还是它成功让投资者相信自己不仅是老牌汽车厂商中的领头羊，也是科技公司中的佼佼者。它从自动驾驶汽车领域的落败者俨然一跃而成了领导者。在法维翰咨询公司（Navigant）的年度排行榜上，通用在一众汽车厂商和科技公司的自动驾驶部门中占据首位，Alphabet的Waymo位居第二。

通用竟排在敢为天下先的硅谷企业之前，也许令人惊讶。但它那些一度遭到怀疑的早期投资现在似乎得到了回报。通用北美地区总裁贝亚伦（Alan Batey）以面向大众市场的长程电动车制造为例。通用在这块业务上处于领先。世界首款该类汽车雪佛兰Bolt已上市一年多，比特斯拉的Model 3以及新一代日产聆风（LEAF）都要捷足先登。

通用计划开展雄心勃勃的无人驾驶拼车业务，Bolt被认为是其基础。上月

12日，通用发布了基于Bolt打造的最新款无人驾驶出租车Cruise AV，没有方向盘和踏板，计划明年起在多个城市投入商业运营。而那些与通用竞争的科技公司和汽车厂商还只是在进行或者计划启动小型的测试项目。

当通用在2016年花费10亿美元收购人工智能创业公司Cruise时，许多分析人士怀疑它是不是在花冤枉钱。但前沿科技公司与大型制造企业的联姻似乎修成了正果。通用学会了变得更加灵活，Cruise则能让自己的精密科技足以应付开放道路的挑战。结果是通用已经能够量产自动驾驶汽车，通用的二把手丹·安曼（Dan Ammann）表示。量产会大大降低自动驾驶汽车上的关键零部件——传感器的成本。

通用之所以能够获得如今的成果，是因为它与其他汽车厂商不同，在提供新型交通服务方面已万事俱备，IHS马基特咨询公司（IHS Markit）的斯蒂芬妮·布林利（Stephanie Brinley）表示。但即便通用不再是恐龙，风险依然存在。特别是它对无人驾驶出租车市场的估计也许过于乐观，对抢先进入该市场的好处可能过于自信。

通用预计市场需求会迅速增加。由于不再有司机这一主要开支，通用预计召车服务的成本将从现在的每英里2.5美元降至约1美元。随着人们都不再自己开车，转而乘坐无人驾驶出租车，仅在美国，通用就能够发掘一个每年约达1.6万亿美元的市场（占总行驶里程的四分之三）。但是，伴随安曼所称的“巨大商机”而来的还有一个负面结果：当人们只需用车而无需买车时，通用传统的有人驾驶汽车业务就会相应衰落。

批评者认为通用可能走得太快了，且在无人驾驶出租车普及之前必须经受多年的亏损。投行贝伦贝格（Berenberg）指出，即使形势进展迅速，受益者可能也不是通用。目前发展召车业务的主要制约因素是需要司机。然而一旦制约消除，唯一的限制就是资金了。结果可能会出现大批无人驾驶出租车争抢乘客、压低价格的情况。到时候乘客可能会选择一个他们已经熟悉的品牌，比如优步和Lyft，而不是通用的召车服务Maven。

如果真这样，抢先进入市场也不会带来多少优势。然而，如果汽车厂商不

想听天由命，除了转型别无他选。超大号的索罗德以及装满了传感器的Cruise AV表明通用已经把握了当下，并且，至少是在尽力保卫自己的未来。 ■



Chinese economy

No ordinary Zhou

China's formative central banker is about to retire, but his influence will live on

WHEN Zhou Xiaochuan took the helm of China's central bank 15 years ago, the world was very different. China had just joined the World Trade Organisation and its economy was still smaller than Britain's. Foreign investors paid little heed to the new governor of the People's Bank of China. He seemed safe to ignore: another black-haired, bespectacled official whose talk was littered with socialist bromides.

Mr Zhou is widely expected to retire in the coming weeks. He leaves with China far stronger and his own role much more prominent. No one person can take credit for the flourishing economy. But Mr Zhou, who is 70, deserves more than most. He helped forge the monetary environment for China's growth. He also went a long way to dragging the financial system out of the mire of central planning, even if reforms fell short of his own wishes.

His achievements are surprising. China makes no pretence of having an independent central bank. The People's Bank is under the State Council, or cabinet. But with political acumen and a command of economics, Mr Zhou carved out power for himself. As the years silvered his hair, his decision to leave it undyed, rare among high-ranking cadres, marked him out as different, even a bit daring.

It did not hurt that, as the son of Zhou Jiannan, a senior Communist official, he enjoyed the privileged status of "princeling". From his early career in the 1980s, he advocated a more market-based economy. He helped design the "bad banks" that freed Chinese banks of their failed loans and paved the way for a boom. As stockmarket regulator, he was nicknamed "The Flayer"

for trying to root out corruption. Mr Zhou was not a radical but, by China's standards, a staunch economic liberal.

When party leaders chose Mr Zhou as central-bank governor in 2002, they made him the point-man for financial reform. Over time he also became the face of Chinese economic policy in global markets, much liked for his jovial manner and straight talk. At the last big shuffle of government personnel five years ago, he was old enough to retire. A former aide says that Mr Zhou hoped to return to his other love, music. Sent to work on a farm during the Cultural Revolution, he kept a contraband collection of classical-music records; in the 1990s, when he was a banker, he wrote a book about musicals on the side. But when Xi Jinping became China's leader in 2012, he asked Mr Zhou to stay on. The Flayer had come to be seen as a wise elder, an indispensable guide for the financial system through a dangerous period.

His first big move as central banker, back in 2005, was to unpeg the yuan from the dollar. China's currency remains tightly managed, but it has not stood still. It rose by a third against the dollar in the decade after unpegging. Mr Zhou also steered China towards a system in which banks set interest rates themselves, rather than merely follow government diktats. Frustrated by the torpor of China's other regulators, he oversaw the creation of a vibrant exchange for "medium-term notes", a bond market in all but name. Rather than big-bang reforms, with all their attendant dangers, these were small changes that added up to something bigger.

Yet Mr Zhou craved more. He wanted to open China's financial system to the world, believing that only with true competition would it be possible to curb wasteful investment. As a vehicle for this he lighted on internationalising the yuan. Politically, it was an easy sell—leaders liked the idea of having a powerful currency. Economically, it proved complex, requiring China to open its sheltered financial system to more risks. When cash flooded out of the country in 2016, the central bank retreated, ratcheting up capital

controls.

Criticism has come from opposite sides. Some economists, mostly in China, feel that Mr Zhou pushed too hard for market forces, especially in his drive to internationalise the yuan. One former adviser, a more conservative economist, calls him “relentless”. The other criticism, more often heard abroad, is that Mr Zhou did too little to cure China’s financial ills. Debt levels soared on his watch, a threat to stability that the government is trying to reduce.

Neither criticism is entirely fair. The project to make the yuan global was never just about the currency. Mr Zhou knew that opening the capital account would reveal financial shortcomings in China and press the government to crack on with reform. To some extent this is now happening, with officials more focused on risks. As for the debt explosion, Mr Zhou could do little to restrain it. Given that the government was committed to ambitious growth targets, the central bank had to provide supportive monetary policy. But it has not let things get out of hand: inflation has remained generally low and stable.

Mr Zhou is well aware that reputations change. He started his term as central-bank governor when Alan Greenspan was seen as the Federal Reserve’s “maestro”, not yet as a villain of the 2008 global financial crisis. Over the past half-year Mr Zhou issued several warnings that debts were too high and that, without stricter regulation, China could face serious trouble. To some it looked as if he was trying to protect his legacy, since, if financial turmoil erupts, he cannot be accused of failing to foresee it.

The front-runners to replace him are Guo Shuqing, China’s most senior banking regulator, and Jiang Chaoliang, party chief of Hubei, a central province. Whoever gets the job will have less personal clout than Mr Zhou. And with decision-making more centralised under President Xi, the central

bank itself may play a diminished role. Yet in one respect its next governor will start from a much stronger position. China's financial reforms are far from finished, but the system as a whole is much more advanced than 15 years ago. As an architect, Mr Zhou never saw his vision fully realised, but he designed solid foundations. ■



中国经济

非凡人物周小川

为中国央行奠基立业的行长即将退休，但他的影响将一直持续

周小川15年前执掌中国央行时，世界与现今迥然不同。当时中国刚刚加入世贸组织，经济总量仍低于英国。外国投资者没把中国人民银行的这位新行长当回事。看起来，忽视他也没什么风险：这不过是又一位黑头发、戴眼镜的官员，一张嘴便是社会主义惯用的陈词滥调。

舆论普遍认为周小川会在未来几周内退休。他退休时的中国已比昔日强大得多，而他个人的作用也更加显著。中国繁荣的经济不能归功于哪一个人，但70岁的周小川比大多数人都劳苦功高。他帮助打造了推动中国发展的货币环境，并且大力帮助金融体系走出中央计划经济的泥沼，即使改革未能达到他自己的期望。

他的成就令人称奇。中国并没有假装自己拥有独立的央行。中国人民银行隶属相当于内阁的国务院。但是凭借政治敏锐度和对经济学的精通，周小川为自己赢得了影响力。岁月染白了他的头发，但他选择以满头华发示人，这在高级干部中很少见，也让他与众不同，甚至带有一点勇者无畏的气概。

周小川是共产党高官周建南的儿子，享有“太子党”的特权地位，这一点对他有帮助。20世纪80年代他刚开始从政时，就倡导更市场导向的经济。他帮助设计成立了“坏账银行”，把中国的银行从不良贷款中解救出来，为繁荣铺平了道路。作为股市的监管者，他因设法根除腐败而获绰号“周扒皮”。周小川算不上激进派，但以中国的标准来看，他是坚定的经济自由主义者。

2002年共产党领导层任命周小川为央行行长，让他担任金融改革的尖兵。随着时间的推移，他也成为了中国经济政策在全球市场的形象大使，因举止亲善、直言不讳而广受好评。五年前上一次政府人事大调整时，他已经

到了退休年龄。一位前助理说周小川希望重拾对音乐的爱好。文革期间他被下放到农场工作时，偷偷留着被禁的古典音乐唱片。90年代在银行任职时，他用闲暇时间写了一本有关音乐剧的书。但是2012年习近平当选中国领导人后，他让周小川继续留任。此时的“周扒皮”已被视为一位睿智的长者、一名带领金融体系度过危险期的不可或缺的向导。

在2005年，他推出了就任央行行长后的第一个重大举措——让人民币与美元脱钩。今天中国的货币仍被牢牢管控，但并非停滞不变。脱钩后的十年里，人民币对美元升值了三分之一。周小川还引领中国朝着银行自主设定利率的金融体系发展，而不是一味遵循政府的指令。对中国其他监管部门的懒政感到失望的周小川主持开发了充满活力的“中期票据”（其实就是一个债券市场）交易。他所做的并不是伴随种种风险的惊天动地的大变革，但这些小变革积少成多也产生了大影响。

然而周小川并未止步于此。他想向世界开放中国的金融体系，相信只有真正的竞争才有可能控制投资浪费。他将人民币国际化视为实现此目标的工具。从政治角度来说这容易被接受——领导人想要拥有有影响力的货币；从经济角度来说可没那么简单，因为这要求中国开放它受保护的金融体系，直面更多风险。2016年大量资本外流，央行退缩，逐步加强了资本管制。

批评的声音来自对立双方。一些经济学家——主要来自中国国内——认为周小川在推动市场力量上用力过猛，特别是在推进人民币国际化上。一名央行前顾问、更偏保守的经济学家说他“毫不留情”。另一种批评大多来自国外，说周小川在诊治中国金融弊病方面几乎无所作为。在他任内债务水平飙升，对稳定造成了威胁，而政府正在试图减轻这种威胁。

两种批评都不完全公正。人民币国际化绝不仅仅关乎货币。周小川知道开放资本账户将会暴露中国金融系统的弊病，从而促使政府加紧改革。由于官员们更加关注风险，这在一定程度上正在实现。至于控制债务激增，周小川几乎无能为力。鉴于政府致力于实现雄心勃勃的增长目标，央行不得不提供支持性的货币政策。但它没有让情势失控：通货膨胀基本保持在低

且稳定的水平。

周小川深知声名沉浮这件事。他始任央行行长时，格林斯潘还被视为美联储的“大师”，但到2008年全球爆发金融危机时却成了恶棍。在过去的半年里，周小川几次发布警告，称债务过高，如果不施以更严格的监管，中国可能有大麻烦。在一些人看来他似乎是试图自保声名，因为如果金融风暴爆发，他就不会被指责未能有所预见。

最有可能接替他的是中国银监会主席郭树清和湖北省委书记蒋超良。不管谁继任，其个人影响力都不及周小川。随着习近平治下决策权更加集中，央行本身的作用也可能减弱。但有一点，央行下一任行长所在的起点会高得多。中国的金融改革远未结束，但金融体系总体上远比15年前先进。作为缔造者，周小川从未看到他的愿景完全实现，但他奠定了坚实的基础。





Economic and financial indicators

Football wealth

Manchester United retained their title as football's richest club in Deloitte's annual Football Money League rankings

Manchester United retained their title as football's richest club when Deloitte, a consultancy, released its annual Football Money League rankings. Despite not being in the lucrative Champions League for the 2016-17 season, the Red Devils won the Europa League, a second-tier competition and, with the broadcasting might of the English Premier League behind them, held off the Champions League and Spanish league winners, Real Madrid. English teams dominate the list. The 2016-17 season was the first of a new three-year Premier League TV deal worth around £2.8bn (\$3.9bn) per season. Such largesse may not last. Analysts warn that future football rights auctions may be less frenzied. ■



经济与金融指标

足球俱乐部财富排名

德勤发布年度足球俱乐部财富排行榜，曼联继续称霸

咨询公司德勤发布了年度足球俱乐部财富排行榜，曼联继续称霸。尽管未参与2016至2017赛季油水丰厚的欧冠，但“红魔”捧得了次一级赛事欧联杯的冠军奖杯，又依托英超联赛转播的吸金能力，得以在财富榜上险胜欧冠及西甲联赛冠军皇家马德里。来自英国的俱乐部横扫榜单。之前英超签订了一个三年的电视转播合同，单赛季的转播费约为28亿英镑（39亿美元）。2016至2017赛季是该合同实施的首个赛季。这样的丰厚收益可能并不会持久。分析人士警告说，未来足球赛事转播权拍卖也许不再会那么狂热。 ■



Free exchange

Great good to come

Central banks must occasionally gamble that faster productivity growth is possible

IN 1996 Alan Greenspan began asking why the flashy information technology spreading across America seemed not to be lifting productivity. He was not the first to wonder. A decade earlier Robert Solow, a Nobel prizewinner, famously remarked that computers were everywhere but in the statistics. But Mr Greenspan was uniquely positioned, as the chairman of the Federal Reserve, to experiment on the American economy. As the unemployment rate dropped to levels that might normally trigger a phalanx of interest-rate rises, Mr Greenspan's Fed moved cautiously, betting that efficiencies from new IT would keep price pressures in check. The result was the longest period of rapid growth since the early 1960s. Despite his success, few central bankers seem eager to repeat the experiment and many remain blinkered to issues other than inflation and employment. That is unfortunate. A little faith in technology could go a long way.

Central bankers are not known to be a visionary bunch. Turning new ideas into more efficient ways of doing things is the job of firms. The capacity of an economy to produce—the supply side—is primarily shaped by things such as technological progress, population growth and the skill level of the workforce. Monetary policy is typically thought not to influence this process. Its responsibility is the demand side of the economy, or people's willingness to spend. Central bankers typically see themselves as drivers who press on a vehicle's accelerator and brakes. The state of the engine is someone else's bailiwick.

Not all economists have seen so sharp a delineation between supply and demand. In 1973 Arthur Okun mused that in an economy with very low

unemployment firms would coax more output out of their workers. More efficient firms would outbid less efficient ones for scarce labour, boosting productivity. By letting spending grow rapidly and unemployment tumble, a central bank might induce productivity to grow faster. In the 1980s Olivier Blanchard and Larry Summers further developed this notion in their work on “hysteresis”. They reasoned that, if weak demand led to a long period of joblessness, workers might find their skills becoming obsolete and their connections to the labour market eroding. A short-run monetary failure could create a long-run drop in supply. Correspondingly, a central bank that responded to recession by allowing unemployment to fall to inflation-stoking levels might find that this overheating lures discouraged workers back into the labour force, and pushes firms to give them the training and equipment they need to thrive. Demand, in such cases, might create its own supply.

In fact, the role of a central bank in managing productivity is even more fundamental than these theories suggest. Good monetary policy is essential to capturing the full benefits of new technologies. Suppose, for example, that a tech firm creates a cheap, AI-powered, wearable doodah as good in monitoring health and diagnosing ailments as going to the GP. Deploying it takes some capital investment and hiring, but also leads to much larger reductions in spending on conventional practices. In other words, this magical innovation leads to a rise in the productivity of health services. Hurrah for that! But the need to shift resources around in response to this disruptive new technology creates some difficulties. Spending on health care is a reliable source of growth in employment and in demand. A sudden drop in such growth might push an economy into a slump. The cost savings that consumers, health insurers and governments enjoy thanks to the new technology would help; perhaps some people would plough their newly saved cash into elective procedures like plastic surgery, at clinics which might then have to expand and hire new workers. But there is no guarantee

that lost spending on doctors and related equipment will be offset by increases elsewhere.

Indeed, in a paper published in 2006, Susantu Basu, John Fernald and Miles Kimball concluded that advances in technology are usually contractionary, tending to nudge economies towards slump conditions. They estimated that technological improvements tend to depress the use of capital and labour (think, in this example, stethoscopes and doctors) and business investment (new clinics) for up to two years. To those living through such periods, this depressing effect would show up in lower inflation and wage rises. That, in turn, suggests that an alert central bank with an inflation target ought to swing into action to provide more monetary stimulus and keep price and wage growth on track. That stimulus should spur more investment in growing parts of the economy, helping them to absorb quickly the resources freed up by the new, doctor-displacing technology and thus averting a slump.

Two obstacles usually get in the way of such a benign outcome. First, these steps unfold with a lag. The slowdown in price and wage growth will be gradual, as displaced workers tighten their belts and compete with other jobseekers for new employment. Central banks might then wait to see whether low inflation reflects a genuine economic trend or is merely a statistical blip. Even after they act, their tools take time to have an effect.

The greater difficulty may be the trouble that central bankers have in imagining that dizzying technological change is possible, let alone imminent. And the risks they face are asymmetric. Had Mr Greenspan been wrong, the high inflation that resulted would have been there for all to see; had he played it safe, no one would have known that a boom had been achievable. Such possibilities can only be guessed at; they are not found in the data. Sober technocrats are not given to leaps of faith. But to risk a bit of inflation for a chance at a productivity-powered windfall is a wager more

central bankers should make. ■



自由交流

大利在望

央行必须偶尔赌一下生产率加速增长的可能

在1996年，艾伦·格林斯潘（Alan Greenspan）开始质疑，为什么席卷美国的耀眼的信息技术革命似乎未能提高生产率。他并非第一个提出这种疑问的人。再倒推十年，诺贝尔奖得主罗伯特·索洛（Robert Solow）有一句名言——计算机无处不在，就是没体现在生产力统计数据上。不过时任美联储主席的格林斯潘具备得天独厚的条件来就美国经济做试验。在失业率降至通常会引发一系列加息的水平时，格林斯潘掌管下的美联储行动谨慎，押注IT新技术带来的效率提升可以抑制住价格压力。结果迎来了自上世纪60年代初以来最长的高速增长期。尽管他获得了成功，但似乎没有几个央行行长有兴趣仿效这一试验，他们中许多人依然对通胀和就业以外的问题视若无睹。这殊为不幸。对科技的一丝信心其实大有助益。

央行行长们并不以高瞻远瞩著称。把新点子变为高效的办事方式是企业的任务。经济体的产能即供给侧主要由技术进步、人口增长和劳动力技能水平等因素决定。人们通常认为货币政策不影响该过程，而是作用在经济的需求侧或消费意愿上。央行决策者常自视为给汽车踩油门和刹车的司机，发动机的状态则是别人的事。

并非所有的经济学家都认为供需之间的界限如此分明。1973年，阿瑟·奥肯（Arthur Okun）提出，在失业率非常低的经济体中，公司会促使员工创造更大的产出。高效的公司会比低效的公司开出更高的价码来争取稀缺劳动力，提升生产率。通过迅速增加支出、压低失业率，央行或许可以让生产率更快增长。上世纪80年代，奥利维尔·布兰查德（Olivier Blanchard）和拉里·萨默斯（Larry Summers）在有关“迟滞现象”的研究中进一步拓展了该理念。他们认为，假如需求疲软导致长期失业，劳动者可能面对技能过时、与劳动市场脱节的问题。短期的货币政策失灵可能导致供给长期下降。相应地，如果央行为应对经济衰退而让失业率下降至可以推高通胀的

水平，它可能发现这种过热会促使原本气馁的劳动者重回劳动力市场，也促使企业向员工提供他们发展所需的培训和设备。在这种情况下，需求可能自行创造供给。

事实上，央行在调节生产力上发挥着根本性的作用，程度甚于上述理论所示。要获取新技术的全部益处，好的货币政策至关重要。举例来说，假设一家科技公司创造出了一款廉价的人工智能可穿戴产品，可以监测用户的健康状况并诊断疾病，堪比全科医生。部署这种设备需要进行一些资本投资和招聘，但在常规诊疗支出上节省下来的钱要多得多。也就是说，这个神奇的创新会提升医疗服务的生产率。多好的事！然而，为适应这一颠覆性的新技术需要重新调配资源，这带来了一些麻烦。医疗支出是就业和需求增长的可靠来源。这类增长的突然下降可能导致经济下滑。消费者、医疗保险公司和政府因新技术而减省了成本，这一点将有所帮助：也许一些人会把节省下来的钱投入到整形这类选择性手术上，促使诊所扩大规模、聘用新员工。但是，并不能保证在医生和相关设备上减少的支出会被在其他方面的支出增长所抵消。

实际上，在2006年发表的一篇论文中，苏桑托·巴苏（Susantu Basu）、约翰·费尔纳德（John Fernald）及迈尔斯·金博尔（Miles Kimball）认为，技术进步通常是收缩性的，往往会使经济陷入低迷。他们估计，技术改进会在长达两年的时间内抑制资本和劳动力的使用（在本文的例子中就是听诊器和医生）和商业投资（如新诊所）。对生活在这样的时期的人来说，这种收缩效应体现为通胀和工资的增速都放缓。这反过来表明，设有通胀目标而反应灵敏的央行应及时行动，加大货币刺激，使价格和工资增长保持正常。这些措施应能刺激对经济中增长领域的投资，助其快速吸收由新技术（比如可以替代医生的新技术）释放的资源，从而避免经济下滑。

有两大障碍会阻挠这一良性结果的实现。首先，上述进程的效果会滞后体现。随着下岗工人勒紧裤腰带并和其他求职者竞争新就业机会，价格和工资增长的放缓将是渐进的。央行可能会静观低通胀究竟是反映了真实的经济走势，还是仅为一时的统计波动。即使央行采取行动，其工具也需要一段时间才能产生效果。

另一个更大的难题也许是，央行决策者无法想象眩目的技术变革有可能发生，更遑论认为它们已迫在眉睫。而他们面临的风险是不对称的。如果格林斯潘判断错误，那么所有人都将看到错误政策引发的高通胀；而假如他当日不冒险，没有人会知道事实上能取得这番繁荣。这些可能性只能靠猜想，不存在于数据中。冷静理智的技术官僚是不大会放手一搏的。但在通胀上冒一点风险来换取生产率增长所带来的意外之财正是更多央行官员应该赌一把的。 ■



Free exchange

Negative justice

Sub-zero interest rates are neither unfair nor unnatural

DENMARK'S Maritime Museum in Elsinore includes one particularly unappetising exhibit: the world's oldest ship's biscuit, from a voyage in 1852. Known as hardtack, such biscuits were prized for their long shelf lives, making them a vital source of sustenance for sailors far from shore. They were also appreciated by a great economist, Irving Fisher, as a useful economic metaphor.

Imagine, Fisher wrote in "The Theory of Interest" in 1930, a group of sailors shipwrecked on a barren island with only their stores of hardtack to sustain them. On what terms would sailors borrow and lend biscuits among themselves? In this forlorn economy, what rate of interest would prevail?

One might think the answer depends on the character of the unfortunate sailors. Interest, in many people's minds, is a reward for deferring gratification. That is one reason why low interest rates are widely perceived as unjust. If an abstemious sailor were prepared to lend a biscuit to his crewmate rather than eating it immediately himself, he would deserve more than one biscuit in repayment. The rate of interest should be positive—and the sharper the hunger of the sailors, the more positive it would be.

In fact, Fisher pointed out, the interest rate on his imagined island could only be zero. If it were positive, any sailor who borrowed an extra biscuit to eat would have to use more than one biscuit in the future to repay the loan. But no sailor would accept those terms because he could instead eat one more piece from his own supply, thereby reducing his future consumption by one, and only one, piece. (A sailor who had already depleted his supplies,

leaving him with no additionalhardtack of his own to eat today, would be in no position to repay borrowed biscuits either.)

That was bad news for thrifty seafarers. But worse scenarios were possible. If the sailors had washed ashore with perishable figs rather than imperishablehardtack, the rate of interest would have been steeply negative. “[T]here is no absolutely necessary reason inherent in the nature of man or things why the rate of interest in terms of any commodity standard should be positive rather than negative,” Fisher concluded.

Two years ago, when the Bank of Japan (BoJ) began charging financial institutions for adding to their reserves at the central bank, its negative-rate policy was harshly criticised for unsettling thrifty households, jeopardising bank profitability and killing growth with “monetary voodoo”. Behind this fear and criticism was perhaps a gut conviction that negative rates upended the natural order of things. Why should people pay to save money they had already earned? Earlier cuts below zero in Switzerland, Denmark, Sweden and the euro area were scarcely more popular.

But these monetary innovations would have struck some earlier economic thinkers as entirely natural. Indeed, “The Natural Economic Order” was the title that Silvio Gesell gave to his 1916 treatise in favour of negative interest rates on money. In it, he spun his own shipwreck parable, in which a lone Robinson Crusoe tries to save three years’ worth of provisions to tide him over while he devotes his energies to digging a canal. In Gesell’s story, unlike Fisher’s, storing wealth requires considerable effort and ingenuity. Meat must be cured. Wheat must be covered and buried. The buckskin that will clothe him in the future must be protected from moths with the stink-glands of a skunk. Saving the fruits of Crusoe’s labour entails considerable labour in its own right.

Even after this care and attention, Crusoe is doomed to earn a negative

return on his saving. Mildew contaminates his wheat. Mice gnaw at his buckskin. “Rust, decay, breakage...dry-rot, ants, keep up a never-ending attack” on his other assets.

Salvation for Crusoe arrives in the form of a similarly shipwrecked “stranger”. The newcomer asks to borrow Crusoe’s food, leather and equipment while he cultivates a farm of his own. Once he is up and running, the stranger promises to repay Crusoe with freshly harvested grain and newly stitched clothing.

Crusoe realises that such a loan would serve as an unusually perfect preservative. By lending his belongings, he can, in effect, transport them “without expense, labour, loss or vexation” into the future, thereby eluding “the thousand destructive forces of nature”. He is, ultimately, happy to pay the stranger for this valuable service, lending him ten sacks of grain now in return for eight at the end of the year. That is a negative interest rate of -20%.

If the island had been full of such strangers, perhaps Crusoe could have driven a harder bargain, demanding a positive interest rate on his loan. But in the parable, Crusoe is as dependent on the lone stranger, and his willingness to borrow and invest, as the stranger is on him.

In Japan, too, borrowers are scarce. Private non-financial companies, which ought to play the role, have instead been lending to the rest of the economy (see chart), acquiring more financial claims each quarter than they incur. At the end of September 2017 they held ¥259trn (\$2.4trn) in currency and deposits.

Gesell worried that hoarding money in this way perverted the natural economic order. It let savers preserve their purchasing power without any of the care required to prevent resources eroding or any of the ingenuity and entrepreneurialism required to make them grow. “Our goods rot, decay,

break, rust,” he wrote, and workers lose a portion of their principal asset—the hours of labour they could sell—“with every beat of the pendulum”. Only if money depreciated at a similar pace would people be as anxious to spend it as suppliers were to sell their perishable commodities. To keep the economy moving, he wanted a money that “rots like potatoes” and “rusts like iron”.

The BoJ shuns such language (and, in the past, has at times seemed determined to keep the yen as hard as a ship’s biscuit). But in imposing a negative interest rate in 2016 and setting an inflation target three years before, it is in effect pursuing Gesell’s dream of a currency that rots and rusts, albeit by only 2% a year. ■



自由交流

负利有理

负利率既不有失公平，也不有违常理

位于埃尔西诺（Elsinore）的丹麦海事博物馆有一件特别令人倒胃口的展品：全世界最古老的船用饼干，来自1852年的一次海上航行。这种饼干被称为硬饼干，曾因保质期长而备受青睐，成为远离陆地的水手们重要的食物来源。伟大的经济学家欧文·费雪（Irving Fisher）也很喜欢这种饼干，不过是喜欢在讲述经济问题时拿它来做形象的比喻。

费雪在1930年的《利息论》（The Theory of Interest）一书中写道，想象有一艘船失事，水手们被困在荒岛上，仅靠他们储备的硬饼干维生。那么水手们之间会以什么条件互借饼干？在这凄凉的经济环境下，会通行什么样的利率？

有人可能会认为答案取决于这些不幸的水手的性格。在许多人心目中，利息是对延迟满足的奖励，这也是为什么低利率被普遍认为不公道的原因之一。如果一个有节制的水手愿意把他的一块饼干借给另一位船员，而不是立即自己享用，对方就理应偿还他一块以上的饼干。利率应该是正的，而且水手们的饥饿感越强，利率就会越高。

而实际上，费雪指出，在这座想象中的海岛上，利率只能是零。如果利率为正，任何借来一块饼干裹腹的水手将来都要用一块以上的饼干来偿还。但是没有水手会接受这样的条件，因为他可以多吃一块自己储备的饼干，这样他将来的口粮就少了一块——但也只会少一块而已（已经吃完自己储备的水手今天没有饼干吃，未来也无力偿还借来的饼干）。

这对于节俭的海员来说是个坏消息，但这种情况还不是最糟糕的。如果和水手们一起冲上岸的只有容易腐烂的无花果，而不是不易腐烂的硬饼干，那么就会出现非常低的负利率。费雪总结说：“在人或物的特性中本身并不存在什么必然的原因决定任何商品的利率应该是正的，而不能是负

的。”

两年前，日本央行开始对金融机构存放在央行的超额储备金实施负利率时，其政策受到了严厉批评。批评人士认为这一政策让节俭的家庭感到不安，危及银行的盈利能力，并且以“货币巫术”遏制增长。在这些担忧和批评的背后可能存在着一种本能的信念，即负利率颠覆了事物的自然秩序。把赚来的钱存起来为什么还要付钱呢？早些时候，瑞士、丹麦，瑞典和欧元区将利率降至零以下的做法几乎都不受欢迎。

但是对一些早期的经济思想家来说，这些货币政策的创新再自然不过了。事实上，西尔维奥·格塞尔（Silvio Gesell）在1916年出版了一部支持货币负利率的著作，书名就叫《自然经济秩序》（The Natural Economic Order）。在书中，他也用了一艘船失事的故事来做比喻。一个唯一幸存下来的鲁滨逊式人物试图攒下足够使用三年的物资，供自己在全力开挖运河时使用。不同于费雪的比喻，在格赛尔的故事中存储财富需要付出很大的努力和才智。肉必须腌制；小麦必须加以遮盖并掩埋；将来用于蔽体的鹿皮必须用臭鼬的臭腺防蛀。储存劳动成果本身就需要投入大量的劳动。

即使鲁滨逊苦苦经营，他积攒的物资仍注定只有负回报。霉菌会污染他的小麦，老鼠会啃噬他的鹿皮。他的其他资产也会因为“生锈、腐烂、破损……干腐、蚁蛀而不断贬损”。

一个同样经历了海难的“陌生人”到来，拯救了鲁滨逊。新来者自己开荒种粮，想向鲁滨逊借一些食物、皮革和工具。这个陌生人承诺，等他站稳脚跟，就用新收获的粮食和新缝制的衣服偿还鲁滨逊。

鲁滨逊意识到，这样的借贷会是异常完美的防腐剂。实际上，通过出借财产，他可以把这些东西运到未来，而“无需付出费用和劳动，也没有任何损失或烦恼”，从而避开了“自然界的千万种破坏性力量”。最终，他很乐意就这项宝贵的服务向这位陌生人付费，现在借他10袋谷子，年底还回8袋。利息为负20%。

如果岛上到处都是这样的陌生人，也许鲁滨逊可以开个更高的价码，要求

对他的借贷品收取正利息。但在这个比喻中，陌生人依赖鲁滨逊，鲁滨逊也同样依赖这个唯一的陌生人，以及他借贷和投资的意愿。

在日本，借贷者也很稀缺。本应扮演这一角色的私人非金融公司却当起了出借方（见图表），每季度获得的债权比承担的债务还多。截至2017年9月底，它们持有的现金和存款高达259万亿日元（2.4万亿美元）。

格塞尔担心这样囤积资金会扭曲自然的经济秩序，它让积攒资金的人保存了自己的购买力，而无需苦心经营以防止资源受侵蚀，也不需要任何聪明才智和创业精神来让它们增长。“我们的商品会腐、会烂、会破、会锈，”他写道，而且“钟摆每摆动一次”，劳动者的主要资产（即他们可以出卖的劳动时间）就损失了一部分。只有当货币以相近的速度贬值时，人们才会像供应商急于卖掉易腐坏的商品那样急于把钱花出去。为了保持经济不断发展，他认为货币该“像土豆一样容易腐烂”、“像铁一样容易生锈”。

日本央行不会使用这样的语言（而且在过去某些时候似乎决意让日元像船用饼干一样坚挺）。然而，日本自2016年起实行负利率，三年前还设定了通胀目标，日本央行实际上追求的正是格塞尔对货币易腐易锈的梦想——尽管每年只会烂掉2%。 ■



Satellite prospecting

There's lithium in them hills

Searching from outer space for minerals on Earth

CORNWALL, a rugged peninsula that forms Britain's south-western extremity, has a history of mining going back thousands of years. Its landscape is dotted with the ruins of long-closed tin and copper mines, along with mountains of spoil from the extraction of china clay (also known as kaolin), a business that still clings to life today. Now, though, prospectors are back on the ground. Or, rather, they aren't. Instead, they are peering down from space. And what they are searching for is not tin, nor copper nor kaolin, but a material that has come into demand only recently: lithium.

The high-flying prospectors in question are a group led by Cristian Rossi, an expert on remote sensing, which has been organised under the auspices of the curiously named Satellite Applications Catapult, an innovation centre backed by the British government. The plan is to use satellites already in orbit to detect and map geological and botanical features that might betray the presence of subterranean lithium. Though satellite prospecting of this sort has been employed before, to look for metals such as gold and copper, using it to search for lithium is new.

The searchers are not searching blind. They know, from mining records dating from the mid-1800s, that there is lithium in Cornwall's rocks. Those records tell of underground springs containing salts of lithium—at that time quite a recently discovered element. Back then these springs were seen, at best, as curiosities, and at worst as flooding risks, because there was then no market for the metal. Today, there is. In particular, lithium is the eponymous component of lithium-ion batteries. These power products ranging from smartphones to electric cars, and are being tested as a means

of grid-scale electricity storage which could make the spread of renewable energy much easier. No surprise, then, that prices have been rising. In 2008 a tonne of lithium carbonate cost around \$6,000. Now it would set you back more than \$12,000.

This price is less a reflection of lithium's overall scarcity than of the rarity of good, mineable deposits of lithium compounds. (Like most metals, it does not occur naturally in its elemental form.) At the moment, the best workable supplies are in Australia, South America and China. But mining companies are eager to discover others. Dr Rossi's team intend to use satellite cameras, both optical and infra-red, and also satellite-borne radar, to look for mineral formations caused by hot liquids reacting with existing rock, and for rock fractures that could act as channels for lithium-bearing brine. They will, as well, record anomalies in vegetation that might be the result of lithium-rich soils, or of hot springs that might contain the element.

The acid test, though, will be to drill where the map thus generated suggests. One group member is ready for that. Cornish Lithium is a newly created firm that has already secured various mineral rights to explore for lithium, and to extract it.

This extraction would not, however, be carried out in the way that it is in the Atacama Desert of Chile, where one of the largest lithium mines in the world prepares lithium salts by drying out vast lakes of brine in the sun. As tourists to Cornwall know all too well, the sun is not to be relied on there. Instead, Cornish Lithium says it will use special filtration techniques called reverse osmosis and ion-exchange to extract and purify lithium compounds from any brine that it finds.

If the experiment in Cornwall proves a success the system could, Dr Rossi reckons, be used to search for lithium in other places. One target would be

Chile's neighbour, Bolivia, which is reckoned to have some of the biggest but still largely untapped deposits of lithium in the world. Any find in Cornwall is likely to be tiny by comparison. But if such a find were made there would be a nice symmetry to it, as one of the world's oldest mining centres became also one of its newest. ■



卫星勘探

山中有锂

从外太空搜索地球上的矿藏

康沃尔（Cornwall）是位于英国西南端的崎岖半岛，有数千年的采矿史。这片土地上遍布废弃已久的锡矿和铜矿，以及因开采陶土（也叫高岭土）而生成的大量弃土堆——这个产业如今仍在挣扎求存。不过，勘探者现在又回到了这片土地。准确来说他们也不是真的回到这里——他们正从太空向这里俯瞰。他们寻找的不是锡，也不是铜和高岭土，而是近些年才形成需求的一种原材料：锂。

这些雄心勃勃的太空勘探者由遥感专家克里斯蒂安·罗西（Cristian Rossi）领导，由英国政府支持的创新中心、名字新奇的“卫星应用弹射器”（Satellite Applications Catapult）出资召集。该项目计划利用已经在轨的卫星来测绘可能显示地下存在锂资源的地理和植物特征。尽管此前这种卫星勘探已被用来勘探金、铜等金属，但用来勘探锂还是头一回。

这些勘探者并非在盲目搜寻。根据19世纪中叶的采矿记录，他们知道康沃尔的岩石中含有锂。那些采矿记录提到当地的地下泉含有锂盐，当时锂还是新近发现的元素。那时候锂还没有市场，因此在当时的人们看来，这些地下泉顶多也就是个稀奇事物，弄不好还会招致洪涝。如今市场已经形成，特别是锂离子电池所需的锂。从智能手机到电动汽车，这种电源产品应用广泛，并正在作为电网级的蓄电手段接受测试，以求让可再生能源的推广变得容易得多。所以锂价格一路上涨并不出奇。2008年，一吨碳酸锂的价格在6000美元左右，现在已经涨到12,000美元以上。

这一价格水平更多反应的是可开采优质锂化合物矿藏的稀有性，而不是锂的整体稀缺性。（和大多数金属一样，锂在自然界不以单质形态存在。）目前，最好的可开采锂矿位于澳大利亚、南美和中国。但矿业公司急切想要找到新矿藏。罗西的团队打算利用光学和红外线卫星相机，以及卫星雷

达来寻找由热液与已有岩石发生反应而形成的矿物结构，以及可充当含锂卤水通道的岩石裂隙。这些设备也可用来记录植被中的异常情况，这些异常可能是富锂土壤或含锂的温泉造成的。

然而结果究竟如何，还要等到根据测绘发现来钻探时才能见分晓。参与卫星勘探的一个成员已经准备就绪。康沃尔锂业（Cornish Lithium）是一家新成立的公司，已获得了锂的各种勘探和开采权。

不过，这里的开采方式和在智利的阿塔卡马沙漠（Atacama Desert）中采用的方式不同。在那里，规模居世界前列的一个锂矿通过晒干大片卤水来提取锂盐。去过康沃尔的游客都非常明白，那里没法依赖太阳。康沃尔锂业表示自己将采用反渗透和离子交换的特殊过滤技术，从找到的卤水中提取和纯化锂化合物。

罗西认为，在康沃尔的尝试如果成功，该系统将可被用于在其他地方探寻锂。目标之一将是智利的邻国玻利维亚。据估计，玻利维亚拥有一些在世界上规模数一数二的锂矿藏，但很大程度上仍有待开发。与之相比，在康沃尔发现的任何矿藏可能都相形见绌。但是，如果真在康沃尔发现锂矿，就会形成一种奇妙的对称：世界上最古老的采矿中心之一同时也成为了最新的一个。 ■



Non-alcoholic drinks

Only the beer gets drunk

Going out need no longer be a headache for teetotallers

BARS and pubs have not usually been the non-drinker's friend. Knocking back pint after pint of juice or fizzy drink quickly gets boring. But beverage manufacturers are now showing more sympathy for their plight. Many companies regard non-alcoholic drinks as the "biggest opportunity in the market", says Frank Lampen, who runs Distill Ventures, which helps small producers with investment and advice, and is backed by Diageo, a British drinks giant.

One of the fund's recent investments, for example, is in Seedlip, a British firm that makes distilled, non-alcoholic "spirits" flavoured with botanicals, and which last year launched in America. Low-alcohol beer, once maligned for its paucity of flavour, is also in fashion. Technological advances mean alcohol can be filtered out of the beer without ruining its taste; other breweries use "lazy" yeast, which produces less alcohol to start with. Over the past couple of years, non-alcoholic craft breweries, such as Nirvana Brewery in London, or WellBeing Brewing Company in Missouri, have popped up; other craft brewers produce a non-alcoholic beer as part of their range.

Even large manufacturers are going on the wagon. ABInBev launched its alcohol-free "Budweiser Prohibition" in 2016, and Heineken followed suit last year with its "0.0" beer. ABInBev expects no- and low-alcohol beer (the latter defined as less than 3.5% alcohol by volume) to amount to a fifth of sales by 2025. As a rough comparison, figures from Euromonitor, a market-research firm, suggest that beer with less than 0.5% of alcohol by volume accounted for only 2% of global sales in 2016.

Nor is the opportunity limited to alcohol-free versions of boozier cousins. Copenhagen Sparkling Tea, for example, is smartly packaged in wine-like bottles, and sold in restaurants across northern Europe. Craft sodas are another new category, says Alex Beckett of Mintel, a market-research firm. These make much of their use of exotic, grown-up ingredients, such as chilli or even stinging nettles. Non-drinkers no longer need compromise on taste or adventure, says Catherine Salway, who runs the no-alcohol Redemption Bar in London, among whose offerings is a cocktail made from activated charcoal.

The buzz around alcohol-free drinks reflects the realisation both that the market has been relatively ignored, particularly at the premium end, and that it is expanding beyond pregnant women and drivers. Alcohol consumption, per person, has flattened or fallen across most large Western economies. Lunchtime drinking is out; “mindful drinking” is in. Cutting back is a popular tactic for the health-conscious and the sugar-wary.

Young people are drinking less frequently than their elders. Less than half of 16- to 24-year-olds surveyed in 2016 by Britain’s Office for National Statistics had had a drink in the previous week, compared with nearly two-thirds of 45- to 66-year-olds. And unlike the saturated markets for many alcoholic drinks such as gin and whisky, says Mr Lampen, there is still room for innovation. Non-drinkers’ cups may soon be running over. ■



非酒精饮料

“酒”不醉人

滴酒不沾的人不用再为外出应酬头痛了

对于不喝酒的人，酒吧和酒馆通常都不是好去处——在这些地方一杯接一杯地灌果汁或碳酸饮料很快就让人觉得乏味。不过现在饮品制造商对他们的困境表现出了更多的同情。弗兰克·兰彭（Frank Lampen）表示，许多公司认为非酒精饮料是“市场上最大的机会”。他运营的“蒸馏风投”（Distill Ventures）属英国酒业巨头帝亚吉欧（Diageo）旗下，通过提供投资和咨询来帮助小厂商。

例如，该基金近期的投资中有一笔投向了英国的Seedlip，这家公司生产植物口味的无酒精蒸馏“酒”，去年开始投放美国市场。一度因味道寡淡而被诟病的低酒精啤酒也流行起来。得益于技术进步，如今从啤酒中过滤掉酒精也不会破坏啤酒的口味；其他啤酒厂则使用“惰性”酵母，本身产生的酒精就比较少。过去几年里，伦敦的“涅槃酿酒”（Nirvana Brewery）和美国密苏里的“健康酿酒”（WellBeing Brewing Company）等无酒精精酿啤酒厂迅速冒头；其他精酿啤酒厂也把无酒精啤酒纳入了产品范围。

连大厂商也加入了进来。百威英博（ABInBev）在2016年推出了无酒精啤酒“Budweiser Prohibition”，喜力（Heineken）去年也跟进，推出了“0.0”啤酒。百威预计，到2025年，无酒精或低酒精啤酒（酒精含量低于3.5%）将达到销量的五分之一。这可与市场调研公司欧睿（Euromonitor）的数据做个粗略的比较：2016年，酒精含量低于0.5%的啤酒仅占全球啤酒总销量的2%。

机会也不仅限于无酒精酒类。例如，哥本哈根气泡茶（Copenhagen Sparkling Tea）就被巧妙地装进酒瓶，在北欧各地的餐馆里出售。市场调研公司英敏特（Mintel）的亚历克斯·贝克特（Alex Beckett）表示，精品汽水是另一类新产品。这类汽水大加利用富有异国风味且适合成人的原

料，如辣椒甚至荨麻。在伦敦经营无酒精“救赎酒吧”（Redemption Bar）的凯瑟琳·萨尔维（Catherine Salway）说，不喝酒的人不再需要在口味或寻求刺激上妥协。该酒吧出售一种用活性炭调制的鸡尾酒。

非酒精饮料引发热烈关注，反映出人们意识到以下两点：首先，这一市场一直相对受忽视，特别是高端市场；第二，该市场正在向孕妇和司机以外的人群扩展。在大多数大型西方经济体，人均饮酒量已趋于平稳或下降。午餐时饮酒的习惯已经过时；“合理饮酒”的理念开始流行。在注重健康和警惕糖分摄入量的人群中，减少饮酒成了流行的做法。

年轻人喝酒的频次少于他们的长辈。英国国家统计局在2016年的一项调查显示，16至24岁的人群中，前一周喝过酒的人不到一半，而在45至66岁的人群中，这个比例接近三分之二。兰彭表示，杜松子酒和威士忌等许多酒类市场已经饱和，但非酒精饮料市场不同，仍有创新空间。滴酒不沾者的杯子可能很快会被满上。 ■



Electric vehicles

Plugging away

Falling costs are opening opportunities for electrified commercial vehicles

ELECTRIC commercial vehicles were once a common sight in Britain's towns and cities. A fleet of 25,000 battery-powered milk floats roved the early-morning streets delivering a crucial part of the nation's breakfast. Short ranges and low top speed were unimportant for a milk round but near-silent running meant customers could sleep. Their demise came as supermarkets expanded, but electrification of business vehicles is gathering pace anew.

Just as better battery technology is bringing down the cost and boosting the range of passenger electric vehicles (EVs), those advances are making electrification of commercial vehicles more appealing. The purchase price is still far higher than a comparable vehicle with an internal combustion engine (ICE). But businesses are more focused than ordinary motorists on the total costs of ownership, and on other reasons to shift to electric power.

Much attention has been paid to battery-powered juggernauts. Tesla has 500 orders for a heavy-duty electric lorry (pictured). Promised (with the usual wild optimism) to hit roads in 2019, Tesla says a version with a range of 800km (500 miles) will cost \$180,000—50% more than an ICE equivalent. Daimler, Cummins, an engine-maker, and others are developing similar vehicles. Yet the chances that batteries will rapidly displace diesel in trucking are slim. Haulage businesses run on slender margins and the economics do not appear to add up. As UBS, a bank, notes, American lorries can take 40 tonnes laden weight and typically 22.5 tonnes of that is given over to cargo. Even by 2022 a comparable electric system will weigh between four and nine tonnes depending on range; a diesel power-train weighs two

tonnes.

Displacing valuable cargo is bad enough. Further questions remain over the durability of Tesla's powertrain (ICEs typically last 1m miles, but batteries degrade quickly and an expensive replacement may be required after half this distance) and also over the lack of a charging infrastructure along intercity routes. Lower fuel costs and maintenance of electric motors will not outweigh the upfront expense and inconvenience for some time.

Electrification is arriving far more swiftly for other types of large vehicle. Buses run on short fixed routes and their batteries, which can be rapidly recharged at either end, can be considerably smaller than in long-haul lorries. Electric buses are expensive but that could change quickly because of the speed of adoption in China.

Generous government subsidies both to clean up filthy city air and to help China become a global EV leader are having an effect. In December Shenzhen completed a switch to make its fleet of 16,500 buses electric. China is pushing other cities to do the same and, as more buy buses, battery and manufacturing costs are sure to fall. Peter Harrop of IDTechEX, a consultancy, reckons Chinese electric buses are on course to undercut diesel versions just on purchase price, and could soon flood the world.

The business case for smaller lorries and vans for local deliveries is also starting to stack up. These require smaller, cheaper batteries for shorter urban journeys and can be recharged at central depots. Britain's Royal Mail is testing larger trucks made by Arrival, a small British firm, and has a big fleet of electric vans. Daimler has begun delivering a few "eCanter" medium-sized trucks with a range of 100km to UPS, an express-package firm, and will make 500 more in the next two years. Delivery companies and mail services are also testing or deploying electric scooters, three-wheelers and

other smaller vehicles.

Electricity could also find its way to other sorts of vehicle. Mr Harrop anticipates strong growth in electric construction, agriculture and mining equipment as costs fall and emissions regulations tighten. There are other benefits. Construction vehicles that are silent could work around the clock. Even ride-on lawnmowers could become quieter and more reliable with batteries. Quiet refuse lorries would be just as welcomed by sleeping residents as the floats that used to deliver milk across Britain. ■



电动车

充电前行

成本下降带来了商用车电动化的前景

商用电动车一度在英国城镇司空见惯。2.5万辆电动送奶车曾穿行在清晨的街道上，投送国民早餐中不可或缺的部分。对送奶这桩任务而言，电动车续航里程短、最高速度低并不重要，几近无声的行驶却可以不惊扰客户安睡。超市扩张后，电动送奶车逐渐消失。不过，商业车辆的电动化正在重新加速。

电池技术的进步正在降低客运电动汽车的成本，提高其续航里程，这些进步同时也让商用车辆的电动化更具吸引力。目前，电动汽车的售价仍比同等的内燃机车辆高很多。但相比普通车主，企业更关注电动车的总体拥有成本以及转用电动车的其他考量。

电动重型卡车已经倍受关注。特斯拉已接到500辆电动重卡（如图）的订单。特斯拉以其一贯过度乐观的态度信誓旦旦地表示，一款续航里程为800公里的重卡会在2019年上路，售价18万美元——比同等的内燃机卡车贵出一半。戴姆勒、发动机制造商康明斯以及其他公司也在研发类似的卡车。然而在货运领域，电池很快取代柴油的可能性微乎其微。货运业利润微薄，电动化看起来并不划算。瑞银指出，美国的卡车满载重量可达40吨，通常其中有22.5吨是货物。即使到2022年，同等功效的电动系统也会根据续航里程不同而重达4到9吨，而柴油动力系统的重量为2吨。

电动系统挤占宝贵的货物空间已经够糟糕了。况且还有特斯拉动力系统的耐久性（内燃机寿命一般为100万英里，而电池退化快，可能行驶50万英里后就要更换昂贵的新电池。）以及城际线路上充电设施不足等问题。一段时间内，燃料成本降低和电动机更易维修保养这些好处还抵不过前期费用高和充电不便等劣势。

其他类型的大型车辆的电动化进程则快得多。公共汽车在短途固定线路上运行，其电池可以在首末站快速充电，因此可以比长途卡车的电池小很多。电动公交车虽然目前成本很高，但由于在中国的快速推广，有望很快发生改变。

为治理污浊的城市空气并帮助中国在电动车领域成为全球领军者，中国政府投入了高额补贴，而这正在显现效果。去年12月，深圳完成了16,500辆公交车的电动化转换。中国正在鼓励其他城市效仿，而随着更多城市购买电动公交车，电池及制造成本肯定会下降。咨询公司IDTechEX的彼得·哈罗普（Peter Harrop）认为，趋势是中国的电动公交车将在售价上低于柴油公交车，并可能很快充斥世界市场。

在本地送货的小型卡车和厢式货车的电动化也开始显现出商业可行性。城市短途运输所需的电池体积更小、更便宜，并且能够在中心站点充电。英国皇家邮政正在测试由英国小公司Arrival生产的大型卡车，而且已拥有一大批电动厢式货车。戴姆勒已经开始向快递公司UPS交付几辆续航里程为100公里的中型卡车“eCanter”，还将在未来两年里再生产500辆。快递公司和邮件服务业也在测试或配置电动踏板车、三轮车及其他小型车辆。

电力在其他类型的车辆上也有用武之地。哈罗普预计，随着成本降低、排放法规收紧，用于建筑、农业以及采矿的电动设备等都会出现强劲增长。好处不止这些。无噪音的建筑车辆可以夜以继日地工作。电池驱动的驾驶式割草机也能变得更安静、更可靠。睡梦中的居民会欢迎安静的垃圾车，就像过去遍布英国的送奶车那样。 ■



Motion sickness

The upchuck wagon

How not to feel queasy in a self-driving motor car

EXPECTATIONS are high, among those boosting the idea of self-driving cars, that people will be able to do other things, such as reading, working on a laptop or having a nap, when riding in such a vehicle. But for many that is an unlikely prospect. Apart from those who have no intention of even getting into an autonomous car, which currently amounts to some 23% of Americans, another 36% would be willing to ride but would not take their eyes off the road, according to a study published in 2014 by the University of Michigan. Some of those people will be looking out of the window because it helps to avoid nausea, dizziness and vomiting, particularly if they are among the 5-10% of the population who regularly experience the unpleasant symptoms of motion sickness.

Help, though, is at hand. The selfsame authors of the Michigan study, Michael Sivak and Brandon Schoettle, who both work for the university's Transportation Research Institute, have just been awarded a patent for a device that could act as a countermeasure against the malady.

Motion sickness is caused by a conflict between signals arriving in the brain from the inner ear (which forms the base of the vestibular system, the sensory apparatus that deals with movement and balance, and which detects motion mechanically), and from the eyes, which detect motion optically. If someone is looking at a stationary object within a vehicle, such as a magazine, his eyes will inform his brain that what he is viewing is not moving. His inner ears, however, will contradict this by sensing the motion of the vehicle. The resulting confusion, at least according to one theory, leads his brain to conclude that he is hallucinating because he has ingested

poison. Hence the need to throw up, to rid the stomach of any toxins.

The idea that Dr Sivak and Mr Schoettle have come up with is to arrange for an array of small lights to appear in the periphery of a potential sufferer's field of view, meaning that these lights can be seen regardless of what the person in question is looking at. Such lights, most probably small panels of LEDs, could be fitted into a headset, a hat or onto the frame of a pair of glasses. They would be controlled by various motion sensors and blink on and off in a way that is designed to mimic the velocity, rolling, pitching and other movements of a vehicle.

For the wearer of such kit, the effect would be to provide a visual response that corresponds to the movements the inner ear is detecting. So, for instance, a panel of LEDs positioned at the side of each eye might flash from the front to the back when a vehicle is moving forward but stop when it is braking. Similarly, the lights could blink in sequence towards the left if the car was turning left. The speed of the flashing and the brightness of the lights could be tuned to match the intensity of the movement, such as the vehicle's rate of acceleration. Dr Sivak and Mr Schoettle think the light arrays could also be fitted to various parts of vehicles' interiors, such as their door pillars, sidewalls and seats. That way a passenger would be aware of them without having to don special equipment.

The Michigan team are making a prototype and the university, which hopes to commercialise the idea, is in discussions with carmakers and automotive suppliers. The system could, of course, also be used by passengers who feel sick in cars with a driver at the wheel—a fate to which children seem particularly susceptible, for reasons that remain obscure. It might also help with other forms of motion sickness, such as airsickness or seasickness, although the ways aircraft and boats move are different from the movement of cars. For many, helping people feel well in cars would be enough. And for taxi companies like Uber and Lyft, which are planning to offer autonomous

vehicles that can be summoned by an app, the flashing lights could save a fortune in cleaning bills. ■



晕动病

“令人作呕”的车

乘坐自动驾驶汽车时怎样才能不犯恶心

那些致力推动自动驾驶汽车这一理念的人热切期望，人们在乘坐这种车时还可以做别的事，比如看书、用笔记本电脑工作，或者打个盹儿。但对很多人来说这不大可能实现。根据密歇根大学于2014年发布的一项研究，除去那些根本就无意乘坐自动驾驶汽车的人——目前约占美国人的23%，还有36%的人虽然愿意乘坐，但不会把眼睛从道路移开。这之中有些人会望向窗外，因为这能帮助避免头晕、恶心或呕吐。尤其如果他们属于人群中常出现晕动病不适症状的那5-10%，就更会往窗外看了。

不过，帮助近在眼前。上述研究的作者、供职于密歇根大学交通研究所的迈克尔·西瓦克（Michael Sivak）和布兰登·索特尔（Brandon Schoettle）发明的一种设备刚刚获得了专利，可能成为晕车的解药。

晕动病是大脑中来自内耳和眼睛的信号产生冲突所致。内耳是前庭系统这一应对运动和平衡的感觉器官的所在，通过机械的方式感知运动；眼睛则是通过视觉感知运动。如果一个人在车内注视一件静止的物品，比如一本杂志，他的眼睛就会传达给大脑：他正在看的这个物件没有移动。然而他的内耳却感觉到了汽车的运动，这就与眼睛传达的信息产生了冲突，从而造成混乱。起码有一种理论认为，这种混乱会让大脑断定这个人是因为服用了毒药而产生了幻觉，因此他需要呕吐，好把胃中的毒素排出来。

西瓦克和索特尔的点子是在有可能晕车的乘客的视野边缘布置一组小灯，这样无论该乘客在看什么，视域内都会出现这些小灯。这种小灯（很可能会是LED光源阵列）可以安装在头戴设备、帽子或眼镜框上，由多种运动传感器控制，通过闪烁来模拟汽车的速度、摇摆、颠簸以及其他动态。

乘客佩戴该设备后，将会接收到与其内耳感知到的运动相一致的视觉响应。举例来说，当车辆行进时，两只眼睛旁边的LED光源阵列或许会自前

向后发光，在车辆制动时停止闪光。同样，如果车辆左转，小灯可能会依次向左闪烁。或许还可以通过调整闪光的速度及光的亮度，使它们与车辆运动的强度相一致，例如加速度。西瓦克和索特尔认为这种光源阵列还可以安装在车内的多个位置上，比如车门立柱、侧壁和座椅，这样乘客不用穿戴特殊装备就能察觉到光亮。

这个密歇根大学的团队正在制造该设备的原型。该校希望能将这一创意成果商品化，正与汽车制造商和汽车零部件供应商洽谈。当然，这一系统也可供那些在有人驾驶的汽车上感到不舒服的乘客使用——小孩子似乎尤其容易出现这种情况，原因尚不清楚。这个设备也许还可以帮助克服其他类型的晕动病，比如晕机或晕船，尽管飞机和船的运动方式与汽车的运动不同。对很多人来说，能让人们在车上感觉舒服些就足够了。优步和Lyft正筹划推出可以通过应用来召车的无人驾驶汽车服务，对这些出租车公司来说，这些闪烁的小灯说不定能节省一大笔清洗费用呢。■



Cancer investing

Hunting for a cure

Growing demand for cancer treatments prompts an investment boom

CANCER is a grim sort of growth market. By 2030 there will be over 22m new cases a year, up from 14m in 2012, according to the International Agency for Research on Cancer. But as the world marks World Cancer Day, on February 4th, scientists are speaking of a revolution in the battle to beat it. Money managers' ears have pricked up. Oncology investing is "hot".

The most straightforward way to invest in treating cancer is through shares in companies that sell blockbuster drugs. Alternatively, biotech indices track a basket of companies, of which typically 40% are oncology-related. Big Pharma now buys rather than builds much of its innovation. So backing oncology startups can be an especially lucrative (if risky) approach. According to CB Insights, a research firm, equity investment in cancer-therapeutics startups has grown from \$2bn in 2013 to \$4.5bn in 2017. Take Juno Therapeutics, founded in Seattle in 2013 to develop immunotherapy drugs. It was acquired on January 22nd by Celgene, a Biotech giant, for a whopping \$9bn.

Eric Schmidt of Cowen, an investment firm, believes that oncology offers "the highest returns on investment of any therapeutic category". Three developments explain the frenzy. First, demand for cancer treatments is rising as prevalence increases and the world's middle classes—who can afford insurance—expand. Between 2012 and 2016 the global costs of cancer-related treatments grew from \$91bn to \$113bn, according to IQVIA, a health-data firm. They are expected to rise to \$147bn by 2021.

Second, scientific progress, particularly around manipulating genes and

cells, has been astonishing. The pipeline of oncology drugs in clinical development has expanded by 45% over the past decade. Immuno-oncology (IO), whereby the patient's own immune system is used to attack cancerous cells, is particularly in vogue. Goldman Sachs, a bank, values the IO market at around \$140bn and, despite calling the field "overhyped", predicts it could grow by another \$100bn.

Third, cancer enjoys faster regulatory approvals than other diseases. As Christiana Bardon, of Burrage Capital, puts it, "patients are dying and they are dying now", so regulatory hurdles are lower.

But as with any hot commodity, the line between well-founded excitement and unfounded giddiness is thin. Andy Smith, from Edison Investment Research, points out that it is still early days for treatments like CAR-T (a specific type of IO). He worries about an "implied halo", comparable to the one that now benefits cryptocurrencies. Investments in oncology and in biotech more generally can also resemble cryptocurrencies in their wild price swings (see chart). Another risk is that new treatments, however brilliant, may never be cheap enough to sell. CAR-T could well be game-changing but only a handful of treatments (which cost around \$500,000 per patient) have reportedly been sold.

Iain Foulkes, director of research at Cancer Research UK (CRUK), a charity, worries that much of the welcome inflow of capital into cancer research is chasing similar opportunities. Rarer types of cancer may get neglected. Partnerships between investors and research institutes can help overcome this. A recently announced tie-up between Merck, a pharmaceutical giant, and CRUK is an example. The drug company will have the right to develop products from any discoveries made; CRUK will share in profits and royalties.

A surge in “ethical” investment, blending financial returns with doing good, will also help. One initiative is a \$550m Healthcare Innovations Fund, from Deerfield, an investment firm, a good chunk of the profits from which goes to underserved research areas. Another is a \$470m Oncology Impact Fund, raised in 2016 by UBS, a bank, for early-stage oncology research. A sizeable share of the profits go to neglected research areas and to improving access to cancer treatment in poor countries. Already, early successes have allowed the fund to “give back” \$2.5m. Its greatest potential lies in future royalties from drugs that make it to market.

Mark Haefele of UBS thinks drug companies should consider similar structures. He notes a desire among clients for more than just financial returns. But he adds that it starts with a compelling investment opportunity—and “few fields are as compelling right now as early-stage oncology.” ■



癌症投资

追逐解药

对癌症治疗的需求不断高涨，引发投资热潮

癌症是一个令人心情沉重的增长型市场。据国际癌症研究机构（International Agency for Research on Cancer）预测，到2030年，每年将会有2200万新增病例，而2012年为1400万。但在2月4日“世界癌症日”，科学家们探讨抗癌战争中将掀起一场革命。资金经理们竖起了耳朵，打探动向。肿瘤研究投资相当“火热”。

投资癌症治疗最简单的方法是买进销售明星药物的公司的股票。或者也可以购买生物科技指数，它们追踪一篮子公司，其中通常有40%都从事肿瘤治疗相关业务。大型制药公司的创新如今大多来自收购而非自行研发。因此投资肿瘤研究创业公司会是一条获利格外丰厚（当然也有风险）的途径。根据调研公司CB Insights的数据，对癌症治疗创业公司的股权投资已经从2013年的20亿美元增加到2017年的45亿美元。一个例子是2013年在西雅图成立的Juno Therapeutics。1月22日，这家研发免疫疗法药物的公司被生物科技巨头新基医药（Celgene）收购，成交价高达90亿美元。

考恩投资公司（Cowen）的埃里克·施密特（Eric Schmidt）认为，肿瘤治疗有着“所有治疗领域中最高的投资回报”。三个发展趋势导致了这一热潮。首先，由于发病率上升以及全球中产阶级人口（能付得起保费）增长，对癌症疗法的需求不断增长。根据医疗数据公司IQVIA的数据，2012年到2016年，全球癌症方面的治疗费用从910亿美元增加到了1130亿美元。到2021年，相关费用预计将达到1470亿美元。

其次，科学进步惊人，尤其在操纵基因和细胞方面。过去十年间，处于临床研发阶段的抗肿瘤药物已经增长了45%。利用病人自身免疫系统来攻击癌细胞的免疫肿瘤治疗（IO）研究正在如火如荼地展开。高盛估计免疫肿瘤治疗市场价值在1400亿美元左右，尽管它称这个领域被“炒过了头”，但

仍预测该市场将再增长1000亿美元。

第三，抗癌领域的监管审批要快于其他疾病。正如柏雷奇资本（Burrage Capital）的克里斯蒂安娜·巴登（Christiana Bardon）所说：“病人濒临死亡，他们正在死亡。”因此监管障碍较低。

但正如所有受追捧的商品一样，有理据的兴奋和无根据的忘乎所以之间的界线很模糊。爱迪生投资研究公司（Edison Investment Research）的安迪·史密斯（Andy Smith）指出，像CAR-T（免疫疗法的一种）这样的疗法还处于发展早期。他担忧的是“自带光环”的情况，加密货币如今正得益于这样的光环。对肿瘤治疗以及更广泛的生物科技领域的投资还可能重演加密货币经历的剧烈价格波动。另一个风险是，新疗法纵然高超，却可能始终无法将成本降到市场能接受的水平。CAR-T很可能是一种颠覆性的疗法，但据报道还只有少量付费治疗的案例（每名患者的花费在50万美元左右）。

慈善机构英国癌症研究中心（Cancer Research UK，简称CRUK）的研究主管伊恩·福克斯（Iain Foulkes）担心，癌症研究所需的资本投入大部分都在追逐相似的机会，不那么常见的癌症可能被忽略。投资者和研究机构之间的合作可以帮助解决这个问题。最近制药巨头默克公司（Merck）与CRUK之间的合作就是一个例子。默克将有权就任何研究成果开发新产品，而CRUK将分享利润和专利使用费。

兼顾财务回报与行善的“道德”投资渐渐盛行，这也会有所帮助。投资公司Deerfield发起了一个项目，设立了5.5亿美元的医疗创新基金（Healthcare Innovations Fund），基金利润的很大一部分将投入到投资不足的研究领域。瑞银集团在2016年也发起了一个项目，募集了4.7亿美元的肿瘤影响基金（Oncology Impact Fund），支持早期肿瘤治疗方面的研究。该基金相当一部分利润投向被忽视的研究领域，以及改善癌症治疗在贫穷国家的普及度。该基金如今已取得初步成功，带来了250万美元的回报。该基金最大的潜力来自未来上市药物的专利使用费。

瑞银集团的马克·哈费尔（Mark Haefele）认为制药公司应该考虑类似结构。他指出客户想要的不仅仅是财务回报。但他也补充说，首先还是要有吸引人的投资机会，而“目前没什么领域能像早期肿瘤治疗那样吸引人”。





University degrees

Time to end the academic arms race

As higher education expands, returns are falling. School-leavers need other options

THERE are plenty of good reasons for a young person to choose to go to university: intellectual growth, career opportunities, having fun. Around half of school-leavers in the rich world now do so, and the share is rising in poorer countries, too.

Governments are keen on higher education, seeing it as a means to boost social mobility and economic growth. Almost all subsidise tuition—in America, to the tune of \$200bn a year. But they tend to overestimate the benefits and ignore the costs of expanding university education. Often, public money just feeds the arms race for qualifications.

As more young people seek degrees, the returns both to them and to governments are lower. Employers demand degrees for jobs that never required them in the past and have not become more demanding since. In a desperate attempt to stand out, students are studying even longer, and delaying work, to obtain master's degrees. In South Korea, a country where about 70% of young workers have degrees, half of the unemployed are graduates. Many students are wasting their own money and that of the taxpayers who subsidise them.

Spending on universities is usually justified by the “graduate premium”—the increase in earnings that graduates enjoy over non-graduates. These individual gains, the thinking goes, add up to an economic boost for society as a whole. But the graduate premium is a flawed unit of reckoning. Part of the usefulness of a degree is that it gives a graduate jobseeker an advantage at the expense of non-graduates. It is also a signal

to employers of general qualities, such as intelligence and diligence, that someone already has in order to get into a university. Some professions require qualifications. But a degree is not always the best measure of the skills and knowledge needed for a job. With degrees so common, recruiters are using them as a crude way to screen applicants. Non-graduates are thus increasingly locked out of decent work.

In any case, the premium counts only the winners and not the losers. Across the rich world, a third of university entrants never graduate. It is the weakest students who are drawn in as higher education expands and who are most likely to drop out. They pay fees and sacrifice earnings to study, but see little boost in their future incomes. When dropouts are included, the expected financial return to starting a degree for the weakest students dwindles to almost nothing. Many school-leavers are being misled about the probable value of university.

Governments need to offer the young a wider range of options after school. They should start by rethinking their own hiring practices. Most insist on degrees for public-sector jobs that used to be done by non-graduates, including nursing, primary-school teaching and many civil-service posts. Instead they should seek other ways for non-graduates to prove they have the right skills and to get more on-the-job training.

School-leavers should be given a wider variety of ways to gain vocational skills and to demonstrate their employability in the private sector. If school qualifications were made more rigorous, recruiters would be more likely to trust them as signals of ability, and less insistent on degrees. “Micro-credentials”—short, work-focused courses approved by big employers in fast-growing fields, such as IT—show promise. Universities should grant credits to dropouts for the parts of courses they have completed. They could also open their exams to anyone who wants to take them, and award degrees to those who succeed.

Such measures would be more efficient at developing the skills that boost productivity and should save public money. To promote social mobility, governments would do better to direct funds to early-school education and to helping students who would benefit from university but cannot afford it. Young people, both rich and poor, are ill-served by the arms race in academic qualifications, in which each must study longer because that is what all the rest are doing. It is time to disarm. ■



大学学位

“学历军备竞赛”可以休矣

高等教育规模逐步扩大，回报却不断下降。中学毕业生需要其他选择

年轻人选择上大学有很多好理由：增长才智、就业机会、寻找乐趣。现在富裕国家大约一半的中学毕业生会进入大学，在贫困国家这一比例也在上升。

政府热衷于高等教育，视之为提高社会流动性和促进经济增长的手段。几乎所有的国家都提供学费补贴，在美国，这一补贴每年高达2000亿美元。但它们往往高估了扩大高等教育的益处，而忽视了其成本。很多时候，公共资金不过是在支持一种学历军备竞赛。

追求学位的年轻人越来越多，学位的回报便随之降低，对他们自己和政府来说都是如此。对于那些过去并没有学位要求的工作职位，雇主现在提出了要求，而这些工作并没有变得更难。为了能脱颖而出，学生们拼尽全力，进一步延长求学时间，延后工作来获得硕士学位。在韩国，大约70%的年轻劳动力有大学学位，而失业者中有一半是大学毕业生。许多学生在浪费自己的钱，也在浪费资助他们的纳税人的钱。

在大学教育上花钱通常受到一个理由的支撑——“毕业生溢价”，即大学毕业生比非大学毕业生赚得多。人们认为，这些个人所得累积起来对整个社会是一种经济推动。但毕业生溢价是一个有问题的计算指标。学位的一部分用处是给了大学毕业生求职上的优势，而这是以非大学毕业生的相对劣势为代价的。学位也向雇主传达了一个信号，表明求职者具备聪明和勤奋等综合素质——他们能考上大学就少不了这些。有些职业对资质有要求。但学位并不总是衡量工作所需技能和知识的最佳尺度。学位如此常见，结果成了招聘人员筛选求职者的一种简单粗暴的方法。结果，非大学毕业生越来越多地被那些体面的工作拒之门外。

无论如何，毕业生溢价只计算了赢家，而未包括输家。在发达国家，有三

分之一的大学生未能毕业。因高等教育扩张而得以入学的是那些能力最弱的学生，最有可能退学的也是他们。这些学生支付学费并牺牲工作机会来学习，但这对他们的未来的收入鲜有帮助。如果把退学者也计算在内，能力最弱的学生攻读一个学位的预期财务回报几乎趋近于零。在大学可能带来的价值上，许多中学毕业生都被误导了。

政府需要向中学毕业的年轻人提供更广泛的选择。它们应该从反思自己部门的雇佣方式入手。大多数政府坚持要求申请公共部门职位的人有大学学历，而在过去，护理、小学教师和许多公务员等职位都是由非大学毕业生担任的。政府应该寻求其他途径，让非毕业生证明他们拥有合适的技能，并让他们接受更多在职培训。

社会应提供更多途径，让中学毕业生在私营部门获得职业技能、展示就业能力。如果学校在颁发资质证书时变得更细致严谨，招聘人员就更有可能相信它们是能力的信号，也就不再那么执着于学位。在这方面，“微证书”带来了希望——这些就业导向的短课程已经获得IT等快速成长领域里的大雇主认可。大学应该给予退学者他们已经完成课程的学分。高校还可以将自己的考试向任何想参加的人开放，并向通过考试者颁发学位。

这些措施将更高效地让人们发展那些能提高生产率的技能，应该还可以节省公共资金。为了促进社会流动，政府最好将资金投入早期学校教育，并帮助那些能从大学获益但又负担不起开支的学生。在这场学历军备竞赛中，青年人无论贫富都深受其扰，每个人都必须花更多的时间求学，因为其他人都在这么做。是时候裁减军备了。 ■



Industrial property

Everything's bigger in Nevada

How a brothel owner created the world's biggest industrial park

PAST the neon lights of Reno and the cookie-cutter homes of neighbouring Sparks, the I-80 highway winds through a thinly populated expanse of arid hills and lunar valleys in Storey County. On one side of the road flows the Truckee River; on the other bands of wild horses forage for parched grass. Signs of civilisation are restricted to electricity pylons and the odd rundown farmhouse. The Wild Horse Saloon, a dark and smoky room connected to a legal brothel, is the only sit-down restaurant for miles. It is not an area that immediately seems conducive to hosting a business park. Yet Storey County in Nevada is home to the world's largest by some measures: the Reno Tahoe Industrial Centre (TRI). The park spans 104,000 acres in total—three times the size of San Francisco.

Near its eastern border hulks Tesla's "gigafactory", a gargantuan white structure where the company hopes to produce batteries for 500,000 electric cars a year. It already has nearly 5m square feet of operational space; when complete, the firm's founder, Elon Musk, expects it to be the world's largest building. In February 2017 Switch, a provider of data centres, opened the biggest in existence on its "Citadel Campus" in TRI. A few months later, Google snapped up 1,210 acres of land—enough to fit nearly 100 American football pitches. One executive whose company owns land in the park muses that no other bit of industrial America has a higher level of investment per square foot.

Demand for industrial property is rising nationally thanks to the strength of the economy and the boom in e-commerce. Long the ugly duckling of commercial property, warehouses and distribution centres are now

emerging as “beautiful swans”, according to a recent report by Jones Lang LaSalle (JLL), a commercial real-estate firm. The proportion of industrial property in America that is vacant has plunged from 10.2% at the start of 2010 to an all-time low of 5% at the end of 2017, notes Craig Meyer of JLL. Almost all new space is being built in parks that are pre-planned and pre-zoned, he says. Companies can get up and running quickly—standalone sites are rare. One of TRI’s anchor tenants calls TRI an “industrial wonderland” for the speed at which firms can move.

Yet the park might have served a rather different purpose. Along with a partner, Lance Gilman, an affable businessman whose uniform consists of cowboy hats, crocodile-skin boots and turquoise jewellery, purchased the land that now forms the TRI for \$20m from Gulf Oil in 1998. The oil company had planned to stuff it with big game and use it as a luxury hunting reserve before the price of oil plummeted and such indulgences were judged inappropriate. Mr Gilman’s idea was to pre-approve the land for industrial uses and sell tracts of it to firms wishing to build swiftly.

He recalls looking out at the park after the purchase, and thinking that it would take three generations to sell it all. He sold plots to small firms and some big ones, like Walmart, but during the Great Recession of 2007-09 sales dropped precipitously. During the lean years TRI relied in part on cash from another of Mr Gilman’s businesses: the brothel, called Mustang Ranch, that houses the Wild Horse Saloon. “Without Mustang Ranch, there might not be TRI,” Mr Gilman says from a red, faux crocodile-skin chair in an office at the bordello.

Things turned around in 2013. Representatives from Tesla flew in for a meeting. They had been scouring the country for a site for their battery plant but had not found anywhere that would allow them to build fast enough. How long would it take to get a grading permit (required when topography

is significantly altered), they asked? In jest, Storey County's community development director pushed a permit across the table and told the visitors to fill it out. The reality was not much slower: Tesla got its permit within a few days.

That initial deal raised TRI's profile. Switch, Google and eBay soon followed. Not long afterwards Mr Gilman began receiving cheques from companies wanting to buy land in the park without even touring it. They are often technology firms; a quarter of leasing demand for American industrial space comes from e-commerce companies wanting to expand operations. In January a firm deploying blockchain technology purchased 67,125 acres of TRI land. Out of the 104,000 acres, only a few hundred acres are still available. Gazing out at a cluster of busy warehouses from a hilltop in the park, Mr Gilman chuckles: "I guess I sold myself out of a job." ■



工业物业

内华达州啥都大

一名妓院老板如何创建了世界上最大的工业园

在穿过里诺市（Reno）闪烁的霓虹和毗邻的斯帕克斯市（Sparks）外形千篇一律的民宅后，80号州际公路蜿蜒进入斯托里县（Storey County）地广人稀的荒芜山丘和有如月球表面的山谷。公路的一边流淌着特拉基河（Truckee River），另一边，成群的野马在觅食干草。只有电力塔和零星的破败农舍显露出一些文明的迹象。

野马沙龙（The Wild Horse Saloon）里灯光昏暗，烟雾缭绕，与一间合法妓院相连，是方圆数英里内唯一可在店内用餐的餐厅。乍看之下，这不是个开办商业园区的好地方。然而按某些标准来衡量，内华达州的这个县拥有世界上最大的商业园区——里诺塔霍工业中心（TRI）。该园区总面积达104,000英亩，是旧金山市面积的三倍。

在靠近它东部边界的地方，坐落着特斯拉的“超级电池工厂”。这是一座巨大的白色建筑，特斯拉希望每年在此生产50万辆电动汽车的电池。工厂的作业区已接近500万平方英尺，特斯拉的创始人伊隆·马斯克预计，建成之后它将成为世界上最大的建筑物。2017年2月，数据中心提供商Switch在自己位于TRI内的“城堡园区”（Citadel Campus）开设了全球最大的数据中心。几个月后，谷歌购买了1210英亩土地，足以容纳近百个美式橄榄球场。一家在TRI拥有土地的公司的高管估计，这个园区每平方英尺的投资额创美国工业用地之最。

随着经济走强、电子商务蓬勃发展，美国全国范围内对工业物业的需求都在上升。商业地产公司仲量联行（JLL）最近的一份报告称，长久以来如同丑小鸭的商业地产、仓库和配送中心正在变身为“美丽的天鹅”。仲量联行的克雷格·迈耶（Craig Meyer）指出，美国工业物业的空置率已从2010年初的10.2%下降到2017年底5%的历史低点。迈耶说，几乎所有在建的新设施都位于预先做好规划和分区的园区内。孤立的新设施很少，这有助于

企业快速投入运营。由于企业可快速进驻和启动，TRI的一个主要租户将这里称为“工业奇境”。

然而，该商业园可能还起到了一个非常不同的作用。兰斯·吉尔曼（Lance Gilman）是一位平易近人的商人，他的标准装扮是牛仔帽、鳄鱼皮靴，搭配绿松石首饰。1998年，他和合作伙伴一起从海湾石油公司（Gulf Oil）那里以2000万美元的价格买下了现在变成了TRI的这块地。海湾石油公司原本打算在这里圈养大型猎物，发展高端狩猎区，后来油价下跌了，这样奢靡的嗜好就不太合适了。吉尔曼的想法是将这块地预批为工业用地，然后分块出售给那些希望迅速启动的公司。

吉尔曼回忆说，买下这块地后他眺望整个园区，觉得需要三代人的时间才能全部将其售出。他向一些小公司和沃尔玛这样的大公司卖了一些地，但2007年至2009年经济危机期间销量急剧下降。在不景气的那几年里，TRI一定程度上要靠吉尔曼的另一块生意来维持，那就是与野马沙龙相连的妓院“野马牧场”（Mustang Ranch）。吉尔曼坐在妓院办公室一张红色仿鳄鱼皮椅上说：“没有野马牧场，可能就不会有TRI。”

情况在2013年峰回路转。特斯拉代表飞到这里会晤。他们之前一直在全国各地为电池工厂寻找厂址，但没有找到任何能让他们快速投入建设的地方。他们问需要多久才能获得土地分级许可（大幅改变地貌时需要这个许可）。斯托里县的社区发展总监开玩笑地推过来一张许可证，说把它填了就好了。真实的过程也没比这慢多少：特斯拉在几天之内就拿到了许可。

这笔早期交易提升了TRI的知名度。Switch、谷歌和eBay很快随之而来。没过多久，吉尔曼开始收到连实地考察都没做就想在这儿买地的公司的支票。它们通常都是科技公司：美国工业物业租赁需求的四分之一来自希望扩大业务的电子商务公司。1月，一个正在部署区块链技术的公司在TRI购买了67,125英亩的土地。总面积为104,000英亩的园区如今只剩下几百英亩可供出售。站在园区的一个小山头上，吉尔曼望着一片繁忙的仓库笑着说：“卖来卖去，我想我把自己的工作都卖没了。”■



Engro

Thar's coal in the desert

Pakistan's biggest private-sector firm is betting on a fabled coal mine

PAKISTAN's enormous mineral wealth has long lain untapped. Since a 1992 geological survey spotted one of the world's largest coal reserves in Thar, a scrubby desert in the southern province of Sindh, prospectors have hardly dug up a lump. Among those to flounder is a national hero. Samar Mubarakmand, feted for his role in Pakistan's nuclear-weapons programme, has just shut the coal-gasification company he founded in 2010, when he vowed on live television to crack Thar.

Environmentalists, many from abroad, argue the reserve's 175bn-ton bounty should remain underground. They point out the coal is lignite—dirty, poor-quality stuff that, in adding to carbon emissions, increases the risk of climate change for Pakistan. Other critics note that by locking itself into coal, Pakistan may miss out on the plummeting price of solar energy.

To such qualms, the government offers three rejoinders. First, severe power shortages have long blighted the nation, and renewable sources cannot offer the daylong, year-round power it needs. Second, coal accounts for less than 1% of current generation, compared with 70% in neighbouring India and China. And third, domestic coal would allow the country to forgo expensive imports of the fuel for newly built power stations, a drain on fast-dwindling foreign-exchange reserves.

Enter Engro, Pakistan's largest private-sector conglomerate. The firm's reputation as a canny risk-taker dates to 1991, when employees bought out its parent company, Exxon, an American energy giant, in the first transaction of its kind in Pakistan. Today, as is common, a single

family—the Dawood clan—has a controlling stake. But it has not lost what analysts describe as its “saviour complex”, a desire to address national shortcomings through managerial talent and a balance-sheet plumped by sales of \$633m-worth of stakes in its fertiliser-and-food businesses in 2016. Lately that has meant a redoubled focus on energy and in particular on the puzzle of Thar.

Eight years ago Engro bought the rights to one of Thar's 13 blocks, containing 1% of the reserve (more than enough given the gargantuan size of the mine). To work on extraction, it formed the country's biggest ever public-private partnership, the Sindh Engro Coal Mining Company (SECMC), in which Engro digs and the state provides infrastructure. Relying on the state can break strong firms. Engro itself almost went bankrupt in 2012 after the government refused to honour a sovereign guarantee to provide gas to one of its fertiliser plants. Yet without similar government support, no other Thar block-owners have secured financing, leaving Engro's diggers, which began work last year, to move ahead.

The endeavour benefits from being in the group of infrastructure projects that make up the \$62bn China Pakistan Economic Corridor, a hoped-for trade route. Western banks shook their heads when approached about a coal project, so Engro has relied on Chinese financing. Analysts note an irony in China's promotion of coal abroad as it withdraws from the fuel at home. Handling the extraction at Thar is the China Machinery Engineering Corporation, a state-owned firm with expertise beyond Pakistan's reach.

Around 126 metres below the sands of Thar, with just 20 more to go, Engro's diggers can now almost touch their prize. When the coal is reached, as is expected in mid-2018, it will feed a pit-mouth power station constructed by Engro, and, in time, three others owned by partners in the SECMC. These stations will furnish around a fifth of the country's electricity for the next

50 years. The financial rewards could be vast. “All my richest friends are jumping up and down [because they did not get there first]”, says the boss of one big multinational construction business.

Hurdles remain, not least complaints from nearby villagers about the disposal of the vast quantities of wastewater from the mine on their ancestral grazing lands in the form of a reservoir. In reply, Engro stresses its social work in the surrounding district of Tharparkar, the poorest in Sindh, which includes the construction of several free schools. More self-interestedly, it is training locals to drive so they can man the dump trucks that trundle day and night around the mine. According to Shamsuddin Shaikh, chief executive of Engro Powergen, the conglomerate’s energy division, Engro also has its sights on Reko Diq, a gargantuan and long-stalled copper mine in Balochistan, the least developed of Pakistan’s provinces. To tap one of the country’s two largest and most niggardly mines is hard enough. Imagine cracking them both. ■



安格鲁公司 塔尔沙漠有煤

巴基斯坦最大的私营企业正押注于一个传说中的煤矿

巴基斯坦储量巨大的矿产资源一直未得到开发。1992年的一次地质调查在巴基斯坦南部信德省（Sindh）灌木丛生的塔尔沙漠（Thar）中发现了世界上最大的煤炭矿藏之一，但勘探者至今都没有挖出一块煤来。一大批人一筹莫展，其中包括一位民族英雄。萨马尔·穆巴拉克门德（Samar Mubarakmand）因为对巴基斯坦核武器项目的贡献而备受赞誉，但他刚刚关闭了自己在2010年成立的煤炭气化公司，那一年他在电视直播中誓言要拿下塔尔。

环保人士——很多来自国外——认为这1750亿吨的资源应该被留在地下。他们指出，这些煤藏是污染严重、质量低劣的褐煤，会增加碳排放，加大巴基斯坦气候变化的风险。其他批评人士指出，巴基斯坦如果紧盯着煤炭不放，可能会错过太阳能价格暴跌的良机。

面对这些疑虑，政府从三方面做出反驳。首先，严重的电力短缺一直困扰着这个国家，而可再生能源无法全天、全年不间断地提供需要的电力。其次，煤电占当前发电总量的不到1%，而在邻国印度和中国，这一比例为70%。第三，国内煤炭可以让该国无需再为新建的发电站购买昂贵的进口燃料——进口燃料会耗尽本已在快速缩减的外汇储备。

巴基斯坦最大的私营企业集团安格鲁（Engro）登场了。早在1991年，该公司就获得了精明冒险家的名声。当时其员工从母公司美国能源巨头埃克森（Exxon）手中买下了控股权，这样的交易在巴基斯坦还是头一回。现在，与常见的情形一样，单个家族——达伍德（Dawood）——拥有控股权。但它并没有丢掉分析师们所称的“救世主情结”——它仍希望解决国家的弊病。而这主要倚赖两个方面：管理人才；通过2016年出售价值6.33亿美元的化肥和食品业务股份而充实起来的资产负债表。因此，这家公司最

近加倍关注能源领域，尤其是塔尔难题。

塔尔共分为13个区块，八年前安格鲁买下了其中一块的开采权，占总储量的1%（鉴于该矿藏的巨大规模，这一储量已相当可观）。为了进行开采，它建立了该国史上最大的公私合营企业——信德安格鲁煤矿公司（SECMC），由安格鲁负责开采，政府提供基础设施。对国家的依赖可以摧毁强大的公司。2012年，由于政府拒绝为它的一家化肥厂供气提供主权担保，安格鲁几乎破产。但是，没有类似的政府支持，其他塔尔区块的所有者都没有获得足够的融资，唯有安格鲁能向前迈进，于去年开工。

该工程因被纳入中巴经济走廊的基建项目而受益，这条规划中的贸易路线价值620亿美元。西方银行对找上门来的煤炭项目只会摇头，因此安格鲁依赖中国的融资。分析人士指出，中国在国内减煤，却在海外推动采煤，颇为讽刺。在塔尔负责开采的是国有企业中国机械设备工程股份有限公司，拥有巴基斯坦达不到的专业能力。

安格鲁的挖掘机现在已经下探到塔尔沙漠下深约126米处，再走约20米就能触碰到他们的战利品了——这预计将在2018年中实现，并开始为安格鲁建造的一个坑口发电站提供燃料，之后还可为SECMC的合作伙伴拥有的另外三个发电站供煤。今后50年这些电站将为全国提供大约五分之一的电力。经济回报可能非常之大。一家大型跨国建筑公司的老板说：“我那些最有钱的朋友都懊恼得直跳脚（因为他们没能抢先到那儿）。”

困难仍然存在，尤其是附近村民们的抱怨——对于在自己祖祖辈辈放牧的土地上建水库来处理大量煤矿废水，他们颇多怨言。安格鲁在回应时强调自己在信德省最穷的塔帕卡县（Tharparkar）周边开展社会福利工作，包括建立了几所免费学校。它还教当地人开车，这更多是从自身利益出发——这样他们就能驾驶着自卸卡车在煤矿周围日夜忙碌。集团的能源部门Engro Powergen的首席执行官沙姆斯丁·谢赫（Shamsuddin Shaikh）称，安格鲁还将目光投向了巴基斯坦最落后的省份俾路支省（Balochistan）一个庞大且长期停滞的铜矿Reko Diq。要开发该国两个最大又最“吝啬”的矿

藏中的一个就已经非常困难，想象一下要同时对付两个会如何。 ■



Wealth and inequality

Beginner's luck

A titan of Facebook considers his good fortune and decides that life is unfair

THERE are strokes of outrageous luck and then there is the life of Chris Hughes. Having found his way to Harvard from a small town in North Carolina, he chose Mark Zuckerberg for a roommate in his second year at university. Mr Zuckerberg quickly enlisted Mr Hughes and a few others to help in his social-networking side-project. Their ownership stakes in what became Facebook were soon worth incomprehensible sums of money.

Such extraordinary good fortune is liable to change a person's outlook. Mr Hughes's convinced him that the world economy is fundamentally unfair. His new book outlines a solution: a guaranteed minimum income, funded by increased taxation of the very rich. Though he makes an admirable case, the book is most interesting for the insight it provides into the mind of the author.

Support for guaranteed incomes is something of a fad in Silicon Valley, where many techies see them as bulwarks against unemployment caused by future technological advances. By contrast, Mr Hughes embraces a relatively modest approach designed to address inequality now.

It is rooted in his own life story. "Fair Shot" is as much a memoir as a manifesto—an endearing effort by the author to understand the meaning of his extraordinary circumstances. Mr Hughes was born to a travelling paper salesman and a maths teacher. His parents' diligence and thrift enabled them to give him a middle-class childhood and the opportunity to move up. Yet this sort of ladder-climbing is increasingly difficult in America, he writes. Hard work alone is no longer a sure route to prosperity. Those

blessed with high incomes also owe their success to luck.

Mr Hughes's chance friendship with Mr Zuckerberg is an example. Yet even Mr Zuckerberg was fortunate to have the hottest social network at just the moment global internet use exploded and tech giants established unassailable market positions.

Success might have convinced Mr Hughes of the value of his unique talents, had not life forced him to confront his limitations. After Facebook, he enjoyed another triumph as part of the digital team on the presidential campaign of Barack Obama. Confident in his golden touch, he bought the *New Republic*, a venerable but financially troubled magazine, in 2012. He thought he could make it profitable—and perhaps reinvent journalism in the process. The effort failed spectacularly, culminating in mass resignations. He sold out, humiliated, in 2016.

This failure seems to have reminded Mr Hughes of the contingency of success. It also convinced him of the virtue of measured idealism. Thus, his proposal for a guaranteed income is humbler than many others, though still extremely ambitious.

American adults living in households earning less than \$50,000 a year—and engaged in paid work, unpaid care work or education—should receive a monthly payment from the government of \$500, he argues. This benefit, which he estimates would cost \$290bn annually, should be funded primarily through a top marginal tax rate of 50% on incomes over \$250,000. Mr Hughes points to encouraging evidence on unconditional-income programmes in Alaska and east Africa, where cash grants appear to boost welfare and reported happiness without discouraging work. Initially, he acknowledges, payments might be more modest—\$100 or so per month, still enough to improve lives.

If the idea is economically appealing, it nonetheless feels like the sort of slapdash fix of which tech types are notoriously fond. The book has little to say about the political mobilisation needed for so dramatic a reform, an omission which echoes its strikingly terse explanation for why inequality exploded in the first place. From the 1970s businesses began lobbying for a lighter regulatory touch, Mr Hughes says, which inaugurated an era of globalisation and financialisation. Yet he treats the rise of giant superstar firms as an inevitable, even necessary, consequence of technological change. Whether labour power must be restored—or the influence of giant firms curtailed—he does not say. ■



财富与不平等

新手有好运

Facebook的联合创始人反思了自己的好运气，认识到人生是不公平的

克里斯·休斯（Chris Hughes）的人生是由一连串好得出奇的运气成就的。他从北卡罗来纳州的一个小镇走入哈佛大学，在大二那年选了马克·扎克伯格当室友。扎克伯格很快就拉上休斯和其他几个人参与他的业余项目，打造社交网络。这就是后来的Facebook。不久，他们持有的股份就价值天文数字。

这种超乎寻常的好运往往会影响一个人的三观。休斯由此深信世界经济从根本上是不公平的。他的新书提出了一个解决方案：提高对顶层富人的征税，以此向大众提供最低收入保障。尽管他提出的观点令人钦佩，但书中最有意思的部分还是对他本人想法的展现。

对“基本收入保障”的支持在硅谷蔚然成风，许多IT人士认为这是一座堡垒，可以对抗未来技术进步导致的失业问题。相比之下，休斯主张用一种相对温和的方法来解决眼下的不平等问题。

这种想法源于他的人生经历。《公平机会》（Fair Shot）既是一部宣言，也是一本回忆录。作者追问自己的非凡境遇所蕴含的意味，令人感佩。休斯的父亲是一名经常出差的纸品推销员，母亲是数学老师。两人勤勉节俭，为儿子提供了中产阶级水平的童年生活和向上攀升的机会。然而，他写道，这样的跨阶层爬升在美国已经越来越难。只靠勤奋工作已经不能确保成功。高收入人群的成功也存在运气的成分。

休斯与扎克伯格偶然成为朋友便是一例。而连扎克伯格也少不了运气相助——他恰好在全球互联网使用呈爆炸式增长和科技巨头建立绝对市场地位的时机推出了最热门的社交网络。

如果后来的遭遇没有迫使休斯直面自身的局限，成功或许会让他确信自己

才华过人，足可成事。在离开Facebook后，他加入了奥巴马的总统竞选数字团队，再次尝到了胜利的滋味。2012年，对自己点石成金的能力满怀信心的休斯收购了享有盛名但陷入亏损的杂志《新共和》（New Republic）。他以为自己能扭亏为盈，甚至同时还会重塑新闻业，结果却一败涂地，最终杂志社员工大规模辞职。2016年，他颜面无光地出售了该杂志。

这次失败似乎提醒了休斯成功的偶然性，也使他深信理想主义也要保持限度。所以，他提出的基本收入保障的力度比许多类似的方案要小，但实现起来仍极其艰巨。

他认为，家庭年收入不足50,000美元，且从事带薪工作、无偿护理工作或在求学的成年人应由政府每月派发500美元的资助。他估计这项福利需每年支出2900亿美元，资金应主要来自对年收入超过25万美元的人按最高的50%边际税率征税。休斯列举了阿拉斯加和东非的无条件收入保障方案鼓舞人心的成果，在这些地方现金补助看来提高了福利水平和幸福感，同时并未消减人们的工作热情。他承认，补助一开始可能会低一些，约为每月100美元，但仍可以改善生活。

这种想法虽然在经济上很有吸引力，但感觉仍像技术派一贯喜用的草率粗放的解决办法。书中几乎没提及开展如此激进的变革所需的政治动员。同样，该书对不平等现象爆发的起因也着墨甚微。休斯表示，上世纪70年代，商界就开始游说政府减轻监管力度，从而开启了全球化和金融化的时代。然而他把巨型明星企业的崛起视为技术变革无可避免甚至必然的结果。是否须重振工人的力量，还是应该削弱大企业的影响力？他并未置言。 ■



Economic and financial indicators

Defence budgets

Global defence spending as a share of GDP was just under 2% last year

Global defence spending as a share of GDP was just under 2% last year, according to the International Institute for Strategic Studies (IISS). America remains the biggest spender, China comes a distant second. Saudi Arabia still outspends them as a proportion of GDP—a staggering 11%. The biggest increase in spending was in Europe: it rose by 3.6% in 2017, in part thanks to American pressure to meet the NATO spending target, of 2% of GDP, and growing geopolitical threats, particularly from Russia. European investment in defence-related research and development is limited though: excluding Britain and France, BAE, Boeing and Lockheed Martin each spent more on R&D than individual countries there. ■



经济与金融指标

国防预算

去年全球国防支出占GDP的比例略低于2%

国际战略研究所（IISS）的数据显示，去年全球国防支出占GDP的比例略低于2%。美国的国防支出额度仍旧最高，远远超过位列第二的中国。不过就比例来说，沙特阿拉伯国防支出占GDP的比例高达11%，比美国和中国都要高。欧洲的国防支出增幅最大，2017年增长了3.6%。这在一定程度上是由于美国的施压，要求欧洲达到北约的国防开支目标，即占GDP的2%。愈演愈烈的地缘政治威胁——尤其是来自俄罗斯的威胁——也是一个原因。不过欧洲在国防相关的研发工作上投入有限：除去英国和法国，单是英国BAE系统公司、波音或洛克希德·马丁中任意一家的研发支出就高过欧洲任何一国的国防研发支出。 ■



Schumpeter

Chinese tech v American tech

Which of the world's two superpowers has the most powerful technology industry?

AMERICANS, and friends of America, often reassure themselves about its relative decline in the following way. Even if the roads, airports and schools continue to slide, it will retain its lead in the most sophisticated fields for decades. They include defence, elite universities, and, in the business world, technology. Uncle Sam may have ceded the top spot to China in exports in 2007, and manufacturing in 2011, and be on track to lose its lead in absolute GDP by about 2030. But Silicon Valley, the argument goes, is still where the best ideas, smartest money and hungriest entrepreneurs combine with a bang nowhere else can match.

Or is it? American attitudes towards Chinese tech have passed through several stages of denial in the past 20 years. First it was an irrelevance, then Chinese firms were sometimes seen as copycats or as industrial spies, and more recently China has been viewed as a tech Galapagos, where unique species grow that would never make it beyond its shores. Now a fourth stage has begun, marked by fear that China is reaching parity. American tech's age of "imperial arrogance" is ending, says one Silicon Valley figure.

China's tech leaders love visiting California, and invest there, but are no longer awed by it. By market value the Middle Kingdom's giants, Alibaba and Tencent, are in the same league as Alphabet and Facebook. New stars may float their shares in 2018-19, including Didi Chuxing (taxi rides), Ant Financial (payments) and Lufax (wealth management). China's e-commerce sales are double America's and the Chinese send 11 times more money by mobile phones than Americans, who still scribble cheques.

The venture-capital (VC) industry is booming. American visitors return from Beijing, Hangzhou and Shenzhen blown away by the entrepreneurial work ethic. Last year the government decreed that China would lead globally in artificial intelligence (AI) by 2030. The plan covers a startlingly vast range of activities, including developing smart cities and autonomous cars and setting global tech standards. Like Japanese industry in the 1960s, private Chinese firms take this “administrative guidance” seriously.

Being a global tech hegemon has been lucrative for America. Tech firms support 7m jobs at home that pay twice the average wage. Other industries benefit by using technology more actively and becoming more productive: American non-tech firms are 50% more “digitised” than European ones, says McKinsey, a consulting firm. America sets many standards, for example on the design of USB ports, or rules for content online, that the world follows. And the \$180bn of foreign profits that American tech firms mint annually is a boon several times greater than the benefit of having the world’s reserve currency.

A loss of these spoils would be costly and demoralising. Is it likely? Schumpeter has compiled ten measures of tech supremacy. The approach owes much to Kai-Fu Lee of Sinovation Ventures, a Chinese VC firm. It uses figures from AllianceBernstein, Bloomberg, CB Insights, Goldman Sachs and McKinsey and includes 3,000 listed, global tech firms, 226 “unicorns”, or unlisted firms worth over \$1bn, plus Huawei, a Chinese hardware giant.

The overall conclusion is that China is still behind. Using the median of the yardsticks, its tech industry is 42% as powerful as America’s. But it is catching up fast. In 2012 the figure was just 15%.

Start with Chinese tech’s weak spots. Its total market value is only 32% of the figure for America’s industry. While there are two huge companies and lots of small ones, there are relatively few firms worth between \$50bn and

\$200bn. China is puny in semiconductors and business-facing software. Tech products do not yet permeate the industrial economy: Chinese non-tech firms are relatively primitive and only 26% as digitised as American ones.

As for investment, Chinese tech's absolute budget is only 30% as big as that of American tech. And it is still small abroad, with foreign sales of 18% of the total that American firms make. Apple rakes in more abroad in three days than Tencent does in a year.

The gap gets much smaller, however, when you look at the most dynamic parts of the tech industry. In the area of e-commerce and the internet, Chinese firms are collectively 53% as big as America's, measured by market value. China's unicorns, a proxy for the next generation of giants, are in total worth 69% of America's, and its level of VC activity is 85% as big as America's based on money spent since 2016. There is now a rich ecosystem of VC firms buttressed by Alibaba and Tencent, who seed roughly a quarter of VC deals, and by government-backed funds-of-funds.

China is improving at "breakthrough" innovations. Take AI. China's population of AI experts is only 6% of the size of America's (if you include anyone of Chinese ethnicity this rises to 16%) and the best minds still work in the United States, for example at Alphabet. But now the number of cited AI papers by Chinese scientists is already at 89% of the American level. China has piles of data and notable companies in AI specialisms, for example Face++ in facial recognition and iFlytek in speech.

At the present pace China's tech industry will be at parity with America's in 10-15 years. This will boost the country's productivity and create tech jobs. But the real prize is making far more profits overseas and setting global standards. Here the state's active role may make some countries nervous about relying on Chinese tech firms. One scenario is that national-security

worries mean China's and America's tech markets end up being largely closed to each other, leaving everywhere else as a fiercely contested space. This is how the telecoms-equipment industry works, with Huawei imperious around the world but stymied in America.

For Silicon Valley, it is time to get paranoid. Viewed from China, many of its big firms have become comfy monopolists. In the old days all American tech executives had to do to see the world's cutting edge was to walk out the door. Now they must fly to China, too. Let's hope the airports still work. ■



熊彼特

中美科技大对决

这两个超级大国谁拥有最强大的科技产业？

面对美国的相对衰落，美国人以及美国的支持者通常以这种思路聊以自慰：虽然美国的道路、机场和学校状况持续变差，但它在高精尖领域的领先优势还会保持几十年。他们认为美国在国防和精英大学方面会继续占优，在商业领域则有科技这张王牌。虽说山姆大叔在2007年将世界第一出口国的宝座拱手让与中国，2011年制造业第一大国的地位也被中国取代，绝对GDP的领先地位也有可能在2030年前后失去，但这些人相信，硅谷仍旧集中了最优秀的创意、最明智的投资和最有抱负的企业家，成果之丰硕没有一个地方能与之匹敌。

真是这样吗？过去20年里，美国对中国科技产业拒不认可，这种态度经历了若干阶段的变化：先是认为它不值一提，之后有时会将中国公司视作山寨企业或产业间谍，再后来，美国眼中的中国成了科技领域的加拉帕戈斯群岛，独特的物种在其中生长，但却永远无法跨越海岸。如今又开始了第四个阶段：美国担心中国快要追上自己了。一位硅谷人士说，美国科技界充满“帝国式傲慢”的时代行将结束。

中国科技产业的领军人物很喜欢造访加州，还在那里投资，但是他们对这个地方不再心生敬畏。就市值来看，中国科技巨头阿里巴巴和腾讯与Alphabet和Facebook已在同阵营。一些企业新星也许会在2018到2019年间上市，其中包括召车服务平台滴滴出行、提供支付服务的蚂蚁金服和提供财富管理服务的陆金所。中国的电子商务销售额是美国的两倍，中国人的移动支付总额是美国人的11倍——美国人到现在还在写支票。

风投（VC）行业正在蓬勃发展。到访过北京、杭州和深圳的美国人被那里勤奋进取的创业精神深深折服。中国政府在去年制定规划，要在2030年成为人工智能（AI）领域的全球领导者。这项规划涵盖的内容包罗万象，

有打造智慧城市和开发自动驾驶汽车，还有设立全球科技标准。就像上世纪60年代的日本产业一样，中国私营企业高度重视这一“行政指导”。

美国凭借科技界全球霸主的地位获得了不少好处。科技公司为美国国内提供了七百万个工作岗位，薪资水平是平均工资的两倍。其他行业也因为更加积极地采用技术成果提高了生产率而受益。咨询公司麦肯锡指出，美国非科技公司的“数字化”程度比欧洲同类公司高出50%。美国设立了许多全世界都在遵循的标准，比如USB接口的设计，或者在线内容的发布规则。美国科技公司每年赚取的海外利润高达1800亿美元，比保有世界储备货币所带来的收益高出几倍。

一旦失去这些好处，不仅损失重大，还会挫伤锐气。这有没有可能发生呢？本专栏编制了十项指标，衡量究竟谁在科技界处于领先地位。此考量方法很大程度上要归功于中国风投公司创新工场的创办者李开复。方法采用的数字来自联博（AllianceBernstein）、彭博、CB Insights、高盛和麦肯锡，涉及3000家上市全球科技公司、226家“独角兽”即估值超过10亿美元的非上市公司，以及中国硬件巨头华为。

总的结论是，中国仍旧落后于美国。从各项指标的中值来看，中国科技产业的实力相当于美国的42%，但正在快速追赶。2012年时这个数字还只是15%。

先来看中国科技产业的短板。中国该产业的总市值只相当于美国科技产业的32%。中国虽然有两家巨头公司和大量小公司，但市值在500亿至2000亿美元的公司相对较少。中国在半导体及商用软件领域的实力十分微弱，科技产品也尚未渗透到行业经济之中：中国的非科技公司相对比较原始，数字化程度只相当于美国非科技公司的26%。

在投资方面，中国科技产业的绝对预算只有美国科技产业的30%，而且在海外的业务规模仍旧较小，海外销售额只有美国科技公司海外销售总额的18%。苹果在海外三天里赚到的钱比腾讯在海外一年赚到的都多。

不过从科技产业最具活力的部分来看，两者间的差距已大幅缩小。在电子

商务和互联网领域，以市值衡量，中国公司的总体规模相当于美国的53%。中国独角兽公司（衡量是否会出现下一代巨头公司的指标）的总市值相当于美国的69%。从2016年之后的投资规模来看，中国的风投活跃度已相当于美国的85%。阿里巴巴和腾讯几乎主导了四分之一的风投交易，在这两家公司以及有政府背景的组合型基金的扶持下，众多风投公司如今已构成了一个丰富的生态系统。

中国在“突破性”创新方面日益进步。以人工智能为例：中国人工智能专家的人数只有美国的6%（如果将此领域所有的华人专家都算上，这个数字会升至16%），而且最优秀的人才还是在美国工作，比如在Alphabet。不过，现在中国科学家被引用的人工智能相关论文数量已经达到美国的89%。中国拥有海量数据，一些拥有人工智能专门技术的公司也值得注意，比如人脸识别领域的Face++和语音识别领域的科大讯飞。

按现在的发展速度，中国的科技产业会在10到15年后赶上美国。这将会提高中国的生产率、创造更多技术工作岗位。不过真正有价值的成果还是大大提升海外利润，以及设立全球标准。在这些方面，中国政府在其中积极扮演的角色可能会令一些国家对依赖中国科技公司感到不安。也许会出现这样一种状况：出于对国家安全的担忧，中国和美国的科技市场将在很大程度上向对方封闭，结果其他各地便成为激烈厮杀的战场。通信设备行业便是这种局面。在世界各地都所向披靡的华为在美国却寸步难行。

硅谷确实该紧张起来了。从中国的角度来看，硅谷很多大公司都已成了志得意满的垄断者。换在过去，美国科技公司的高管如果想见识世界最尖端的科技，只要推开门到外面看看就够了。如今他们还得飞去中国瞧瞧。希望机场还能正常运转吧。 ■



Gender and work

The glass-ceiling index

Progress has been slow but steady

“PRESS for progress” is the theme of this year’s International Women’s Day on March 8th. As our sixth glass-ceiling index shows, disparity between countries remains wide. But women have made some progress towards equality in the workplace in the past year.

The index ranks the best and worst countries to be a working woman. Each score is based on average performance in ten indicators: educational attainment, labour-market attachment, pay, child-care costs, maternity and paternity rights, business-school applications and representation in senior jobs (in managerial positions, on company boards and in parliament).

Equality-conscious Nordics typically do well while workplace parity for women in Japan, South Korea and Turkey still lags badly. America under President Donald Trump rose from 20th to 19th place thanks in part to a higher female labour-force participation rate. This year Sweden ranks first, scoring well in female labour-force participation, which is over 80%, and the share of women in parliament (44%).

Women broadly lifted their presence in the workplace. There has been an increase in the share of women in the labour force, with a tertiary education and of those taking business-school entrance exams, which are a pipeline for senior executive jobs. Yet advances may be slower than expected. MSCI, a financial-data firm, has pushed back its estimate by a year to 2028 for when the global share of women on boards will hit 30% (the figure is now 17.3%).

Countries at the bottom of our index show signs of change in cultural

attitudes. Last year the Global Summit of Women, a business and economic gathering of over 1,300 leaders from 60-odd countries, was held in Japan for the first time. The #MeToo movement, a social-media campaign against sexual assault and harassment, arrived in South Korea with fervour. Allegations of inappropriate behaviour against senior prosecutors, *chaebol* owners and board members there have since come to light as more women are feeling empowered. ■



性别与工作

玻璃天花板指数

进展缓慢但稳定

“奋勇向前”是今年国际妇女节的主题。正如我们第六次发布的玻璃天花板指数所示，各国间的差异仍旧很大。但在过去的一年里，女性在职场平等方面还是取得了一些进展。

这一指数为各国职业女性的境况好坏打分。各国的得分是由10个指标的表现综合而来，它们包括：受教育程度、劳动市场参与度、工资、育儿成本、生产与陪产权利、商学院申请，以及担任高级职位的情况（进入管理岗位、公司董事会和议会）。

注重平等的北欧国家普遍表现较好，而日本、韩国和土耳其的女性职场平等情况仍严重落后。特朗普治下的美国从第20位上升至19位，一定程度上是因为女性劳动力参与率的提高。今年瑞典名列第一，在女性劳动力参与率（超过80%）和议会中女性比例（44%）上得分很高。

女性普遍提高了她们在职场上的影响力。劳动女性有高等学历的比例和参加商学院入学考试（这是高管职位的敲门砖）的比例都有提高。但进展也许低于预期。金融数据公司MSCI原本预计全球公司董事会中女性董事的比例会在2027年达到30%（目前为17.3%），现在已将这一预期推后到2028年。

在指数中排名靠后的那些国家在文化态度上有了改变的迹象。去年全球妇女峰会（Global Summit of Women）首次在日本举行，来自60多个国家的1300多位商业和经济领袖济济一堂。社交媒体上的反性侵和性骚扰运动#MeToo把火烧到了韩国。越来越多的女性受到了鼓舞，针对高级检察官、财阀老板和董事不当行为的控诉浮出水面。■



Women in the boardroom

Skirting boards

Quotas are spreading. But there are better ways to promote women

SINCE the days of the Vikings, when they farmed while men marauded, Norwegian women have played a big role in their community's economy. So it was fitting that, ten years ago, Norway pioneered a policy to deal with a stubborn gender gap: the dearth of women directors on company boards.

Amid objections from shareholders, Norway introduced compulsory quotas requiring stockmarket-listed companies to give women at least 40% of their board seats (up from less than 8% in 2002), or face dissolution. Critics, including this newspaper, decried mandatory quotas as the wrong way to promote women. But they have caught on. In Belgium, Germany and France women make up 30-40% of board directors in large listed firms, three to five times the share of a decade ago. In America, which has no quotas, representation has inched up to 20%. It is no surprise that companies follow the rules rather than face punishment. But does the spread of women in the boardroom justify the quota system itself?

The good news is that quotas have not borne out their critics' fears. Those who opposed them said the idea of token non-executives was demeaning for women, who would prefer to rise on the basis of merit rather than sex. It also jeopardised corporate governance, the sceptics warned, by putting women in positions for which they were possibly underqualified, or staffing several boards with the same clique of high-achievers—known disparagingly as “golden skirts”.

The evidence suggests otherwise. In large listed European companies “golden trousers” are almost as common: 15% of male directors sit on three

or more boards; 19% of women directors do. Compared with the clubby, white-maned boards of old, women bring youth and foreign experience.

Yet, the evidence so far also undermines the business case for quotas. Studies from at least six countries on companies' performance, decision-making and stockmarket returns fail to show that quotas make a consistent difference, good or bad. That has not stopped pension funds lobbying for more inclusiveness. In Britain they are urging some listed companies to give women 30% of boardroom and senior-executive jobs.

That highlights a problem with boardroom quotas. They are a distraction from the task of advancing the prospects for women further down the career ladder—which really could make a difference to women and the companies that employ them. In Norway only 7% of the biggest companies have female bosses. In Britain, France, Germany and the Netherlands 80-90% of senior-management jobs are still held by men. In rich countries the median full-time wage for women is less than for men, because more women have lower-paid jobs. You might think that a larger number of women on boards would help right these imbalances. So far they have not.

The wrong response to this would be more mandatory prescriptions, such as quotas. The workplace is too complicated for that. At the very most they should be voluntary and temporary tools to accelerate progress, not permanent fixtures. Other proven policies are a better bet. Fathers should be encouraged to take parental leave, so that child-bearing does not harm a mother's chance of making it to the top. Variable working hours should become the norm. High-quality child care, and more accommodating school calendars, would help.

Time may yet prove that boardroom quotas are good for the business as a whole. So far, they have been a sideshow. The more important task is to make it easier for more women lower down the company to keep good jobs

and fight their way to the top on their own merits. ■



董事会里的女性

裙裾摇曳的董事会

配额制正流行，但还有更好的方法来晋升女性

在维京时代的挪威，男人征战掠夺，女人留守耕牧，自那时开始，挪威女性一直在社会经济中发挥着重要作用。难怪十年前挪威会率先推出政策，来解决性别差距中的一大顽固问题：公司董事会中女性董事稀少。

在股东的反对声中，挪威实行了强制性的配额制，要求上市公司的董事会把至少40%的席位留给女性（2002年女性占比不足8%），否则将被解散。包括本刊在内的批评者曾抨击强制配额是晋升女性的错误方式。但配额制如今已风靡各地。在比利时、德国和法国，大型上市公司董事会内的女性比例为30%至40%，是十年前的三到五倍。在没有实行配额制的美国，董事会内女性比例缓慢上升至20%。公司自然会遵从规定以免受罚。但是，女性董事比例上升就能证明配额制合理吗？

好消息是，配额制并未印证批评者的担忧。反对人士认为，女性更愿意依靠自身才能而非性别获得擢升，担任象征意义的非执行董事反而有辱她们的尊严。怀疑论者警告道，把女性放到她们可能并不胜任的位置上，或是让同一群顶尖女性（被贬称为“金裙党”）占据多家上市公司的董事席位，都会危害公司治理。

但证据表明并非如此。在大型欧洲上市公司中，“金裤党”几乎同样常见：15%的男性董事在三个或以上的公司董事会任职；女性董事的这一数字为19%。相对于以往白人男性抱团的董事会，女性董事往往能带来年轻活力和海外经验。

然而，目前这些证据同时也表明配额制的商业理据不足。在至少六个国家就公司业绩、决策制定及股票市场回报的研究表明，配额制未能带来持续的变化，无论是正面还是负面。这并未打消养老基金游说企业增加女性高层的热情。在英国，它们正敦促部分上市公司把30%的董事会席位和高层

职位给予女性。

这突显了董事会配额制的一个问题。改善女性在职场上晋升的前景对女性和她们的雇主都会产生积极的影响，然而配额制却是与这项任务相背离的。在挪威，只有7%的大公司由女性担任总裁。在英国、法国、德国和荷兰，80%到90%的高管职位仍由男性担任。在富裕国家，全职女性的工资中位数低于男性，因为女性更多从事较低薪酬的工作。你可能觉得让大量女性进入公司董事会能纠正这种不平衡，但目前为止并没有。

对此，如果再推行更多的硬性规定，如增加配额，会是一种错误的应对方
式。职场太复杂，不宜如此简单地处理。这类措施最多可被用作能加速进
程的自愿执行和临时性工具，而非永久性的解决办法。其他业经证明的政
策是更稳妥的选择。应鼓励男性休育儿假，这样女性在职场登顶的机会就
不会因育儿而受损。弹性工作制应成为常态。高质量的托儿服务及更灵活
的学校日程安排也会有所帮助。

也许时间会证明董事会配额制在整体上对商界有益。但到目前为止，它们
只是一出插曲。更重要的任务是要帮助更多中低层女性保住好工作，以及
创造条件让她们更容易凭自身才干力争上游。 ■



The state of the world

A future perfect

Because people can think logically, life will keep getting better, argues Steven Pinker in his exhilarating new book

TO ANYONE who reads a newspaper, this can seem a miserable world. Syria is still at war. Another lunatic has gone on a gun rampage in an American school. The tone of political debate can rarely have been as crass and poisonous as it is today.

Front pages are grim for the same reason that Shakespeare's plays feature a lot of murders. Tragedy is dramatic. Hardly anyone would read a story headlined "100,000 AEROPLANES DIDN'T CRASH YESTERDAY". Bad things often happen suddenly and telegenically. A factory closes; an apartment block burns down. Good things tend to happen incrementally, and across a wide area, making them much harder to film. News outlets could have honestly reported that the "NUMBER OF PEOPLE IN EXTREME POVERTY FELL BY 137,000 SINCE YESTERDAY" every day for 25 years. But readers might get bored.

Negative news is one reason why people consistently underestimate the progress humanity is making, complains Steven Pinker. To discern the true state of the world, he says, we should use numbers. In "Enlightenment Now", he does just that. The result is magnificent, uplifting and makes you want to rush to your laptop and close your Twitter account.

The world is about 100 times wealthier than 200 years ago and, contrary to popular belief, its wealth is more evenly distributed. The share of people killed annually in wars is less than a quarter of that in the 1980s and half a percent of the toll in the second world war. During the 20th century Americans became 96% less likely to die in a car crash, 92% less likely to

perish in a fire and 95% less likely to expire on the job.

Mr Pinker's best-known previous book, "The Better Angels of Our Nature", showed that humankind has grown less violent. His new one demonstrates that steady, cumulative progress is occurring on many fronts. For this he credits the values of the 18th-century Enlightenment, summarised by Immanuel Kant as "Dare to understand!" By applying reason to problems, people can solve them—and move on to the next. Trade and technology spread good ideas, allowing rich countries to grow richer and poor ones to catch up.

Progress has often been stunningly rapid. The vast majority of poor Americans enjoy luxuries unavailable to the Vanderbilts and Astors of 150 years ago, such as electricity, air-conditioning and colour televisions. Street hawkers in South Sudan have better mobile phones than the brick that Gordon Gekko, a fictional tycoon, flaunted in "Wall Street" in 1987. It is not just that better medicine and sanitation allow people to live longer, healthier lives, or that labour-saving devices have given people more free time, or that Amazon and Apple offer a dazzling variety of entertainment to fill it. People are also growing more intelligent, and more humane.

In every part of the world IQ scores have been rising, by a whopping 30 points in 100 years, meaning that the average person today scores better than 98% of people a century ago. How can this be, given that intelligence is highly heritable, and clever folk breed no more prolifically than less gifted ones? The answer is better nutrition ("brains are greedy organs") and more stimulation. Children are far likelier to go to school than they were in 1900, while "outside the schoolhouse, analytic thinking is encouraged by a culture that trades in visual symbols (subway maps, digital displays), analytic tools (spreadsheets, stock reports) and academic concepts that trickle down into common parlance (*supply and demand, on average, human rights*)."

Mr Pinker contends that this braininess has moral consequences, since people who can reason abstractly can ask: “What would the world be like if everyone did this?” That is consistent with the observable spread of Enlightenment values. Two centuries ago only 1% of people lived in democracies, and even there women and working-class men were denied the vote. Now two-thirds of people live in democracies, and even authoritarian states such as China are freer than they once were.

Belief in equality for ethnic minorities and gay people has shot up, as demonstrated not only by polls (which could be biased by the knowledge that bigotry is frowned upon) but also by internet activity. Searches for racist jokes have fallen by seven-eighths in America since 2004. Those who enjoy them are dying out: online searches for racial epithets correlate with interest in “Social Security” and “Frank Sinatra”, Mr Pinker notes. Even the most conservative places are loosening up. Polls find that young Muslims in the Middle East are about as liberal as young western Europeans were in the early 1960s.

Many readers will find this bubbly optimism hard to swallow, like too much champagne. We may be materially richer, some will protest, but aren’t we less happy because we know that others have even more? We may have supercomputers in our pockets, but aren’t they causing an epidemic of loneliness among the young? And what about global warming or North Korea’s nuclear missiles?

Mr Pinker has answers for all these questions. In 45 out of 52 countries in the World Values Survey, happiness increased between 1981 and 2007. It rises roughly in line with absolute income per head, not relative income. Loneliness, at least among American students, appears to be declining. Global warming is a big threat, but not insurmountable. The number of nuclear weapons in the world has fallen by 85% since its peak.

The rise of populism challenges Mr Pinker's thesis. Supporters of Donald Trump, Brexit and various authoritarian parties in Europe tend to believe that the old days were golden, that experts can't be trusted and the institutions of liberal democracy are a conspiracy to enrich the elite. Some want to tear down these institutions and start again—which would at the very least interrupt the incremental progress that Mr Pinker champions.

Without downplaying the risks, he remains optimistic. The checks and balances that populists decry are reasonably effective in most rich countries and will outlast the current crop of demagogues. Supporters of populism will become disillusioned, or will simply die off. Mr Pinker draws especial comfort from the decline of faith. Worldwide, although 59% of people are religious, that share has fallen from nearly 100% a century ago. As people grow richer, he argues, they abandon the crutch of belief and rely more on reason.

Pessimism has its place—it fosters caution. And the human instinct to focus on problems is sound—it means they often get fixed. Nonetheless, Mr Pinker's broad point is surely right. Things are not falling apart. And barring a cataclysmic asteroid strike or nuclear war, it is likely that they will continue to get better. ■



世界形势

完美的未来

史蒂芬·平克在其振奋人心的新书中指出，因为人们能够理性思考，所以生活将持续向好

任何一个看报纸的人可能都会觉得自己身处一个悲惨世界。叙利亚仍饱受战火摧残。又有一个持枪的疯子在美国校园大开杀戒。几乎没有那个时候的政治辩论气氛像如今这样，粗野而又充满敌意。

报纸头版之所以充斥坏消息，跟莎剧满是谋杀是一个道理。悲剧才能震撼人心。没有谁会愿意看“昨天有十万架飞机没有失事”这种标题的新闻。不好的事情往往是突发的，且适于电视传播，像是一家工厂关门，一栋公寓大楼被烧毁。好事的发生常常是渐进的，覆盖的范围也很广，要以影像记录下来难度要大得多。媒体或许可以连续25年每天都如实报道：“生活在极端贫困中的人口较昨天减少了13.7万人。”但读者可能会腻烦。

史蒂芬·平克（Steven Pinker）抱怨说，人们一贯低估人类取得的进步，负面新闻是原因之一。他认为，要辨明世界的真实状况，我们应当运用数字。在《当下的启蒙》（Enlightenment Now）这本书中，他做的正是这件事，且成果卓然，令人振奋。读罢此书，恨不得立刻冲向笔记本电脑，注销自己的推特账号。

当今世界的富裕程度大约是200年前的100倍，而且与普遍的看法相反，财富分配也更趋于均衡。如今每年死于战争的人数不到上世纪80年代的四分之一，或相当于二战死亡人数的0.5%。上个世纪，美国人死于交通事故的可能性降低了96%，因火灾丧生的可能性降低了92%，因工伤死亡的可能性降低了95%。

平克在他最知名的上一本著作《人性中的良善天使》（The Better Angels of Our Nature）中论证了人类已不像从前那么暴力。在新书中，他阐明多个领域都在日积月累地持续取得进步。他将这归功于18世纪启蒙运动所倡

导的价值观，康德将它概括为“敢于知晓！”面对问题时运用理性，人们就可解决它们，进而去应对新的问题。贸易和科技将优秀的创意传播至各处，让富国愈富，穷国则能奋起直追。

人类进步的速度往往快得惊人。150年前，就算是范德堡（Vanderbilt）和阿斯特（Astor）家族也享受不到如今绝大多数美国贫困人口都享有的奢侈，如电力、空调和彩色电视机。1987年的电影《华尔街》中的大亨戈顿·盖柯（Gordon Gekko）手中的大砖头还不如今天南苏丹街头小贩用的手机。医疗及公共卫生的进步让人们更健康长寿，节约劳动力的设备让人们有了更多的空闲时间，亚马逊和苹果提供了让人眼花缭乱的娱乐方式来消磨时光。不仅如此，人们还变得愈加聪明、更有仁慈之心。

无论在世界何处，人们的智商分数都在不断上升，100年来竟提高了30分。也就是说，如今一个普通人的得分比一个世纪前98%的人都要高。要知道智力具有高度遗传性，而聪明人的生育率并不比资质较差的人更高，那么这一成就是如何取得的呢？答案是更好的营养（“大脑是非常贪吃的器官”），以及更多的激发。如今儿童上学的可能性远高于1900年，而在学校之外，人们身处的文化广泛采用视觉符号（地铁线路图、数字显示屏）和分析工具（电子表单、股票报告），各种学术概念也逐步渗透到日常语汇（“供求”、“平均”、“人权”），这就激发了人们的分析性思考。

平克声称，人们才智的增长具有道德影响，因为有能力进行抽象思维的人能够发问：“如果所有人都这么做，世界会怎样？”这与启蒙运动所倡导的价值理念的明显传播是相一致的。两个世纪以前，只有1%的人生活在民主国家，而就算是在那些国家里，女性和劳动阶级男性也没有投票权。如今有三分之二的人口生活在民主国家，而且即便是中国这样的威权国家也比从前更自由。

少数族裔及同性恋人士应享受平等对待的观念愈加深入人心。这不仅体现在民意测验中（测验结果可能存在偏误，因为人们明白固守偏见会遭人鄙视），人们在互联网上的行为也印证了这一点。在美国，2004年以来有种族歧视意味的笑话的搜索量下降了八分之七。喜欢这种笑话的人快要消

失了：平克发现，有种族侮辱性质称谓的网络搜索与对“社会保障”和“弗兰克·辛纳屈”（Frank Sinatra）感兴趣之间存在关联。即使是在最保守的地方，社会氛围也变得更宽松了。民调显示，如今中东年轻穆斯林的开放程度和20世纪60年代初期的西欧年轻人差不多。

对于这般亮眼的乐观，很多读者会觉得难以照单全收，就像无法灌下太多香槟一样。一些人会提出异议：我们在物质上也许确实是更富有了，但我们不也因为知道其他人比我们更富有，而变得更不快乐吗？我们口袋里或许揣着超级电脑，可它们不也使孤独如流行病般在年轻人中蔓延吗？我们对全球变暖和朝鲜的核武器又有什么办法？

平克对所有这些问题都给出了解答。世界价值观调查（World Values Survey）对52个国家的研究显示，有45个国家在1981年至2007年间提升了幸福感。幸福感大体随着绝对人均收入而非相对收入而上升。孤独的情况似乎也在逐步缓解，起码在美国的学生中是这样。全球变暖是一个重大威胁，但也并非无法攻克。世界核武器的数量已从顶峰期下降了85%。

民粹主义的兴起对平克的观点构成了挑战。支持特朗普、英国脱欧或欧洲各种威权政党的人倾向于认为过去的时光才美好，并认为专家不可信。他们还相信自由民主建制是一场阴谋，其存在就是为了养肥精英阶层。一些人想捣毁这一建制，另起炉灶——最起码，这会阻碍平克所拥护的渐进式进步。

平克并没有淡化这些危险，但他仍旧乐观。民粹主义者抨击的制衡机制在大多数富裕国家都相当行之有效，会比眼下这批煽动者的生命更长久。民粹主义的信众会幻灭或离世。宗教信仰的式微尤其让平克感到欣慰。虽然全世界范围内仍有59%的人信教，但这一比例在一个世纪前几乎达到100%。他指出，随着人们日渐富有，他们已不再仰仗信仰的支撑，而是更加依赖理性。

悲观也有用处：它会让人小心谨慎。人类出于本能总是紧盯着问题，这也是合理的一—这意味着问题常常会得到解决。然而，平克的大体观点无疑

是正确的。世界并不是快完蛋了。而且，除非发生小行星撞击地球或是核战争这样的灾难，世界很可能会继续变得更美好。■



The rise and fall of Anbang

Out with a whimper

China's government takes control of its would-be financial colossus

“WHEN it comes to the meaning of life, we will all return to zero one day.” So philosophised Wu Xiaohui, a Chinese tycoon, as he reflected on his success in 2015. Little did he realise how soon his words would be proved true. He founded his firm, Anbang, as a small car-insurance company just over a decade ago. By 2017 it ranked among the world’s biggest insurers, with some \$300bn of assets, including stakes in hotels and financial firms in America, Europe and Asia. But then, even more vertiginous than its ascent, came its fall. On February 23rd China’s government said it had taken over Anbang and would prosecute Mr Wu for economic crimes.

Rarely in corporate history has a giant grown and collapsed so quickly. But Anbang’s tale is also interesting for what it reveals about China’s economic landscape. It is the clearest demonstration that regulators are serious about defusing debt risks that have built up in recent years. And it reveals the murky political waters running through the financial system. As Xi Jinping, China’s president, consolidates his grip on power, these seem to be getting rougher.

On the surface, nationalising Anbang is a case of smart, preventive regulation. The insurance watchdog said it intervened because illegal operations had “seriously endangered” Anbang’s solvency. It did not spell out Anbang’s alleged offences, but two features of its business were problematic. The first was its method of raising cash. It sold high-yielding, short-term investment products disguised as insurance, turning what should have been the safest part of the financial system, the insurance sector, into one of the most dangerous.

The second was what it did with that cash. It was an aggressive, some say foolhardy, investor overseas. It paid \$2bn for New York's Waldorf Astoria hotel and \$6.5bn for hotels owned by Blackstone Group, the world's largest private-equity firm. When Mr Xi last year called for a crackdown on "financial crocodiles"—companies destabilising the economy with reckless borrowing and investment—Anbang's misery deepened. The regulator blocked its overseas deals, reined in its insurance business and detained Mr Wu.

Beneath the surface, though, there are political currents. The overseas investments of other high-flyers, notably HNA and Wanda, two of China's biggest private conglomerates, have also faced close scrutiny. They, too, are racing to sell assets to repay debts. But none has come under as much pressure as Anbang.

That may be because Anbang lacks defenders in high places. State-owned banks are some of the main creditors to HNA and Wanda, whereas Anbang has relied more on premiums from insurance sales. For a time, Mr Wu was backed by powerful princelings, as the descendants of revolutionary leaders are known. He was married to the granddaughter of Deng Xiaoping, China's revered former leader. Chen Xiaolu, the son of a military commander under Mao, was listed as a company director. Mr Wu was also reputed to have a close relationship with Xiang Junbo, the top insurance regulator during Anbang's rise.

But under Mr Xi, these connections appear to have frayed. In 2015 *Caixin*, a Chinese financial magazine, reported that Deng's granddaughter had separated from Mr Wu. Mr Chen distanced himself as well, saying he was merely an adviser. He died last week of natural causes. And early last year Mr Xiang, the regulator, was detained for corruption.

There will be three things to watch in the coming months. The first is

whether regulators can limit the collateral damage as they unwind Anbang's excesses. The stated goal is to manage the firm for one year, stabilise its operations and return it to private hands. The real goal, according to two executives with other insurers, is to pay off policy-holders and honour its debts by selling its assets. Although Anbang might have overpaid on its international forays, it bought into domestic banks and property developers when they were priced more cheaply. Its stakes in Minsheng Bank and China Merchants Bank, two of the country's top lenders, will be sought after by other insurers.

The second is the impact on the financial sector. With its reliance on short-term debt and undisciplined deal-making, Anbang's business model was inherently unstable. Closing the loopholes it exploited should put China's economy on a more stable footing. Credit Suisse, a bank, says that Anbang's rush to expand generated "irrational competition" in the insurance sector. Its takeover will help stop that.

Finally, there is the political backdrop. Mr Xi has warned many times that no one is immune from his crackdown on corruption. But princelings have, for the most part, been less affected. The question is whether Mr Wu's takedown is a sign that all tycoons, no matter how well connected, are now vulnerable—or whether his protection had simply evaporated. ■



安邦兴衰

悲泣出局

中国政府制服迅速成长中的金融巨鳄

“我想到生命的意义，我们都有归零的那一天。”2015年，中国金融大亨吴小晖回顾自己的成功经历时发出了这样的感悟。他万万没想到这么快就一语成谶。十多年前刚创立之时，安邦还只是一家做汽车保险的小公司，但到2017年已跻身全球最大保险公司之列，资产总值约达3000亿美元，其中包括对欧美和亚洲一些酒店和金融公司持有的股份。然而紧接着，安邦就迎来了比其跃升更令人晕眩的跌坠。上月23日，中国政府宣布已经接管安邦，吴小晖也因涉嫌经济犯罪被提起公诉。

纵观商界历史，巨头这般迅速生长而又转瞬崩塌的例子实属罕见。不过安邦这个故事的耐人寻味之处还在于它对中国经济局势的揭示。它极为清晰地表明监管机构动了真格，要着力化解近年来积聚的债务风险，也显示出中国金融体系内政治暗流涌动。随着中国国家主席习近平进一步巩固自身权力，暗流似乎正变得愈加汹涌。

表面上，接管安邦是英明的防范性监管举措。保监会表示，之所以出手干预是因为非法经营已经“严重危及”安邦的偿付能力。保监会未说明安邦涉嫌的具体罪行，但其业务存在两大问题。首先是筹集资金的方式。安邦出售伪装成保险的短期高收益投资产品，把本该是金融体系中最稳健部分的保险业变成了最危险的领域之一。

第二个问题是安邦对这些资金的使用。安邦的海外投资非常激进，有人指斥为鲁莽。该集团曾以20亿美元收购纽约的华尔道夫-阿斯托里亚酒店（Waldorf Astoria Hotel），还花费65亿美元收购全球最大私募股权公司黑石集团旗下的多家酒店。去年，习近平号召惩处“金融大鳄”（指大肆借贷、轻率投资从而破坏经济稳定的公司），令安邦更陷困境。保监会阻止安邦的海外并购交易，限制其保险业务，吴小晖也遭扣押。

然而在这之下还有政治暗流。其他巨头的海外投资项目也面临严密审查，特别是中国两大私营企业集团海航和万达。这些大集团也在竞相出售资产来偿还债务。但安邦所受的压力无人能及。

这可能是因为安邦朝中无人。海航和万达的主要债权人中有国有银行，而安邦更多是依靠保险销售所得的保费。吴小晖一度有强大的“太子党”即革命领袖的后代作后盾。他是备受敬仰的中国前领导人邓小平的外孙女婿。安邦的董事陈小鲁则是毛泽东手下将领陈毅的儿子。风传吴小晖还与在安邦崛起期间任保监会主席的项俊波关系密切。

但习近平掌权后，这些人脉似乎已不再稳固。2015年，中国财经杂志《财新》的报道称邓小平的外孙女已与吴小晖离婚。陈小鲁也撇清关系，称自己只是安邦的顾问。上周他因病去世。而去年年初，项俊波则因涉嫌贪腐遭拘押。

未来几个月将有三件事值得关注。一是监管机构在叫停安邦违规过度扩张的同时能否减低连带损害。官方宣称的目标是接管公司一年，待经营稳定后交还私人经营。但其他保险公司的两位高管表示，真正的目标是通过出售资产偿付投保人并偿还债务。安邦的海外投资也许是高位入市，但在国内，安邦却是在低位时投资银行和房地产开发商的。安邦在国内两大银行民生银行和招商银行的股份将受到其他保险公司的追逐。

第二是此事件对金融部门的影响。由于依赖短期债务和轻率的并购，安邦的商业模式本身就不牢靠。修补它所利用的漏洞应该能让中国的经济基础更加稳固。瑞信银行认为，安邦的大肆扩张导致保险业出现了“非理性竞争”。保监会接管将有助于遏制这种情况。

最后值得关注的是政治走向。习近平曾多次警告称其反腐运动“无禁区、全覆盖”。但太子党总体来说受影响较小。有待分晓的是，吴小晖的垮台是否表明了如今无论背景有多深，大亨们谁都难保无虞，还是说，这一切只不过是他个人的保护伞消失所致。 ■



Tariffs

The threat to world trade

The rules-based system is in grave danger

DONALD TRUMP is hardly the first American president to slap unilateral tariffs on imports. Every inhabitant of the Oval Office since Jimmy Carter has imposed some kind of protectionist curbs on trade, often on steel. Nor will Mr Trump's vow to put 25% tariffs on steel and 10% on aluminium by themselves wreck the economy: they account for 2% of last year's \$2.4trn of goods imports, or 0.2% of GDP. If this were the extent of Mr Trump's protectionism, it would simply be an act of senseless self-harm. In fact, it is a potential disaster—both for America and for the world economy.

As yet it is unclear exactly what Mr Trump will do (see Briefing). But the omens are bad. Unlike his predecessors, Mr Trump is a long-standing sceptic of free trade. He has sneered at the multilateral trading system, which he sees as a bad deal for America. His administration is chaotic, and Gary Cohn's ominous decision on March 6th to resign as the president's chief economic adviser deprives the White House of a rare free-trader, signalling that it has fallen into protectionist hands. Not since its inception at the end of the second world war has the global trading system faced such danger.

This danger has several dimensions. One is the risk of tit-for-tat escalation. After the EU said it would retaliate with sanctions on American goods, including bourbon and Harley-Davidson motorbikes, Mr Trump threatened exports of European cars.

The second danger springs from Mr Trump's rationale. The tariffs are based on a little-used law that lets a president protect industry on grounds of

national security. That excuse is self-evidently spurious. Most of America's imports of steel come from Canada, the European Union, Mexico and South Korea, America's allies. Canada and Mexico look set to be temporarily excluded—but only because Mr Trump wants leverage in his renegotiation of the North American Free-Trade Agreement, which has nothing to do with national security. Mr Trump is setting a precedent that other countries are sure to exploit to protect their own producers, just as spuriously.

It is not clear whether other countries can respond legally when national security is invoked in this way. This puts the World Trade Organisation (WTO) into a rat trap. Either Mr Trump will provoke a free-for-all of recrimination and retaliation that the WTO's courts cannot adjudicate, or the courts will second-guess America's national-security needs, in which case Mr Trump may storm out of the organisation altogether.

Mr Trump has lobbed his grenade as the WTO is already under strain. The collapse of the Doha round of trade talks in 2015, after 14 fruitless years, put needed reforms on hold indefinitely. Disputes that might have been swept into a new trade round have fallen to the WTO's dispute-resolution machinery, which is too slow and too frail to carry the burden. The WTO has not kept pace with economic change. Investment is increasingly tied up in intangibles, such as patents and copyright, rather than physical assets, such as steel mills. Rules drafted for rich, market-led economies cannot always police state capitalism. The implicit subsidies China gives its producers were a cause of global gluts in industrial metals. No wonder that the world's second-biggest economy has been the focus of so much anger.

Whatever the WTO's problems, it would be a tragedy to undermine it. If America pursues a mercantilist trade policy in defiance of the global trading system, other countries are bound to follow. That might not lead to an immediate collapse of the WTO, but it would gradually erode one of the foundations of the globalised economy.

Everyone would suffer. Mr Trump seems to think trade is a zero-sum affair, in which a deficit is a sign of a bad deal. But the vast improvement in living standards after the second world war went hand in hand with a rapid expansion in world trade over eight trade rounds, each of which lowered barriers. Imports are in fact welcome, because they benefit consumers and spur producers to specialise in what they do best.

Without the WTO, cross-border trade would continue—it is unstoppable—but the lack of norms and procedures would leave disputes to escalate. The fewer the rules, the more scope for mercantilist mischief and backsliding. Trade policy could be captured by special interests. Military power would hold greater sway in trade disputes than economic fair play. Transnational investment could drain away. As a vast continental economy, America would lose less from this than other countries. It would nonetheless lose a lot, including a pillar of the system that has underpinned its post-war political influence.

How should the world get out of this bind? Even as Mr Trump behaves with astonishing irresponsibility, others must keep their heads. Some may impose limited retaliation—that, after all, is how to treat bullies, and the threat to local manufactures will strengthen the hand of Republicans pressing Mr Trump to relent. But such action must be proportionate and limited. A tit-for-tat war with America would be disastrous.

The more important task is to shore up support for trade. It would be comforting to think there is global backing to fix the WTO. But just now, there is not. The only new trade deals on offer are regional, such as the Trans-Pacific Partnership (TPP), an 11-country pact signed this week that sets out to be a blueprint for trade modernisation. Although Mr Trump abandoned it, he has hinted he may reconsider, which would be a start.

The best way to help the WTO would be for its other members to co-ordinate

any action, including bringing in a WTO complaint about Mr Trump's tariffs. Even though that may burden the WTO's court, it would be a vote of confidence in the idea that the global economy should be governed by rules.

The world is a long way from the 1930s, thank goodness. Yet ignorance and complacency have put the trading system in grave danger. Free-traders need to recognise that the WTO can help keep markets open in the face of protectionist lobbying, at home and abroad. It is vital they make the intellectual case for rules-based trade. That will not be easy. For the first time in decades, their biggest foe is the man in the Oval Office. ■



关税

对世界贸易的威胁

基于规则的体系岌岌可危

特朗普不是第一个单方面加征进口关税的美国总统。自卡特以来，椭圆办公室的每一任主人都实施过一些贸易保护主义措施，通常是针对钢铁行业。特朗普誓言对钢铁征收25%的关税，对铝征收10%的关税，这本身也不会对经济造成什么损害：钢铁和铝仅占去年2.4万亿美元进口商品总额的2%，占GDP的0.2%。如果特朗普的保护主义到此为止，那只会是一种毫无意义的自残行为。但实际上，这对美国和世界经济都可能是一场灾难。

目前尚不清楚特朗普到底会做什么，但前景不妙。与历任美国总统不同，特朗普一直对自由贸易持怀疑态度。他对多边贸易体系嗤之以鼻，认为该体系令美国受到了不公正的待遇。他的政府混乱无序，而本月6日加里·科恩（Gary Cohn）又做出了一个让人感觉不妙的决定：辞去总统首席经济顾问一职。这下白宫内本就稀有的自由贸易支持者又少了一人，表明这届政府已成为贸易保护主义者的天下。全球贸易体系自二战后建立以来从未面临过这样的危险。

危险表现在几方面。一是以牙还牙的报复行动有升级的风险。在欧盟表示要对波本威士忌、哈雷摩托车等美国商品实施反制措施后，特朗普威胁要向欧盟出口的汽车征税。

第二个危险来自特朗普的行动依据。此番征收关税的依据是一项极少援引的法律：总统可以以国家安全为由保护工业。这个理由显然站不住脚。美国进口的钢材大部分来自它的盟友，如加拿大、欧盟、墨西哥和韩国。加拿大和墨西哥看起来暂时会得到豁免，但这只是因为特朗普希望在重新谈判《北美自由贸易协定》时有筹码在手，与国家安全毫无关联。特朗普开创了一个先例，今后其他国家势必效仿，以同样难以成立的理由来保护本

国生产商。

美国此番搬出国家安全的名义，其他国家是否可以诉诸法律仲裁目前尚不清楚。世贸组织（WTO）陷入了窘境。要么是特朗普将引发一场互相指责和报复的混战，令世贸组织的法庭无法裁决；要么法庭对美国的国家安全需求做事后批评，在这种情况下，特朗普可能会愤然退出该组织。

特朗普扔出这枚手榴弹之际，世贸组织本已承受重压。经过14年没有成果的会谈后，2015年多哈回合贸易谈判破裂，令必需的改革无限期搁置。一些争端本可能会进入新一轮贸易谈判，然而世贸组织的争端解决机制太过缓慢和脆弱，无法承担此重负。世贸组织没有跟上经济变化的步伐。投资越来越多地和专利、版权这样的无形资产联系在一起，而不是像钢铁厂这样的有形资产。为市场主导的富裕经济体制定的规则并不总能管制国家资本主义。中国向其生产商提供的隐性补贴是导致全球工业金属过剩的原因之一。难怪这个世界第二大经济体已经成为众矢之的。

无论世贸组织有怎样的问题，破坏它都将酿成一场悲剧。如果美国无视全球贸易体系，奉行重商主义的贸易政策，其他国家肯定会效仿。这可能不会导致世贸组织立即崩溃，但会逐渐侵蚀全球经济的一大根基。

谁的日子都不会好过。特朗普似乎认为贸易是一种零和活动，而赤字是糟糕交易的信号。然而二战后生活水平的巨大提高与世界贸易的快速扩张密切相关，推动这种扩张的八个贸易回合谈判中，每一回合都降低了贸易壁垒。进口商品其实是受欢迎的，因为它们使消费者受益，还会促使生产者专注于他们最擅长的产品。

如果没有世贸组织，跨境贸易仍将继续，毕竟这是不可阻挡的，但缺乏规范和规程将导致争端升级。规则越少，重商主义制造麻烦和倒退的余地就越大。贸易政策可能会被特殊利益集团把持。在贸易争端中，军事力量会比经济上的公平竞争更具影响力。跨国投资可能会流失。作为一个巨大的大陆经济体，美国的损失会少于其他国家。然而它还是会损失重大，包括支撑其战后政治影响力的体系中的一大支柱。

全世界应该如何摆脱这一困局？特朗普表现出惊人的不负责任之时，其他人必须保持冷静。一些人可能会采取有限的报复措施，毕竟对恃强凌弱者就是要反击，而对本土制造商的威胁也会让共和党人极力劝说特朗普放宽政策。但这类行动必须适度且有限度。对美国以牙还牙将会是一场灾难。

更重要的任务是加强对贸易的支持。如果全球都支持修整世贸组织，可能会让人稍感安慰。但现状并非如此。仅有的新贸易协议也是地区性的，比如《跨太平洋伙伴关系协定》（TPP），这个于本周签署的十一国协定将成为贸易现代化的蓝图。尽管特朗普之前放弃了这一协定，但暗示他可能会重新考虑，这可能会是个开始。

要帮助世贸组织，最好的办法是其他成员在任何行动上协调一致，包括向世贸组织投诉特朗普的关税政策。尽管这可能会给世贸组织的法庭带来负担，但这将会是一张“信任票”，表示各国相信全球经济应当受到规则的管理约束。

谢天谢地，我们离上世纪30年代已经很遥远了。然而，无知和自满让贸易体系岌岌可危。支持自由贸易的人士要认识到，在面对贸易保护主义的游说时，世贸组织有助于市场保持开放，无论是在国内还是国外。至关重要的一点是，他们得证明基于规则的贸易是有理有据的。这不容易。眼下他们最大的敌人就是椭圆办公室里的那个人。几十年来，这还是头一遭。





Schumpeter

Are China's state giants reformable?

Suspend your disbelief for a moment. Here is what China's technocrats say

AMONG investors it is fashionable to say that China's state-owned enterprises (SOEs) do not matter much any more and that entrepreneurs now power the world's second-largest economy. But China's SOEs are still hard to avoid. They account for 40% of its stockmarket and a third of its investment, and they dominate heavy industry. On the global stage, SOEs' appetites sway commodity prices and many are expanding abroad.

These empires of men and machines account for 45 cents of every dollar of debt in China, so their health determines whether the country's financial system will escape a crisis or blow up. And SOEs have become a loaded gun on the negotiating table between China and America. Treasury officials argue that China has broken the promises it made upon joining the World Trade Organisation in 2001 about further liberalising its economy. According to one negotiator, it is "abusing the system" by subsidising SOEs which in turn rig markets, dump cheap exports abroad and deter foreign firms from winning market share in China.

Schumpeter is sympathetic to the complaints, but to hear the other side, he met the State-owned Assets Supervision and Administration Commission (SASAC), an agency at the heart of China's industrial deep state. It controls 100-odd of the largest SOEs. The overall impression is of an organisation that wants to modernise state firms, but which is struggling to reconcile goals that appear to be fundamentally contradictory.

Forty years ago most industries were government departments without proper book-keeping or independent regulators. Today 63% of SASAC's

portfolio is listed on the stockmarket. Reform was intended to make firms more efficient and responsive to market signals. In the 2000s it was possible to dream that China might eventually relinquish control of its SOEs.

But after the subprime crisis in 2008 things went in the other direction. China's stimulus programme led SOEs to expand and run up debts. Since Xi Jinping became China's leader in 2012, he has bossed about both SOEs and private firms. On February 22nd the state seized control of Anbang, a private insurer that is accused of fraud. Some reckon the Chinese government may have indirectly helped fund Geely's purchase of a 9.7% stake in Daimler, which was announced on February 24th. At least 30 SOEs listed in Hong Kong have changed their constitutions since 2016, to give the Communist Party a formal role in their governance. The top 60 listed SOEs, excluding banks, collectively trade at a lowly 1.2 times capital employed—suggesting investors are unsure if they are run for politicians or shareholders.

While SASAC is not explicit about it, it has three, conflicting, objectives: to boost profits and cut debts; to persuade foreigners that SOEs have more autonomy, and to cement the party's muscular role. According to SASAC, the Party wants to guide the conduct of SOE bosses but not micromanage. SASAC itself does not want to be responsible for firms' results, but wants to set the boundaries of strategy. So if PetroChina, an energy giant, bought an oilfield, for example, SASAC says it would not intervene, but if it tried to buy a goldfield it would. Likewise, SASAC caps the salaries of SOEs' top brass whereas it is relaxed about underlings' pay.

One option would be to copy Singapore. It has Temasek, an independent firm with holdings in "strategic" listed firms. Temasek is expected to maximise long-term returns and rarely meddles. SASAC replies that China's SOEs are too big for this structure to work well. The top 60, excluding banks, have a market value of \$1.5trn, seven times that of Temasek's holdings. SASAC argues that a Chinese Temasek, huge and with autonomy, would have

too much power (SASAC is also enormous but part of the government and subservient to it).

Is there any way to square the circle? SASAC's experiments fall into two buckets. In the first are less-than-convincing initiatives, such as changing SOEs' culture so that they allocate resources more like private firms. That is impossible to verify. It has promoted "mixed ownership" in which SOEs raise private capital. Last year China Unicom, a telecoms firm, raised \$12bn from a consortium that included Tencent and Alibaba. But Unicom, like most SOEs, already had private minority investors so it is not clear what has really changed. SASAC has also pushed for mega-mergers, such as that between Shenhua Group, a coal firm, and China Guodian Group, a power company. It is likely that such combinations cut costs, improve profits and lower debt. But they might also create a new class of monster SOEs with even more clout.

In the other bucket are SASAC ideas that could make some difference. It says that in "competitive" industries (including coal, steel, pharmaceuticals and construction) it will let its stake drop well below 50%. That could signal a willingness on the part of the state to concede some ground. And SASAC wants SOEs to find ways to expand abroad while containing political tensions. An example is ChemChina, which in 2016 bought Syngenta, a Swiss chemicals firm, for \$46bn. The deal was controversial and in order to convince customers and the Swiss that Syngenta is not run from the party's leadership compound, Zhongnanhai, ChemChina gave its target an unusual degree of autonomy—it will keep its headquarters in Basel and is to have independent directors.

SASAC has a hard task to sway critics. At the very least it should press SOEs to boost returns as a way of showing that they are not underpricing products or being subsidised. Total operating profits for the top 60 listed SOEs (excluding banks) have risen by 17% since 2016, according to Bloomberg

data, and leverage has stabilised. That is progress, yet returns on capital are still a dismal 5%, half the level expected of private firms. Mr Xi clearly sees business as an arm of state power. SASAC will therefore struggle to show the world that SOEs are free from interference. But demonstrating that they make commercial rates of return would help. ■



熊彼特

中国的国企巨人改得了吗？

把你的怀疑暂搁一旁，听听中国的技术官员怎么说

在投资者当中有种说法很流行：中国的国有企业已不再举足轻重，如今推动世界第二大经济体发展的是企业家。但你仍然难以无视这些国有企业。它们占据了中国股市市值的40%和投资额的三分之一，并主宰着重工业。在全球舞台上，它们的需求影响着大宗商品的价格，它们中有许多目前还在海外扩张。

这些充斥着人和机器的企业帝国占了中国债务的45%，所以它们的健康状况决定了中国的金融体系是会摆脱还是爆发危机。国企已成为中美谈判桌上一个火药桶。美国财政部官员认为，中国违背了2001年加入世贸组织时关于进一步开放经济的承诺。一位美方谈判代表表示，中国“滥用世贸体系”，对国企进行补贴，而国企转而操纵市场，将廉价产品倾销到国外，并阻止外国企业在中国争取市场份额。

本专栏记者对这些抱怨表示认同，但为了听听中方的意见，他探访了中国的国资委。国资委是在背后控制中国工业的核心机构，掌控着100多家最大的国企。该机构给人的总体印象是，它想实现国企的现代化，但却难以调和似乎从根本上相互矛盾的各个目标。

四十年前，大多数行业都是政府部门，没有健全的财务体系或独立的监管机构。如今国资委下属企业有63%都是上市公司。改革是为了提高企业的效率及对市场信号的反应能力。在本世纪的头十年，还可以梦想一下中国政府有朝一日会最终放弃对国企的控制权。

但2008年次贷危机爆发之后，趋势转向。中国的刺激计划导致国企扩张，债务累积。习近平自2012年接任中国领导人后，把国企和私企都纳入掌控。上月22日，政府接管了被控欺诈的私营保险公司安邦。24日，吉利宣布收购戴姆勒公司9.7%的股份，有人认为中国政府可能为吉利的收购提

供了间接的资助。2016年以来，已经有至少30家在香港上市的国企修改了公司章程，正式确立了共产党在公司治理中的地位。前60大上市国企（不包括银行）的总市值仅为资本总量的1.2倍，表明投资者不确定这些企业是为政客还是股东的利益服务。

尽管国资委没有明言，但它有三个相互冲突的目标：增加利润并减少债务、说服外国人相信国企拥有更多的自主权、巩固党的重要地位。国资委称，共产党想要引导国企管理层的行为，而不想管得太细。国资委本身并不想为企业的盈亏负责，但要为其战略划定范围。所以举例来说，如果能源巨头中石油收购了一个油田，国资委不会介入，但如果它试图收购一个金矿，国资委就要干预了。同样，国资委将设定国企领导的薪水上限，而不太会插手员工的薪酬制定。

有一种选择是效仿新加坡。新加坡政府拥有淡马锡——一家持有“战略性”上市公司的独立公司。淡马锡的目标是实现长期回报的最大化，很少干预企业的经营。对此，国资委的回应是中国的国企规模太大，不适合这种结构。不包括银行在内的前60大国企的市值总和为1.5万亿美元，是淡马锡控股资产的七倍。国资委认为，一个庞大而自主的“中国淡马锡”会拥有太多的权力（国资委同样规模巨大，但它隶属并听命于政府）。

有什么办法可以解决这个难题呢？国资委的改革尝试分为两种。首先是一些不那么令人信服的举措，比如改变国企文化，让国企在资源分配方面更接近私企。试验的结果无从验证。国资委一直在推动“混合所有制”，让国企引入私人资本。去年，电信公司中国联通从包括腾讯和阿里巴巴在内的财团那里融资120亿美元。但与大多数国企一样，联通本已拥有私人中小股东，因此不清楚真正的改变是什么。国资委还推动大型并购，例如煤炭公司神华集团和电力公司中国国电集团之间的大合并。这种合并可能会降低成本，提高利润，削减债务，但也可能会创造出一类影响力更大的新型国企巨兽。

国资委的另一种改革思路也许会带来一些真正的改变。国资委表示自己在“竞争性”行业（包括煤炭、钢铁、制药和建筑业）的持股比例将减至远低

于50%。这可能表示国家愿意做出一些让步。国资委希望国企能找到方法，在海外扩张的同时不刺激紧张的政治关系。中国化工就是一个例子，它在2016年以460亿美元收购了瑞士化工公司先正达（Syngenta）。这笔交易颇具争议，而为了让客户和瑞士政府相信先正达并不会接受中南海的指令，中国化工赋予了其收购目标不同寻常的自主权——保留在巴塞尔的总部，并拥有独立董事。

国资委要说服批评者绝非易事。最起码它应该督促国企提高回报率，以表明它们没有低价倾销或依靠政府补贴。彭博的数据显示，自2016年以来，前60大上市国企（不包括银行）总营业利润增长了17%，杠杆率也已趋于稳定。这算是进步，但资本回报率仍只有区区5%，仅为私企预期水平的一半。习近平显然将商业视为国家权力的一部分，因此国资委将难以向世界表明中国国企不受政府的干预。但是，证明国企的回报率可以合乎市场水平还是会有所帮助。 ■



The impact on industry

Selling rides, not cars

Carmakers, tech companies and ride-hailing firms are all fighting for a piece of the action

IF YOU WANT to buy a fully self-driving car, you may have to wait for another decade. Autonomous vehicles will initially be offered for sale not to private owners but to robotaxi-fleet operators, for two reasons. First, LIDAR sensors are still so expensive that, deployed in production cars, they would cost more than the rest of the vehicle put together. For AVs in a robotaxi fleet, that is less of a problem, because vehicles will be operating, and thus generating revenue, throughout the day, whereas private cars are in use only about 5% of the time.

Second, getting AVs to work safely and reliably is much easier if their geographical range is limited to places that have been mapped in fine detail, such as city centres. So your first ride in an AV will be in a vehicle you hail using an app, not one you own.

Waymo, Alphabet's AV effort, is testing a robotaxi service in Chandler, a suburb of Phoenix, and hopes to launch a commercial service later this year. Uber is operating driverless taxis in parts of Phoenix and Pittsburgh; users who hail a ride may find themselves being picked up by an autonomous car, supervised by an engineer (Uber gives riders the option to use an ordinary car instead if they prefer). Voyage, an AV startup, runs a robotaxi service in The Villages, a retirement community in San Jose, and is expanding to a second location, in Florida. Navya, a French startup, is operating an eight-seater autonomous shuttle bus in downtown Las Vegas, with three stops along a 1km (0.6 mile) route. It also has shuttles running in several other cities around the world, as does Easymile, a rival French firm. Large-scale

deployments of AVs are most likely to start with geofenced robotaxi services in parts of cities such as Singapore or Dubai, and then expand over several years, predicts Nikolaus Lang of BCG.

It is likely to be many years before AVs are cheap enough for individuals to buy them, and capable enough to operate outside predefined, geofenced areas. Meanwhile, the roll-out of cheap robotaxis in urban areas might encourage many young urbanites, who are already going off car ownership anyway, to abandon it altogether. The combination of ride-hailing and autonomous-driving technology confronts carmakers with “the most profound challenge to their business models in a century”, declares a recent report from BCG. That is why carmakers are now piling into ride-hailing and car-sharing services and pushing on with their own AV programmes. In an autonomous future where ownership is optional, they need to be selling rides, not cars.

This shift offers carmakers a big opportunity. The car market is worth around \$2trn a year globally, whereas the market for personal transport is worth as much as \$10trn, according to Morgan Stanley, a bank. But it also exposes them to new competitors, in the form of technology companies and ride-hailing networks. Some carmakers have launched their own mobility services; others may prefer to act as fleet managers, providing capacity for ride-hailing operators and charging them by the mile. Some will even make “white label” fleets badged with the name of a city or a ride-hailing network, rather than their own brand.

Robotaxi fleets running around the clock will generate predictable yields that will appeal to institutional investors. Turning themselves into asset managers for such fleets would be a logical step for carmakers, whose finance arms are already involved in fleet management, says David Lesne of UBS.

Pricing models for users will change, too: Uber is already testing telecoms-like monthly price plans in some cities, which include a certain number of rides or miles for a fixed price, just as a mobile calling plan offers a certain amount of calls, texts and data.

One big question is the effect of AVs on the number of vehicles sold worldwide per year, currently around 80m. Since most cars sit unused 95% of the time, switching to shared robotaxis that operate around the clock could greatly reduce the number of vehicles on the road. UBS reckons the global fleet size will halve by 2030 (see chart). But if robotaxis are in use 50% rather than 5% of the time, they will need to be replaced far more often, says Johann Jungwirth, chief digital officer of Volkswagen. So unless vehicle lifespans can be greatly extended, the number of new vehicles needed each year will rise.

Making vehicles reliably in large quantities is hard, as Tesla's production problems have shown. "The core expertise that we've had for decades is excellent manufacturing," says Ponz Pandikuthira, head of product planning for the European arm of Nissan. So even in a world of robotaxis, being a carmaker could still be a big business—just a different one from what it is today. After 130 years making hardware, says Mr Jungwirth, "we need to take software and services just as seriously." That requires taking on new staff, retraining, acquisitions and partnerships. AVs will also accelerate the switch to electric vehicles, which have fewer components and need fewer assembly workers.

It will not just be carmakers that change shape; so will cars. Just as early "horseless carriages" resembled horse-drawn carriages, without the horse, most autonomous vehicles today are ordinary cars, retrofitted to drive themselves. But take away the need for a steering wheel and pedals, and AVs can assume a much wider range of shapes and sizes; Volkswagen's Sedric

and the Mercedes-Benz F015 are pods in which passengers sit facing each other. Future AVs may need to allow for some physical separation of passengers to encourage people to share vehicles with strangers, says Karl Iagnemma of nuTonomy, while families might hail a different vehicle that lets everyone sit together.

All this is bad news for car dealers. Most are barely profitable now and make their money from car financing and servicing, so even a small shift from car ownership to shared robotaxis could hit them hard. Repair shops and partsmakers could also suffer, assuming AVs reduce the number of car accidents. Already, some parts suppliers are listing AVs as a threat to their future profitability in regulatory filings. Insurers would be hit hard by a fall in private car ownership and fewer accidents. Health-care providers and personal-injury lawyers would also suffer if there were fewer accidents, though few will feel sorry for them.

People who drive taxis, delivery vehicles and trucks are most directly threatened by AVs. Uber and Lyft say they will continue to need human drivers on some routes for years to come, but driving jobs might be redefined rather than abolished. Delivery drivers could be employed to manhandle large packages into customers' homes. Truck drivers might become overseers of platoons of vehicles travelling on highways. And AVs will create new jobs for remote fleet supervisors and mobile repair workers.

It already seems clear that AVs will cause the car industry and its adjacent businesses to change shape dramatically over the next couple of decades. But the consequences will not stop there. Like cars before them, AVs are sure to have far-reaching cultural and social effects too, most obviously in cities. ■



对行业的冲击

卖的是车票，不是车

汽车制造商、科技公司和网约车公司都在力求分一杯羹

你若想买一辆全自动驾驶车，可能还得等上十年。无人驾驶汽车一开始会被卖给机器人出租车（robotaxi）运营商而非私人车主，有两个原因：第一，激光雷达（LIDAR）传感器仍太过昂贵，部署在量产车中的成本比一辆车所有其余部分的总成本还要高。但对于机器人出租车队来说这就不是个大问题，因为它们从早到晚都在路上跑并产生收入，而私家车大约只有5%的时间上路行驶。

第二，如果能把无人车的行驶范围局限于城市中心这类已经被详细测绘的地区，要让它们安全、可靠地工作就会容易得多。所以，你第一次搭乘的无人车将会是用手机应用叫来的，而不是你自己的车。

Alphabet旗下的无人车公司Waymo正在凤凰城郊区的钱德勒（Chandler）测试机器人出租车，希望能在今年稍晚时推出一项商业服务。优步正在凤凰城和匹兹堡的部分地区运营无人驾驶出租车。用户在叫车后可能会发现来了一辆无人车，但会有一名工程师监控它（假如用户要求，优步也提供了普通汽车的选项）。无人车创业公司Voyage在圣荷西的退休社区The Villages推出了机器人出租车服务，目前在向位于佛罗里达州的第二个地点拓展业务。法国创业公司Navya正在拉斯维加斯市中心运营一种八人座无人驾驶通勤巴士，在总长一公里的行驶线路上共有三站。它在世界上几个其他城市也推出了这种通勤巴士服务。它的竞争对手、另一家法国公司Easymile也一样。波士顿咨询公司（BCG）的尼古拉斯·郎（Nikolaus Lang）预测，要大规模地部署无人车，最有可能是从在新加坡或迪拜等城市的特定地理围栏内运行的机器人出租车服务开始，在接下来几年里再进一步推广。

无人驾驶汽车要便宜到适合个人买，且有能耐在预先界定的、划定地理围

栏的范围以外的地区运作，很可能还需要许多年。与此同时，随着便宜的无人出租车队在都会区不断扩张，原本就已经不大想买车的城市年轻人可能会完全打消买车的念头。波士顿咨询公司近期的一份报告写道，网约车模式结合无人驾驶技术，让汽车制造商的商业模式“面临一个世纪以来最深刻的挑战”。这就是为什么如今汽车制造商争相进入网约车和共享汽车服务领域，还要奋力发展自己的无人驾驶项目。在一个无人驾驶的未来里，买车已经不是必须，那么这些公司要卖的就不是车而是车票了。

这种转变给汽车制造商带来了一个巨大的机遇。摩根士丹利的数据显示，目前全球汽车市场的价值约为每年两万亿美元，而个人交通市场价值高达10万亿美元。但汽车制造商也遭遇新的竞争对手：科技公司和叫车网络。一些汽车制造商已经推出了自己的出行服务，另一些则可能更倾向成为车队的管理者，为网约车运营商提供运力，按里程向它们收费。一些汽车制造商甚至将制造“贴牌”车队——这些车不再使用自家品牌，而是贴着某个城市或某个叫车网络的名字。

昼夜不停行驶着的机器人出租车队将产生可预期的收益，吸引到机构投资者。变身为这些车队的资产管理者将是汽车制造商迈出的合理一步，它们的金融部门已经在参与车队管理，瑞银的大卫·莱内（David Lesne）说。

对用户的收费模式也会改变。优步已经在一些城市里测试类似电信公司使用的月付计划：用户每月支付固定价格，可获得一定里程数或乘车次数，就像手机套餐包含特定的通话时长、短信数量和数据流量。

一大问题是无人驾驶汽车对全球汽车年销量的影响，这个数字目前约为八千万辆。既然大部分汽车在95%的时间里都停着不用，那么改用终日运转的共享无人出租车将极大减少路面上的车辆。瑞银估计到2030年全球汽车存量将减小一半（见图表）。但是，如果无人出租车有一半的时间（而不是5%）都在使用中，那么它们更换的频率就会大大提高，大众汽车的首席数字官约翰·容维尔特（Johann Jungwirth）说。因此，除非汽车的寿命极大地延长，否则每年需要的新车数量将会增加。

正如特斯拉的量产问题已经显现的那样，可靠地大批量生产汽车是有难度的。“几十年来我们拥有的核心专长是杰出的制造能力。”日产汽车欧洲分公司的产品企划主管庞斯·潘迪库提拉（Ponz Pandikuthira）说。因此，即便是在一个机器人出租车的世界里，汽车制造商仍可能拥有一笔大生意——只是和今天有所不同而已。容维尔特说，经过130年的硬件制造后，“我们需要同样认真地对待软件和服务”。这就需要雇用新人、再培训、并购及合作。无人驾驶汽车的扩张也会加快向电动汽车的过渡，而电动汽车的部件更少，需要的装配工人也更少。

将要变形的不仅是汽车制造商，汽车也一样。正如早期的“无马马车”的外形和马车没什么两样——只是没了那匹马，今天大部分的无人驾驶汽车都是改装普通汽车让它们能自行运转。但在不需要方向盘和脚踏板之后，无人驾驶汽车的形状和大小选择就可以多得多。大众Sedric和梅塞德斯·奔驰Fo15的外形接近一节火车车厢，乘客相对而坐。nuTonomy公司的卡尔·亚格涅玛（Karl Iagnemma）说，以后无人驾驶汽车可能需要在乘客之间留出一些空间，让大家愿意和陌生人拼车，而一家人出行时就要召一辆能让所有人挤在一起的车了。

上述种种对于汽车经销商而言都是坏消息。它们中大多数现在就已经很难赚到钱，主要靠汽车贷款和售后服务维持，因此，哪怕只是从买向共享机器人出租车迈出一小步，都会给它们沉重的打击。修车店和零部件生产商也会受到冲击——如果我们假定无人驾驶汽车会减少车祸的话。一些零部件供应商已经在监管申报材料中将无人驾驶汽车列为对自身未来盈利能力的一项威胁。私家车数量和车祸的减少也将重击保险公司。假如车祸真的减少，医疗部门和人身事故赔偿律师也会受影响——虽然没人会因此同情他们。

出租车、送货车和卡车司机是最直接受到无人车威胁的人群。优步和Lyft称，未来多年里它们的某些路线仍将需要人类驾驶员，但驾驶这项工作可能会被重新定义而非完全取消。送货司机的主要任务会变成把大件包裹搬进客户家中。卡车司机可能会变成高速公路上的车队监控者。无人驾驶汽

车还将创造出车队遥控员和流动维修员这样的新工种。

未来二三十年里，无人驾驶汽车将急剧改变汽车及相关行业的形态，这一点似乎已经很明确了。但其影响不止于此。正如其前身曾经所做的那样，无人车必将带来深远的文化和社会影响。这一点在城市最为明显。■



Urban planning

The new autopia

How autonomous vehicles will reshape cities

MODERN CITIES, PARTICULARLY in America, are habitats for cars as much as people, devoting huge amounts of space to roads and parking. “America is a great place to be—if you’re a car,” says Donald Shoup of the University of California at Los Angeles. The expectation that people should be able to drive anywhere, encountering little or no congestion on the way and parking at their destination, led to a splurge of construction in the 20th century. Urban freeways, commuter suburbs and mandatory parking requirements reshaped cities. Now AVs promise to transform them once again, undermining many car-centric assumptions made in the 20th century, opening up new possibilities and turning urban-planning debates upside down. “For the first time in a generation, we can really rethink what suburban development looks like,” says Alan Berger, a professor of urban studies at the Massachusetts Institute of Technology.

Simply put, building cities around cars increases congestion, discourages the use of public transport and encourages sprawl, all of which urban planners generally disapprove of. The odd thing is that AVs could either reverse or accelerate each of these trends. They could reduce or increase traffic; make affordable transport more or less accessible; and lead to denser cities or more sprawl. It all depends on the rules for their use, and in particular the pricing. AVs know exactly where they are at all times, which makes it much easier to introduce fine-grained road tolls and congestion charges based on time of day, traffic levels and so on. That makes them a powerful and flexible policy tool.

Start with congestion. A switch to shared robotaxis could increase vehicle

occupancy rates, reducing the number of vehicles needed to move people around and easing congestion. But low-cost robotaxis might also encourage more people to take more trips—the familiar problem of “induced demand” when road travel is cheap and easy. The roads could also fill up with autonomous delivery vehicles with nobody on board. The nightmare scenario, says William Riggs of the University of San Francisco, is that “we create another form of congestion—it just happens to be automated congestion.” But careful pricing of roads and rides should be able to prevent that. Some cities already have congestion-charging schemes of various kinds, or rules to encourage vehicle-sharing, such as dedicated car-sharing lanes. Some are starting to price access to kerb space, for example at airports. AVs would allow far more subtle forms of charging, taking account of time, place, vehicle type, number of riders, traffic levels and so forth, to maximise sharing and minimise congestion. “It will be that interplay that ensures we don’t end up with highly congested roads,” says Justin Erlich of Uber.

What about the impact on public transport? A study by UC Davis found that among Uber and Lyft riders in America, bus use fell by 6% and light-rail use by 3%. AVs would be cheaper, so they could draw even more people away from public transport and onto the roads. This might discourage further investment in public transport, which in turn could create more “transit deserts” where large numbers of people (typically the poor and the elderly) depend on public transport but get an inadequate service. The economics of robotaxis will work best in dense urban centres, says Mr Riggs, so “we could see social-equity implications around the fringes of cities.” But again, there is also a rosier scenario. Using AVs for the “last mile” to move people to and from railway stations could make public transport more viable in less densely populated areas. Some cities might also operate their own robotaxi fleets, or subsidise rides in poor neighbourhoods using toll revenues collected in rich ones.

The emergence of AVs helpfully coincides with a change in the structure of cities, says Shlomo Angel, an urban-studies expert at New York University. He argues that the monocentric model, with a centre surrounded by suburbs, is a thing of the past. In many large American and European cities, jobs are moving from downtown to the periphery, and workers increasingly commute from one suburb to another, rather than to and from the centre. His analysis shows that 75% of jobs in a typical American city are outside the urban centre. In European and Asian cities with dense public-transport networks this decentralisation is easier to cope with, but retrofitting the necessary infrastructure onto American cities would be too expensive. “American cities need door-to-door transport systems to get to work, and driverless cars will play this role beautifully,” says Mr Angel. Robotaxis hailed on demand promise to be a lot more efficient than privately owned vehicles, he says, and are well suited to the spatial structure of both present and future American cities. Mr Berger agrees. “It’s not affordable to build mass transit that goes from suburb to suburb,” he says. “The best solution I’ve seen in my career is the idea of shared autonomous vehicles.”

That raises the question of urban sprawl. On the one hand, a switch to shared AVs by urban dwellers could lead to denser cities as some of the space currently used for parking is reallocated to housing. New high-density housing is already being planned with pick-up and drop-off zones for ride-hailing vehicles, and fewer parking spaces. On the other hand, AVs could also encourage sprawl by making long commutes more acceptable, because riders will be able to work or even sleep on the move. “The biggest negative of suburban living is the driving and the amount of space that has to be devoted to cars,” says Joel Kotkin of Chapman University. By doing away with driving and making city centres easier to access, AVs will increase the appeal of suburban living. So it seems likely that AVs will make cities both denser and more spread out, depending on the road-pricing regime.

AVs could also make possible new kinds of suburbs, updating the 20th-

century dream of garden cities. “Over the last 100 years our landscape has been drastically altered by the automobile,” says Mr Berger. With AVs, “all the land we’ve given to the automobile can be put back into landscape and ecological functions.” By doing away with parking and using one-way, single-lane roads that loop through neighbourhoods, the area of paved surface can be reduced by 50%, he calculates. That means more space for plants, more biodiversity and better water retention, reducing the risk of flooding in the urban core. Suburbs will have enough space to generate their own solar power or grow their own food.

City centres will end up looking different, too. In effect, cities have banked a large amount of valuable real estate in the form of parking lots and garages, notes Peter Norton of the University of Virginia, and must decide how to spend their windfall. Housing is one obvious use; parks are another. Some streets could be reconfigured to more imaginative uses than high-volume thoroughfares, he suggests. In particular, some quieter streets could become spaces where pedestrians and slow-moving AVs share the roadway as equals, with neither having priority. This would mark a return to the way streets worked a century ago, before cars took over. “Streets should not just be roads for cars but places for people,” says Mr Shoup.

In retrospect, many drawbacks associated with cars in the 20th century arose from a failure to price their use properly. With appropriate pricing, AVs should be able to avoid many of those problems, giving urban planners and policymakers a much wider range of choices about how cities and transport systems could be structured. The challenge will be to choose wisely. ■



城市规划

自动化理想国

无人车将如何重塑城市

现代城市是人的栖息地，同样也是车的栖息地，在美国尤为如此。巨大的空间被划拨给了道路和停车场。加州大学洛杉矶分校的唐纳德·舒普（Donald Shoup）说：“美国是一个极好的地方——如果你是一辆车的话。”人们希望自己能开车到达任何地方，一路畅通无阻，到了目的地就有地方停车——这种期望引发了20世纪的建设狂潮。城市高速公路、通勤郊区和强制提供停车位的要求重塑了城市。现在，无人车必将再次改造它们，颠覆20世纪诸多以汽车为中心的假设，开辟新的可能性，为关于城市规划的辩论带去翻天覆地的变化。麻省理工学院城市研究教授艾伦·伯杰（Alan Berger）说：“这是一代人第一次真正重新思考郊区发展的面貌。”

简言之，围绕汽车建设城市增加了拥堵，阻碍了对公共交通的利用，促使城市扩张，所有这些都是城市规划人员普遍不赞成的。奇怪的是，无人车既可能扭转这些趋势，也可能令它们加速。它们有可能减少或者增加交通流量、使得平价出行更容易或者更不容易获得、让城市变得更密集或者进一步向外扩展。这一切都取决于其使用规则，尤其是定价。无人车始终都知道自己所处的位置，这使得我们很容易根据一天中的时间段、交通流量等因素来收取细分的道路收费和拥堵费。这使它们成为一种强大而灵活的政策工具。

先说拥堵问题。转用共享机器人出租车可以提高车辆的利用率，从而减少运送人员所需的车辆数量并缓解拥堵。但是，低成本的机器人出租车也可能鼓励更多人出行——当道路旅行便宜又便捷时，就会出现“诱发需求”的老问题。道路上还可能充斥无人驾驶的自主送货车辆。旧金山大学的威廉姆·里格斯（William Riggs）说，一种噩梦般的可能性是“我们又制造出了另一种形式的拥堵——只不过恰好是‘自动化’拥堵。”但是，审慎的道路收费和乘车定价应该能够防止这种情况发生。一些城市已经推出了各种拥堵

收费机制或鼓励车辆共享的规则，比如开辟共享车专用道。一些城市开始对机场等地的路边停车收费。无人车可以让收费方式变得精细得多，把时间、地点、车辆类型、乘客数量、交通水平等因素都计算在内，以最好地增加共享、减少拥堵。“要确保我们不会把道路弄得水泄不通，就得靠这种相互作用机制。”优步的贾斯汀·厄利克（Justin Erlich）说。

那么对公共交通的影响呢？加州大学戴维斯分校的一项研究发现，在美国的优步和Lyft用户当中，公交车的使用减少了6%，轻轨的使用减少了3%。无人车会降低出行成本，所以它们会把更多人从公共交通工具中吸引到道路上来。这可能会阻碍对公共交通的进一步投资，继而又会创造出更多“交通沙漠”，即在大量人群（通常是穷人和老人）依赖公共交通的地方却服务不足。里格斯说，机器人出租车的经济效益在人群密集的市中心会是最好的，所以“我们可能看到在城市边缘出现社会公平问题。”然而，事情同样有乐观的一面。使用无人车来解决往返火车站的“最后一英里”，可以让人口较少地区的人们更便捷地利用公共交通工具。一些城市还可能推出政府运营的机器人出租车队，或者用富裕社区的道路收费收入补贴贫困社区的乘车费用。

纽约大学城市研究专家舒洛莫·安吉尔（Shlomo Angel）说，无人车崛起之时，城市结构正好也在发生着一种变化，前者为后者提供了一种解决方案。他认为，以多个郊区围绕一个中心的单一中心模式已经成为过去。在美国和欧洲许多大城市，就业机会正在从市中心转移到周边地区，而劳动者越来越多地在两个区间通勤，而不是往返于郊区和市中心。他的分析显示，一个典型的美国城市中有75%的工作岗位不在市中心。在拥有密集公交网络的欧洲和亚洲城市，这种去中心化更易应对，但要在美国城市里改造所需的基础设施就太过昂贵了。安吉尔说，“在美国的城市里，人们需要门到门的交通系统去上班，而无人车将非常出色地扮演这一角色。”他说，按需使用的机器人出租车要比私家车高效得多，非常适合美国城市当前和未来的空间结构。伯杰对此表示赞同。“建造从郊区到郊区的大众交通工具是不经济的，”他说，“我在职业生涯中看到的最佳解决方案就是共享无人车。”

这带来了城市扩张的问题。一方面，城市居民转用共享无人车可能导致城市变得更密集，因为目前用于停车的一些空间将被重新拿来盖房子。新的高密度住宅已在规划中，它们划出了网约车的上下车区域，减少了停车位。另一方面，由于无人车乘客将能在路上工作甚至睡觉，长途通勤会变得更易接受，从而促进城市扩张。查普曼大学的乔尔·科特金（Joel Kotkin）说：“郊区生活的最大负面因素是开车以及必须留给汽车的大量空间。”有了无人车后，人们不再需要驾车，也更容易前往市中心，这就增加了在郊区生活的吸引力。因此，无人车既可能让城市变得更密集，又可能更向外扩散——取决于道路收费机制。

无人车也可能催生新型郊区，更新20世纪的花园城市的梦想。“过去一百年里，我们的景观已经被汽车彻底改变。”伯杰说。有了无人车，“我们划给汽车的所有土地都可以重新投入到景观和生态功能中。”他估算，通过取消停车位并使用环绕整个社区的单向单车道，铺设道路面积可以减少50%。这意味着更多的绿地空间、更多的生物多样性，以及更好的保水能力——从而降低城市核心区的内涝风险。郊区将有足够的空间建设太阳能发电或栽种自己的食物。

市中心也会大为改观。弗吉尼亚大学的彼得·诺顿（Peter Norton）指出，实际上，城市已经以停车场和车库的形式储备了大量有价值的房地产，它们必须决定如何使用这笔意外之财。住房是一个明显的用途，公园是另一个。他建议，一些街道可以改作更有想象力的用途，而不总是用作高运力的主干道。特别是一些比较安静的街道可被改建成由行人和缓慢行驶的无人车平等共享的空间——谁也不比谁更优先。这将标志着街道将回到一个世纪前尚未被汽车统治时的功能。舒普说：“街道不该只是让汽车使用的道路，它们也该是人的去处。”

回望历史，20世纪汽车的许多缺点源于未能恰当地对用车定价。通过适当的定价，无人车应该能够避免许多这类问题，极大地增加城市规划者和决策者在建构城市和交通系统上的选择。挑战在于如何做出明智的选择。■



Society

A different world

Foreseen and unforeseen consequences

ROAD TRIPS. DRIVE-THROUGHS. Shopping malls. Freeways. Car chases. Road rage. Cars changed the world in all sorts of unforeseen ways. They granted enormous personal freedom, but in return they imposed heavy costs. People working on autonomous vehicles generally see their main benefits as mitigating those costs, notably road accidents, pollution and congestion. GM's boss, Mary Barra, likes to talk of "zero crashes, zero emissions and zero congestion." AVs, their champions argue, can offer all the advantages of cars without the drawbacks.

In particular, AVs could greatly reduce deaths and injuries from road accidents. Globally, around 1.25m people die in such accidents each year, according to the WHO; it is the leading cause of death among those aged 15-29. Another 20m-50m people are injured. Most accidents occur in developing countries, where the arrival of autonomous vehicles is still some way off. But if the switch to AVs can be advanced even by a single year, "that's 1.25m people who don't die," says Chris Urmson of Aurora, an AV startup. In recent decades cars have become much safer thanks to features such as seat belts and airbags, but in America road deaths have risen since 2014, apparently because of distraction by smartphones. AVs would let riders text (or drink) to their heart's content without endangering anyone.

Evidence that AVs are safer is already building up. Waymo's vehicles have driven 4m miles on public roads; the only accidents they have been involved in while driving autonomously were caused by humans in other vehicles. AVs have superhuman perception and can slam on the brakes in less than a millisecond, compared with a second or so for human drivers. But "better

than human" is a low bar. People seem prepared to tolerate deaths caused by human drivers, but AVs will have to be more or less infallible. A realistic goal is a thousandfold improvement over human drivers, says Amnon Shashua of Mobileye, a maker of AV technology. That would reduce the number of road deaths in America each year from 40,000 to 40, a level last seen in 1900. If this can be achieved, future generations may look back on the era of vehicles driven by humans as an aberration. Even with modern safety features, some 650,000 Americans have died on the roads since 2000, more than were slain in all the wars of the 20th century (about 630,000).

To take advantage of much lower operating costs per mile, most AVs are almost certain to be electric, which will reduce harmful emissions of two kinds: particulates, which cause lung and heart diseases, and climate-changing greenhouse gases. Even electric vehicles, however, still cause some particulate emissions from tyre and road wear, and the drop in greenhouse-gas emissions depends on how green the power grid is. The switch to electric vehicles will require more generating capacity (UBS estimates that it will increase European electricity consumption by 20-30% by 2050) and new infrastructure, such as charging stations and grid upgrades. For urban dwellers, the benefits will be better air quality and less noise.

Whether AVs will be able to reduce congestion is much less clear. The lesson of the 20th century is that building more roads to ease congestion encourages more car journeys. If robotaxis are cheap and fast, people will want to use them more. Yet there are reasons to think that the roads would become less crowded. Widespread sharing of vehicles would make much more efficient use of road space; computer-controlled cars can be smart about route planning; and once they are widespread, AVs can travel closer together than existing cars, increasing road capacity.

What is certain is that riders who no longer have to drive will gain an

enormous amount of time that can be used to work, play or socialise. “Americans can take back a total of 30bn hours per year that they now spend driving, sitting in traffic or looking for a parking space,” says BCG.

Yet to think about AVs as a fix for the problems caused by cars is to risk falling into a familiar historical trap. This is exactly how people thought about cars when they first appeared: as a fix for the problems caused by horses. In the 1890s, big cities around the world were grappling with growing volumes of horse manure and urine and the rotting bodies of thousands of dead horses, spreading disease. In 1894 the *Times* of London famously predicted that by the 1940s every street in the city would be buried under nine feet of manure. By comparison, cars seemed clean and hygienic, a key reason why they were adopted so quickly in the 20th century. “Cars replaced something that was in many ways far worse,” says Donald Shoup of the University of California at Los Angeles. “But because of bad planning, they had unintended consequences.” What might follow from AVs?

Cars transformed retailing, giving rise to suburban malls with lots of shops and plenty of parking. AVs, combined with the rise of e-commerce, could transform it again. “The Walmart of the future might be fleets of vehicles ready to drop off anything that you might get at a Walmart,” says Peter Norton of the University of Virginia. Or you might order an AV to take you home from work, and arrange to have your groceries, or a meal, waiting for you when you climb aboard. And why should shops, restaurants or other facilities be fixed in place? Coffee shops or food stands could restock at a central depot and then migrate to business neighbourhoods in the morning and entertainment districts in the evening, suggests Chenoë Hart, an architectural designer at the University of California at Berkeley. Mobile shops selling items such as shoes, clothes or cosmetics could visit particular neighbourhoods on a regular schedule, or when hailed by a customer. “It gives us flexibility to reassign space,” says Ms Hart.

Carmakers are experimenting with delivery vehicles that draw up outside a customer's home, announce their arrival by text message and allow items to be retrieved from a locked compartment by entering a code. Low-cost deliveries using AVs could stimulate local production of all kinds of things, most notably food. Already, food-delivery services like UberEats, Deliveroo, Seamless and GrubHub have given rise to "ghost restaurants" that produce food for delivery only, centralising food production in a few kitchens. Cheap autonomous deliveries could make this kind of model more widespread.

Another possibility, says Johann Jungwirth of Volkswagen, is that restaurants or retailers might cover the cost of travel to encourage customers to visit them. Fancy restaurants might lay on luxury AVs to ferry sozzled customers home, as part of the cost of a meal. Retailers could offer to pay for shoppers' rides. Ride-hailing networks have a lot of customer data that could be used to target in-vehicle advertising. Hail an AV to go to one shop or restaurant, and you might see ads for a rival. Riders may be offered cheaper rides with ads or more expensive ones without them.

Self-driving vehicles could also deliver other services, letting you work out with your personal trainer on the way to the office or summon a hairdresser to your home. Toyota's e-Palette vehicles are boxes on wheels in different sizes that can be kitted out as mobile shops, offices or beauty salons. Moreover, AVs could give rise to new kinds of social activities, just as cars provided teenagers with new social opportunities. Ride-hailing networks might group together people with similar interests or friends in common when assigning rides. Or they might work with a dating app, pairing people up with a potential match when they take a ride. AVs might also function as mobile party venues, or double as sleeping pods on long trips, offering an alternative to hotels and low-cost airlines.

What unintended consequences might there be? One much-heralded benefit of AVs is that they will offer freedom and independence to people

who cannot drive cars: the very old, the very young and the disabled. Such vehicles are already ferrying around people in retirement communities, and one of Google's videos shows a blind man doing errands in an autonomous car. But AVs could also encroach on freedom by invading people's privacy. Robotaxi operators will chronicle their riders' every move, so they will end up knowing a great deal about them. Some taxis already record riders for security reasons; robotaxis will surely surveil both their passengers and their surroundings to protect themselves. Police investigating a crime will ask AVs in the vicinity what they saw.

If people no longer drive cars, one consequence may be new forms of segregation, notes Ms Hart. Access to some places may be restricted to certain riders or robotaxi networks, just as some online services are "walled gardens" or cannot be accessed on all devices. She thinks there may be a need for a physical equivalent of "network neutrality" rules, to ensure that all locations are equally accessible to all AVs. In authoritarian societies, AVs could be a powerful tool of social control.

AVs could also trigger a shortage of organ donors (many of whom are young people killed in car accidents) and a drop in smoking (more than half of all tobacco sales in America are made at petrol stations, which will vanish, notes Mr Evans). And if cars are no longer symbols of independence and self-definition for the young, other things will have to take their place. Like cars before them, AVs will change the texture of everyday life. ■



社会

别样的世界

已预见和无法预见的后果

公路旅行。驾车点餐窗口。购物广场。高速公路。飞车追逐。路怒。汽车以各种不可预见的方式改变了世界。它们给了我们巨大的人身自由，但反过来也让我们付出了沉重的代价。无人车从业者通常认为这种车主要的好处是减少了这些代价，特别是道路交通事故、污染和拥堵。通用汽车的老板玛丽·巴拉（Mary Barra）喜欢谈论“零车祸、零排放和零拥堵”。拥护者认为，无人车可以提供汽车的所有优点而消除了其缺点。

无人车尤其能够大大减少交通事故伤亡。据世卫组织统计，全球每年约有125万人死于车祸。它是15至29岁人口的主要死因，另有两千万至五千万人受伤。大多数事故发生在发展中国家，在那里无人车上路还需要时间。但是，无人车创业公司Aurora的克里斯·厄姆森（Chris Urmson）说，如果可以提前哪怕仅仅一年转向无人车，“就可以救下125万条命”。近几十年来，因为有了安全带和安全气囊等设备，汽车已变得安全得多，但是自2014年以来，美国道路死亡人数开始上升——显然是智能手机让人分了心。无人车能让乘客随心所欲地发短信（或喝酒）而不危及任何人。

无人车更安全的证据已经越来越多。Waymo的车辆在公共道路上行驶了400万英里，它们在自动驾驶时发生的唯一一次事故是其他车辆中的人造成的。无人车拥有超人的感知力，可以在不到一毫秒的时间内刹车，而人类驾驶员需要一秒左右的时间。但“比人强”是个很低的标准。对于人类司机造成的死亡，人们似乎有心理准备而更能容忍，但无人车必须几乎不出错才行。无人车技术开发商Mobileye的阿姆农·沙舒华（Amnon Shashua）表示，一个现实的目标是比人类司机强一千倍。这将使美国每年的道路死亡人数从4万减少到40人，上次达到的这一水平是在1900年。如果能够实现这一目标，我们的后代可能会把人类驾车的时代看做是一个

畸形的时期。即使拥有现代化的安全功能，自2000年以来，仍有约65万美国人死于车祸，超过了20世纪所有战争的死亡人数（约63万人）。

为让每英里运营成本大幅降低，大多数无人车几乎肯定是电动的，这将减少两种有害的排放物：导致肺和心脏疾病的颗粒物，以及导致气候变化的温室气体。然而，即使是电动汽车，仍然会因轮胎和道路磨损造成微粒排放，而温室气体排放量的下降则取决于电网的绿色程度。转向电动汽车将需要更多的发电能力（瑞银估计，到2050年欧洲电力消耗将增加20-30%）以及充电站和电网升级等新基础设施。对于城市居民来说，好处是空气质量更好，噪音更小。

无人车到底能不能减少拥堵就很难说了。20世纪的教训是，修更多路以缓解拥堵会鼓励人们更多开车出行。如果机器人出租车既便宜又快速，人们会希望更多乘坐这些车。但我们有理由认为道路会变得不那么拥挤。车辆的广泛共享可以大幅提高道路空间的利用效率；计算机控制的汽车可以智能地规划路线；一旦它们大规模铺开，无人车可比现有的汽车更为密集地行驶，从而提高道路运力。

可以肯定的是，不再需要开车的乘客将获得可用于工作、娱乐或社交的大量时间。“美国人每年可以拿回总计300亿小时原本花在开车、堵在路上或寻找停车位的时间。”波士顿咨询公司说。

然而，如果盼着无人车解决汽车引发的问题，就有可能陷入一个熟悉的陷阱。汽车刚出现的时候人们恰恰就是这么想的：它可以解决马引起的问题。19世纪90年代，世界各地的大城市都在疲于应付日益增多的马粪和尿液，以及会传播疾病的成千上万死马腐烂的尸体。1894年，伦敦《泰晤士报》提出了一个著名的预言：到20世纪40年代，伦敦每条街道都将被埋在9英尺的粪便之下。相比之下，汽车看起来干净卫生，这正是它在20世纪如此迅速普及的关键原因。“汽车取代了一个在许多方面都糟糕得多的东西，”加州大学洛杉矶分校的唐纳德·舒普（Donald Shoup）说，“但是由于计划不周，汽车也产生了意想不到的后果。”无人车又会带来什么呢？

汽车改变了零售业，产生了拥有许多商店和大量停车场的郊区商场。伴随着电子商务的兴起，无人车可能再次改变它。弗吉尼亚大学的彼得·诺顿

(Peter Norton) 说：“未来的沃尔玛可能是一个车队，随时准备送上你可在沃尔玛买的任何东西。”或者你可以叫一辆无人车送你下班回家，并在你上车前就安排好了食品杂货或餐点等着你。为什么商店、餐馆或其他设施要固定在一个位置呢？加州大学伯克利分校的建筑设计师切诺·哈特

(Chenoe Hart) 建议说，咖啡店或食品摊可以在中央仓库上货，然后早上前往商业区，晚上迁往娱乐区。销售鞋子、衣服或化妆品等物品的移动商店可定期访问特定的社区，或者由客户随叫随到。“这给了我们重新分配空间的灵活性。”哈特说。

汽车制造商正在试验可以停靠在客户家门口的送货车，到达时通过短信告知，并让客户输入代码来从锁定的车厢中取出物品。使用无人车的低成本送货可以刺激各种物品的本地生产，特别是食品。像UberEats、Deliveroo、Seamless和GrubHub这样的食品递送服务已经创造了只生产外卖食品的“鬼屋餐厅”，它们在几个厨房里集中生产食品。廉价的无人车送货可能会使这种模式更加普遍。

大众汽车的约翰·容维尔特 (Johann Jungwirth) 说，另一种可能性是餐馆或零售商可能会支付车费以鼓励顾客前往店内。高档餐厅可以安排豪华无人车将醉醺醺的乘客送回家，费用算进餐费。零售商可以许诺为购物者付车费。叫车网络拥有大量客户数据，可由此生成有针对性的车载广告。如果你叫一辆无人车去一家商店或餐厅，可能会看到其竞争对手的广告。乘客也许可以选择更便宜的有广告乘车，或更昂贵的无广告乘车。

无人车也可以提供其他服务，比如让你在前往办公室的途中与私人教练一起锻炼，或者将理发师叫到家中。丰田的e-Palette车就是放在车轮上的不同尺寸的盒子，可被装备成移动商店、办公室或美容院。此外，无人车可能会引发新的社交活动，就像汽车为青少年提供了新的社交机会一样。在安排乘车时，叫车网络可以将具有相似兴趣或共同朋友的人聚集在一起。或者它们可能会与约会应用合作，把可能合适的人在搭车时配上对。无人车也可作为移动聚会场所，或者在长途旅行时兼作睡眠舱，可作为酒店和

低成本航空公司的替代品。

可能会有什么意想不到的后果呢？无人车得到广泛宣传的一个好处，是它们将为不能开车的人——老人、幼儿和残疾人——带去自由和独立。已经有无人车在退休社区把人们运来运去，谷歌的一个视频中显示一名盲人利用无人车去办事。但无人车也可能因侵犯人们的隐私而危害自由。机器人出租车的运营商会记录乘客的一举一动，到头来就会对他们了如指掌。出于安全原因，一些出租车已经开始记录乘客；机器人出租车肯定会监视乘客和周围环境来保护自己。调查犯罪的警察会向附近的无人车询问它们所看到的情况。

哈特指出，如果人们不再开车，一个后果可能是新形式的隔离。某些地方可能仅限于某些乘客或机器人出租车网络通行，就像某些在线服务是“有围墙的花园”或无法在所有设备上访问一样。她认为可能需要类似于“网络中立性”的实体规则，以确保所有无人车对所有地点都有均等通行权。在威权主义社会里，无人车可能是社会控制的有力工具。

无人车也可能导致器官捐献者短缺（许多捐献者是在车祸中丧生的年轻人），以及吸烟率下降（埃文斯发现，美国全部烟草销量中，一半以上是在加油站卖出的，而这些销售量将会消失）。如果汽车不再是年轻人独立性和自我定义的象征，肯定会有其他东西来取代它的位置。像之前的汽车一样，无人车会让日常生活的质感大不一样。■



Implications for policymakers

Rules of the road

Smart regulation and smart technology must go hand in hand

REGULATING A COMPLEX new technology is hard, particularly if it is evolving rapidly. With autonomous vehicles just around the corner, what can policymakers do to ensure that they arrive safely and smoothly and deliver on their promise?

The immediate goal is to make sure that AVs are safe without inhibiting innovation. In America, experimental AVs are allowed on the roads in many states as long as the companies operating them accept legal liability. Chris Urmson of Aurora says American regulators have got things right, working closely with AV firms and issuing guidelines rather than strict rules that might hamstring the industry. “It’s important that we don’t leap to regulation before we actually have something to regulate,” he says.

At the other end of the spectrum, Singapore’s government has taken the most hands-on approach to preparing for AVs, says Karl Iagnemma of nuTonomy, an AV startup that has tested vehicles in the city-state. For example, it has introduced a “driving test” that AVs must pass before they can go on the road. This does not guarantee safety but sets a minimum standard. The city of Boston has done something similar, requiring AVs to be tested in a small region before roaming more widely.

Elsewhere, regulators have permitted limited testing on public roads but want to see more evidence that the vehicles are safe before going further, says Takao Asami of the Renault-Nissan-Mitsubishi alliance. “Simple accumulation of mileage will never prove that the vehicle is safe,” he says. Instead, regulators are talking to carmakers and technology firms to develop

new safety standards. Marten Levenstam, head of product strategy at Volvo, likens the process to that of developing a new drug. First you show in the laboratory that it might work; then you run clinical trials in which you carefully test its safety and efficacy in real patients; and if they are successful, you ask for regulatory approval to make the drug generally available. On this analogy, autonomous cars are currently at the clinical-trial stage, without final approval as yet.

What form would that approval take? Eventually, it will mean formal certification of vehicles capable of operating fully autonomously, so they can be offered for sale. But initial approval is likely to be granted to operators of specific robotaxi fleets, rather than vendors of particular vehicles, suggests Mr Levenstam, because fleet operators will monitor all vehicles closely to ensure and maintain safety. Even this will be a calculated risk. It is not possible to prove that a new drug is entirely safe, but the risk is worth taking because of the benefits the drug provides. It will be the same for AVs, he suggests. After all, the status quo of human-driven vehicles is hardly risk-free.

Mr Asami draws another analogy, with aviation. “Black box” data recorders and careful testing have enabled air transport to evolve, despite crashes, because passengers know safety is taken seriously. In fact, America’s National Transportation Safety Board (NTSB) has started applying its aviation expertise to autonomous vehicles. In many ways AVs are more complex than aircraft, says Deborah Bruce of the NTSB, because they are closely surrounded by other things that move in unpredictable ways.

But medicine and aviation have global (or at least regional) regulatory standards, whereas AVs do not. The current patchwork of regulation will have to be simplified if the technology is to be widely deployed. “Uniformity is the friend of scalability,” says Mr Iagnemma. Questions of insurance and liability will also have to be worked out. Amnon Shashua of Mobileye

worries that because of today's regulatory uncertainty, fatal accidents involving fully autonomous vehicles could plunge the industry into legal limbo, or kill it altogether. He has proposed a set of rules that define how a car should respond in all 37 scenarios in the 6m-entry accident database maintained by NHTSA, America's car-safety regulator, and would like to see these rules adopted as an open industry standard. That would absolve carmakers from making implicit ethical choices in their software while leaving room for innovation in other areas. Mr Iagnemma thinks it is a good start. Without such standards, he says, every company will develop its own way of translating the rules of the road, devised for humans, into a code that can be followed by machines.

The risk of a backlash seems real enough. A survey by Advocates for Highway and Auto Safety, a consumer lobby, found that 64% of Americans were worried about sharing the road with AVs. In another survey, by the Pew Research Centre, 56% of Americans said they would not ride in a self-driving vehicle (see chart). Seeing AVs in action will be an important element of building public trust. In cities where AVs are commonplace, drivers have got used to them. Uber, Waymo and others are also starting to provide robotaxi rides in limited areas, so people can discover that riding in an AV is thrilling for the first 30 seconds and then quickly becomes boring. "But that's the response we really want," says Noah Zych of Uber, because it means riders feel safe.

Assuming that AVs can be shown to be safe, regulators will face a second challenge: setting the rules around how and where they operate, and how they relate to other forms of transport. Fine-tuning of pricing will, in theory, let planners control congestion and promote equal access to mobility.

Governments wishing to encourage the adoption of robotaxi services could go further, restricting the use of private cars (Gothenburg, London, Milan,

Singapore and Stockholm already have congestion charges of various kinds) or banning them from some areas. That might be unpopular, and not just with car-owners. “I think there will be some real resistance to measures that compel people to use autonomous vehicles,” says Peter Norton of the University of Virginia. AVs could be seen as an Orwellian technology, an instrument of surveillance and social control.

Protesters might object by standing in front of AVs and blocking traffic. That could lead to calls for AV lanes to be fenced off, “thus making city streets even more inhospitable to non-motorists than they already are”, says Brian Ladd, author of “Autophobia”, a history of opposition to cars. But an unregulated introduction of robotaxis could also cause problems. Rival fleet operators might flood the roads with vehicles offering cut-price rides, making congestion worse.

Choices about transport and pricing are inescapably political in nature. How cities deal with them will depend on both economics and political dynamics, notes Justin Erlich of Uber. “We should be exploring lots of different policies in lots of different cities,” he says. Meanwhile, two principles can help.

The first is to consider AVs in the context of the wider transport system, and be clear about what role they are expected to play. AVs might be deployed as the primary means of transport in a particular area; or they could be used in “first mile, last mile” mode to ferry people to and from railway stations, filling mobility gaps and complementing other forms of transport.

The second principle is to be mindful of the balance of freedoms. AVs can potentially free people from driving, congestion, pollution and parking—but in return may require them to give up some other freedoms, such as the ability to take their own vehicle anywhere. In liberal countries,

AVs will be accepted only if people feel that they enhance freedom rather than reduce it.

A century ago cars raised fundamental questions about personal autonomy, freedom of choice and mobility. AVs will do the same again. But this time around, with the benefit of hindsight, there is a chance that they will be seen not simply as a new form of transport but as a technology with far-reaching social and economic implications. Driverless cars present an opportunity to forge a new and better trade-off between personal mobility and societal impact. But AVs will deliver on their promise only if policymakers—like passengers climbing into a robotaxi—are absolutely clear about where they want to end up. ■



对决策者的影响

交通法规

明智监管和智能技术须齐头并进

监管复杂的新技术很难，如果技术发展迅速就更是难上加难。无人驾驶汽车已经近在眼前，政策制定者可以做些什么来确保它们安全顺利地到来并履行承诺？

眼前的目标是确保无人车安全而不抑制创新。在美国，实验性无人车可以在许多州上路，只要运营它们的公司承担法律责任。Aurora的克里斯·厄姆森（Chris Urmson）表示，美国监管机构做得不错，它们与无人车公司密切合作并发布指导方针，而不是制定可能会阻碍行业发展的严格规则。他说：“很重要的一点是，在真正有东西可以监管之前，不要先急着去监管。”

而在另一个极端，新加坡政府为迎接无人车则插手甚深，无人车创业公司nuTonomy的卡尔·亚格涅玛（Karl Iagnemma）如是说。该公司已在这个都市国家测试车辆。例如，新加坡政府推出了“驾驶测试”，要求无人车必须通过该测试才能上路。这并不能保证安全，但设定了最低标准。波士顿也做了类似的事情，要求无人车在四处漫游之前先在一个小区域内进行测试。

在其他地方，监管机构允许在公共道路上展开有限的测试，但希望看到更多的证据表明车辆安全才会为下一步放行，雷诺-日产-三菱联盟的浅见孝雄说。他还说，“简单的里程积累永远不会证明车辆是安全的。”相反，监管机构正在与汽车制造商和科技公司讨论以制定新的安全标准。沃尔沃产品战略负责人马腾·列文斯坦（Marten Levenstam）将这一过程比作开发新药的过程。首先你会在实验室中看到它可能起效，然后进行临床试验，在真实患者身上仔细测试安全性和有效性，如果成功了，你需要获得监管部门的批准才能让药物面向大众。相形之下，自动驾驶汽车目前正处于临

床试验阶段，尚未获得最终批准。

批准会是什么形式的？说到底，这将意味着正式认证那些能够完全自主运行的车辆并允许其上市销售。但列文斯坦认为，最初的批准可能授予特定机器人车队的运营商，而不是特定车辆的供应商，因为车队运营商将密切监控所有车辆以确保并维持安全。哪怕这也会有一定的风险。要证明一种新药完全安全是不可能的，但由于药物会带来好处，冒风险也是值得的。他表示，无人车也一样。毕竟，现在由人驾驶的汽车也远远不是无风险的。

浅见孝雄用航空做了另一个类比。“黑匣子”数据记录仪和仔细的测试使航空运输业虽有坠机事故却依然能够发展，因为乘客知道安全性是被重视的。实际上，美国国家运输安全委员会（NTSB）已经开始将其在航空方面的专业技术用于无人驾驶汽车。该委员会的黛博拉·布鲁斯（Deborah Bruce）说，无人车在许多方面比飞机更复杂，因为它们周围到处都是运动方式不可预知的东西。

但是医药和航空业有全球性（或至少区域性）监管标准，而无人车则没有。如果这项技术要得到广泛部署，则必须简化目前零散杂乱的法规。亚格涅玛说：“统一性是可扩展性的朋友。”保险和责任问题也必须解决。Mobileye的阿姆农·沙舒瓦（Amnon Shashua）担心，由于当前监管的不确定性，涉及完全自动驾驶汽车的致命事故可能会使该行业陷入法律僵局，甚至完全扼杀它。沙舒瓦提出了一套规则，根据美国汽车安全监管机构NHTSA维护的一个有六百万条目的事故数据库，界定了无人车在这些事故对应的所有37种情形下应作何反应。他希望这些规则能够成为开放的行业标准。这样汽车制造商就不需要在软件中隐含道德选择，却仍给其他领域留下创新空间。亚格涅玛认为这是一个好的开始。他说，如果没有这样的标准，每个公司都要自行开发解读交通法规的方式，把为人类设计的法规翻译成机器可遵循的代码。

遭到反弹的风险似乎真真切切。消费者游说团体“高速公路和汽车安全倡导者”所做的调查发现，64%的美国人担心与无人车共享道路。在皮尤研

究中心的另一项调查中，56%的美国人表示他们不会乘坐无人车（见图表）。看到实际的无人车运行将是建立公众信任的重要因素。在常能见到无人车的城市，司机对它们已经司空见惯。优步、Waymo和其他公司也开始在有限的区域提供机器人出租车，以便让人们发现乘坐无人车的前30秒惊心动魄，然后很快变得无聊。“但那正是我们真正想要的反应，”优步的诺亚·齐奇（Noah Zych）说，因为这意味着乘客感到安全。

假设无人车可以被证明是安全的，监管机构将面临第二项挑战：制定关于它们如何以及在哪里运营的规则，以及它们与其他形式的交通工具之间的关系。理论上，微调定价将使规划人员能够控制拥堵并促进平等的通行权。

希望推广机器人出租车的政府可以更进一步——限制使用私家车（比如哥德堡、伦敦、米兰、新加坡和斯德哥尔摩已经在收取各种拥堵费），或者禁止某些地区使用私家车。这可能不受欢迎，而反对者不仅仅是车主。弗吉尼亚大学的彼得·诺顿（Peter Norton）说：“我认为要迫使人们使用无人车的措施会面临强烈的抵制。”无人车可以被看作是奥威尔式的技术——监控和社会控制的工具。

抗议者可能会站在无人车前面并阻碍交通。这可能会导致一些人呼吁将无人车车道隔离开来，“从而使得城市街道对非驾车者愈发不友好”，布莱恩·拉德（Brian Ladd）说。他撰写的《汽车恐惧症》（Autophobia）一书讲述了反对汽车的历史。但是，推行机器人出租车而不加管制也会出问题。相互竞争的车队运营商可能会让道路上充斥降价载客的车辆，而使拥堵变得更严重。

有关运输和定价的选择，本质上不可避免要涉及政治。优步公司的贾斯汀·厄利克（Justin Erlich）指出，城市如何处理这些问题将取决于经济和政治动态。“我们应该在很多不同的城市探索许多不同的政策。”同时，有两个原则会有帮助。

首先是在更宏大的运输体系背景下思考无人车，并且要清楚预期它们将扮演的角色。无人车可以被部署为特定地区的主要交通工具；或者以“最初一英里、最后一英里”模式从火车站接送人员，填补通行空白，并作为其他形式交通工具的补充。

第二个原则是要注意自由的平衡。无人车有可能让人们免于驾驶、拥堵、污染和停车，但是作为交换，可能需要他们放弃其他一些自由，比如把自己的车开到任何地方的能力。在自由主义国家，只有当人们觉得它会增加而不是减少自由时，无人车才会被接受。

一个世纪前，汽车引发了关于个人自主权、自由选择权和机动性的基本问题。无人车会再做一次。但是这一次，得益于往昔的教训，它们有可能不仅仅被看作一种新的交通方式，而会被视为具有深远社会和经济影响的技术。无人驾驶汽车创造了一个新的机会，让我们有可能在个人机动性与社会影响之间取得新的更好的平衡。但是，唯有政策制定者完全清楚他们想要去往哪里，就像登上机器人出租车的乘客那样，无人车才会兑现它们的承诺。 ■



Economic and financial indicators

Corruption perceptions

At least 6bn people around the world live in corrupt countries

At least 6bn people around the world live in corrupt countries, according to Transparency International's (TI) latest ranking of corruption in the public sector. Based on surveys with analysts and business folk, TI found 69% of countries scored less than 50 (100 being "very clean") in its index for 2017. Somalia languished at the bottom with a score of 9; New Zealand came top with 89. TI highlights the inverse relationship between graft and free speech. Nine out of every ten journalists killed since 2012 were in countries that scored less than 45. Bahrain suffered the biggest fall. In June the government shut down the country's only independent newspaper as part of a wider crackdown on dissent. ■



经济与金融指标

清廉指数

全球至少有60亿人生活在腐败的国家

透明国际（TI）最新的公共部门清廉指数排名显示，全球至少有60亿人生活在腐败的国家。在该组织基于对分析人员和商界人士的调查所得出的2017年指数中，有69%的国家得分低于50（100分表示“非常清廉”）。索马里得分为9分，排名垫底。新西兰以89分名列第一。该组织的研究突显出腐败与言论自由呈反比关系。2012年以来丧生的记者中有九成来自得分低于45分的国家。巴林分数下降最多。去年6月，在一场广泛的镇压异见的运动中，该国政府关闭了国内唯一一家独立报纸。■



The car business

Last lap of luxury

Germany's high-end cars have the most to lose from the dramatic changes facing the auto industry

GERMAN carmakers have much in common with the self-confident roadhogs who favour their vehicles. The cars they produce, with sleek design, doors that close with a satisfying thunk and roomy interiors swagged with leather and technology, are the dominant force at the upper end of the car market worldwide. At home, too, they are the purring engine of the economy; carmaking is by far Germany's biggest industrial sector.

But cars are changing. Electric power and autonomous vehicles will alter radically the way they are used (see special report). The difficulty in adapting threatens not only future revenues and profits at the big three—Daimler, BMW and Volkswagen (VW)—but also Germany's status as a mean economic machine.

For now they are ahead. Brands built on unmatched quality mean four-fifths of the world's premium cars have German badges. BMW and Daimler's Mercedes-Benz both make over 2.2m cars a year. VW vies with Toyota and the Renault-Nissan-Mitsubishi alliance as the world's biggest carmaker. It knocks out some 10m vehicles annually but relies on selling around 2m Audis and Porsches for 65% of its profits. The three companies' total output of over 15m vehicles in 2016 represented around a fifth of the global total. "We are still the best car producers in the world", brags Matthias Machnig, a deputy economy minister.

Yet the industry has three big problems. The first is one of public trust. VW's emissions scandal in 2015, when it admitted it installed software in cars to trick tests of emissions, and accusations last year of collusion on

diesel standards on a vast scale, have damaged carmakers' reputations and also their political backing. A reminder of the seriousness of the issue came on February 27th when a federal court in Leipzig said that authorities in Stuttgart and Düsseldorf can prohibit entry of diesel cars, a ruling relevant to some 70 German cities. The prospect of city bans across Europe on polluting cars is drawing closer. Anti-diesel sentiments are spreading beyond Germany, with other cities, such as Paris and London, imposing bans.

Second, the industry is woefully behind in designing and selling electric vehicles (EVs), which consumers are increasingly taking to. It is not the Germans, supposedly the leading innovators in cars, but Renault-Nissan-Mitsubishi, a mass-market rival, that makes the world's bestselling EV, the Nissan Leaf, sales of which have reached some 300,000 since the car's launch in 2010. Chinese carmakers are streets ahead (see chart).

Third, the complex mechanical machines at which the country's engineers excel are gradually transforming into (battery-powered) computers on wheels that will drive themselves. Superior mechanical-engineering technology has been the industry's foundation, but there is no guarantee that it will lead in the electronic engineering and IT data-processing capabilities that will count most in future. Matthias Wissmann, president of the German Automobile Industry Association, concedes that such developments together mean his members face a "challenging moment".

The tyre tread of its carmakers has left a big impression on Germany. Cars are worldwide road-going adverts for the national brand. "Made in Germany" has become a guarantee of engineering prowess that has helped to promote the country's exports of industrial equipment and a myriad of niche products from the Mittelstand of medium-sized firms. Around four-fifths of all cars made in Germany, worth €256bn (\$283bn) in 2016, are

exported. A workforce of around 800,000 is employed directly or by suppliers. And these are plum jobs, with high pay and lots of perks (including, for some, big company cars).

The industry's success comes in part because the premium segment has long been growing faster than the car market as a whole. As motorists get richer they tend to trade up to a nicer set of wheels. The Germans have also cannily expanded what counts as a premium car. Once they specialised in big saloons. But a decade or so ago they put their badges on smaller, cheaper cars, such as BMW's 1-Series or the Mercedes A-Class. For a little extra drivers could have a prestigious German marque, a step up from mass-market models, which ceded market share.

Scale and strong brands have kept competitors at bay. Toyota's Lexus division and Jaguar Land Rover (JLR), a British-based Indian-owned firm with, not coincidentally, a former BMW executive in charge, have mounted the most successful challenge but are still minnows in comparison. They sold over 670,000 and 610,000 cars respectively in 2017. The premium brands of other carmakers have made even less of a dent. Only Tesla's swish electric cars have given the Germans cause to lose sleep.

The Institute for Economic Research (IFO) says that carmakers account for 13% of industrial value creation in Germany. Cars are a spur of the technological innovation for which the country is famed. In 2016 the industry spent nearly €22bn on research and development, over a third of Germany's total. Serving the car industry is a key part of the businesses of industrial giants such as Bosch and Siemens.

This economic power has in turn given the car manufacturers plenty of political heft. The Christian Democratic Union (CDU) is heavily supported by the car companies; the Social Democrats by trade unions at the big three. Winfried Kretschmann, leader of Baden-Württemberg, home to many car

producers, is from the Green Party. Even he has defended the long-term production of diesel cars.

Critics complain of a revolving door that has led carmakers to believe that they could get away with bad behaviour. A recent president of Germany, the previous chancellor and the current deputy chancellor have all served on VW's board. Eckart von Klaeden, once a senior official in the CDU, became Daimler's chief lobbyist in Berlin in 2013. Mr Wissmann, the boss of Germany's leading car-lobbyist group, also held a senior position in the CDU, and was transport minister in the 1990s. And so the list goes on.

These links have bestowed seeming advantages. "Free driving for free citizens" runs one German saying. Bosses and politicians flit between cities on autobahns with no speed limits. Germans pay no road tax. Tax policy keeps diesel substantially cheaper at the pump than petrol, nudging consumers to prefer big cars that rely on diesel engines to meet emissions regulations. Other tax rules also encourage companies to provide workers with premium cars and fuel allowances.

Germany's current chancellor, Angela Merkel, has been only too willing to help. She pressed the EU to block an agreement on toughening carbon-dioxide emissions in 2013 (big German cars remain heavy emitters, although diesel produces less carbon dioxide than petrol). German politicians lobbied the European Commission to temper the severity of the latest set of emissions rules, for 2020 and beyond, announced in November. As Lutz Meier, a motor journalist in Berlin puts it, cars, and the policies that favour them, have helped to "determine our national psyche".

Yet consumers, especially younger ones, are increasingly doubtful about diesel-powered cars. The share of diesel sales has tumbled in Germany from a peak of 48% in 2012 to 33% this year and is plummeting elsewhere in Europe too. Germany's car firms are heavily reliant on diesel sales in Europe;

they make up well over a third of global sales for Daimler and for BMW and a quarter for VW. So if German cities do impose driving bans on diesel cars, in response to evidence that pollution threatens residents' health, that could prove to be a "Fukushima moment" for the industry, suggests Christian Hochfeld, of Agora, a Berlin think-tank focused on energy and transport, referring to the fact that Germany's nuclear business collapsed following the disaster in Japan in 2011. He also notes that resale values of diesel cars are tumbling. If carmakers are obliged to retrofit diesel vehicles with hardware to reduce nitrogen oxide emissions, as many people are now calling for, the cost to them would run to billions of euros in Germany alone.

Coddling of the industry by politicians is likely to decline. Mrs Merkel told bosses of the main car firms in September that "a lot of trust has been destroyed" in recent scandals. In November she warned the industry that it is running out of time to react to public worries over air pollution from their cars. As political opponents grow more outspoken in favour of bans—the Greens in parliament suggest sending petrol and diesel cars to the scrapyard nationwide by 2030—even Mrs Merkel's ruling party is adjusting its position on diesel. Last month a junior minister suggested that temporary driving restrictions on some routes might be introduced in an effort to limit the worst episodes of urban smog.

Political support in past years helped the industry in the short term but is widely felt to have contributed to complacency and to German manufacturers' lagging position in the EV race. Getting the cold shoulder from government might be beneficial if it spurred firms to act faster in responding to changing consumer tastes, producing electric or cleaner vehicles and keeping up with changing demand from abroad. But carmakers will fret that they are losing support, and if the mesh of rules and incentives that keep consumers driving their national treasures change, it could have a sharply detrimental effect on the industry.

Today it is Tesla that dominates the luxury market for EVs. This year JLR will be the first premium carmaker to start selling a direct competitor to Tesla's Model S saloon, the I-Pace. Audi's Q6 e-tron will arrive later in 2018 and Porsche's Mission E will not arrive until 2019. Volkswagen's and Daimler's EVs are based on established internal combustion engine (ICE) vehicles and sell only in small quantities. In 2017 VW sold under 13,000 of its most popular all-electric model in Europe and Mercedes just over 5,000. BMW has done better with its "i" sub-brand, established in 2011. Global sales of the i3, a neat if pricey saloon, exceeded 31,000 in 2017 but sales have never matched the firm's expectations.

Tardy arrival has significant costs. Suppliers are not in place to support an entirely new industry. German expertise in making chemicals and electronics could have been deployed to produce a battery industry to feed a thriving electric-car market. "We have no one in Germany who really understands batteries, and we lack the value chain; we are very, very late", laments Ferdinand Dudenhöffer, of the Centre for Automotive Research, in Essen.

Further delays in switching to rapid development of electric cars would prove more costly for everyone, executives say. "The longer you wait, the more jobs you lose", says Mr Dudenhöffer. Many are at stake. The IFO offers a startling estimate that 426,000 jobs among the main carmakers, plus another 130,000 jobs among suppliers, depend directly on making parts for ICE vehicles.

In theory, German carmakers have the skills and cash to respond quickly, by building high-quality hybrid, plug-in or all-electric cars. And they have ambitious plans to catch up. VW says up to 25% of its cars sold in 2025 will be electrified. But they will not come cheap. EVs are pricier to make than cars powered by an ICE. Daimler, which also says that up to 25% of its cars will be electrified by the same date, admits the shift will hit profits hard.

Most carmakers are looking to spread the cost. Geely, a Chinese carmaker, announced on February 23rd that it had taken a 9.7% stake in Daimler, partly, it is thought, to forge an alliance to share the costs of developing EVs.

Another problem is how to defend the carefully nurtured brands themselves from disruption. The reputation was built on superior engineering, ICEs and driving pleasure. Premium cars sell for more because they are on the cutting edge of developments in motoring. Antilock brakes, turbocharged (diesel) engines and a host of other whizzy extras all showed up first on German cars. In return carmakers can charge more and rake in fatter profits than their mass-market counterparts (margins average around 10% compared with 5% or below in the mass market).

Yet desirable brands and mechanical brilliance may be much less use as carmaking is turned upside down. EVs, mobility services and autonomous vehicles are likely to be increasing sources of profits. Electric motors are largely standardised and may not command the same premium. German cars, engineered to please their discerning drivers, are unlikely to carry the same kudos when vehicles drive themselves. BMW, which advertised its cars as “The Ultimate Driving Machine” may have to rethink its marketing.

German manufacturers, naturally, argue that there is plenty of scope for premium brands as the landscape transforms. The engine, after all, is a small part of a package that includes those plush interiors, smooth suspension and superior design, they note. That is because by using clever electronics, car manufacturers can tweak the performance of electric engines to give a premium experience, they say. To be on the safe side, BMW is even manufacturing its own electric engines. Passengers will still pay extra for a better driving experience even if they are no longer at the wheel, they contend.

Like all carmakers, Daimler, VW and BMW are trying to reinvent themselves as “mobility providers”. They have pilot projects for services including sharing ones such as Daimler’s car2go and BMW’s DriveNow. In late 2016 VW created MOIA, a separate division dedicated to new mobility, including an investment in Gett, a ride-hailing firm, and plans for carpooling and shuttle services. It says MOIA will “generate a substantial share” of revenues by 2025. Yet it offers no details on how.

Yet even if demand for fancy vehicles is still there, the business model is highly uncertain. The convention of making money chiefly from selling cars (the industry also profits from after-sales services) will have to be augmented and perhaps eventually replaced by new sources of income. As car drivers switch from ownership to services, revenues from sales will fall. It is unclear how long it will take for robotaxis and shared services to hit car ownership but some forecasts suggest that private sales will fall dramatically once these emerge.

Neither is it clear what carmakers reckon those models will be. As Dieter Zetsche, boss of Daimler, admits, he cannot say where the big returns will come in the future. “Maybe robotaxis and a sharing model...maybe something else”. He adds that for short journeys no one will much care about what brand of vehicle they are in. That leaves luxury robotaxis used on longer journeys, perhaps by wealthier commuters who are happy to pay more for added luxury and status.

Even if the road to future profits is hard to make out, at least the Germans are more advanced in some areas than many competitors. Daimler, for example, is widely acknowledged as a technological leader in developing autonomous cars. All three have teamed up to buy HERE, a mapping company of the sort that is vital for self-driving. The Germans do have the luxury of “deep pockets, deep thinking and time”, notes Max Warburton of Bernstein, a bank. It may be that the last hold-outs who drive themselves

are the rich and indulgent. If so, conventional luxury cars will still have some customers. But that could be an ever dwindling niche. The onus is on carmakers to prove they can successfully reinvent themselves—and continue to keep the German economy in the fast lane. ■



汽车产业

最后的安逸时光

汽车行业面临剧烈变革，德国高端汽车品牌的损失将最为严重

德国汽车制造商的架势和那些自信的“路霸”——往往也喜欢德国车——颇为相像。它们生产的车设计时尚，关车门时发出的那声“砰！”无可挑剔，宽敞的车厢里装点着真皮内饰和各种高科技成果——它们是全球高端汽车市场上的主导力量。在本国，它们是驱动经济发展的引擎——汽车制造业绝对是德国最大的产业部门。

但汽车在变。电动车和无人驾驶汽车将会大大改变人们使用汽车的方式。如果难以适应变化，受到威胁的将不仅是戴姆勒、宝马和大众这三大车企未来的收入和利润，德国这台运转有力的经济机器也会受损。

眼下三巨头仍然领先。无与伦比的品质造就了强大的品牌，以至于全世界五分之四的高档车都是德国货。宝马以及戴姆勒旗下的梅赛德斯-奔驰年产量都超过220万辆。大众则与丰田以及雷诺-日产-三菱联盟争抢世界最大汽车制造商的宝座。大众每年生产约1000万辆汽车，不过它65%的利润要靠售出的大约200万辆奥迪和保时捷来贡献。三巨头在2016年的总产量超过1500万辆，大约占全球总产量的五分之一。“我们仍旧是全世界最棒的汽车制造商。”德国经济部的一位副部长马蒂亚斯·马赫尼希（Matthias Machnig）夸口道。

然而德国汽车业有三大问题。第一个事关公众的信任。2015年大众深陷“排放门”丑闻，承认在车中安装软件来在尾气排放测试中作弊。去年，多家德国车企又被指控合谋在柴油排放处理系统上造假。这些丑闻不仅令德国车企名誉扫地，还动摇了它们获得的政治支持。2月27日，莱比锡的联邦行政法院裁定斯图加特和杜塞尔多夫这两个城市有权禁止柴油车进城。从这一事关大约70个德国城市的裁决中足见损伤公众信任这一问题的严重性。全欧洲各个城市禁止重污染汽车上路的可能性越来越大。反柴油车的

情绪已蔓延至德国以外，其他城市如巴黎和伦敦已开始向柴油车颁布禁令。

消费者对电动汽车的兴趣日益浓厚，而德国汽车业的第二个问题就是在电动车的设计和销售方面严重落后。德国车企按说应该是汽车业最领先的创新者，但全世界销量最好的电动车并不是德国品牌，而是由德国车在大众市场上的竞争对手雷诺-日产-三菱联盟生产的日产聆风（Nissan Leaf）。自2010年上市以来，聆风已售出约30万辆。中国汽车制造商的电动车销量则遥遥领先（见图表）。

第三，德国工程师很擅长打造汽车这一复杂的机械设备，但汽车正逐步变身为（由电池驱动的）能自动驾驶的“轮子上的电脑”。卓越的机械工程技术一直是德国汽车产业的根基，但未来最重要的能力将是电子工程和IT数据处理，很难保证德国汽车产业在这些方面也会走在前列。德国汽车工业联合会（German Automobile Industry Association）主席马蒂亚斯·维斯曼（Matthias Wissmann）坦言，行业内的这些动态意味着该组织的成员们正面临一个“充满挑战的时刻”。

德国汽车制造商的发展对该国产生了重大影响。汽车如同行走的广告，让民族品牌在全世界得以推广。“德国制造”已成为强大工程技术实力的保证，帮助德国工业设备以及中小型企业生产的大量利基产品走出国门。2016年，德国生产的汽车有五分之四用于出口，价值2560亿欧元（2830亿美元）。约有80万人或是直接供职于车企，或是受聘于车企的供应商，而且这些工作都是高工资、附带很多特殊待遇的美差（某些公司还会给员工配车）。

德国汽车行业如此成功，一定程度上是因为高档汽车领域的增速一直都快于汽车市场的总体水平。车主钱包鼓起来后往往会上升自己的座驾。德国车企还精明地扩大了高档车这一概念所涵盖的范围。从前它们专门生产大型轿车，但大约十年前这些车企开始生产尺寸更小、价格更低的汽车，如宝马1系或梅赛德斯-奔驰A级。只要多花一点钱，车主就能跳脱大众车

型、拥有一辆知名德国品牌的汽车，而车企也由此扩大了市场份额。

德国高档汽车产业的规模及强大的品牌令竞争对手望洋兴叹。丰田的雷克萨斯和捷豹路虎（JLR）发起的挑战最为成功，但和德国车企比起来仍是小巫见大巫（捷豹路虎是一家总部在英国的印度公司，其掌门人是宝马的一位前高管——这并非巧合）。这两家公司2017年的销量分别是67万和61万辆以上。其他汽车制造商旗下的高档品牌带来的冲击就更小了。只有时髦的特斯拉电动车让德国人夜不能寐。

德国经济研究所（Institute for Economic Research，简称IFO）称，汽车制造商贡献了德国13%的工业价值创造。汽车行业促进了令德国扬名世界的技术创新。2016年，该行业在研发上投入近220亿欧元，相当于德国研发总投入的三分之一以上。为汽车行业服务构成了博世和西门子等工业巨头的关键业务。

汽车制造商进而凭经济实力获得了强大的政治影响力。基督教民主联盟（Christian Democratic Union）高度依赖车企的支持，社会民主党（Social Democrats）仰赖三巨头工会的支持。汽车生产重镇巴登-符腾堡的领导人温弗里德·克雷奇曼（Winfried Kretschmann）是绿党人士，不过就连他也曾为柴油车的长期生产辩护。

批评人士指出，由于“旋转门”的存在，德国汽车制造商以为自己不会因不良行径受到惩罚。最近的某任总统、上一任总理以及现任副总理都担任过大众的董事。2013年，曾在基督教民主联盟担任高级官员的埃卡特·冯·克莱登（Eckart von Klaeden）成为戴姆勒在德国的首席游说专家。作为德国最大的汽车行业游说组织领导人的维斯曼也曾在基督教民主联盟担任要职，上世纪90年代还担任过交通部长。这样的例子不胜枚举。

德国汽车行业靠这些关系赚到了表面上的好处。德国有个说法是“自由公民想怎么开车就怎么开”。老板和政客们在不限速的高速公路上驰骋，穿梭于各个城市。德国人不用缴纳公路税。在现行税收政策下，加油站里的柴油比汽油便宜得多，这就令消费者更青睐那些要靠柴油机来达到排放标准

的大块头汽车。其他税收规定也促使企业向员工提供高档车和燃油津贴。

德国现任总理默克尔也一直不遗余力地帮助德国汽车行业。2013年，她极力劝说欧盟推迟一项加强二氧化碳排放管理的协议生效（虽然柴油产生的二氧化碳比汽油少，但德国产大块头车仍是碳排放大户）。去年11月，欧盟公布了2020年及之后的最新二氧化碳排放规定，德国政客游说欧盟委员会减轻规定的执行力度。用柏林一位报道汽车业的记者卢茨·迈尔（Lutz Meier）的话来说，汽车以及种种有利于汽车行业的政策帮助“塑造了我们的国民心态”。

然而消费者尤其是较年轻的消费者对柴油车越来越持怀疑态度。在德国，柴油车的销售份额已从2012年48%的峰值跌至今年的33%，在欧洲其他国家也在骤降。德国车企严重依赖欧洲的柴油车销售——这部分销售在戴姆勒和宝马全球总销售的占比均远超过三分之一，在大众的全球销售中占到四分之一。专注能源及交通的柏林智库Agora的克里斯蒂安·霍赫菲尔德

（Christian Hochfeld）以2011年日本福岛核事故发生后德国核能产业崩溃这一事实为参照，指出如果德国各个城市在排放威胁居民健康的证据面前决定禁止柴油车上路，那么汽车产业可能会迎来一个“福岛时刻”。他还指出，柴油车的转售价值正在暴跌。如果汽车制造商如很多人目前所要求的那样，利用硬件升级的方式改善柴油车以减少氮氧化物的排放，那么单在德国成本就高达数十亿欧元。

政客们可能不再娇惯这个行业。去年9月，默克尔告诫主要几家车企的领导人，近年的一系列丑闻“严重损伤了人们对汽车行业的信任”。11月，她又警告业界说，时间已经不多，它们应尽快就民众对汽车污染空气的担忧作出回应。而随着政治对手们愈发直言支持柴油车禁令（议会中的绿党建议到2030年在全国范围内报废汽油及柴油车），连默克尔所在的执政党也开始调整自己在柴油车上的立场。上个月一位副部长建议，或许可在某些路段实行临时限行，以控制最严重的城市雾霾爆发。

过去几年的政治支持在短期内帮助了汽车行业，但人们普遍感觉到，这种

支持助长了该行业固步自封，并导致德国汽车制造商在电动汽车的比拼中落于下风。假如政府不顾它们的死活，说不定会激励它们加快行动，顺应消费者喜好的变化，生产电动车或更清洁的汽车，跟上不断变化的海外需求，这倒是好事一桩。但是，这也会让汽车制造商坐立不安，害怕自己失去了支持。而且，消费者之所以一直都选择它们所生产的“国宝”，是因为一系列规则及鼓励措施的存在。如果这些因素生变，可能会对汽车产业造成极为不利的影响。

如今主导豪华电动车市场的是特斯拉。捷豹路虎将成为第一个叫板特斯拉的高档汽车生产商：其于今年上市的I-Pace将正面迎战特斯拉的Model S轿车。奥迪Q6 e-tron将于今年晚些时候上市，保时捷的Mission E上市则要等到2019年。大众和戴姆勒的电动车以传统的内燃机汽车为基础，且只售出少量。2017年，大众最受欢迎的一款全电动汽车在欧洲的销量不到13,000辆，梅赛德斯-奔驰只售出5000多辆。宝马于2011年成立的子品牌“i”表现更出色些。2017年，外形美观但价格昂贵的i3轿车全球销量超过31,000辆，但一直都没达到公司的预期。

老牌车企进场太晚，代价高昂。能为一个全新行业提供支持的供应商群体尚未到位。德国本可以利用自己在化学品及电子设备制造方面的专长发展电池产业，满足蓬勃发展的电动车市场的需求。“在德国，一个真正懂电池的人都没有。价值链也没有形成。我们来得实在太晚了。”埃森汽车研究中心(Centre for Automotive Research)的费迪南德·杜登霍夫(Ferdinand Dudenhöffer)哀叹。

高管们表示，车企如果再耽误下去，不加紧步伐顺应电动车快速发展的潮流，所有人都将付出更大的代价。杜登霍夫指出，“等的时间越久，损失的工作机会就越多。”很多工作岗位都要保不住了。德国经济研究所给出了一个令人震惊的估算结果：各大车企的42.6万个工作岗位，再加上其供应商的13万个工作岗位都直接依赖内燃机汽车配件的制造。

理论上说，德国汽车制造商既有技术也有资本迅速应战，打造出高品质的插电式混合动力车或全电动车。而且它们还制定了雄心勃勃的追赶计划。

大众表示，到2025年电动车将占到其售出车辆的25%。但电动车的售价不会低。它们比内燃机汽车的造价要高。戴姆勒设立了与大众相同的目标，并承认这一转变会严重影响利润。大多数汽车制造商都在想办法分摊成本。中国汽车制造商吉利在2月23日宣布已买入戴姆勒9.7%的股份，据信此举一定程度上是为了打造一个可以分摊电动车研发成本的联盟。

德国汽车制造商还有一个问题：如何捍卫精心培育的品牌，使之免受颠覆。卓越的工程技术、内燃机和驾驶体验让德国车赢得了口碑。高档汽车之所以售价更高，是因为它们站在汽车制造技术发展的最前沿。防抱死制动系统、涡轮增压（柴油）发动机以及其他大量高科技成果都最先出现在德国车上。汽车制造商也就可以开出更高的售价，所获利润也高出面向大众市场的制造商（高档车的平均利润水平为10%左右，大众车型为5%或更低）。

然而在汽车制造遭受颠覆之际，广受追捧的品牌和精湛的机械技术的重要性可能会小得多。电动汽车、出行服务以及无人驾驶汽车可能会是利润增长点。电动马达大体上已实现标准化，似乎不大可能凭借它让车卖出高价。德国车能让眼光很高的车主满意，然而在无人驾驶的时代可能并不会收获同样的荣光。宝马曾标榜自己是“终极座驾”，如今它可能得重新思考营销策略了。

德国汽车制造商自然会辩称，尽管产业格局发生了天翻地覆的变化，高端品牌仍有大把的机会。它们指出，一辆好车包含很多元素，像是豪华内饰、出色的减震装置和一流的设计，发动机说到底只是一个小问题。它们说这是因为只要采用精妙的电子设备就可以改进电动引擎的性能，给人优质的驾乘体验。为了保险起见，宝马甚至正在自主生产电动引擎。汽车制造商声称，就算人们不再自己开车了，也仍旧会为更好的乘坐体验额外花钱。

和所有汽车制造商一样，戴姆勒、大众和宝马都在试图变身为“出行服务提供商”。它们推出了包括共享出行服务在内的试点项目，例如戴姆勒推

出了car2go，宝马推出了DriveNow。2016年年底，大众成立了致力于新型出行服务的独立子公司MOIA，还向召车公司Gett投资。另外大众还计划推出拼车和接驳服务。大众称，到2015年MOIA将会“贡献相当可观的收入份额”。不过至于该如何实现，它并未详述。

然而，就算人们对豪华汽车仍有需求，这个商业模式也充满高度不确定性。主要靠卖车赚钱（售后服务也是该行业的利润来源）这个老路子需要变得更加行之有效，而且最终可能还得找到新的收入来源取代它。随着人们放弃买车转而选择各种出行服务，来自汽车销售的收入将会下降。尚不清楚再过多久机器人出租车和共享服务会让人们放弃买车的念头，但有些预测表示，一旦这些事物兴起，私家车的销售量将急剧下跌。

同样不确定的还有汽车制造商是否明了该用什么模式来取代旧模式。戴姆勒的老板蔡澈（Dieter Zetsche）承认，他不确定未来可以靠什么赚取高额回报。“可能是机器人出租车和共享模式……也可能是别的什么。”他补充说，如果是短途旅行，人们不大会在意乘坐的是什么牌子的车。那么可能就要靠用于较远途旅行的豪华机器人出租车来盈利了。那些经济状况较好、愿意为享受奢侈和彰显地位花更多钱的通勤族可能会选择它们。

虽然要找到未来获利的途径不容易，但德国汽车制造商至少在某些领域是走现在很多竞争者前面的。例如，戴姆勒在无人驾驶汽车研发方面是公认的技术领导者。三巨头联手收购了地图测绘公司HERE——要实现无人驾驶，HERE这样的公司必不可少。投行伯恩斯坦（Bernstein）的麦克斯·沃伯顿（Max Warburton）指出，德国汽车制造商确实享有“雄厚的资本、深度的思考和迎头赶上的时间”。到最后仍坚持自己开车的也许会是那些“有钱任性”的人。如果是这样，传统高档汽车仍会有一些客户。不过这个部分可能会是一个不断缩小的小众业务。德国汽车制造商需要证明它们能够成功地重塑自我——并且让德国经济继续行驶在快车道上。■



Free Exchange

Xi v Marshall

Will China's Belt and Road Initiative outdo America's plan to rebuild post-war Europe?

SEVENTY years ago America passed the Economic Co-operation Act, better known as the Marshall Plan. Drawing inspiration from a speech at Harvard University by George Marshall, America's secretary of state, it aimed to revive Europe's war-ravaged economies. Almost five years ago, at a more obscure institution of higher learning, Nazarbayev University in Kazakhstan, China's president, Xi Jinping, outlined his own vision of economic beneficence. The Belt and Road Initiative (BRI), as it has become known, aims to sprinkle infrastructure, trade and fellow-feeling on more than 70 countries, from the Baltic to the Pacific.

Mr Xi's initiative, which also has geopolitical goals (see Banyan), has invited comparison with America's mid-century development endeavour. Some even suggest it will be far bigger. But is that credible? The Marshall Plan, after all, is synonymous with statesmanlike vision and vigour. According to Marshall's successor, Dean Acheson, America's provision of food, raw materials and equipment was described by Winston Churchill as the "most unsordid act in history". At the time of the Harvard speech Europe was on the brink of economic chaos. By the time the plan was completed, the continent was on the verge of an economic miracle. Surely China could not match such a feat?

But in fact, as opposed to folklore, the Marshall Plan was surprisingly modest, as economic historians such as Alan Milward, Brad DeLong and Barry Eichengreen have pointed out. It amounted to about \$13bn between April 1948 and the summer of 1951. That is equivalent to \$130bn today, based on American consumer-price inflation, or less than \$110bn, based on a

broader measure of rising prices. Divided between 16 countries, it averaged less than 2.5% of the recipients' GDP.

By permitting higher investment and imports, the money certainly helped Europe's recovery. But not by much. Mr Eichengreen calculates the direct impact as an increase in growth of only 0.3 percentage points over the plan's life. Nor was it actually the "most unsordid act" of its time. Churchill in fact bestowed that praise not on the Marshall Plan but on America's earlier "lend-lease" policy, which aided the Allies from 1941 to 1945.

How does the demystified plan stack up against China's? Comparisons are tricky, because no one knows how big the BRI will be. According to official figures, China's direct investment in BRI countries (excluding in the financial sector) amounted to just \$56bn from 2014 to 2017. A tot-up of announced investments by Derek Scissors of the American Enterprise Institute reaches \$118bn. But neither number includes loans from China's banks, including state-directed "policy banks" such as China Development Bank (which claims to have lent \$180bn by the end of 2017) and Export-Import Bank of China (\$110bn by the end of 2016).

These past commitments already surpass Marshall's billions. And the BRI is just getting started. A government-sponsored forum in May 2017 estimated that China would invest up to \$150bn over the next five years. The total over the life of the initiative is anyone's guess, although Chinese officials seem comfortable with a number in excess of \$1trn. (The origin of the figure of \$8trn that pops up in some reports is untraceable, but may owe something to the Asian Development Bank's estimate in 2009 of Asia's infrastructure needs in the coming decade.)

Such an amount would dwarf the Marshall Plan in size, but not necessarily in generosity. Over 90% of the Marshall money was a handout, not a loan. And the money all came from America's government. BRI investments, on

the other hand, are from a variety of sources, including private entities, and are supposed to earn a return for their financial backers. The most attractive projects might have been financed even without Mr Xi's vision.

A better measure of China's munificence is the gap between the return it earns on BRI projects and the higher rate the market would demand. Some of this reflects a genuine financial sacrifice on China's part. But some reflects a lower default risk, because for many borrowers defaulting on loans from state-backed Chinese entities is a scarier prospect than bilking a commercial lender.

Just as raw dollar figures overstate the BRI's contribution, they also understate the Marshall Plan's impact. According to Mr DeLong and Mr Eichengreen, the American plan's true significance lay not in the cash it provided but in the market-friendly policies it encouraged. To receive aid, European governments had to commit to restore financial stability and to remove trade barriers. They also had to match the Marshall dollars with money of their own, which could be spent only with America's approval.

The Americans did not always get their way. But the Marshall aid nonetheless encouraged the Europeans to quash inflation and to narrow their deficits while eventually dismantling price controls and import barriers. These reforms had enormous benefits. Before 1948 fear of inflation and taxation prompted German farmers to feed their harvests to their cattle, rather than sell it to the cities for money that might be diluted by inflation or seized by the government. According to Henry Wallich, an economist, factories paid workers in kind, with light bulbs or shoes from their assembly lines, or coal intended for their furnaces. Once faith in the currency was restored, farmers and factory-hands could once again work for money, reviving production and exchange.

The BRI will have no comparable influence. China is still wary of meddling

in the internal economic affairs of other countries (unless its core interests are threatened). And most of the BRI economies already enjoy more economic freedom than China. The Marshall Plan worked by giving markets a decisive role in allocating resources. The BRI will not even try to export that principle abroad. After all, its sponsor has yet to adopt it at home. ■



自由交流

习vs马歇尔

中国的“一带一路”倡议会胜过美国重建战后欧洲的计划吗？

七十年前，美国通过了《经济合作法案》也就是人们熟知的“马歇尔计划”。这一计划的灵感来自时任美国国务卿的乔治·马歇尔（George Marshall）在哈佛大学的一次演讲，计划的目标是重振饱受战争蹂躏的欧洲经济。大约五年前，在一所不那么有名气的高等学府——哈萨克斯坦的纳扎尔巴耶夫大学（Nazarbayev University）里，中国国家主席习近平提出了自己对经济善举的构想。这就是现在广为人知的“一带一路”倡议。从波罗的海到太平洋地区，该倡议计划同沿线70多个国家展开基础设施和贸易合作，建立伙伴关系。

习近平的倡议也有地缘政治目标，已有人拿它来和美国上世纪中叶的这一欧洲复兴计划作比较。有些人甚至认为“一带一路”的格局更大得多。但这可信吗？毕竟“马歇尔计划”可是政治家的远见和活力的代名词。据马歇尔的继任者迪安·艾奇逊（Dean Acheson）说，美国提供食品、原材料和设备的行为被丘吉尔称作“史上最圣洁的善举”。哈佛演讲发生之际，欧洲濒临经济混乱。到计划结束之时，欧洲大陆已接近创造经济奇迹。中国想必无法达成这样的壮举吧？

然而正如阿兰·米尔沃德（Alan Milward）、布拉德·德隆（Brad DeLong）和巴里·艾肯格林（Barry Eichengreen）等经济历史学家指出的那样，与坊间流传的说法不同，马歇尔计划的规模其实小得令人惊讶。从1948年4月到1951年夏天，累计援助额约为130亿美元。按美国的消费价格通胀率计算，这相当于今天的1300亿美元，按更广泛的价格涨幅计算，约合不到1100亿美元。在16个国家分配下来，平均还不到受援国GDP的2.5%。

这些资金促进了投资和进口，无疑有助于欧洲复苏。不过帮助并不大。据艾肯格林计算，其直接影响仅仅是在计划期间帮助经济增长了0.3个百分

点。而且它其实也不是那个年代“最圣洁的善举”。丘吉尔的这一赞誉实际上并不是指马歇尔计划，而是美国更早的《租借法案》。该法案在1941年至1945年间向同盟国提供了援助。

如此祛魅后，这一计划和中国的倡议相比又如何呢？其实很难比较，因为没人知道“一带一路”倡议会达到多大的规模。根据官方数据，2014至2017年，中国对“一带一路”沿线国家的直接投资（不包括金融业）仅为560亿美元。美国企业研究所（American Enterprise Institute）的史剑道（Derek Scissors）称已公布的投资总计1180亿美元。但这两个数字都不包含中国各家银行提供的贷款，包括由国家主导的“政策性银行”，如国家开发银行（该行称截至2017年底已贷出1800亿美元）和中国进出口银行（截至2016年底已贷出1100亿美元）。

“一带一路”过往的这些投入在规模上已经超过马歇尔计划，而且它才刚刚起步。2017年5月，一个由政府主办的论坛估算，今后五年中国的投资将高达1500亿美元。倡议最终会达到怎样的规模谁也说不准，不过中国官员似乎有把握会超过一萬亿美元。（有些报道中出现了“八万亿美元”这一数字，原始出处无从得知。不过可能跟亚洲开发银行在2009年对下个十年亚洲基础设施需求的估计有些关系。）

论规模，“一带一路”的大手笔会让马歇尔计划相形见绌，但若说慷慨的程度却未必。马歇尔计划超过90%的资金是援助而非贷款，并且这些钱都来自美国政府。而“一带一路”的投资则源自包括私人实体在内的各个渠道，且意在为出资者赚得回报。即便没有习近平提出的愿景，那些最吸引人的项目可能也已经获得了融资。

衡量中国慷慨的程度还有一个更好的指标：它在“一带一路”项目上的收益与市场要求的更高回报率之间有多大的差距。这一差距部分反映出中国在金融方面真正的牺牲，但也反映出违约风险较低，因为对许多借款人而言，拖欠有政府背景的中国实体的贷款比赖商业贷款机构的帐更可怕。

正如赤裸裸的美元数字夸大了“一带一路”的贡献，它也低估了“马歇尔计

划”的影响。德隆和艾肯格林认为，美国这一计划的真正作用并不在于它提供的现金，而是在于促进了利于市场发挥作用的政策。要获得援助，欧洲各国政府必须承诺恢复金融稳定并消除贸易壁垒。它们还必须根据“马歇尔计划”提供的援助资金，给出同样规模的配套资金，且只有在美国批准后方可使用。

美国人并没有事事都如己所愿。尽管如此，马歇尔计划的援助还是鼓励了欧洲人抑制通货膨胀、缩小赤字，最终取消价格控制和进口壁垒。这些改革带来了巨大的益处。在1948年之前，出于对通货膨胀和税收的恐惧，德国农民宁愿把田里的收成拿去喂牛，也不愿卖到城里，因为赚到的钱可能会被通货膨胀稀释或者被政府收去。经济学家亨利·瓦里克（Henry Wallich）说，工厂以实物支付工人工资，发给他们装配线上生产的灯泡、鞋子，或是用来烧锅炉的煤炭。一旦恢复了对货币的信心，农民和工人就可以再次为钱工作，让生产和交换恢复活力。

“一带一路”不会产生类似的影响。中国仍对干涉他国内部经济事务持谨慎态度（除非其核心利益受到威胁）。而且，大多数“一带一路”经济体的经济自由程度已高于中国。“马歇尔计划”是通过让市场在资源配置中起决定性作用而起效的。“一带一路”压根不会去尝试把这一原则输出到国外。毕竟，它的倡议人在本国都还没有采用这一原则。 ■



The pharma business

Making Merck work

A pharmaceutical company bets big on a cancer drug

WHEN Ken Frazier, chief executive of Merck, an American pharmaceutical giant, started his job in 2011, he had a hard decision to make. The firm had promising new drugs—such as Januvia, for diabetes, and Gardasil, a vaccine against cervical cancer. But the pharma industry was struggling with dismal returns on R&D and investors were questioning if companies were overspending on science. Some surrendered and started buying in drugs instead. But Mr Frazier opted to carry on backing his labs and promised publicly to spend on R&D for the long term, not for the stockmarket's immediate gratification.

An opportunity to implement the pledge soon arrived. Merck's merger with another pharma firm, Schering-Plough, in 2009, had brought it an obscure new cancer drug. At first Merck's scientists were unimpressed and relegated the drug to a list of assets to be licensed out. There was widespread scepticism at the time about whether drugs that attacked cancer using the immune system would work.

Then the firm noticed that a rival, Bristol-Myers Squibb (BMS), was having success in trials of immuno-oncology drugs, and it fired the starting gun on the drug MK-3475, as it was then known. Using an innovative trial design, the firm pushed the drug through testing as quickly as possible. It won status as a breakthrough drug worthy of speedier approval from the regulator in 2013. By 2014 Keytruda (pembrolizumab) had reached the market to treat advanced melanoma, beating BMS's rival drug, Opdivo (nivolumab), by months. It sold well, reaching \$1bn in cumulative sales by the second quarter of 2016.

The real commercial prize, however, was lung cancer, from which the industry makes a lot of money. Here Merck made another crucial decision, which was to use a “biomarker”, a way of choosing the patients most likely physically to respond well, which increases the likelihood of a successful trial outcome. The downside of the approach is that, once approved, a drug can only be given to patients who have that marker—which will crimp sales.

That problem became clear as Merck and BMS chased a series of approvals for their drugs to be used in lung cancers—initially as a second treatment choice and then as a primary treatment. The limitation resulting from Keytruda’s need to test for a biomarker helped Opdivo outsell it. But a turnaround came when Keytruda showed in mid-2016 that it was effective in trials that used it as a first treatment on a common type of lung cancer. Meanwhile, Opdivo, not using a biomarker and tested on a broader population of patients, failed (the lack of a biomarker made it harder to show that it improved survival rates).

In 2017 Keytruda’s sales almost tripled and surpassed \$3.8bn. In the most recent quarter its sales nearly caught up with those of Opdivo. Merck’s fortunes now rely heavily on its wonder drug. Vamil Divan, an analyst at Credit Suisse, a bank, predicts that Keytruda sales will be about \$10.7bn in 2030—not bad for a firm with annual revenues of \$40bn. But the caveat is that this estimate lies in the middle of a whopping \$4bn range of possible outcomes. The firm also does well in vaccines, making \$6.5bn last year, and has a robust animal-health division. Yet sales of its cholesterol drugs, Zetia and Vytorin, have plunged thanks to competition from generics, while two lucrative diabetes medicines Januvia and Janumet, are likely to be threatened by newer medicines.

Keytruda has new competition. Firms such as Roche and AstraZeneca are also rushing to deliver their own versions of immuno-oncology agents. Moreover Merck’s keen focus on oncology, and on one drug in particular,

makes analysts worry that the firm is not sufficiently diversified. Yet it is pushing on regardless. Last year it agreed to pay AstraZeneca, a British pharma firm, up to \$8.5bn to develop and commercialise its cancer drug Lynparza (olaparib), which seems likely to work well alongside Keytruda. It also acquired an immuno-oncology biotech firm, Rigontec, in September for \$554m. The company says it is creating “a pipeline within a product”, arguing that it is diversified but in many different types of cancer.

Merck's confidence recalls the period when it was one of the most admired firms in America; the Apple or the Amazon of its day. Its innovation in cholesterol-lowering drugs and HIV medicines in the 1990s gave it a reputation as a company that made society, as well as people, better.

After the millennium it took a series of blows. In addition to patent expiries came the news that its drug Vioxx, used to treat osteoarthritis, also increased the risk of cardiovascular disease. These left it risk-averse for years. But under Mr Frazier, Merck appears to have regained its focus. Fighting cancer makes historic sense. Rising cancer rates, after all, are partly the result of lifespans extended by its earlier generations of blockbuster drugs. ■



制药业

撑起默沙东

一家制药公司对一种抗癌药押下重注

美国制药业巨头默沙东（Merck）的首席执行官肯·弗雷泽（Ken Frazier）在2011年上任时面临一项艰难的抉择。该公司有多款前景光明的新药，如用于治疗糖尿病的捷诺维（Januvia）和预防宫颈癌的疫苗加卫苗

（Gardasil）。但当时制药业研发回报惨淡，投资者纷纷质疑制药公司是否在科研上花费过多。一些制药公司于是放弃自主研制，转而从外部收购新药。但弗雷泽选择继续支持公司的实验室团队，并公开承诺着眼长远利益投资于研发，而不会迎合股市的短期喜好。

贯彻这一承诺的机会很快就出现了。2009年，默沙东与另一家制药公司先灵葆雅（Schering-Plough）合并，得到了一款不为人知的抗癌新药。起初，默沙东的科学家对这种药不感兴趣，将其归入对外授权开发的资产之列。当时人们普遍怀疑利用免疫系统攻击癌细胞的药物是否会有疗效。

但接着，默沙东留意到对手公司百时美施贵宝（BMS）在免疫肿瘤药物的试验中取得了成功，于是也吹响号角，开始试验这款当时名为MK-3475的新药。通过创新的试验设计，默沙东以最快的速度推进这种药通过了测试。2013年，该药被认定为突破性新药，可获得药品监管机构的加快审批。2014年，新药健痊得（商品名Keytruda；通用名为pembrolizumab，派姆单抗）率先获批上市用于治疗晚期黑色素瘤，比百时美施贵宝的同类药物欧普迪沃（商品名Opdivo；通用名nivolumab，纳武单抗）早好几个月。默沙东的这款新药很畅销，截至2016年第二季度累计销售额达十亿美元。

然而，真正的商业“金矿”存在于肺癌领域，制药业从中赚了大钱。在这方面，默沙东做出了另一个关键决定：采用“生物标记”法，即选择最有可能对药物响应良好的患者，以提高药物测试成功的几率。这种方法的不足之

处是，获批使用的药物只能提供给带有相应生物标记的患者使用，这就会限制销量。

默沙东和百时美施贵宝努力推动各自的药物获批用于治疗肺癌——起初是申请用作治疗次选项，后来是用作治疗首选药，过程中上述问题明确显现出来。使用健痊得需要做生物标记测试，这一局限导致它的销售被欧普迪沃赶超。但在2016年年中局势又被扭转——试验结果显示健痊得在用作一种常见肺癌类型的首选治疗方案时取得了疗效。与此同时，没有使用生物标记的欧普迪沃在更广泛的患者群中测试失败，因为缺乏生物标记使之更难证明患者存活率提高。

2017年，健痊得的销售额几乎增长了两倍，超过38亿美元，最近一季度的销售额几乎追上了欧普迪沃。默沙东的命运如今十分依赖这种神奇药品。瑞信银行的分析师万米尔·迪旺（Vamil Divan）预测，到2030年，健痊得的销售额将达到约107亿美元，对这家年收入400亿美元的公司来说还算不错。但要注意的是，该估算中包含了高达40亿美元的未知结果。默沙东在疫苗方面也表现不俗，去年收入达65亿美元，动物保健业务也发展强劲。但由于来自非专利药物的竞争，其降胆固醇药物艾泽庭（Zetia）和维多灵（Vytorin）销量下降，而两款热销糖尿病药捷诺维（Januvia）和捷诺达（Janumet）则可能面临新药的威胁。

健痊得已出现新对手。罗氏制药（Roche）和阿斯利康（AstraZeneca）等公司也在争相推出自家的免疫肿瘤药物。另外，默沙东对肿瘤治疗尤其是单一一种药的高度专注令分析师担心它不够多元化。但默沙东不受影响，继续按自己的想法走。公司去年同意向英国制药公司阿斯利康支付85亿美元，合作研发阿斯利康的抗癌药Lynparza（通用名为olaparib，奥拉帕尼）并将其商业化，该药与健痊得合用似乎会有不错的疗效。去年9月，默沙东还以5.54亿美元收购了免疫肿瘤生物技术公司Rigontec。它表示自己是在实现“一种产品的系列化”，声称自己是多元化的，只不过是体现在对抗各种不同的癌症上。

默沙东的自信让人想起当年它的声望在美国数一数二的那段日子。那时的

默沙东就是今天的苹果或亚马逊。上世纪90年代，默沙东在降胆固醇药物和艾滋病药物方面的创新为它赢得了“造福社会与人类的公司”的美誉。

千禧年后，默沙东遭受了一系列打击。除了药品专利过期外，又爆出消息称该公司的骨关节炎药物万络（Vioxx）会加重心血管疾病的风险。这些事件让默沙东多年来一直采取避险策略。但在弗雷泽的带领下，默沙东似乎重新找回了方向。攻克癌症具有历史传承意义。毕竟，癌症发病率上升，某种程度上正是默沙东的前几代重磅药物帮助人们延年益寿的结果。





Trade wars

A lose-lose deal

If China cannot placate Donald Trump, it will fight him instead

PRESIDENT DONALD TRUMP has not yet started a global trade war. But he has started a frenzy of special pleading and spluttered threats. In the week since he announced tariffs on steel and aluminium imports, countries have scrambled to win reprieves. Australia, the European Union and Japan, among others, have argued that, since they are America's allies, their products pose no risk to America's security. If these appeals fail, the EU has been most vocal in vowing to retaliate, in turn prompting Mr Trump to threaten levies on European cars.

In China, ostensibly the focus of Mr Trump's actions, the public response has been more restrained. Officials have said the two countries should strive for a "win-win outcome", a favourite bromide in their lexicon. As a rival to America, China knows that an exemption from the tariffs is not on offer. It also knows that it needs to conserve firepower. If this is the first shot in a trade war, it is, for China, small bore. Its steel and aluminium exports to America amount to roughly 0.03% of its GDP, not even a rounding error.

It is two shots to come that have China more worried. Mr Trump has asked China to slash its \$375bn bilateral trade surplus by as much as \$100bn, a nigh-impossible task. And an investigation into China's intellectual-property practices is almost over. Mr Trump wants to punish China for the alleged theft of American corporate secrets. Reportedly he will seek to place tariffs on up to \$60bn of Chinese imports, focused on technology and telecommunications (see briefing).

Until recently, Chinese officials thought they had the measure of Mr Trump.

During a state visit to China in November, he was treated to a lavish banquet and signing ceremonies for \$250bn in cross-border deals. He still speaks fondly of the dinner, but the glow faded quickly on the deals, many of which were restatements of previous commitments. The tariffs on steel and aluminium, though negligible in their impact on China, signalled that hawkish advisers to Mr Trump were in the ascendancy. So behind their mask of calm, Chinese officials are searching for ways to fight back.

The demand that China cut its trade surplus by \$100bn is, in a technical sense, risible. As Mei Xinyu, a researcher in a Chinese commerce-ministry think-tank, observes, America complains that China is not a market economy, but asks for a hard target that only a planned economy could hit. The true bilateral trade gap is smaller than reported, since Chinese exports contain many inputs from elsewhere. Add in services, including Chinese students in America, and it is smaller still.

Politically, the demand has helped focus China's thinking. "There is a sense that they need to give Mr Trump a win, and that the win must be in the form of a big round number that he can tout," says Eswar Prasad, an economist at Cornell University, who has spoken with Chinese trade officials. One possibility is that China might buy more of its oil and gas from America, and perhaps even make a hefty down payment on future purchases.

But if America imposes stiff penalties in the intellectual-property case—along with stinging tariffs, it might also place new restrictions on Chinese investment and travel visas—China will take a much harder line. A government adviser in Beijing says that regardless of the economic consequences, Xi Jinping, China's president, will want to show that he is no pushover. Counter-measures will be varied, says David Dollar, America's former treasury representative in Beijing. China will buy more soyabeans from Brazil instead of from America. It will buy more Airbus planes instead of Boeings. It will tell its students and tourists to go to other countries. It

will drag its feet on approvals for American companies in China.

Worryingly, each side thinks that in a trade war of attrition, it would have the advantage. America calculates that China has the bigger surplus, and thus more to lose. But China's exports to America are less than 3% of its GDP—large but not critically so. China, for its part, thinks Americans would object to paying higher prices for manufactured goods from toys to televisions. But much low-end production is migrating from China to other developing countries and, in a pinch, American consumers might rally round the flag. To invert China's much-loved win-win motto, this has all the makings of a lose-lose battle. ■



贸易战

双输交易

如果不能安抚特朗普，中国将转向硬斗

美国总统特朗普尚未打响全球贸易战。但他已开始连番诡辩，并撂下狠话。在他宣布对进口钢铁和铝材加征关税后的一周内，各国纷纷争取豁免。澳大利亚、欧盟、日本等国声称，自己是美国的盟友，因而产品对美国安全不构成威胁。欧盟立场最鲜明，明言如果申请豁免失败，必将采取报复措施，这反过来又促使特朗普威胁对欧洲汽车征税。

中国显然是特朗普行动的靶标，而中国政府的公开回应一直较为克制。中国官员表示，两国应争取“双赢结果”——这是他们最爱挂在嘴边的套话。作为美国的竞争者，中国知道自己不可能获得关税豁免，同时也明白需要保存火力。如果这是贸易战的第一枪，那么对中国而言只是小打小闹而已。中国对美国的钢铁及铝材出口约占该国GDP的0.03%，连个零头都算不上。

中国更担心的是未打响的两枪。针对中国对美国3750亿美元的双边贸易顺差，特朗普已向中国提出削减高达1000亿美元的顺差，但这几乎不可能实现。另外，美国针对中国知识产权政策的一项调查即将完成。特朗普打算就中国涉嫌窃取美国公司机密施以惩罚。据报道，他将寻求对价值高达600亿美元的中国进口产品加征关税，主要针对科技和电信领域。

直到最近，中国官员们还以为已经摸清了特朗普的路数。去年11月特朗普对中国进行国事访问，中国隆重设宴款待，两国还签署了总值2500亿美元的跨境交易协议。对于那场晚宴，特朗普仍津津乐道，但那些协议的光彩已迅速消退，毕竟其中有许多不过是对已有协议的重新签署。尽管钢铝关税对中国的影响微不足道，但这是特朗普的鹰派幕僚得势的信号。因此，在心平气和的面具背后，中国官员正在谋划反击。

要求中国减少1000亿美元的贸易顺差，这在技术层面上来说是可笑的。正

如中国商务部下属智库的研究员梅新育所言，美国抱怨中国并非市场经济体，但又给中国设下一个只有计划经济体才能达到的硬性指标。中美双边贸易的实际差距要小于报告数据，因为中国出口的产品包含了许多来自其他地区的进口。再算上服务业，包括在美的中国留学生，实际贸易差额还要更小。

从政治上说，这项要求帮助中国理清了思路。曾与中国贸易官员交谈的康奈尔大学的经济学家伊斯瓦·普拉萨德（Eswar Prasad）表示：“他们感觉需要让特朗普赢一次，而且必须是个大数字，好让他能拿来吹嘘表功。”一种可能是中国会加大从美国购入石油和天然气，甚至可能会为未来的采购支付高额预付款。

但如果美国就知识产权问题对华实施严厉惩罚（除了高额关税，美国还可能对中国的投资活动和旅游签证增加限制），中国的应对将强硬得多。北京一位政府顾问表示，无论经济上的后果如何，中国国家主席习近平都要显示自己不是好欺负的。美国财政部前任驻京代表杜大伟（David Dollar）认为，中国将有多种多样的抗衡措施。中国会从巴西而非美国购买更多大豆，购入更多空客飞机而非波音飞机，推荐国民到其他国家留学和旅游，拖慢对在华美国企业的各种审批程序。

令人担忧的是，双方都认为自己在这样的贸易消耗战中占有优势。美国的算盘是，中国贸易顺差大，打起贸易战来损失也就更大。但中国对美国的出口不到其GDP的3%，数字虽大，却不至于动摇根本。中国则认为美国国民不会愿意为从玩具到电视机等工业制成品支付更高的价格，因而会反对美国政府加征关税。但许多低端商品的制造正从中国转移到其他国家，而且到了关键时刻，美国消费者可能会上同仇敌忾，支持征收关税。与中国一贯奉行的双赢宗旨相反，眼下趋势已经极可能是一场两败俱伤之战。 ■



Free exchange

Faction and friction

In America, a political coalition in favour of protectionism may be emerging

THE post-war system of global trade has been close to expiring, seemingly, for most of the post-war period. It tottered in the 1980s, when Ronald Reagan muscled trading partners into curbing their exports to America. It wobbled with the end of the fruitless Doha round of trade talks. The system now faces the antediluvian economics of President Donald Trump, who seems bent on its destruction.

Mr Trump's mercantilism is gaining steam. Straight after saying he would slap hefty tariffs on aluminium and steel imports, he is setting his sights on China, a favourite stump-speech bogeyman. Last week he blocked the takeover of an American chipmaker by a Singaporean rival, because of fears of Chinese technological leadership. He is poised to act against China over its theft of intellectual property and its trade surplus.

And yet global trade has proven itself to be remarkably resilient. An optimist could argue that, historically, it is big political realignments that overturn trade-policy regimes, rather than the rogue actions of consensus-bucking presidents. Recent polling suggests many Americans are unenthusiastic about Mr Trump's steel and aluminium tariffs. The levies have also generated howls of complaint from the business community, which seems likely to persuade Mr Trump to carve out exceptions. The damage he causes could be undone in future. Unfortunately, there is reason to fear the emergence of a new, less liberal consensus.

When discussing trade-policy trade-offs, economists typically focus on conflicts between producers and consumers. They see consumers

benefiting from liberal trade rules, enjoying foreign wines and cheap Chinese electronics. But households, they reckon, are rarely animated enough about trade fights to mount serious opposition to producers, who are assumed to favour protection and who are highly motivated and organised in their lobbying for tariffs and other barriers.

Yet in practice, interests diverge across industries and regions. In America, as Douglas Irwin describes in his magisterial history of trade policy, “Clashing over Commerce”, battles between blocs determined trade strategy. Before the civil war Democratic, export-oriented southern states held the political upper hand over the pro-tariff, industrialising states of the north, which tended to vote for the Republican Party and its precursors. The war altered the political balance of power and ushered in an era of industry-supporting protectionism, and Republican dominance, that persisted into the 1930s.

Today's established policy paradigm has its origin in the early post-war period, when politics strongly favoured liberalisation. Both parties backed expanded trade, for geopolitical reasons and because America's world-beating export industries faced few competitive threats. The General Agreement on Tariffs and Trade, in operation since 1948, created the environment in which tariffs have tumbled to their present low rates. A scaffolding of treaties, institutions and laws now supports a global economy as interconnected as it has ever been.

That has had two contradictory effects. In some ways globalisation has neutered its potential political opponents. Liberalisation has undercut producers in those sectors most vulnerable to foreign competition, who are also the constituency most in favour of protectionism. Many more jobs, dollars and votes now depend on industries that use steel in production and therefore suffer when it becomes more expensive, than on steelmaking itself. Similarly, liberalisation nurtured the growth of international supply

chains, which increased cross-border interdependence and reduced political support for tariffs among firms that are both importers and exporters. NAFTA-bashing elicits cheers at Mr Trump's speeches, but also causes American firms to leap to the defence of their Canadian and Mexican partners.

In other ways, however, globalisation created the conditions for a significant backlash. In the 1950s and 1960s Americans associated liberalisation with rapid, broad-based economic growth. No longer. Though cosmopolitan Democrats embrace global co-operation and live in cities built on exports of high-value services, concerns about harm to workers and the environment have nudged the party toward a more trade-sceptical position. Elizabeth Warren, a prominent Democrat and senator from Massachusetts, has spoken in favour of tariffs.

More striking is the Republican evolution. Since 2015 Republican voters' view of trade agreements has flipped from positive to sharply negative. Recent research finds that in congressional districts in which firms had to compete with a larger influx of rival Chinese goods, political support shifted toward more radical candidates overall and, in presidential contests, toward the Republican candidate. Republican policy is shifting in response.

Just as important, the number of industries fed up with China's overzealous use of its economic power keeps rising. American firms have been forced to sign up to joint ventures with Chinese ones in order to gain access to China's market. They have lost intellectual property to theft. They face competition from Chinese firms bolstered by state support. Security concerns over new technologies and artificial intelligence further fuel Sino-scepticism in advanced economies.

Political support for an old-fashioned, Trump-style trade war is thin on the ground. Yet a coalition in favour of a showdown with China, made up of

both Republicans and Democrats and with the backing of business interests, is all too easy to imagine. The result—a world increasingly divided into rival economic blocs—might well have emerged even without Mr Trump. It will certainly outlast him, too. ■



自由交流

派系与摩擦

在美国，支持保护主义的政治联盟可能正在形成

战后大部分的时间里，全球贸易体系似乎都处于瓦解的边缘。上世纪80年代，里根采取强硬措施限制贸易伙伴对美国的出口，令这个体系摇摇欲坠。多哈回合贸易谈判无果而终后，该体系又一次风雨飘摇。现在，它又要面对特朗普老掉牙的经济观念。特朗普似乎执意要将该体系摧毁。

特朗普的重商主义势头渐盛。在表示将对铝和钢材进口征收高额关税后，他旋即盯上了中国——政客在演讲时最喜欢搬出来吓人的“恶魔”。上周，他阻止了新加坡的一家芯片制造商收购美国的竞争对手，原因是担心这会让中国取得技术领先地位。他还准备针对中国窃取知识产权和贸易顺差的问题采取行动。

不过，全球贸易体系还是展现出了强大的复原能力。乐观主义者可能会认为，从历史上看，颠覆贸易政策制度的是重大的政治重组，而不是某些破坏共识的总统的无赖行径。最近的民意调查显示，许多美国人对特朗普征收钢铝关税的做法欠缺热情。征税也让商界怨声载道，而这似乎有可能说服特朗普做出豁免。他造成的损害将来有可能被修复。不幸的是，我们有理由担心，一个更缺少自由化精神的新共识即将形成。

在讨论如何权衡贸易政策时，经济学家通常关注的是生产者与消费者之间的冲突。他们看到消费者受益于自由贸易规则，享受外国葡萄酒和廉价的中国电子产品。但他们认为，家庭很少关心贸易纷争，不会对生产者发起有威胁的对抗；而生产者往往被认为是支持保护主义的，在游说设置关税和其他贸易壁垒时积极性高，组织性强。

而实际上，各行业和各地区的利益有很大差异。正如道格拉斯·欧文（Douglas Irwin）在其贸易政策史权威著作《贸易的冲突》（Clashing over Commerce）中所描述的，在美国，决定贸易战略的是利益集团之间

的斗争。在美国内战之前，南方各州以出口为导向，广泛支持民主党，而发展工业化的北方各州则支持征收关税，倾向曾几经更名的共和党。政治上南方比北方更有优势。内战改变了政治力量的对比，开启了为扶持本国产业而奉行贸易保护主义、共和党一统江山的时代。这种局面一直持续到上世纪30年代。

今天的既定政策范式起源于二战后初期，当时的政治气候强烈支持自由化。民主共和两党都支持扩大贸易，这既有地缘政治方面的原因，也因为当时美国的出口行业称霸全球，几无竞争威胁。1948年《关贸总协定》开始生效，创造了令关税不断下降的环境，直至目前的低关税水平。现在，大量的条约、机构和法律支撑起了一个全球化的经济，各国经济之间的关联程度前所未有。

这带来了两个相互矛盾的结果。在某些方面，全球化已使它在政治上的潜在反对者变得虚弱无力。自由化削弱了那些最容易受外国竞争冲击的行业里的生产者，而它们也是最支持保护主义的人群。如今有大量岗位、收入和选票有赖于使用钢铁作为生产原料的行业，而非钢铁行业本身，当钢价上涨时它们都会遭受损失。同样地，自由化促进了国际供应链的发展，增加了国家之间的相互依赖，也让同时涉及进口和出口的企业减少了对关税的政治支持。特朗普抨击《北美自由贸易协定》（NAFTA）的讲话引来听众的欢呼，但同时也让美国公司纷纷挺身维护它们在加拿大和墨西哥的合作伙伴。

然而在其他方面，全球化也致使自身遭到重大抵制。上世纪五六十年代，美国人将自由化与快速、广泛的经济增长联系在一起。但今非昔比。虽然民主党人生活在依赖高附加值服务出口的城市里，更信奉国际化和全球合作，但对工人和环境可能受损害的担忧已经推动该党转向更为怀疑自由贸易的立场。来自马萨诸塞州的著名民主党参议员伊丽莎白·沃伦（Elizabeth Warren）就已公开表示赞成关税政策。

共和党的变化更引人注目。2015年以来，共和党选民对贸易协议的看法已经从正面转为极为负面。最近的调研发现，在企业不得不与更多大量涌入

的中国产品竞争的国会选区，政治支持总体上转向了更为激进的候选人，并在总统竞选中转向了共和党候选人。共和党的政策也在相应转变。

同样重要的是，越来越多的行业受够了中国过度使用其经济力量。为进入中国市场，美国公司被迫与中国公司签署合资协议。它们的知识产权被窃，还要面临来自有国家支持的中国企业的竞争。对新技术和人工智能的安全担忧进一步加深了发达经济体对中国的怀疑态度。

老派的特朗普式贸易战得到的政治支持很薄弱。然而不难想象会有这样一种可能性，即共和党和民主党人结成联盟，在商业利益集团的支持下，转而选择与中国摊牌。如此一来，世界会日益分化为互相竞争的经济集团。即便没有特朗普，这一局面也很可能出现，而且也肯定会比他的任期持续更长久。 ■



Facebook

Epic fail

The social-media giant faces a reputational crisis. Here is how it and the industry should respond

LAST year the idea took hold that Mark Zuckerberg might run for president in 2020 and seek to lead the world's most powerful country. Today, Facebook's founder is fighting to show that he is capable of leading the world's eighth-biggest listed company or that any of its 2.1bn users should trust it.

News that Cambridge Analytica (CA), a firm linked to President Donald Trump's 2016 campaign, got data on 50m Facebook users in dubious, possibly illegal, ways has lit a firestorm (see United States section). Mr Zuckerberg took five days to reply and, when he did, he conceded that Facebook had let its users down in the past but seemed not to have grasped that its business faces a wider crisis of confidence. After months of talk about propaganda and fake news, politicians in Europe and, increasingly, America see Facebook as out of control and in denial. Congress wants him to testify. Expect a roasting.

Since the news, spooked investors have wiped 9% off Facebook's shares. Consumers are belatedly waking up to the dangers of handing over data to tech giants that are run like black boxes. Already, according to the Pew Research Centre, a think-tank, a majority of Americans say they distrust social-media firms. Mr Zuckerberg and his industry need to change, fast.

Facebook's business relies on three elements: keeping users glued to their screens, collecting data about their behaviour and convincing advertisers to pay billions of dollars to reach them with targeted ads. The firm has an incentive to promote material that grabs attention and to sell ads to

anyone. Its culture melds a ruthless pursuit of profit with a Panglossian and narcissistic belief in its own virtue. Mr Zuckerberg controls the firm's voting rights. Clearly, he gets too little criticism.

In the latest fiasco, it emerged that in 2013 an academic in Britain built a questionnaire app for Facebook users, which 270,000 people answered. They in turn had 50m Facebook friends. Data on all these people then ended up with CA. (Full disclosure: *The Economist* once used CA for a market-research project.) Facebook says that it could not happen again and that the academic and CA broke its rules; both deny doing anything wrong. Regulators in Europe and America are investigating. Facebook knew of the problem in 2015, but it did not alert individual users. Although nobody knows how much CA benefited Mr Trump's campaign, the fuss has been amplified by the left's disbelief that he could have won the election fairly.

But that does not give Facebook a defence. The episode fits an established pattern of sloppiness towards privacy, tolerance of inaccuracy and reluctance to admit mistakes. In early 2017 Mr Zuckerberg dismissed the idea that fake news had influenced the election as "pretty crazy". In September Facebook said Kremlin-linked firms had spent a mere \$100,000 to buy 3,000 adverts on its platform, failing at first to mention that 150m users had seen free posts by Russian operatives. It has also repeatedly misled advertisers about its user statistics.

Facebook is not about to be banned or put out of business, but the chances of a regulatory backlash are growing. Europe is inflicting punishment by a thousand cuts, from digital taxes to antitrust cases. And distrustful users are switching off. The American customer base of Facebook's core social network has stagnated since June 2017. Its share of America's digital advertising market is forecast to dip this year for the first time. The network effect that made Facebook ever more attractive to new members as it grew could work in reverse if it starts to shrink. Facebook is worth \$493bn, but

only has \$14bn of physical assets. Its value is intangible—and, potentially, ephemeral.

If Mr Zuckerberg wants to do right by the public and his firm, he must rebuild trust. So far he has promised to audit some apps, restrict developers' access to data still further, and help people control which apps have access to their data.

That doesn't go nearly far enough. Facebook needs a full, independent examination of its approach to content, privacy and data, including its role in the 2016 election and the Brexit referendum. This should be made public. Each year Facebook should publish a report on its conduct that sets out everything from the prevalence of fake news to privacy breaches.

Next, Facebook and other tech firms need to open up to outsiders, safely and methodically. They should create an industry ombudsman—call it the Data Rights Board. Part of its job would be to set and enforce the rules by which accredited independent researchers look inside platforms without threatening users' privacy. Software is being developed with this in mind (see Science section). The likes of Facebook raise big questions. How does micro-targeting skew political campaigns? What biases infect facial-recognition algorithms? Better they be answered with evidence instead of outrage.

The board or something like it could also act as a referee for complaints, and police voluntary data-protection protocols. Facebook, for example, is planning to comply worldwide with some of the measures contained in a new European law, called the General Data Protection Regulation. Among other things, this will give users more power to opt out of being tracked online and to stop their information being shared with third parties. Adherence to such rules needs to be closely monitored.

Tech has experience of acting collectively to solve problems. Standards on hardware and software, and the naming of internet domains, are agreed on jointly. Facebook's rivals may be wary but, if the industry does not come up with a joint solution, a government clampdown will become inevitable.

Facebook seems to think it only needs to tweak its approach. In fact it, and other firms that hoover up consumer data, should assume that their entire business model is at risk. As users become better informed, the alchemy of taking their data without paying and manipulating them for profit may die. Firms may need to compensate people for their data or let them pay to use platforms ad-free. Profits won't come as easily, but the alternative is stark. If Facebook ends up as a regulated utility with its returns on capital capped, its earnings may drop by 80%. How would you like that, Mr Zuckerberg? ■



Facebook

脸书劫数

这家社交媒体巨头面临信誉危机。它和它所在的行业当以如下策略应对

去年，人们已经普遍认为马克·扎克伯格可能会在2020年竞选总统，争取领导世界上最强大的国家。而现在，这位Facebook的创始人需要竭力证明自己有能力领导全球八大上市公司，或者这家公司应该被它的21亿用户信任。

据报道，剑桥分析（Cambridge Analytica）这家与特朗普2016年竞选活动有关联的公司以可疑且可能是非法的方式获得了5000万Facebook用户的 data。消息爆出后激起轩然大波。扎克伯格在五天后才做出回应，他承认 Facebook过去曾让用户失望，但他似乎没有意识到这家社交媒体的业务面临更广泛的信任危机。经过几个月有关政治造势和假新闻的讨论，欧洲的政客以及越来越多的美国政客都认为Facebook已经失控且还否认事实。国会希望扎克伯格作证。一场严苛的盘问为时不远了。

消息传出后，投资者惊恐不已，Facebook的股价已经蒸发掉9%。后知后觉的消费者终于意识到，把数据交给如黑箱般运作的科技巨头危险重重。智库皮尤研究中心称，大多数美国人已经表示不再信任社交媒体公司。扎克伯格和社交媒体行业需要改变，且刻不容缓。

Facebook的业务依赖三大要素：让用户眼不离屏；收集其行为数据；说服广告主支付数十亿美元向用户投放定向广告。该公司有动力“做大”吸睛的内容以及向任何人出售广告。它的文化中融合了对利润的无情追求和对自身美德的过分乐观与自恋。扎克伯格控制着公司的投票权。显然，他受到的批评太少了。

最近这次惨败中爆出的事件是这样的：英国一位学者在2013年编写了一款面向Facebook用户的问卷应用，27万人参与作答，而他们共有5000万 Facebook好友。最终，所有这些人的数据都落到了剑桥分析的手中（完全

披露：《经济学人》曾雇用剑桥分析做一项市场调研）。Facebook表示这种情况不会再发生，还声称该学者和剑桥分析违反了它的规定，但那两方都否认自己有错。欧洲和美国的监管机构正在调查。Facebook在2015年就知道了这个问题，但并没有提醒个人用户。虽然没人知道剑桥分析到底帮了特朗普竞选活动多大的忙，但左翼人士怀疑他并非公平胜出，这就使得问题变大了。

但这并不能为Facebook提供无罪辩护。此次事件符合它的一套固有模式：对隐私的草率、对不准确的容忍、不愿承认错误。去年年初，扎克伯格驳斥假新闻影响选举的说法“非常疯狂”。9月，Facebook表示，与克里姆林宫有关联的公司只花了10万美元在其平台上购买了3000条广告，但没有第一时间说明有1.5亿用户看过俄罗斯特工发布的免费帖子。它还多次在用户统计数据方面误导广告主。

Facebook尚不会被禁止或关闭，但监管部门强烈反弹的可能性在加大。从数字税到反垄断案件，欧洲正在对它“千刀万剐”。心存疑虑的用户已开始弃之不用。自去年6月以来，Facebook核心社交网络的美国用户数量已经停滞不前。而据预测，该网站占美国数字广告市场的份额今年将首次下降。一旦它开始萎缩，在它扩张时令它对新用户的吸引力不断加大的网络效应就开始反向作用。Facebook的市值为4930亿美元，但仅拥有140亿美元的实物资产。它的价值是无形的——因此也有可能转瞬即逝。

如果扎克伯格想做对公众和自己的公司正确的事，他必须重建信任。他已经承诺审查一些应用，进一步限制开发者访问数据，并帮助人们控制哪些应用可以访问他们的数据。

但这还远远不够。Facebook需要对其处理内容、隐私和数据的方式展开全面、独立的审查，包括它在2016年大选和英国退欧公投中所起的作用。这应该被公之于众。每年Facebook都应该发布一份报告，陈述公司在各类事件中的行为表现，从假新闻流行到隐私侵犯等。

然后，Facebook和其他科技公司需要安全而讲求方法地向外界开放。它们

应该设立一个行业监察机构——我们可以称之为数据权利委员会。它的一部分工作是制定并执行规则，确保经认证的独立研究人员在调研这些平台时不威胁到用户的隐私。顾及这一点的软件正在研发中。Facebook这类公司引发了一些重大的议题。微目标定位如何影响了政治竞选的公正性？什么偏见会影响面部识别算法？这些问题最好是用证据而不是怒火来回答。

这样一个委员会或类似的机构也可以充当投诉的仲裁方，并监督那些自愿实施的数据保护协议。例如，Facebook正计划在全球范围内遵循一项名为《通用数据保护条例》（General Data Protection Regulation）的欧洲新法律所包含的一些措施。这会有各种好处，其一是用户会获得更多的权力，选择不被在线追踪，或不与第三方共享自己的信息。对这些法规的遵循情况需要密切监测。

科技行业有集体行动解决问题的经验。软硬件的标准、互联网域名的命名，都是经各方一致同意而设定的。Facebook的竞争对手可能会有所顾虑，但如果该行业不拿出一个联合解决方案，一场来自政府的打压将无可避免。

Facebook似乎认为自己只需微调方式方法。而实际上，它和其他大量获取消费者数据的公司应该假定自己的整个商业模式都已经面临危险。如今用户已经更加了解这些模式，免费获取他们的数据并操控数据来获利的炼金术可能会失灵。公司可能需要就数据补偿用户，或者让用户付费使用无广告平台。利润来得不会再那么容易，但若不这么做，后果不堪设想。如果Facebook最终成为一个受监管的公用事业公司，资本回报封顶，那么其收益可能会减少80%。你觉得怎么样呢，小扎同学？■



Schumpeter

Inside Buffett's deal machine

Berkshire Hathaway has evolved into an acquisition engine. The returns look pedestrian

SOME things about Warren Buffett never change, including his non-stop jokes, famous annual letter and his reputation as the world's best investor. What is less understood is that over the past decade Mr Buffett's company, Berkshire Hathaway, has sharply altered its strategy. For its first 40 years Berkshire mainly invested in shares and ran insurance businesses, but since 2007 it has shifted to acquiring a succession of large industrial companies.

In some ways it is hard to criticise Berkshire. Its shares have kept up with the stockmarket and its standing is exalted. It is the world's seventh-most-valuable publicly traded firm (the other six are tech concerns). But Mr Buffett's behemoth is a puzzle. Its recent deals have had drab results, suggesting a pivot to mediocrity.

It has been quite a spree. Since 2007 Berkshire has spent \$106bn on 158 firms. The share of its capital sunk into industry has risen from a third to over half. The largest deals include BNSF, a North American railway, Precision Castparts (PC), a manufacturer, various utilities, and Lubrizol, a chemicals business. Further transactions are likely. Berkshire has roughly \$100bn of spare cash. In his latest letter, published on February 24th, Mr Buffett complains about high valuations but says there is a possibility of "very large purchases". Berkshire thinks of itself as a friendly buyer to which families and entrepreneurs are happy to pass on their crown jewels. There is something comforting about its mission to be a home for old-school businesses run by all-American heroes.

Yet it is not an obvious formula for superior performance. Berkshire must

pay takeover premiums and has \$64bn of goodwill. It enjoys no synergies of the sort corporate buyers claim and unlike private-equity firms does not overhaul management at its targets. There is no clear reason why being owned by Berkshire improves performance. Mr Buffett has largely missed the past decade's tech boom, the big force behind the stockmarket.

Can Berkshire turn water into wine? Schumpeter has attempted to answer this by crunching the numbers, using a certain amount of guesswork. There are two ways to capture how Berkshire creates value, both of which Mr Buffett has in the past endorsed. One is measuring Berkshire's own book value and how this increases. The other is to examine its "look through" profits, which are made up of the earnings of its wholly-owned businesses as well as its share of the earnings from the firms in which it owns small stakes. Over the past five years its book value has grown by a compound annual rate of 11%. Berkshire's look through return on equity (ROE) has usually been 8-9% (all further figures exclude the impact of a \$29bn one-off gain booked in 2017 relating to America's law slashing corporate tax).

Those results are worthy of Mr Buffett, but the next step is to split Berkshire into two areas and examine the larger part—its acquired industrial businesses, spanning its railway, energy, utility, manufacturing, services and retail units. These have a total book equity of \$191bn, most of which was built up in the past decade. By this measure Berkshire is the second-largest industrial concern in America. The industrial arm's operating performance is bog standard and, once you include the goodwill, its ROE is a weak 6%, down from 9% in 2007 before Berkshire shifted course (these sums exclude the amortisation of intangible assets, which is in accordance with how Mr Buffett assesses profits).

The industrial businesses' lacklustre record mean they account for about 60% of Berkshire's sunk capital but have generated only about half of its look through profits, and 40% of its growth in book value over the past five

years. For the five big industrial companies where figures are consistently available, total profits have risen by 4% a year since 2012, which is no better than a basket of similar peers. Profits at BNSF, for example, have risen only just above inflation and in line with other railways. Speaking to CNBC on February 26th, Mr Buffett suggested that a sixth business, PC, had not met its own internal targets.

Since Berkshire cranks out an annual return of about 8-11% a year overall, the other area of its business, its financial operations, must have done much better. These include insurance underwriting, leasing, stock-picking, gains on derivatives and lucrative one-off transactions struck by Mr Buffett, for example when he bought bonds issued by Goldman Sachs and General Electric during the financial crisis. Overall, Berkshire's financial arm has a solid average ROE of 11%, achieved with low leverage.

Why, then, is Berkshire making large industrial acquisitions? There is a chance that profits will grow faster in future, pushing up the low ROE of the acquired businesses, yet most of them are mature. Or Berkshire may hope that selected acquisitions, when valued in line with their listed peers, will show a big rise in their value since being bought, which accounting profits do not capture. BNSF, which Berkshire bought in the depths of the crisis in 2009, has yielded an annual return of about 15% if measured in this way. However the other deals are unlikely to look nearly as good: two thirds of them (by value) took place after the end of 2011, once markets had bounced back from the crash.

Berkshire has three possible paths forward. One is that Mr Buffett and his partner, Charles Munger, return cash to shareholders and accept that Berkshire must be less ambitious. The two men do not seem ready for this. A second is that they do more big takeovers now, with stockmarkets high. That would likely depress Berkshire's returns for years and make it more reliant on fireworks from its financial arm. The third path is that Mr Buffett and

Mr Munger sit and wait, hoping for a stockmarket crash, when Berkshire's war chest will let it pick up bargains that make better returns than its recent acquisitions have done. Twenty years ago this strategy would have been uncontroversial, but the two men are aged, respectively, 87 and 94. Berkshire is enough of a conundrum to perplex even the world's greatest value investor. ■



熊彼特

探究巴菲特的并购机器

伯克希尔·哈撒韦公司已成“收购火车头”，但看起来回报平平

关于沃伦·巴菲特，有些事情从没变过，包括频出的笑话金句、著名的年度致股东信，以及身为全球最佳投资者的盛名。比较不为人所知的是，过去十年，巴菲特的伯克希尔·哈撒韦公司（Berkshire Hathaway，以下简称伯克希尔）已大幅改变经营策略。该公司在成立的头40年里主要投资股票，同时经营保险业务，但自2007年起已转向收购一系列大型工业企业。

从某些方面来说，要指摘伯克希尔很难。它的股票一直能跟上大市水平，公司地位崇高，是全球第七大上市公司（前六家都是科技公司）。但巴菲特的这家巨兽公司令人费解。它近期的并购回报平平，似有渐入平庸之势。

这一轮并购颇为疯狂。自2007年以来，它已对158家公司投资共计1060亿美元。投入工业领域的资本从占总额的三分之一增至一半以上。最大型的并购包括北美铁路公司BNSF、制造企业精密机件公司（Precision Castparts，简称PC）、各类公用事业公司以及化学品公司路博润（Lubrizol）。公司很可能还有进一步的并购交易。伯克希尔现在持有约1000亿美元的备用现金。在上月24日最新发布的巴菲特致股东信中，他抱怨企业估值太高，但表示可能有“非常大的收购行动”。伯克希尔自视为友善的买家，家族和企业家都乐意把自己珍视的企业出售托付。它的宗旨是成为汇聚全美精英人物经营的老牌企业的家园，听起来让人感到些许宽慰。

然而，这并不是造就卓越业绩的一条公认的公式。伯克希尔必须支付收购溢价，因而有了640亿美元的商誉。伯克希尔的收购并不具备并购者声称的那类协同效应，也不像私募股权公司那样会对目标企业的管理层大换血。没有明确的理由相信企业被伯克希尔收购后便能改善业绩。过去十年

是科技热潮在强力推动股市，而巴菲特在很大程度上错过了这一大潮。

伯克希尔能点石成金吗？熊彼特专栏尝试通过分析数字再加一点猜测来回答这个问题。有两种方式来了解伯克希尔如何创造价值，两者在过去都被巴菲特认可。一是衡量伯克希尔自己的账面价值及其增长。另一个方式是计算其“透视”（look through）利润，即它全资拥有的企业的收益加上其少量持股公司的收益分红。过去五年，伯克希尔账面价值的年复合增长率为11%，透视股本回报率通常为8%至9%（所有数据都排除了2017年290亿美元一次性收益的影响，这项收益与美国实施了削减企业税的法案有关）。

这些结果不负巴菲特的英名，但下一步是要将伯克希尔分为两部分，并审视较大的那部分，也就是它收购的各类工业企业，涵盖其铁路、能源、公用事业、制造、服务及零售部门。这些企业的账面价值合计达1910亿美元，大部分是在过去十年间积累起来的。用这一衡量标准，伯克希尔是美国第二大工业集团。但其工业分支的经营业绩实在平平无奇，如果再计入商誉，其股本回报率仅为6%，低于2007年伯克希尔改变经营策略前的9%（这些数字不包括无形资产的摊销，与巴菲特评估利润的标准一致）。

这些工业企业的表现乏善可陈，虽然它们占了伯克希尔沉没资本的约60%，但过去五年只贡献了透视利润的约50%和账面价值增长的40%。一直有公开数据可查的五家大型工业企业中，自2012年来利润总额年增速为4%，并没有高过同业的平均水平。举例来说，BNSF的利润增速仅略高于通胀率，与其他铁路公司相当。上月26日巴菲特在接受CNBC专访时表示，伯克希尔收购的第六大工业企业精密机件公司的表现未达到集团内部目标。

既然伯克希尔每年的总体回报率约为8%至11%，那么它涉足的另一个领域也就是金融业务的业绩一定好得多。这包括保险、租赁、选股服务、衍生品收益及巴菲特达成的获利丰厚的一次性交易，例如他在金融危机期间购买的由高盛和通用电气发行的债券。总的来说，伯克希尔旗下金融业务的

股本回报率平均为稳健的11%，而且是以低杠杆取得。

那么，伯克希尔为何还在大规模收购工业企业？一种可能是它指望未来利润增长会加速，推高被收购企业目前低迷的股本回报率。但它们大多已无太大的增长空间。或者，伯克希尔可能希望，收购时估值与上市同业一致的部分企业在收购后价值会大幅上涨，而这是会计利润未能反映出来的。如果以此计算，伯克希尔在2009年金融危机深重之时收购的BNSF年收益率约达15%。然而，其他被收购企业的表现远不及此：三分之二（按价值计算）的收购是在2011年底后发生，当时市场已从金融危机的谷底反弹。

伯克希尔前路有三。一是巴菲特及其合伙人查理·芒格（Charles Munger）向股东返还资金，并承认伯克希尔必须收敛野心。但两人似乎还没有这样的打算。第二条路是在股市处于高位的当下开展更多大型收购。这可能会压制伯克希尔未来多年的回报，使之更依赖旗下金融业务的出彩表现。第三条路是巴菲特和芒格持币观望，坐待股市崩盘，到时伯克希尔将可使用这些储备资金低价收购企业，得到高于近期收购的回报。如果是在20年前，这一策略不会有争议，但问题是现在两人分别已是87岁和94岁高龄。伯克希尔已然是一道谜题，足以让全球最伟大的价值投资者也为之挠头。 ■



Transplants and biotechnology

Mix and match

Stem cells and gene editing may turn domestic animals into organ factories

TAKE the fertilised egg of a pig. From each cell in the resulting embryo cut out a gene or genes that promote the development of the animal's heart. Inject human stem cells from a patient who needs a new heart into the embryo and then place it into the womb of a sow. Wait nine months. The result is an adult pig with a heart made of human cells. The pig can be slaughtered and the heart transplanted into the patient who provided the stem cells, for whom the organ will be a genetic match.

That, at least, is the hope of a panel of researchers who presented their work to the AAAS meeting. For, though this kind of biological melding may trip the disgust circuits, the value of such a procedure, were it possible, is clear.

First, transplantable organs are scarce and demand for them is increasing. As life in general, and cars in particular, become safer, the supply of bodies with healthy organs in them is shrinking. Meanwhile, people are living longer. As a result, some 75,000 individuals in America alone are waiting for organs. Every day around 20 of them die. Besides increasing the supply of organs, growing them in animals might also increase their utility. The genetic match between organ and patient would mean those receiving transplanted organs would no longer need to take immunosuppressive drugs to stop rejection.

All this makes growing organs in livestock a tantalising alternative to harvesting them from the dead. Thousands of years of breeding have yielded beasts which grow fast, so a patient need not wait long while his future heart develops inside a young animal. Sheep, cows and pigs are all roughly the

right size to host human organs. And, since such animals are already raised for their flesh and skin, their use to grow more valuable things should meet with no objection beyond squeamishness.

Creating human organs in this way would rely on the union of two recent developments in biotechnology. CRISPR/Cas9, a genetic-engineering tool discovered in 2012, would snip away portions of the animal-host's genome that control the development of the organ being grown. This would create a "genetic vacuum" which could be filled by induced pluripotent stem cells, the second breakthrough, made in 2006. Human pluripotent stem cells can grow into many different kinds of tissues, filling the void left in the developing animal with an organ made from the patient's own cells.

That this combination works in principle was first shown last year, when a group at the Salk Institute in California reported making mice with eyes, pancreases, hearts and other organs composed of rat cells. Such mixed-species creatures are known as chimeras, after a monster in Greek mythology. Many of these mouse-rat chimeras lived to adulthood, and one reached its second birthday which, for a small rodent, is old age. A second group, led by Hiromitsu Nakauchi of Stanford University showed that a mouse pancreas grown this way in a rat, which then had parts of it transplanted into a mouse genetically identical to the one that supplied the stem cells employed, could control diabetes in that mouse. Dr Nakauchi had thus created a working, transplantable organ.

The creation of chimeras that include human organs is more challenging, because people are less closely related to sheep and pigs than mice are to rats. Nevertheless, Dr Nakauchi and his group have followed up their mouse work by growing human pancreas cells in pig fetuses. Another panellist, Pablo Ross of the University of California, Davis, said he had managed a similar feat in sheep. In both cases the chimeric animals were not brought to term. Were that to happen, their human pancreas cells might hypothetically

be extracted and transplanted into people suffering from diabetes, in order to revive a patient's ability to produce insulin.

Dr Nakauchi and Dr Ross both performed their tricks by using CRISPR/Cas9 to snip a gene called *Pdx1* from the embryos of their pigs and sheep. This gene encodes a protein crucial to pancreatic development, thus creating the genetic vacuum that the human pluripotent stem cells go on to fill. But *Pdx1* is not the only gene that can be silenced in this way. Daniel Garry of the University of Minnesota uses the technique to shut down *Etv2* in pigs. *Etv2* controls the development of the vascular system, including the heart. Dr Garry, too, is then able to persuade human stem cells to grow into organ cells—in his case heart cells—though at the moment they form only a small proportion of the cells in the resultant embryonic hearts.

In their quests for pancreatic cells, Dr Nakauchi and Dr Ross have encountered similar problems of rarity. But these are early days. Dr Garry, whose laboratory is now producing two or three pig-human fetuses a week, is studying those fetuses to try to understand why it is that in some only one heart cell in 100,000 is human while in other fetuses the number is one in 100. If he can discover the underlying principle, then the aim of replacing pig cardiac cells entirely with human ones will have come closer. ■



器官移植与生物技术

混搭

干细胞与基因编辑技术也许能把家畜变为器官工厂

取一头猪的受精卵，从所生成胚胎的所有细胞里取出促成心脏发育的一个或多个基因。把需要新心脏的患者的人类干细胞注入该胚胎，然后将胚胎置入母猪的子宫内。九个月后，得到的是一头心脏由人体细胞构成的成年猪。把这头猪宰杀，把它的心脏移植到先前提供干细胞的患者体内，该器官与患者的基因将完全匹配。

至少，这是一些研究人员希望达成的结果。他们在美国科学促进会（AAAS）的会议上介绍了自己的研究。虽然这种生物融合术可能会触发人们的厌恶心理，但如果真能实现，其价值是显而易见的。

首先，对可移植器官的需求不断增长，但供应稀缺。随着人们的生活总体上更加安全，特别是汽车安全性的提高，包含健康器官的尸体的供应量日益减少。同时，人们又越来越长寿。结果，单单在美国就有约75,000人在等待器官，他们当中每天约有20人离世。在动物体内培育人体器官除了可以增加器官供应外，也能提升其成效。器官与患者之间的基因匹配意味着接受移植的患者不再需要服用免疫抑制药物来抑制排斥反应。

鉴于上述原因，在家畜体内培育器官就成了从死人身上采集器官以外的一个诱人选项。人类千万年饲养动物的经验造就了速生型的家畜，所以患者无需花太长时间等待他未来的心脏在幼畜体内完成发育。绵羊、奶牛和猪的体型基本上都适合用于培育人体器官。而且，由于人们早已饲养这些动物用于肉类及皮毛的消费，用它们来培育更有价值的东西顶多会让一些人觉得不适，而不会引发多么大的异议。

以这种方式培育人体器官有赖于两项最新生物技术的结合。2012年问世的基因工程工具CRISPR / Cas9可用于剔除动物宿主身上控制拟培育器官发育

的那部分基因组。这会形成一个“基因真空”，可被“诱导多能干细胞”填补。这种干细胞就是第二项技术突破，诞生于2006年。人类多能干细胞可以生长成许多不同类型的组织，用患者自身细胞培育的器官来填补发育动物体内的空位。

这种组合在理论上的可行性在去年首次得以证实。当时报道称，美国加州索尔克生物研究所（Salk Institute）的一个研究小组正在培育一种小鼠，它的眼睛、胰脏、心脏等器官由大鼠细胞构成。这种混种生物被称为“嵌合体”（chimeras，希腊神话中一个怪兽的名字）。这些大小鼠嵌合体许多都活到了成年，其中一只甚至活了两年，这对小型啮齿动物来说算是高寿了。在斯坦福大学，由中内宏光（Hiromitsu Nakauchi）领导的另一个研究小组用这种方式在大鼠体内培育小鼠胰脏，然后部分移植到一只基因与提供干细胞的小鼠完全匹配的小鼠身上，结果令这只小鼠的糖尿病得到了控制。就这样，中内宏光创造了一个可持续工作的可移植器官。

创造包含人体器官的嵌合体挑战更大，因为人类和绵羊及猪之间的亲缘关系不如小鼠和大鼠那么紧密。尽管如此，在大小鼠嵌合体研究后，中内宏光的团队已开始在猪胚胎中培育人类胰脏。另一个与会专家，加州大学戴维斯分校的帕布罗·罗斯（Pablo Ross）表示已在绵羊身上完成了类似的试验。这两个例子中的嵌合动物都没有培育到足月。如果培育完成，理论上可以提取其体内的人类胰脏细胞移植到糖尿病患者身上，帮助他们恢复分泌胰岛素的能力。

中内宏光和罗斯都是运用CRISPR/Cas9把名为Pdx1的基因（编码一种对胰脏发育至关重要的蛋白质）分别从猪和羊的胚胎中剔除，形成人类多能干细胞可填补的基因真空。但Pdx1并非唯一可用这种方法剔除的基因。明尼苏达大学的丹尼尔·加里（Daniel Garry）以该技术成功在猪体内屏蔽了名为Etv2的基因。Etv2控制包括心脏在内的血管系统的发育。之后，加里也能诱导人类干细胞发育为器官细胞（在他的实验里是心脏细胞），虽然目前它们在合成胚胎心脏的细胞里只占一小部分。

在努力培育胰脏细胞的过程中，中内宏光和罗斯遇到了类似的问题——细

胞数量稀少。但这些都还是早期试验。加里的实验室现在每周培育两到三个人猪嵌合胚胎，通过研究这些胚胎，他想了解为什么在有些嵌合胚胎的心脏中人类细胞占比仅为十万分之一，而在另一些胚胎中则有百分之一。假如他能解开其中奥秘，那么我们将更接近用人类心脏细胞完全置换猪心脏细胞的目标。■



Digital currency

Tales from the crypto-nation

A banking centre seeks to reinvent itself

ON A clear day, sunset over Lake Zug is magnificent. Snow-dusted mountains cut through the orange glow above and are mirrored in the lake below. “Zug is our spiritual home,” says Jeremy Epstein, from Washington, DC, who has just taken 40 foreigners to tour the small Swiss town south of Zurich. They came not for sunsets, though, but to find out how Zug has become known as “crypto-valley”—meaning the home of many firms dealing in crypto-currencies and related activities.

Switzerland’s famous banking secrecy is falling to a global assault on money-laundering and tax evasion. But financial security remains in demand. The country should seek to become the “crypto-nation”, said the economy minister, Johann Schneider-Ammann, in January. Zug aims to be the capital of that nation.

To that end, Switzerland is maintaining loose rules for crypto-businesses, even as other countries are tightening theirs. An industry is developing to store tangible crypto-assets, such as the hard drives on which cryptographic keys are stored, offline in cold, dry, secret sites complete with rapid-response teams. Where better than a decommissioned military bunker in the Swiss Alps? In Zug, friendliness to crypto-currencies is in evidence all around. “Bitcoin accepted here” stickers adorn the city hall and several shops, including the wine merchant’s. In 2016 Zug became the first place in the world to accept bitcoin for some public services. Residents can get a blockchain-based digital identity.

About a quarter of last year’s global total of \$5bn in initial coin offerings

(ICOs, a form of crowdfunding whereby investors are issued with digital tokens) was raised in Switzerland, estimates PwC, a consultancy. Of the ten largest ICOs, four were in part based in Zug.

The town decided early on to attract crypto-entrepreneurs, for example by allowing companies to incorporate based on bitcoin wealth, rather than insisting that it be converted into fiat currency. Taxes have long been low. After the second world war the former fishing village cut its corporate-tax rate to 8.5%. The rate is still competitive, at 14.6% compared with Zurich's 21%.

The crypto-chapter of Zug's history began in earnest in 2013 when the Ethereum Foundation, a non-profit to support the development of the eponymous blockchain, based itself there. More crypto-firms followed. Now, having dealt with 150-odd of them, the local tax authorities are experts, as are the accountants and lawyers.

Two years ago Lakeside Partners, which runs a business centre in Zug, housed just five blockchain-related companies, of a total of 30. Now the number is 70 out of 90. "They landed like flying saucers," says the mayor, Dolfi Mueller. At first he was unsure that the invaders would benefit the town, but "curiosity and being open to the world have brought us much wealth in the past."

Switzerland's decentralised government, direct democracy and history of libertarianism are all essential to Zug's success. These contrast with rival hubs such as Hong Kong and Singapore, and appeal to fans of blockchain technology, which underlies most crypto-currencies and is essentially a distributed ledger maintained collectively by some users. There are practical benefits for crypto-entrepreneurs, too. The federal government takes a light approach to regulation in general, and to new technologies in particular. Cantons have wide latitude in how they deal with companies. A

fintech licence, expected to become available next year, should make life even easier for fintech startups.

A final draw is a reputation for security and safety—including from governments. “You can have all the armoured walls in the world, but if your vault is in China or Singapore and the government says, ‘I’m seizing your assets’, there’s nothing you can do,” says Niklas Nikolajsen of Bitcoin Suisse, a financial-services provider. “That would never happen in Switzerland.”

Regulators elsewhere see it as their job to protect consumers from dubious new crypto-currencies. But Switzerland’s take a more bracing approach. “Our consumers should have the freedom to invest in exotic instruments, even gamble,” says one official. Jörg Gasser, the state secretary for international finance, has little doubt that, if and when the bitcoin bubble bursts, investors will ask for regulation. But, he says, the sector must not be regulated to death.

That does not mean anything goes. His priority, says Mr Gasser, is to protect the integrity of Switzerland as a financial centre. The national regulator, FINMA, is investigating several ICOs for possible breaches of regulations, including anti-money laundering rules. On February 16th it issued guidance on how it would apply existing market legislation, and warned that some tokens would be treated as securities and have to follow stricter rules. A working group has been assembled to look at which rules, if any, ought to apply to ICOs. The aim is to increase legal certainty and ensure that, in the words of a press release from the State Secretariat for International Finance, a government department, “Switzerland remains an attractive location in this area.”

Crypto-entrepreneurs took the measured tone as indicating that Switzerland is still keen on their business. Indeed, as the sector matures, places that offer some regulatory protection or licensing should benefit,

says Joey Garcia, a lawyer at Isolas LLP, who has just helped develop a licensing system in Gibraltar, a rival crypto-centre.

While crypto-companies are growing, physical hubs with well-crafted rules and a critical mass will continue to seem attractive. But crypto-currencies' intrinsically decentralised nature means that eventually the benefits of being part of a cluster may weaken. Unless Zug continues to court them, only the vaults carved into the Swiss granite will stand the test of time. ■



数字货币

加密国传奇

一个银行业中心设法重塑自我

晴朗的日子里，楚格湖（Lake Zug）上的日落壮丽非凡。在橙色余晖的映衬下，白雪皑皑的山峦倒映在山脚下的湖面上。来自华盛顿特区的杰里米·爱普斯坦（Jeremy Epstein）说：“楚格是我们的精神家园。”他刚刚带着40位外国人游览了这个苏黎世以南的瑞士小镇。不过，他们来这儿并不是为了看日落，而是为了弄明白楚格是怎样吸引了众多从事加密货币及相关活动的公司进驻这里，从而成为“加密谷”的。

在全球对洗钱和逃税的打击下，瑞士著名的银行保密制度正在瓦解。但是金融安全仍有市场。瑞士经济部长约翰·施奈德-阿曼（Johann Schneider-Ammann）1月表示，该国应该努力成为一个“加密国”。楚格的目标是成为这个加密国的首都。

为此，在其他国家收紧监管之时，瑞士仍对加密业务维持了宽松的法规。一个行业发展起来，以顺应这样一种需求——把存储密钥的硬盘等有形加密资产离线保存在冰冷干燥、配有快速反应团队的隐秘地点。还有哪里比瑞士阿尔卑斯山里废弃的军事掩体更好？在楚格，对加密货币的友好态度随处可见。市政厅和包括葡萄酒商在内的几家商店贴着“接受比特币”的贴纸。2016年，楚格成为世界上第一个接受比特币支付某些公共服务费用的地方。居民可以得到一个基于区块链的数字身份。

咨询公司普华永道（PwC）估计，去年全球总计50亿美元的首次代币发行（ICO，一种向投资者发行数字代币的众筹）中，约有四分之一在瑞士发行。最大的十次ICO中，有四次部分在楚格发行。

这个小镇早前决定要吸引加密业务的创业者，比如允许以比特币为资产成立公司，而不是坚持要求将其转换为法定货币。这里的税收一直很低。第二次世界大战后，这个从前的小渔村把公司税率降到了8.5%。如今的数字

为14.6%，与苏黎世的21%相比仍然很有竞争力。

楚格于2013年正式迈入了加密业这一历史阶段，当时以太坊基金会（Ethereum Foundation）在此创立，这是一家为支持同名区块链的发展而成立的非盈利组织。多家加密公司紧随其后。如今当地的税务部门、会计师和律师已经跟150多家这类公司打过交道，成了这方面的专家。

两年前，在楚格经营着一个商务中心的Lakeside Partners共有30家公司入驻，其中只有五家是区块链相关企业。而现在那里的90家公司中有70家与区块链相关。“它们像飞碟一样降落到这里。”市长多尔非·穆勒（Dolfi Mueller）说。起初，他不确定这些不速之客是否会让小镇受益，但是“在过去，正是好奇心和对世界开放给我们带来了许多财富”。

瑞士的分权政府、直接民主制和自由主义的历史都是楚格成功的关键。这些特点与香港和新加坡等竞争对手形成了鲜明对比，对区块链技术的粉丝很有吸引力。区块链技术是大多数加密货币的基础，本质上是由部分用户共同维护的分布式总账。加密创业者也能得到实际的好处。联邦政府总体上采取了一种温和的监管方式，特别是对新技术。在如何与公司打交道方面，各州有很大的自由度。瑞士预计会在明年推出金融科技公司牌照，应该会使金融科技创业公司的日子更加好过。

最后的吸引力来自保障和安全方面的声誉，包括不受政府干预。“不管你筑起多少道防护墙，如果你的金库是在中国或新加坡，然后那里的政府说：‘我要没收你的资产’，那你一点办法也没有。”金融服务提供商瑞士比特币公司（Bitcoin Suisse）的尼克拉斯·尼克拉森（Niklas Nikolajsen）说，“这在瑞士是绝对不会发生的。”

其他地方的监管机构认为，保护消费者利益免受可疑的新型加密货币损害是自己的职责所在。但瑞士采取了一种更加包容支持的方式。一位官员表示：“我们的消费者应该享有投资新奇工具的自由，甚至是赌一把的自由。”瑞士联邦国际金融事务国务秘书约克·加瑟尔（Jörg Gasser）深信，如果比特币泡沫破裂，投资者将会要求监管。但他表示，该行业不能被监

管扼杀。

这并不表示该行业可以为所欲为。加瑟尔说，他的首要任务是保护瑞士作为金融中心的诚信度。该国的监管机构瑞士金融市场管理局（FINMA）正在调查几次ICO中可能存在的违规行为，包括违背反洗钱规定。2月16日，该机构发布了如何运用现有市场法规的指导意见，并警告有些代币将被视为有价证券，须遵守更严格的规定。目前瑞士已经组建了一个工作组，研究哪些规则（如果有的话）应当被用在ICO上。此举的目的是增加法律确定性，并且确保——借用瑞士国际金融事务国务秘书处在新闻稿中的说法——“瑞士在这个领域仍然是个有吸引力的地方”。

加密创业者语带谨慎地表示瑞士对他们的业务仍有热情。实际上，伊索拉斯律师事务所（Isolas LLP）的律师乔伊·加西亚（Joey Garcia）说，其实随着该行业的成熟，提供一些监管保护或发牌制度的地方应该会获益。他刚刚帮助直布罗陀开发了一个发牌系统，那里也在力争成为加密中心。

加密公司日益成长，拥有完善法规和足够体量的实体中心仍会显得有吸引力。但加密货币的本质是去中心化，这意味着作为集群一份子的好处最终可能会缩水。除非楚格继续对它们献殷勤，否则经得起时间考验的就只有建在瑞士花岗岩山体中的保险库了。 ■



Central-bank digital currencies

Proceed with caution

A primer on blockchain-based versions of central-bank money

BITCOIN, Ethereum, XRP, Stellar, Cardano: the infant world of cryptocurrencies is already mind-bogglingly crowded. Amid the cacophony of blockchain-based would-be substitutes for official currencies, central banks from Singapore to Sweden have been pondering whether they should issue digital versions of their own money, too. None is about to do so, but a report prepared by central-bank officials from around the world, published by the Bank for International Settlements on March 12th—a week before finance ministers and central-bank heads from G20 countries meet in Buenos Aires—offers a guide to how to approach the task.

The answer? With care. For a start, it matters who will be using these central-bank digital currencies (CBDCs). Existing central-bank money comes in two flavours: notes and coins available to anyone; and reserve and settlement accounts open only to commercial banks, already in electronic form (though not based on blockchain) and used for interbank payments. Similarly, CBDCs could be either widely available or tightly restricted. A CBDC open to all would in effect allow anyone to have an account at the central bank.

CBDCs could be transferred either “peer to peer”, like cash, or through the banking system. They could be held anonymously, preserving the privacy of cash, or tagged, making it easier to trace suspicious transactions. Should they bear interest, that would affect demand not only for CBDCs but also for cash, bank deposits and government bonds.

The report weighs up CBDCs’ possible effects on payment systems,

monetary policy and financial stability. A steep decline in the use of cash could strengthen the case for a widely available CBDC. In Sweden the Riksbank is contemplating an “e-krona” for small payments. But in most countries, despite the growing use of cards, accelerated by the advent of contactless payments, cash remains popular (see chart). Experiments with a CBDC just for interbank payments, says the report, have “not shown significant benefits”.

A widely available, interest-bearing CBDC could, in principle, tighten the link between monetary policy and the economy. An interest rate tied to the policy rate may put a floor under money-market rates. Banks may have little choice but to pass changes in the CBDC rate on to depositors. Negative rates would be easier to implement, especially if high-denomination banknotes were abolished. But all this is uncertain. Retail depositors are less sensitive than institutional investors to changes in rates. Central banks already have plenty of tools. The authors are not sure that the putative gains yet warrant creating CBDCs.

On financial stability, they are more cautious still. In times of stress, depositors flee wobbly banks for safer homes—and a CBDC would allow “digital runs” to the central bank. Even in normal conditions, banks would face higher funding costs if they had to compete with the central bank for deposits. Digital versions of currencies used internationally (eg, the dollar) could worsen these complications, if foreigners were free to use them.

Central bankers focus more on the rise of private crypto-currencies, warning that they are speculative gambles. Expect more such admonitions in Buenos Aires—and no rush to mint CBDCs. ■



央行数字货币

谨慎前行

区块链版央行货币的入门指南

比特币、以太币、瑞波币、恒星币、艾达币——新生加密货币世界的成员之多令人惊讶。在一片关于基于区块链的数字货币可能替代官方货币的喧嚣声中，新加坡和瑞典等国的央行已在认真考虑是否应发行自己的数字货币。还没有哪个国家会立刻行动，不过，国际清算银行在本月12日（二十国集团的财长和央行行长在布宜诺斯艾利斯举行会议的前一周）发布了由世界各国央行官员编写的一份报告，为如何应对这项任务提供了指南。

答案是什么呢？谨慎行事。首先，必须弄清楚谁将使用这些央行数字货币（CBDC）。现有的央行资金分两类：一是任何人都能使用的纸币和硬币，二是只对商业银行开放的储备和结算账户，资金已经是电子形式（尽管不是基于区块链），用于银行间支付。同样地，央行数字货币也可以是广为开放的或严加限制的。如果是对所有人开放，那么实际上就等于任何人都可以在央行开立账户。

央行数字货币可以像现金那样“点对点”直接转移，也可以通过银行系统来转账。这些货币可匿名持有，从而保留现金的私密性，也可以加注标记，方便追踪可疑的交易。如果它们会产生利息，那么不仅会影响人们对它们的需求，也会影响对现金、银行存款和政府债券的需求。

该报告评估了央行数字货币对支付系统、货币政策及金融稳定性可能造成的影响。在现金使用量急剧下降的情况下，央行会更有理由推出广泛发行的数字货币。瑞典央行就在考虑推出“电子克朗”用于小额支付。但在大多数国家，尽管“刷卡”变得愈发普遍——非接触式支付的出现更加速了这一进程，但现金仍广受欢迎（见图表）。而据报告称，对仅用于银行间支付的央行数字货币的试验“并未显现出明显的好处”。

理论上，广泛使用且产生利息的央行数字货币可使货币政策与经济的关系更加紧密。与政策利率挂钩的央行数字货币利率也许能够托底货币市场利率。银行可能别无选择，只能把央行数字货币利率的变化转嫁到储户的身上。负利率会更易实施，如果发生大额纸币被废止的情况就更是如此。但所有这些都还无法确定。个人储户对利率变化的敏感度低于机构投资者。各国央行已有很多工具可用。报告作者并不确信基于这些假定的益处就应发行央行数字货币。

在金融稳定性方面，他们就更是小心翼翼了。经济不稳定时，储户会把资金从岌岌可危的银行转移到更安全的港湾，而央行数字货币会令央行面对“数字挤兑”的情况。即便在正常的经济环境里，如果银行为争取存款而不得不与央行竞争，银行的融资成本也会上升。如果数字货币可跨国使用（例如美元），外国人可自由使用这些货币，可能会令问题变得更加复杂。

央行官员更关注的是私人加密货币的崛起，警告说那是投机赌博。估计在布宜诺斯艾利斯的峰会上将出现更多此类告诫，他们也不会急着要发行自己的数字货币。 ■



Economic and financial indicators

World GDP

The OECD reckons that global growth will rise to 3.9% this year

The world economy grew by 3.3% in the last quarter of 2017 compared with a year earlier, according to our estimates. That was slightly less than in the third quarter, but higher than the average of the past five years. The euro area's economy kept recovering, helped by strengthening export markets and the central bank's easy monetary policy. Growth in America increased to 2.5% year on year: its economy has now been expanding for eight consecutive years. Russia and Brazil strengthened as well, after a period of political ructions and low commodity prices. The OECD, a think-tank, reckons that global growth will rise to 3.9% this year thanks to investment growth, stronger trade and higher employment. ■



经济与金融指标

全球GDP

经合组织预测今年全球经济增速将升至3.9%

据本刊估算，2017年最后一季度全球经济同比增长3.3%。这个数字略低于去年第三季度，但高于过去五年的平均水平。欧元区出口市场扩大，加之央行宽松货币政策的助力，经济持续复苏。美国经济同比增长2.5%，如今已连续八年实现扩张。俄罗斯和巴西在经过一段时间的政治骚动和大宗商品价格低迷后，经济也已走强。智库经合组织（OECD）估计，由于投资增长、贸易加强、就业率提高，今年全球经济增长率将升至3.9%。■



The workplace of the future

AI-spy

As it pushes beyond the tech industry, artificial intelligence could make workplaces fairer—or more oppressive

ARTIFICIAL intelligence (AI) is barging its way into business. Firms of all types are harnessing AI to forecast demand, hire workers and deal with customers. In 2017 companies spent around \$22bn on AI-related mergers and acquisitions, about 26 times more than in 2015. The McKinsey Global Institute, a think-tank within a consultancy, reckons that just applying AI to marketing, sales and supply chains could create economic value, including profits and efficiencies, of \$2.7trn over the next 20 years. Google's boss has gone so far as to declare that AI will do more for humanity than fire or electricity.

Such grandiose forecasts kindle anxiety as well as hope. Many fret that AI could destroy jobs faster than it creates them. Barriers to entry from owning and generating data could lead to a handful of dominant firms in every industry.

Less familiar, but just as important, is how AI will transform the workplace. Using AI, managers can gain extraordinary control over their employees. Amazon has patented a wristband that tracks the hand movements of warehouse workers and uses vibrations to nudge them into being more efficient. Workday, a software firm, crunches around 60 factors to predict which employees will leave. Humanyze, a startup, sells smart ID badges that can track employees around the office and reveal how well they interact with colleagues.

Surveillance at work is nothing new. Factory workers have long clocked in and out; bosses can already see what idle workers do on their computers.

But AI makes ubiquitous surveillance worthwhile, because every bit of data is potentially valuable. Few laws govern how data are collected at work, and many employees unguardedly consent to surveillance when they sign their employment contract. Where does all this lead?

Start with the benefits. AI ought to improve productivity. Humanyze merges data from its badges with employees' calendars and e-mails to work out, say, whether office layouts favour teamwork. Slack, a workplace messaging app, helps managers assess how quickly employees accomplish tasks. Companies will see when workers are not just dozing off but also misbehaving. They are starting to use AI to screen for anomalies in expense claims, flagging receipts from odd hours of the night more efficiently than a carbon-based beancounter can.

Employees will gain, too. Thanks to strides in computer vision, AI can check that workers are wearing safety gear and that no one has been harmed on the factory floor. Some will appreciate more feedback on their work and welcome a sense of how to do better. Cogito, a startup, has designed AI-enhanced software that listens to customer-service calls and assigns an "empathy score" based on how compassionate agents are and how fast and how capably they settle complaints.

Machines can help ensure that pay rises and promotions go to those who deserve them. That starts with hiring. People often have biases but algorithms, if designed correctly, can be more impartial. Software can flag patterns that people might miss. Textio, a startup that uses AI to improve job descriptions, has found that women are likelier to respond to a job that mentions "developing" a team rather than "managing" one. Algorithms will pick up differences in pay between genders and races, as well as sexual harassment and racism that human managers consciously or unconsciously overlook.

Yet AI's benefits will come with many potential drawbacks. Algorithms may not be free of the biases of their programmers. They can also have unintended consequences. The length of a commute may predict whether an employee will quit a job, but this focus may inadvertently harm poorer applicants. Older staff might work more slowly than younger ones and could risk losing their positions if all AI looks for is productivity.

And surveillance may feel Orwellian—a sensitive matter now that people have begun to question how much Facebook and other tech giants know about their private lives. Companies are starting to monitor how much time employees spend on breaks. Veriato, a software firm, goes so far as to track and log every keystroke employees make on their computers in order to gauge how committed they are to their company. Firms can use AI to sift through not just employees' professional communications but their social-media profiles, too. The clue is in Slack's name, which stands for "searchable log of all conversation and knowledge".

Some people are better placed than others to stop employers going too far. If your skills are in demand, you are more likely to be able to resist than if you are easy to replace. Paid-by-the-hour workers in low-wage industries such as retailing will be especially vulnerable. That could fuel a resurgence of labour unions seeking to represent employees' interests and to set norms. Even then, the choice in some jobs will be between being replaced by a robot or being treated like one.

As regulators and employers weigh the pros and cons of AI in the workplace, three principles ought to guide its spread. First, data should be anonymised where possible. Microsoft, for example, has a product that shows individuals how they manage their time in the office, but gives managers information only in aggregated form. Second, the use of AI ought to be transparent. Employees should be told what technologies are being used in their workplaces and which data are being gathered. As a matter of routine,

algorithms used by firms to hire, fire and promote should be tested for bias and unintended consequences. Last, countries should let individuals request their own data, whether they are ex-workers wishing to contest a dismissal or jobseekers hoping to demonstrate their ability to prospective employers.

The march of AI into the workplace calls for trade-offs between privacy and performance. A fairer, more productive workforce is a prize worth having, but not if it shackles and dehumanises employees. Striking a balance will require thought, a willingness for both employers and employees to adapt, and a strong dose of humanity. ■



未来的工作场所

AI间谍

人工智能向科技行业以外扩张，它可能让工作场所变得更公平，也可能变得更高压

人工智能（AI）横冲直撞，闯入了商业领域。各种各样的公司都在利用人工智能来预测需求、雇用员工、与客户打交道。2017年，企业在AI方面的并购支出达220亿美元上下，大约是2015年的26倍。咨询公司麦肯锡的内部智库麦肯锡全球研究院（McKinsey Global Institute）认为，仅仅是将人工智能应用到营销、销售和供应链上，未来20年就能创造2.7万亿美元的经济价值，包括利润和效率。谷歌的老板甚至宣称对人类而言，人工智能比火和电的用处更大。

如此宏伟的预测既点亮了希望，也带来了焦虑。许多人担心AI摧毁就业岗位的速度会比创造就业机会的速度更快。拥有数据和生成数据存在准入门槛，这可能会导致每个行业中只有少数几家公司占据主导地位。

人们不太熟悉、但同样重要的一个问题是AI将如何改变工作场所。利用AI，管理者可以非常严密地控制他们的员工。亚马逊获得专利的腕带可以追踪仓库工人的手部动作，并通过振动敦促他们提高效率。软件公司Workday研究了大约60个因素来预测哪些员工会离职。创业公司Humanyze销售的智能工牌可以跟踪员工在办公室的动向，显示他们与同事的互动情况。

工作中的监控并不是什么新鲜事。工厂工人一直都在打卡上下班；老板们也已经能看到无所事事的员工在电脑上干什么。但是有了AI之后，就值得部署无处不在的全面监控了，因为每一个数据都有潜在的价值。很少有法律规定该如何收集工作数据，而且许多员工在签订雇佣合同时都会毫无戒心地同意接受监控。这一切会导致什么结果？

先从好处说起。AI应该能提高生产率。Humanyze公司将其智能工牌中的数据与员工的日程表和电子邮件信息结合分析，可以获得一些发现，比如

办公室的布局是否有利于团队合作。职场即时通讯应用Slack帮助管理者评估员工完成任务的速度。公司不仅能发现员工打瞌睡，还能看到他们何时行为不当。公司还开始用AI来筛查费用报销中的异常，把晚间异常时段的发票标注出来，比那些会算账的活人效率更高。

员工也会获益。有赖于计算机视觉的进步，AI可以检查工人是否穿好了安全设备，车间里是否有人受伤害等。有些人会很高兴获得更多有关自己工作的反馈，并乐于知道怎样做更好。创业公司Cogito设计了一款AI增强软件，可以监听客服电话，根据客服的体恤度、解决顾客投诉的速度和能力打出“共情分”。

机器有助于确保加薪和晋升的机会留给那些应得的人。这从招聘就开始了。人往往有偏见，而如果设计得当，算法能比人更公正。软件可以标识出人可能注意不到的模式。Textio是一家利用AI改进岗位描述的创业公司，它发现女性更有可能应征那种谈及“发展”团队而非“管理”团队的工作。算法会发现不同性别和种族间的薪酬差异，以及人类管理者有意无意忽略的性骚扰和种族歧视。

不过人工智能在带来好处的同时也会有许多潜在的缺陷。算法也许难免会受程序员偏见的影响。它们也会产生意想不到的后果。AI或许可以通过上下班路程的长短预测员工是否会辞职，但关注这一点也可能在无意中伤害到经济状况较差的求职者。年长的员工可能比年轻员工手脚慢，如果AI只关注生产率，那他们可能就会丢掉饭碗。

而且监控可能会让人感觉身处奥威尔笔下的世界。这可是个敏感的问题——人们已经开始质疑Facebook和其他科技巨头究竟掌握了多少有关他们的私生活内容。公司开始监控员工花多长时间在工间休息上。软件公司Veriato的产品甚至追踪和记录员工在电脑上的一举一动，以此来衡量他们对雇主是否尽心尽力。如今企业不仅可利用AI筛查员工的工作通讯，还能详查他们的社交媒体信息。Slack这个名字就很能说明问题——它是一个缩写，代表“所有对话和信息的可搜索日志”（searchable log of all conversation and knowledge）。

一些人会比其他人更有底气让雇主不要做得太过头。如果市场需要你的技能，那么你就比那些可被轻易取代的人更可能抵挡住这种趋势。在零售业等低薪行业里领取小时工资的员工处境尤其不妙。这可能会促使力图代表员工利益、寻求制定规范的工会复兴。但即便真的如此，在某些岗位上将只有这样的选择：要么被机器人取代，要么被当机器人对待。

监管机构和雇主在权衡职场应用AI的利弊时，应采用三大原则来指导这项技术的普及。首先，在可能的情况下，数据应该匿名。例如微软有个产品，可向个人展示他们如何管理自己的工作时间，但只向经理们提供整合后的信息。其次，AI的使用应该是透明的。公司应告知员工正在使用哪些技术收集哪些数据。公司用于雇用、解雇和晋升决策的算法应接受测试，看是否存在偏见或意外后果，而且这应成为常规做法。最后，各国应该允许个人索要自己的数据，不管他们是想就被解雇提出异议的前员工，还是希望向未来雇主展示自己能力的求职者。

AI大举进军工作场所，人们需要在隐私和绩效之间权衡取舍。一个更公平、生产率更高的工作场所值得拥有，但如果它束缚了员工，抹杀了人性，就得不偿失了。要在两者间取得平衡需要深思熟虑，需要雇主和雇员都有调适的意愿，还需要大量的人性关怀。 ■



AI in society

The unexamined mind

Artificial intelligence now does real work. That it cannot explain its own actions is a problem

SCIENCE fiction is littered with examples of intelligent computers, from HAL 9000 in “2001: A Space Odyssey” to Eddie in “The Hitchhiker’s Guide to the Galaxy”. One thing such fictional machines have in common is a tendency to go wrong, to the detriment of the characters in the story. HAL murders most of the crew of a mission to Jupiter. Eddie obsesses about trivia, and thus puts the spacecraft he is in charge of in danger of destruction. In both cases, an attempt to build something useful and helpful has created a monster.

Successful science fiction necessarily plays on real hopes and fears. In the 1960s and 1970s, when HAL and Eddie were dreamed up, attempts to create artificial intelligence (AI) were floundering, so both hope and fear were hypothetical. But that has changed. The invention of deep learning, a technique which uses special computer programs called neural networks to churn through large volumes of data looking for and remembering patterns, means that technology which gives a good impression of being intelligent is spreading rapidly. Applications range from speech-to-text transcription to detecting early signs of blindness. AI now runs quality control in factories and cooling systems in data centres. Governments hope to employ it to recognise terrorist propaganda sites and remove them from the web. And it is central to attempts to develop self-driving vehicles. Of the ten most valuable quoted companies in the world, seven say they have plans to put deep-learning-based AI at the heart of their operations.

Real AI is nowhere near as advanced as its usual portrayal in fiction. It

certainly lacks the apparently conscious motivation of the sci-fi stuff. But it does turn both hope and fear into matters for the present day, rather than an indeterminate future. And many worry that even today's "AI-lite" has the capacity to morph into a monster. The fear is not so much of devices that stop obeying instructions and instead follow their own agenda, but rather of something that does what it is told (or, at least, attempts to do so), but does it in a way that is incomprehensible.

The reason for this fear is that deep-learning programs do their learning by rearranging their digital innards in response to patterns they spot in the data they are digesting. Specifically, they emulate the way neuroscientists think that real brains learn things, by changing within themselves the strengths of the connections between bits of computer code that are designed to behave like neurons. This means that even the designer of a neural network cannot know, once that network has been trained, exactly how it is doing what it does. Permitting such agents to run critical infrastructure or to make medical decisions therefore means trusting people's lives to pieces of equipment whose operation no one truly understands.

If, however, AI agents could somehow explain why they did what they did, trust would increase and those agents would become more useful. And if things were to go wrong, an agent's own explanation of its actions would make the subsequent inquiry far easier. Even as they acted up, both HAL and Eddie were able to explain their actions. Indeed, this was a crucial part of the plots of the stories they featured in. At a simpler level, such powers of self-explanation are something software engineers would like to emulate in real AI.

One of the first formal research programs to attempt to crack open the AI "black box" is the Explainable AI (XAI) project, which is being run by the Defence Advanced Research Projects Agency (DARPA), an organisation that

does much of America's military research. In particular, America's armed forces would like to use AI to help with reconnaissance. Dave Gunning, XAI's head, observes that monitoring places like North Korea from on high, by spy plane or satellite, creates a huge amount of data. Analysts looking at these data would certainly value something that alerted them automatically to suspicious activity. It would, though, also be valuable if such an agent could explain its decisions, so that the person being alerted was able to spot and ignore the inevitable false positives. Mr Gunning says that analysts from one of America's spy agencies, the NSA, are already overwhelmed by the recommendations of old-fashioned pattern-recognition software pressing them to examine certain pieces of information. As AI adds to that deluge, it is more important than ever that computer programs should be able to explain why they are calling something to a human operator's attention.

How the NSA is responding to this is, understandably, a secret. But civilian programmes are also trying to give neural networks the power to explain themselves by communicating their internal states in ways that human beings can comprehend. Trevor Darrell's AI research group at the University of California, Berkeley, for example, has been working with software trained to recognise different species of birds in photographs. Instead of merely identifying, say, a Western Grebe, the software also explains that it thinks the image in question shows a Western Grebe because the bird in it has a long white neck, a pointy yellow beak and red eyes. The program does this by drawing on the assistance of a second neural network which has been trained to match the internal features of the agent doing the recognising (ie, the pattern of connections between its "neurons") with sentences that people have written, describing what they see in a picture being examined. So, as one AI system learns to classify birds, the other learns simultaneously to classify the behaviour of the first system, in order to explain how that system has reached its decisions.

A team led by Mark Riedl at the Georgia Institute of Technology has

employed a similar technique to encourage a game-playing AI to explain its moves. The team asked people to narrate their own experiences of playing an arcade game called Frogger. They then trained an AI agent to match these narratives to the internal features of a second agent that had already learned to play Frogger. The result is a system which provides snippets of human language that describe the way the second agent is playing the game.

Such ways of opening the black box of AI work up to a point. But they can go only as far as a human being can, since they are, in essence, aping human explanations. Because people can understand the intricacies of pictures of birds and arcade video games, and put them into words, so can machines that copy human methods. But the energy supply of a large data centre or the state of someone's health are far harder for a human being to analyse and describe. AI already outperforms people at such tasks, so human explanations are not available to act as models.

Fortunately, other ways exist to examine and understand an AI's output. Anupam Datta, a computer scientist at Carnegie Mellon University, in Pittsburgh, for instance, is not attempting to peer inside the black box directly, in the ways that Dr Darrell and Dr Riedl are. Rather, he is trying to do so obliquely, by "stress-testing" the outputs of trained systems—for example, those assessing job candidates.

Dr Datta feeds the system under test a range of input data and examines its output for dodgy, potentially harmful or discriminatory results. He gives the example of a removals firm that uses an automated system to hire new employees. The system might take a candidate's age, sex, weightlifting ability, marital status and education, as described in the application, as its inputs, and churn out a score which indicates how likely that candidate is to be a good employee.

Clearly one of these pieces of information, the ability to lift heavy things, is both pertinent and likely to favour male candidates. So in this case, to test the system for bias against females, Dr Datta's program alters randomly selected applications from women to make them appear to be from men and, separately, swaps the weightlifting abilities of female applicants—again, at random—with that of applicants from both sexes. If the randomisation of sex produces no change in the number of women offered jobs by the AI, but randomising weightlifting ability increases it (because some women now appear to have “male”abilities to lift weights), then it is clear that weightlifting ability itself, not an applicant's sex, is affecting the hiring process.

Dr Datta's approach does not get to the heart of how and why agents are making decisions, but, like stress testing an aircraft, it helps stop undesirable outcomes. It lets those who make and operate AI ensure they are basing decisions on the right inputs, and not harmful spurious correlations. And there are other ways still of trying to peer into machines' minds. Some engineers, for example, are turning to techniques, such as cognitive psychology, that human beings use to understand their own minds. They argue that, since artificial neural networks are supposed to like brains, it makes sense to employ the tools of human psychology to investigate them.

One example of such an approach is research by DeepMind, an AI firm in London that is owned by Google's parent company, Alphabet. This has yielded an intriguing insight into the behaviour of a piece of image-matching software the company has designed. A group of DeepMind's engineers, led by David Barrett, showed the software sets of three images. The first of each set was a “probe” image of a certain shape and colour. Of the other two, one matched the probe in shape and the second matched it in colour. By measuring how often the system chose the shape match as opposed to the colour match, Dr Barrett and his team were able to deduce

that DeepMind's image matcher equates images in the way that people do—that is, according to shape rather than colour. Elucidating in this way the broader principles of how a particular AI makes decisions might be useful when preparing it for deployment in the world. It might also help accident investigators, by directing them towards the most likely sorts of explanation for a failure.

Those inclined to try to crack open the “minds” behind AI thus have many ways of doing so. Some people, however, think this whole approach wrongheaded. They observe that those decisions made by AI which are hardest to scrutinise are necessarily the most complex and thus likely to be the most useful. Easy-to-parse tasks, like playing video games and naming birds, are of limited value. Decisions made while balancing an electrical grid or managing a city’s traffic flow are harder to explain, especially as many of them are taken at levels beyond human processing capabilities. Yoshua Bengio, a computer scientist at the University of Montreal, calls this kind of processing artificial intuition.

Dr Bengio says such artificial intuition was on display during the most public demonstration of deep-learning that has ever taken place. This was a Go match held in 2016 between an AI agent and Lee Sedol, the world’s greatest human player. The agent in question, AlphaGo, was trained by DeepMind. It sometimes made unexpected moves that human experts could not explain. At first those moves appeared to be errors. But AlphaGo then used the surprising position thus generated to dominate the rest of the match.

Intriguingly, moves like these are also sometimes made by human Go masters. They are known in Japanese as *kami no itte* (“the hand of God”, or “divine moves”). As the name suggests, a player who feels a move is divinely directed in this way usually cannot say how or why he placed a certain stone where he did. Indeed, the fact that players cannot explain

the reasoning behind their best moves offers a hint as to why old-style Go-playing computers, based on formal logic, were never any good. Neural learning systems, both those that have evolved in brains and those now being put into computers, can handle the task of playing Go. But human language cannot describe it.

There is, though, a crucial difference between the explanations that humans offer up for their own behaviour, and those available from machines. As Dan Sperber, a cognitive scientist at the Jean Nicod Institute, in Paris, observes, people tend to construct reasons for their behaviour which align with information mutually available to speaker and listener, and with their own interests, rather than describing accurately how their thoughts led to a decision. As he puts it, “the reason to give reasons is so that others will evaluate your actions and beliefs”. Today’s autonomous machines do not have their own interests to serve. Instead, their explanations are forged by and for human beings.

Some speculate that this may change in the future, if AI is developed which, like the fictional variety, seems to have motives of its own, rather than merely acting at human whim. Jacob Turner, a specialist in international law, suggests ascribing legal personhood to AI will then be necessary if those harmed by such advanced agents are to seek compensation and justice.

That is probably a long way off. But even today’s AI may raise ticklish legal questions. In particular, machine minds that cannot explain themselves, or whose detailed operation is beyond the realm of human language, pose a problem for criminal law. As Rebecca Williams, a legal scholar at Oxford University, observes, if machines lack the ability to explain their actions, current law might struggle to identify criminal intent in acts that arise because of decisions they have made. “In criminal law,” she says, “the thing that’s interesting is having the third party breaking the chain of causation

that is not a human being. That is really new."

This is not a matter of AI agents themselves acting in a criminal manner in the way Mr Turner speculates might one day happen. But if the process by which a machine made a decision cannot be subject to cross-examination, because neither the machine nor its creator is able to explain what went on, then deciding the guilt or innocence of a human being associated with that decision may be impossible.

For example, if a neural network that authorises loans cannot explain why it gives certain people certain scores that seem biased against one social group or another, it may be impossible to determine whether its operators had arranged this intentionally (which would be an offence in most jurisdictions), or whether lazy coding by its designers had led to accidental bias (which would probably be a matter for the civil courts rather than the criminal ones). Similarly, if the AI that ran the visual systems of a driverless taxi were a black box that could not be interrogated about its choices, it might be hard to know whether a death caused by that car was the fault of the manufacturer or of the firm responsible for maintaining the vehicle.

The world is still a few years from the moment a case involving a driverless car might come before the courts. A case of social bias, however, is eminently conceivable even now. It does not require the imaginations of Arthur C. Clarke or Douglas Adams, the inventors, respectively, of HAL and Eddie, to envisage the advantages of software that can not only act, but also explain the reasons behind its actions. ■



人工智能走进社会

无法检验的思维

人工智能已应用于实际工作，但它无法解释自己的行为是一大问题

从《2001太空漫游》（2001: A Space Odyssey）中的哈儿（HAL 9000）到《银河系漫游指南》（The Hitchhiker's Guide to the Galaxy）中的艾迪（Eddie），科幻小说中一直不乏智能计算机的戏份。这类虚构机器的一个共同特点是容易出问题，给故事中的人物造成损害。在一次飞往木星的任务中，哈儿杀害了大部分宇航员。艾迪则执着于细枝末节，险些导致它控制的太空船解体。这两个故事中，人们试图打造得力的机器助手，不料却创造出了怪物。

成功的科幻作品必然会利用真实的希望和恐惧。上世纪六七十年代哈儿和艾迪被创作出来时，创造人工智能（以下简称AI）的尝试陷入了困境，因此希望和恐惧都是假想出来的。但这已经改变。随着深度学习技术（名为“神经网络”的专用电脑程序处理大量数据以寻找并记住其中的模式）的诞生，给人“聪慧”印象的科技正在快速传播。从语音转录文字到检测早期失明症兆，各种智能应用应有尽有。如今AI已被用于控制工厂的质检程序和数据中心的冷却系统。政府希望运用AI识别恐怖分子的宣传网站并将之从网络上删除。另外，AI也是自动驾驶汽车研发的核心所在。在全球市值最高的十大上市公司中，有七家表示已计划将基于深度学习的AI技术作为核心事务。

真正的AI远不如虚构作品中惯常描写的那般先进。它肯定没有科幻小说中那种貌似有意识的动机。但它确实把希望和恐惧都变成了当前的现实，而不是模糊不定的未来。许多人甚至担心现在的“轻度AI”工具也足以演变为怪物。最令人害怕的还不是AI设备不服从指令，而是它虽然听从指令（或至少尝试服从指令），却是以人们无法理解的方式执行。

造成这种恐惧的原因是，深度学习程序会在处理的数据中发现模式，并据

此重组自身的数字结构，从而完成学习过程。具体来说，这些程序是模拟神经科学家所认为的人脑学习机制——程序内的计算机代码就如同大脑的神经元，程序就是通过改变这些代码的连接强度来学习的。这意味着一套神经网络受训后，连它的设计者也无法了解其行事方式。因此，如果允许这些智能代理来管理关键基础设施或做出医疗决策，就相当于把人命付托给了没人真正了解其运作方式的设备。

但如果AI代理能以某种方式解释自己运作的原因或动机，不但会增进人们对它们的信任，它们本身也会变得更有用。而且万一出现问题，它们对自身行动的解释对后续调查也会大有助益。就连胡作非为的哈儿和艾迪也能解释自己的行为——事实上这在它们存在的故事中还是情节的关键部分。在更简单的层面，这种自我解释的能力是软件工程师希望在现实AI中效仿的。

美国国防部高级研究计划局（DARPA，负责美国军方的大部分研究工作）开展的“可解释AI项目”（Explainable AI project，以下简称XAI）是最早试图打开AI“黑箱”的正式研究项目之一。美国军方尤其希望运用AI助力侦察工作。XAI的负责人戴夫·冈宁（Dave Gunning）发现，侦察机或间谍卫星在高空监控朝鲜这类地方时会产生大量数据。处理这些数据的分析员自然希望能有辅助工具自动提示可疑活动。这种智能代理如果能解释自身判断也是好事，这样收到警报的人就可以发现并忽略难免出现的误报。冈宁表示，美国情报机构国家安全局（以下简称NSA）使用的老式模式识别软件会大量提示工作人员去核查某些信息，让他们不堪重负。AI的应用会进一步加大这种压力，因此，计算机程序能够解释为何提示操作人员注意某些信息就前所未有地重要了。

NSA对自己的应对方式自然是保密的。但民间项目也在尝试让神经网络以人类能理解的方式表达其内部状态，从而解释自身的行动。例如，加州大学伯克利分校的特雷弗·达雷尔（Trevor Darrell）领导的AI研究小组一直在训练软件分辨图片中不同种类的鸟。该软件不单能识别出某种鸟，比如北美鶲鶲，还能说明它的判断是基于图中的鸟拥有白色长脖子、黄色尖喙和红色眼睛。要做到这一点，程序需借助另一个神经网络，后者已经过训

练，可把执行识别任务的智能代理的内部特点（即其“神经元”之间的连接模式）与人们描述图片时的语句相匹配。也就是说，在一个AI系统学习分辨鸟类的同时，另一个AI在同步学习对前一个系统的行为做分类，从而解释其判断思路。

在佐治亚理工学院，由马克·里德尔（Mark Riedl）带领的团队采用类似的技术调教一款游戏AI系统解释自己的操作。该团队请来一些人描述自己玩街机游戏《青蛙过河》（Frogger）的体验，然后训练一个AI代理把这些描述与已学会玩《青蛙过河》的第二个智能代理的内部编码结构作配对。结果，该团队打造出一套系统，能使用人类语言片段描述第二个智能代理玩游戏的方式。

这些方法能在一定程度上打开AI黑箱，但顶多也就能达到人类能达到的解释水平，因为这些方法本质上就是在模拟人类的解释。人能辨析鸟类图片和街机游戏的复杂细节并用语言表达，机器也就能仿照这种方式来解释自己的行为。但是，要让人去分析描述某个大型数据中心的能源供应情况或者某个人的健康状况就困难得多了。AI完成这些任务的能力已超越人类，所以人类的解释不可用作模型。

幸好还有其他方法来检查和理解AI的输出。例如，有别于达雷尔和里德尔的做法，在位于匹兹堡的卡内基梅隆大学，计算机科学家阿努邦·达塔（Anupam Datta）并不直接窥探黑箱的内部，而是另辟蹊径，对受训练系统（例如求职者评估系统）的输出进行“压力测试”。

达塔博士向受测试系统输入一系列数据，再检查其输出是否存在可疑、可能有害或者歧视性的结果。他以一家采用自动化招聘系统的搬家公司为例来说明问题。这个系统可能以求职者在申请表中所述的年龄、性别、力气、婚姻状况及受教育程度作为输入数据，然后得出分数，显示这位求职者胜任工作的可能性。

显然，在上述信息中，搬举重物的能力这一项很重要，也很可能使得系统更偏向男性求职者。所以在这种情况下，为测试系统是否存在歧视女性的

问题，达塔的项目先后做了两个实验：第一个是随机挑选部分女性求职者，将她们的信息改得好像是男性求职者；第二个是把一些女性求职者（也是随机挑选的）的负重能力与部分有男有女的求职者的数字对调。假如性别的随机化没有改变AI系统决定聘用的女性人数，但负重能力的随机化却使获聘女性增加（因为部分女性现在显示的是“男性”的负重能力），那么，影响系统做出聘用决策的无疑就是负重能力本身，而非求职者的性别。

达塔的方法并未触及智能代理判断方式与理据的核心，但与飞机的压力测试一样，它有助于防范不理想的结果。这种方法能让开发及操作AI的人员确保决策是基于正确的输入，而非有害的虚假关联。而且，人们仍可以利用其他方法来窥探机器的“思维”。例如，一些工程师正从人类用来探秘自己大脑的方法中寻找灵感，比如认知心理学。他们认为，既然人造神经网络会像大脑般运作，那么自然可以运用研究人类心理的工具来研究这些网络。

这方面的一个例子是DeepMind开展的研究，这家位于伦敦的AI企业隶属于谷歌的母公司Alphabet。该研究对DeepMind设计的一款图像匹配软件的工作方式得出了有趣的见解。由大卫·巴雷特（David Barrett）带领的DeepMind工程师团队向此软件展示三幅一组的多组图片。每组的第一幅图片是“探测”图像，上面的图案有着特定的形状和颜色；另外两幅图片中，一幅与第一幅的形状匹配，另一幅与第一幅的颜色匹配。通过统计系统取形状匹配而舍颜色匹配的频率，巴雷特和他的团队推断出DeepMind的这一软件匹配图像的方式与人类相同，都是看形状而非颜色。以上述方法阐释特定AI程序做决策的更广泛原则，或许有助于在现实世界安排部署相关程序，也许还可以帮助事故调查人员确定最有可能的事故原因。

所以，想撬开黑箱一探AI的“头脑”还是有不少方法。然而，有人认为这种思路总体是错误的。他们发现，最难探查解释的AI决策必然是最复杂的，因而也很可能是最有用的。玩电子游戏和识别鸟类这类易于解析的任务实际上意义有限。电网调度或城市交通流量管理中的决策更难解释，特别是其中许多判断已经超出了人类的处理能力。蒙特利尔大学的计算机科学家

约书亚·本吉奥（Yoshua Bengio）称这种处理为“人工直觉”。

本吉奥表示，这类人工直觉在深度学习技术最为公开的一次演示中就有体现，那就是2016年一台智能代理与世界顶级围棋棋手李世石的对弈。参战的智能代理AlphaGo正是由DeepMind公司训练的。它有时会走出人类高手无法解释的怪着。起初，这些着法看似错着。但随后AlphaGo就运用由此形成的新奇布局在后续棋局中占尽优势。

有趣的是，人类高手有时也会下出这样的着法，日语称之为“神之一手”。顾名思义，就是说棋手往往无法解释自己当时如何或为何选择在某处落子，感觉仿佛是受到神明的指点一般。事实上，从棋手无法解释自己为何走出最妙的那几步棋这一点上，恰恰能窥见为何过去基于形式逻辑的围棋程序一向表现不佳。神经学习系统，无论是大脑内进化而来的还是如今设置在计算机中的，都能下好围棋。但人类语言无法描述这一过程。

不过，人类与机器对自身行为的解释存在重大差异。据巴黎让尼科德研究所（Jean Nicod Institute）的认知科学家丹·斯珀波（Dan Sperber）观察，人们在为自身行为构建理由时，一般会让这些理由与自己及听者的共有信息相一致、符合自身利益，而不是如实描述决策思路。正如他所说，“给出理由的目的是为了让其他人评估你的行动及观点”。当今的自主机器没有什么自身利益要满足。相反，它们的解释是由人类打造、为人类服务的。

有人推测，如果AI未来发展成科幻小说里的智能机器那样，看似拥有自己的动机，而不仅仅是听从人类的指挥，那么上述情况可能就会改变。国际法专家雅各布·特纳（Jacob Turner）提出，到时就需要赋予AI法律人格，这样，被这些先进的智能代理伤害的人们才能寻求公道与赔偿。

这也许是很久以后才会发生的事。但即便在今天，AI也可能引发棘手的法律问题。机器思维无法自我解释，其具体运作也无法以人类语言描述，这两点尤其对刑法构成了挑战。正如牛津大学的法学家丽贝卡·威廉姆斯（Rebecca Williams）所见，假如机器无法解释自身行动，现行法律可能

就难以对机器决策引发的行动认定犯罪意图。“在刑法中，”她说，“有趣的是打破因果关系链的第三方并非人类。这的确是个新情况。”

问题并非智能代理有朝一日会否像特纳推测的那样为非作歹。但是，如果因为机器及其创造者都无法做出解释，所以无法交叉讯问一台机器作出决策的过程，那么恐怕就难以判定与此决策相关的人是否存在罪责。

举个例子，假如一个审批贷款的神经网络系统无法解释为何给某些人的评分显得它似乎对某个社会群体抱有偏见，那么可能就无从判断这是操作者有意为之（在大多数司法管辖区均属违法），还是系统设计者在编程时的疏忽大意导致了偏见（可能属于民事范畴，而不构成刑事犯罪）。同样地，如果无人驾驶出租车上操控视觉系统的AI是个黑箱，无法调查其决策过程，那么一旦该车造成伤亡，要认定这是制造商还是车辆运营公司的责任或许也会很困难。

说不定还得再过几年才会出现涉及无人驾驶汽车的诉讼案件。然而，涉及社会偏见的案件即便是现在也是完全可以想象的。就算没有阿瑟·克拉克（Arthur C. Clarke，创造了哈尔）和道格拉斯·亚当斯（Douglas Adams，创造了艾迪）这两位作者的想象力，也能想见既能行动、又可解释自身行动的软件的好处。■



Free exchange

Better, stronger, faster

Labour-monitoring technologies raise efficiency—and hard questions

BOSSES have always sought control over how workers do their jobs. Whatever subtlety there once was to this art, technology is now obliterating. In February Amazon received patents for a wristband apparently intended to shepherd labourers in its warehouses through their jobs with maximum efficiency. The device, were Amazon to produce and use it, could collect detailed information about each worker's whereabouts and movements, and strategically vibrate in order to guide their actions. Using such technology seems an obvious step for firms seeking to maximise productivity. Whether workers should welcome the trend, or fear it, is harder to say.

Workplace discipline came into its own during the Industrial Revolution. As production came to depend ever more on expensive capital equipment, bosses, not keen to see that equipment sitting idle, curtailed their workers' freedom, demanding they work during set hours, in co-ordination with other employees, at a pace dictated by the firm. Technology creates new opportunities for oversight. Editors can see which of their journalists attract the most readers (though many wisely focus on other measures of quality). Referees at sporting events are subject to reviews that check their decisions to within millimetres.

Workers and labour activists have often attacked strict discipline as coercive, unfair and potentially counterproductive. Textbook economics suggests, though, that in a competitive labour market any attempt to coerce people into working harder than they want will fail, since workers can simply switch jobs. Studies of factory work paint a more complicated

picture, however. People would like to work hard and earn high wages, this story goes. But they struggle with self-control and do not work as hard as they wish they would. They consequently choose to work for firms that use disciplinary measures to push them. During industrialisation, workers “effectively hired capitalists to make them work harder”, says Gregory Clark of the University of California, Davis, in a seminal paper on the subject.

If that seems an implausibly sunny description of life in 19th-century factories, researchers have found evidence for such behaviour in modern contexts. Supreet Kaur, of Columbia University, and Michael Kremer and Sendhil Mullainathan, of Harvard University, ran a 13-month experiment using data-entry workers, who were paid according to the amount of work successfully completed. Some struggled with self-control, the authors determined, as shown by their tendency to slack off for much of each month but put in more effort as payday approached. When workers were offered contracts that penalised them for failing to hit performance targets, those who struggled to stay on-task disproportionately accepted, and achieved big gains in output and pay as a result.

In many settings, pay is less clearly linked to performance. Whether additional effort translates into higher wages depends on the other options available to workers and on their bargaining power—in particular, whether they feel able to leave if the pay is not worth the trouble. Indeed, in the past, high turnover helped motivate some factory owners to share the gains from workplace discipline with workers. The “\$5 day” introduced by Henry Ford in 1914 was an “efficiency wage”, according to Daniel Raff, of the University of Pennsylvania, and Larry Summers, of Harvard University. Workers on Ford’s assembly lines spent entire shifts doing mind-numbingly repetitive work, and many could not stick it for long. Ford’s solution was to pay a wage well above what workers could earn elsewhere. That helped compensate them for their suffering. More important, it led to a long queue of eager applicants, and the knowledge that anyone who left would quickly be

replaced and could not easily return.

But high turnover does not appear to bother Amazon much. The past decade's weak labour markets have meant queues of willing workers even without the promise of above-market pay. The same technologies that monitor workers can also reduce the training time needed to prepare new employees, since the gadgets around them guide most of their activity.

And new disciplinary technologies create an additional risk for workers. Heaps of data about their activities within a workspace are gathered, while their cognitive contribution is reduced. In both ways, such technologies pave the way for automation, much as the introduction of regimentation and discipline in factories facilitated the replacement of humans by machines. The potential for automation increases the power of firms over workers. Anyone thinking of demanding higher pay, or of joining a union in the hope of organising to grab a share of the returns to increased efficiency, can be cowed with the threat of robots.

White-collar workers are not spared oppressive bosses. Indeed, as the *New York Times* reported in 2015, Amazon has experimented with data-driven management techniques known to drive some white-collar workers to tears. (Others, though, told the *Times* that they thrived at Amazon, "because it pushed them past what they thought were their limits".)

The high pay of workers with exacting jobs in finance or technology can reasonably be seen as compensation for their burdensome working conditions. And unhappy professionals can usually find less oppressive work that pays a lower but still decent wage. As Amazon and other firms embrace new tools to monitor and direct their workers, the difference between progress and dystopia comes down to whether workers feel comfortable demanding raises, and whether they can quit without fear of serious hardship. Indeed, firms could ponder such matters themselves

before the inevitable backlash. ■



自由交流

更好，更强，更快

劳工监控技术提升了效率，也带来了难以回答的问题

老板们总是在设法掌控员工的工作状况。无论他们过去使用的手段多含蓄，科技已经让这种隐晦荡然无存。今年2月，亚马逊拿到了一款腕带的专利，它似乎是为了最有效地全程监管仓库工人工作而设计的。如果亚马逊生产并使用这种设备，它将能收集有关每名员工的行踪与动作的详细信息，并适时振动以指导他们的行动。对追求生产力最大化的公司来说，采用这种技术似乎是当然之举。而员工们对此是该欣喜还是担忧就不好说了。

工业革命时期，职场纪律尽显其用。当时，生产越来越依赖昂贵的固定设备，而老板们不愿看到设备闲置，于是要求员工在固定时间里按公司规定的步调工作并与同事协作，限制了员工的自由。而今，科技为监管创造了新条件。主编们可以知道哪位记者最受读者欢迎（虽然还是有很多主编明智地将关注点放在其他质量标准上）。体育赛事中，裁判要接受复查，看他们的裁定是否“失之毫厘”。

员工和劳工维权人士经常抨击严格的管理，指其有强迫性质、不公平，而且可能适得其反。不过按照教科书中的经济学理论，在竞争性的劳动力市场上，任何罔顾员工意愿、强迫其更加卖力工作的企图都会失败，因为他们完全可以跳槽。然而对工厂工作的研究发现，实际情况要更复杂。这些研究认为，人们愿意卖力工作挣得高薪，但他们苦于自控力不够，达不到自己希望的努力程度。因此他们选择为那些采用劳动纪律来鞭策员工的公司工作。就这一议题，加州大学戴维斯分校的格雷戈里·克拉克（Gregory Clark）在一篇颇具影响力的论文中指出，在工业化时期，员工“实质上雇用了资本家来迫使自己更卖力地工作”。

这种对19世纪工厂生活的描述也许正面得令人难以置信，但研究人员已经

在现代社会中为这种行为找到了证据。哥伦比亚大学的苏普瑞特·考尔（Supreet Kaur）以及哈佛大学的迈克尔·克雷默（Michael Kremer）和塞德希尔·穆来纳森（Sendhil Mullainathan）以数据录入员为对象进行了为期13个月的实验，录入员按照成功完成的工作量领取报酬。三位作者判断，部分录入员自制力薄弱，因为他们往往在一个月的大部分时间里都懒懒散散，但在发薪日临时会加倍努力。不能完成业绩目标就要受罚——当这样的合同摆在员工面前时，那些难以专心工作的员工接受合同的比例却出人意料地高，随后他们的产出大幅增长，获得的报酬也上了一个台阶。

在很多情况下，报酬与业绩的关联并没那么明确。额外的努力是否能换得更高的报酬取决于员工是否有其他选择以及他们的议价能力，特别是当报酬与所承受的辛劳不相称时是否有离职的底气。实际上，在过去，频繁的人员流动促使一些工厂主将劳动监督产生的红利拿出来与工人分享。宾夕法尼亚大学的丹尼尔·拉夫（Daniel Raff）和哈佛大学的拉里·萨默斯（Larry Summers）认为，1914年亨利·福特实行的“5美元日薪”就是一种“效率工资”。福特装配线上的工人全部当班时间都在做着让人头昏脑涨的重复性工作，很多人不能长久坚持。福特的解决办法是付给员工高工资，远远超过他们能在别处挣得的水平。这有助于弥补他们的痛苦。更重要的是，这使得热切的求职者大排长队，也让人们知道，离职者很快就会被取代，而且不能轻易回头。

不过人员的频繁流动似乎没给亚马逊带来多大的困扰。过去十年，劳动力市场疲软，即便没有高于市价的工资承诺，求职者还是源源不断。用以监视员工的科技同样也能减少新员工入职所需的培训时间，因为员工周围的这些小玩意儿指导了他们大部分的行动。

劳动管理方面的新科技给员工带来了其他风险。他们在工作场所内活动的大量数据被收集，而他们在认知层面的贡献却减少了。就这两方面来说，这种新科技为自动化铺平了道路，这与工厂实行严格的管理和纪律促进了机器取代人类如出一辙。以自动化取代工人的可能性增强了公司对工人的控制力：任何人如果想加薪，或想加入工会以期团结起来在效率提升所获

的回报中分得一杯羹，都会因为机器人的威胁而没了底气。

白领员工同样不能幸免于老板的压迫。据《纽约时报》在2015年的报道，事实上亚马逊已经试用了基于数据的管理办法，据悉逼哭了一些白领员工。（不过，也有其他亚马逊员工告诉该报说自己在亚马逊干得很出色，“因为亚马逊激发了他们的潜能”。）

金融或科技领域的员工要面对严苛的工作要求，他们的高薪自然可被视作对其繁重工作的补偿。而对现有工作不满的专业人士总可以换个压力小一些的工作，得到虽低一些但仍算不错的薪资。亚马逊等公司采用新工具来监督和指示员工，究竟是会带来进步还是堕入反乌托邦的境地，主要得看员工是否可以放心地要求加薪，以及能否在没有沉重的后顾之忧的情况下离职。实际上，在遭遇不可避免的抵制之前，企业倒是可以自己先掂量一下这类事情。 ■



Robot laboratories

Gene machines

The design of synthetic lifeforms could become a new industry

IN THE basement of Imperial College sits the London DNA Foundry. The word “foundry” calls forth images of liquid metal being poured into moulds—of the early phase of the Industrial Revolution, in other words. This foundry is, however, determinedly modern. Liquid is indeed being moved around and poured. But it is in minuscule quantities, and it is not metal. Instead, it is an aqueous suspension of the genetic codes of life.

The laboratory is an example of a wider movement. Similar biofoundries are being set up around the world, from the Broad Institute in Cambridge, Massachusetts, via Silicon Valley, to the National University of Singapore. All offer ways of centralising the donkey work of genetic-engineering research. Instead of biotechnology companies buying and operating their own laboratories, foundries will do it for them.

London DNA Foundry’s operations room is filled with boxy devices, each designed to do one particular operation, such as pipetting, repeatedly and quickly. A robotic arm shuttles small plastic dishes between the machines. Each dish contains up to 1,536 minuscule wells. And in each of those wells sits several microlitres of liquid and a few strands of DNA. Using this arrangement, the foundry can mix, in the precise concentrations required, 150,000 samples of DNA in a morning.

The starting-point for the process is a library of what David McClymont, the foundry’s head of automation, calls “parts”. These are snippets of genetic code from which different genetic “circuits” can be assembled. A circuit, in biotech speak, is a collection of genes that work together towards a common

goal—for example, generating a series of enzymes that convert one type of chemical into another. The genes comprising a potential circuit are then assembled into circular DNA molecules called plasmids.

To obtain appropriate plasmids the foundry's customers may simply order parts from the library. They may also provide their own proprietary snippets. All the required parts are then transferred to bar-coded wells in the dishes and their contents mixed automatically. The whole process is controlled by a piece of computer code, provided by the customer, that describes the experiment.

Once the mixture is correct, the test plates are whisked into a machine which multiplies the number of plasmids in each well using a process called a polymerase chain reaction (PCR). And then, when the PCR has done its work, the plasmids are introduced into living cells—either bacterial or yeast. After that, the cells are incubated, and the result is tested to see which, if any, of the circuits performs as expected.

Such is the London DNA Foundry's scale that it can build and test about 15,000 different genetic designs in a day. True to its name, the foundry is set up to build and test DNA plasmids only. Some other biofoundries, however, offer a wider range of services. For example Transcriptic, a firm in Silicon Valley, will also allow customers to store entire cell lines that may be tested later, or to grow tissues from them for testing.

One of Transcriptic's particular specialities is preclinical drug screening. This involves testing vast numbers of compounds that might possibly end up as drugs. A drug might, for example, be intended to alter the operation of a particular protein that shuttles, say, calcium in and out of a cell. In that case, potential drugs might be screened against both the protein in free suspension, and intact cells that have such channels in their membranes.

Many of Transcriptic's customers are small, newly founded firms that cannot afford their own test facilities. One such, Pliant Therapeutics, also in Silicon Valley, is using Transcriptic to test treatments for fibrotic disease—the formation of scar tissue in places like the lungs and the heart. Large, established firms use its facilities, too, though. It is often cheaper for them to do so than to carry out tests in house.

At the moment, each foundry is going its own way, as the industry finds its feet. But Paul Freemont, a director of the London DNA Foundry, hopes that once it is clear what processes are of most interest to customers, the sorts of industrial standards which are commonplace in other industries will start to emerge among biofoundries. That will make it easier for the process of designing new synthetic lifeforms to be scaled up from the bespoke boutique business it is now to something more like a global industry. That day is not yet here. But if there is demand, then biofoundries will surely play their part in the next phase of the Industrial Revolution. ■



机械化实验室

基因机器

合成生命体设计可能成为一个新产业

伦敦DNA铸造厂（London DNA Foundry）座落在帝国理工学院的地下室里。“铸造厂”一词会让人想起液态金属被倒入模具的场面，也就是工业革命早期的场景。然而，这座铸造厂绝对是现代的产物。那里的确有液体被四处移动和灌注，但量极少，而且也不是金属，而是包含生命遗传密码的悬浊液。

一场广泛的运动正在发生，这个实验室只是其中一例。从马萨诸塞州剑桥市的布罗德研究所（Broad Institute）到硅谷，再到新加坡国立大学，类似的生物铸造厂正在全球各地建立起来。它们都能集中完成基因工程研究中那些乏味而又繁重的工作。生物技术公司无须再购入和运营自己的实验室，生物铸造厂将为之代劳。

伦敦DNA铸造厂的操作室里布满了盒子状的设备，每台设备都可以反复而快速地完成一项特定的操作，例如移液。一条机械臂在机器之间传送小型塑料测试皿。每个测试皿内最多有1536个微孔，每个微孔内注有数微升的液体和多条DNA链。通过这种方式，该铸造厂可精确按所需浓度在一个早上配制15万个DNA样本。

这个过程的起点是一个库，存有该铸造厂自动化主管大卫·麦克利蒙（David McClymont）所说的“零件”。所谓零件其实是一些遗传密码片段，可用于组装不同的遗传“回路”。在生物技术术语中，一个回路就是协作完成一个共同目标的一组基因，比如协作生成一系列酶来把某种化学物质转化为另一种化学物质。接下来，铸造厂会把有可能构成一组回路的基因组装成名为“质粒”的环状DNA分子。

要得到合适的质粒，铸造厂的客户可直接从“基因零件库”里订购，也可以提供自己专有的遗传密码片段。一切所需零件随后会被转移到测试皿中带

条形码的微孔内，然后这些物质会自动混合。整个过程由客户提供的、描述该实验的计算机代码控制。

得到了合乎要求的混合物后，测试板将被放入一台机器中，通过名为聚合酶链式反应（PCR）的过程令每个微孔中的质粒繁殖。完成PCR后，形成的质粒会被导入活细胞——细菌或酵母。之后，铸造厂会培养这些细胞，并测试结果，确定是否有能按预期发挥作用的回路。

伦敦DNA铸造厂每天可生成并测试约15,000个不同的基因回路设计。诚如其名，该铸造厂仅生产和测试DNA质粒。而其他一些生物铸造厂则提供更广泛的服务，例如硅谷公司Transcriptic还让客户存储整个细胞系供日后测试，或者从这些细胞系中培养组织来做测试。

Transcriptic的一大专长是临床前药物筛选。这涉及测试大量最终可能成为药物的化合物。例如，如果要找一种药物来改变某种在细胞内外运输钙的蛋白质的运作，那么既要用悬浮液里的这种蛋白质来筛选潜在药物，也要细胞膜中带有这类通道的完整细胞来测试。

Transcriptic的许多客户都是新创立而无力购买自有测试设施的小公司。其中一家是同样位于硅谷的Pliant Therapeutics，该公司正利用Transcriptic的服务来测试针对纤维化疾病（在肺部和心脏等器官形成疤痕组织）的疗法。不过也有大型老公司使用Transcriptic的设施，这往往要比在公司内部做测试更省钱。

这个行业才刚刚起步，目前各家生物铸造厂仍各行其是。但伦敦DNA铸造厂的董事保罗·弗里蒙特（Paul Freemont）希望，在明确了客户对哪些流程最感兴趣后，其他领域常见的那类行业标准也会在生物铸造厂中出现。这会为设计新合成生命体这项工作提供助力，使之从如今的小型定制业务变成更为全球性的产业。这一天还没到来。但只要有需求，生物铸造厂势必会在工业革命的下一阶段发挥作用。 ■



Passenger drones

Free as a bird

The dream of soaring above traffic jams may come true, in the form of passenger-carrying drone aircraft

TRAVELLERS have long envied the birds. In 1842 William Henson, a British lacemaker, somewhat optimistically filed a patent for an “aerial steam carriage”. It took another 60 years and the arrival of the internal combustion engine before Orville and Wilbur Wright flew the first practical aeroplane. In the 1920s Henry Ford began tinkering with the idea of making cars fly. “You may smile,” he said. “But it will come.” In 1970 his company considered marketing the Aerocar, one of the few flying-car designs that managed to gain an airworthiness certificate.

Yet flying cars have never taken off. That is not because they are impossible to build, but because they are, fundamentally, a compromise, neither good on the road nor graceful in the sky. They are also inconvenient. Most designs require a runway to take off and land, and a pilot’s licence to operate. But that is changing. Developments in electric power, batteries and autonomous-flight systems have led to a boom in sales of small drone aircraft. Several entrepreneurs have had the idea of scaling up such machines to the point that people can fit inside them. The ultimate goal is a pilotless passenger drone that can either be parked outside your house like an ordinary car, or even summoned with a smartphone app, like a taxi.

Dozens of firms are trying to build such machines. They include Workhorse, an American maker of electric vehicles; Joby Aviation, a Californian company whose backers include JetBlue Airways and Toyota; AeroMobil, a Slovakian company; and Lilium, a German firm working on an air taxi that uses jet-type electric thrusters. Some of their products are convincing

enough to have attracted powerful backing. Lilium's investors include Tencent, a giant Chinese investment firm. Larry Page, one of the co-founders of Google, has put his money into several such projects, including the Kitty Hawk Flyer, which the rider sits astride much like a flying motorcycle. Not to be left out, aircraft makers such as Boeing, Airbus and Bell Helicopter have also shown off in-house designs of their own.

Some of the new flying machines are modern variations on the familiar flying-car design. One of the most advanced is the TF-X, developed by Terrafugia, a company from Massachusetts. The TF-X is based on the Transition, a petrol-engined car with foldable wings and a rear-mounted propeller. That machine is already flying and is due to go on sale next year. The TF-X is a plug-in hybrid that can drive but can also take off and land vertically, like a helicopter. Although it is several years away from making its first test flights, Terrafugia says the TF-X will be able to operate autonomously with four people on board for 800km (500 miles) at a cruising speed of 320kph. The idea has attracted interest from bigger firms. In 2017 Terrafugia was bought by Geely, a Chinese firm that also owns Volvo.

The TF-X's ability to do without a runway is a common feature of many of the new designs. Most conventional drones achieve this with a number of small, electrically powered rotors mounted on the corner of the vehicle, or on extended arms. Many of Terrafugia's competitors, though, are abandoning the idea of flying machines that can also drive. Focusing on flight keeps things simple and helps save both money and weight.

One example is Volocopter, a German firm which has attracted investment from Daimler, the parent company of Mercedes-Benz, and interest from Intel, a big American chipmaker. It has been flying prototypes of its 18-rotor autonomous taxi since 2016, when it was first granted a "permit to fly" by regulators. In 2017 it took Brian Krzanich, the chief executive of Intel, on a joyride inside an exhibition hall, with a pilot on the ground controlling

the aircraft remotely. A short autonomous flight was carried out in Dubai last year, although no people were on board. This way, step-by-step, Florian Reuter, Volocopter's chief executive, hopes to persuade regulators that passenger drones are safe enough for more ambitious flights and pilotless operations.

For makers of passenger drones face legal hurdles as well as technical ones. Since obtaining its permit to fly, EHang, a dronemaker based in Guangzhou, has been putting its drone, the EHang 184 (pictured), through its paces. That has included flying at 130kph, climbing to 300 metres and operating in a storm. Huazhi Hu, EHang's founder, says it will be necessary to demonstrate that the technology works before air-safety regulators come up with the necessary rules to allow commercial operations. To that end, EHang has got a representative on a technical experts' committee for unmanned aerial vehicles, which has been set up by the Civil Aviation Administration of China to consider what those regulations should be.

Aviation regulators, understandably, tend to be risk-averse. That means that, although the eventual goal is fully autonomous flight, the first passenger drones are likely to be fitted with manual controls and to require some sort of pilot's licence to operate—just as the first self-driving cars require licensed humans to keep their hands on the wheel at all times. But manufacturers and governments are already discussing how restrictions might be eased. Volocopter, for instance, is hoping that the European Aviation Safety Agency can be persuaded to classify its passenger drone as a “light sports aircraft”, which would mean that it can be flown by a person holding a simplified pilot's licence which requires less training.

Eventually, passenger drones may be classified as an entirely new type of aircraft. For that to happen, though, will require a number of changes to existing rules. For instance, most aircraft are supposed to carry enough spare fuel for 30 minutes of extra flying time in an emergency. For many of

the current crop of electric passenger drones that rely solely on their own batteries, though, 30 minutes is around the limit of their endurance.

Some dronemakers hope to persuade regulators that an emergency reserve could be found by running the batteries down completely. As with smartphones and electric cars, the lithium-ion batteries used in drones usually stop discharging when they are about 80% drained in order to protect themselves from damage. Another option might be to fly only at low altitudes, with pre-planned emergency landing points along the route. A final safeguard is an emergency parachute, which many designs already sport.

Another problem is other aircraft. Self-flying drones will probably need specialised “sense and avoid” equipment to prevent collisions. Such systems do not yet exist, though they are being worked on by NASA, among others. Stephen Prior, a drone expert at the University of Southampton, in England, points out that air-traffic control will be another headache. Passenger drones are designed to fly directly from place to place, rather than making use of existing airfields, as conventional aircraft do. That would make the tricky job of directing airborne traffic even more complicated than it already is. The answer will probably involve handing at least part of the job to computers, but such systems are also some way off.

The final issue is price. At least at first, passenger drones will cost supercar money: mooted prices tend to be around \$200,000-300,000. That, combined with the requirement to have at least some form of pilot’s licence, will limit demand, at least at first. But as with all technology, if the machines prove popular, their prices will fall, especially once autonomous operations are routine. These new machines may not look like the flying cars that Henry Ford imagined, but he was right. Their time may, at last, have come. ■



载客无人机 如鸟儿般自由

随着载客无人机的到来，从空中避开交通拥堵的梦想可能会成真

出行者对鸟儿的羡慕由来已久。1842年，英国蕾丝制造商威廉·亨森（William Henson）申请了“飞行蒸汽车”专利，但他过于乐观了。又过了60年，内燃机出现以后，莱特兄弟才成功试飞了第一架真正的飞机。20世纪20年代，亨利·福特开始琢磨制造“会飞的车”。“你可能会笑，”他说，“但它一定会来到的。”1970年，他的公司曾考虑销售飞行汽车Aerocar，这是少数获得适航证的飞行汽车设计之一。

然而“会飞的车”从未真正起飞。倒不是因为造不出来，而是因为它们从根本上是一个折中方案，因而在道路上不够劲爆，在天上又不够优美。而且还很不方便。大多数设计都需要跑道来起飞和着陆，驾驶员还要有飞行执照。但情况正在发生变化。电力、电池和自动飞行系统的发展推动小型无人机的销量激增。一些企业家已经有了把这些无人机做得更大，好用来载人的想法。最终的目标是研发出无人驾驶的载客无人机，可以像普通汽车一样停放在屋外，甚至可以用智能手机应用像召出租车那样召用无人机。

目前有数十家公司都在尝试建造这样的无人机，其中包括美国电动汽车生产商Workhorse、获捷蓝航空和丰田投资的加州企业Joby Aviation、斯洛伐克公司AeroMobil，以及德国公司Lilium。Lilium正在研发使用电动喷气推进器的“空中的士”。这些公司的一些产品具有足够的说服力，吸引了强大的资金支持。Lilium的投资者包括中国投资大户腾讯。谷歌的联合创始人之一拉里·佩奇（Larry Page）已经投资了几个这样的项目，其中之一是电动载人飞行器Kitty Hawk Flyer，乘客跨坐上去，就像骑飞行摩托车一样。飞机制造商也不甘落后，波音、空客和贝尔直升机（Bell Helicopter）等公司也都展示了内部研发的设计。

这些新型飞行器当中，有些是为人熟悉的“会飞的车”设计的现代变体。

TF-X是其中最先进的设计之一，由马萨诸塞州的Terrafugia公司研发。它的前身是Transition——一款带有可折叠机翼和后置螺旋桨的汽油驱动车。Transition已经开始试飞，将于明年起售。TF-X为插电式混合动力，可以在地面行驶，也可以像直升机那样垂直起降。它要到几年后才首次试飞，Terrafugia表示届时它将能搭载四名乘客，以每小时320公里的巡航速度自主行驶800公里。这个设想吸引了大公司的兴趣。2017年，Terrafugia被吉利收购，这家中国公司还拥有沃尔沃。

TF-X无需跑道就能起降，这是许多新设计的共同特征。大多数传统无人机都是靠安装在机体角或延伸臂上的多个小型电动旋翼来起降。不过Terrafugia的许多竞争对手正在放弃让飞行器能兼顾地面行驶的想法。专注于飞行让事情变得更简单，也有助于节省成本和减少重量。

德国公司Volocopter就是其中一例。该公司吸引了梅赛德斯-奔驰的母公司戴姆勒的投资，以及美国芯片制造巨头英特尔的兴趣。2016年，Volocopter首获监管机构颁发“准飞证”，自此一直在试飞装有18个旋翼的自动飞行出租车的原型机。2017年，在地面驾驶员的遥控下，英特尔的首席执行官布科再奇（Brian Krzanich）在一个展厅内搭乘该原型机兜了兜风。去年在迪拜，这款飞行器又做了一次短程自动飞行，不过没有搭载乘客。Volocopter的首席执行官弗洛里安·罗伊特（Florian Reuter）希望通过这种方式一步步地说服监管机构，载客无人机足够安全，可以开展更大胆的飞行和无人驾驶操作。

这是因为载客无人机的制造商同时面临着技术和法律上的障碍。自从获得飞行许可后，总部位于广州的无人机制造商亿航一直在测试其无人机亿航184（如图），包括以每小时130公里的速度飞行、爬升300米、在风暴中航行等。亿航的创始人胡华智表示，有必要先行一步，在航空安全监管部门提出允许商业运营的必要规则之前证明自己的技术是可行的。为此，亿航派出一名代表加入了无人机技术专家委员会，该委员会由中国民航总局设立，负责研究制定相关规则。

航空监管部门自然会倾向于规避风险。这就意味着，虽然最终目标是完全

自主飞行，但首批载客无人机很可能会配备手动控制装置，并要求驾驶员具备某种飞行执照——正如第一批无人驾驶汽车要求持照人类驾驶员把双手时刻放在方向盘上那样。但制造商和政府已经在讨论限制如何可能被放宽。例如，Volocopter希望可以说服欧洲航空安全局（European Aviation Safety Agency）将其载客无人机列为“轻型运动飞机”，这意味着持有简化版飞行执照的人就可以驾驶它，需要的培训也较少。

最终，载客无人机可能被列为一类全新的飞行器。但要实现这种划分，需要对现有规则做出一些更改。例如，按规定大多数飞机应携带足够的备用燃料，保证可在紧急情况下额外飞行30分钟。然而对于目前那批仅靠电池供电的电动载客无人机来说，30分钟大多已接近它们的极限续航时间。

一些无人机制造商希望说服监管机构，可以在用完电池电力后获得紧急储备动力。与智能手机和电动汽车一样，无人机使用的锂离子电池通常会在耗电达到80%左右时停止放电，以保护电池免受损坏。另一种选择可能是让无人机仅在低空飞行，沿途预先设好紧急着陆点。最后的一道保障是安装紧急降落伞，许多设计已经配备。

另一个问题来自其他的飞行器。自主飞行无人机可能需要专门的“感知和回避”设备来防止彼此碰撞。这样的系统尚未出现，尽管美国国家航空航天局（NASA）等机构正在研发。英国南安普敦大学（University of Southampton）的无人机专家斯蒂芬·普莱尔（Stephen Prior）指出，空中交通管制将是另一个令人头疼的问题。载客无人机是用于两地之间的点对点飞行，而不是像传统飞机那样利用现有的机场。这会让本已棘手的空中交通指挥变得更为复杂。将至少一部分工作交由计算机去处理可能是个解决办法，但这样的系统同样有待开发。

最后一个问题是价格。载客无人机的价格将堪比超级跑车，起码一开始会是这样——目前讨论中的价格通常在20万到30万美元左右。再加上需要至少某种飞行执照，这至少在一开始会限制需求。但与其他所有技术一样，如果载客无人机备受欢迎，价格将会下降，特别是在自动飞行成为常态之后。这些新的飞行器可能不像亨利·福特想象中的“会飞的车”，但他说得

对，它们的时代可能最终到来了。 ■



Telecoms gear

Telephone tower v rubber boots

Ericsson and Nokia are now direct rivals. How do they compare with each other?

“SUCCESS is toxic”, says Risto Siilasmaa, Nokia’s chairman, as snowflakes swirl in the wind outside. Asked what lesson to draw from his firm’s collapse, which started a decade ago, he underlines the dangers of doing too well. In its heyday, Nokia was a monster; its market capitalisation surpassed \$290bn in mid-2000 and by 2007 it accounted for 40% of global handset sales. Yet its dominance in hardware, which encouraged a relaxed attitude towards software, bred failure. It is now worth \$33bn.

No executive at Ericsson, Nokia’s big European rival based some 400km to the west near Stockholm, would put it quite that way. But the experience of the Swedish firm has been strikingly similar. Early this decade Ericsson provided 40% of the world’s mobile infrastructure and its market capitalisation hovered above \$40bn. Now both numbers are about half that.

The two firms are also direct competitors once again, which invites assessment of who is ahead. Another question is whether European governments will do anything to give them a boost. They are among the last of the continent’s makers of mobile devices and network equipment, which once ruled the world but are now lagging behind American and Chinese firms. If Ericsson and Nokia continue to shrink, only one European firm, Schneider Electric, would be left among the world’s 35 biggest tech companies by revenue.

Nokia has long been a master of reinvention. It started as an operator of a pulp mill in 1865. A pair of rubber boots in its small company museum highlights the firm’s varied history. But Nokia needed some luck to fall on

its feet. That came in the form of a mind-bogglingly generous deal from Microsoft, which in 2013 paid \$7.2bn for Nokia's flailing handset business. That big dose of cash, plus another \$2.8bn from the sale of HERE, a mapping business, "basically saved Nokia", reckons Mr Siilasmaa. The money let the firm rebuild itself. Using its smallish network-equipment business as a base, Nokia has quickly expanded, mostly by acquisition. It bought Siemens out of a joint holding, Nokia Siemens Networks (NSN) in 2013, paying \$2.2bn. Two years later Nokia took over Alcatel Lucent, a French-American vendor, for \$17bn in shares.

Most previous marriages in telecoms gear had failed, because dropping products to get the efficiency gains while keeping hold of customers had been exceedingly difficult. But at the time of Nokia's big deal the technology was changing. Networks were no longer mainly about physical connections, but more defined by software, which made merging product lines easier. As important, Rajeev Suri, Nokia's boss, had free rein from his board to rethink strategy. He had proved himself a capable boss of NSN since 2009, a job nobody wanted.

If rubber boots symbolise Nokia's history, Stockholm's telephone tower (pictured) is emblematic for Ericsson. It operated in Sweden's capital until 1913, serving over 5,000 lines. Founded in 1876 as a maker of telecoms gear, it was natural that Ericsson should stick to defending its share of that market when in the mid-2000s Chinese vendors, mostly Huawei, but also ZTE, became serious competitors. It also expanded its business of running customers' networks. In the short term the strategy worked. While other Western firms lost business to the Chinese and were forced to merge, Ericsson expanded its market share.

Yet neither effort did much to improve margins. When profits plunged in late 2007, the firm's share price dropped by nearly a third. Ericsson was left more vulnerable when investment in mobile networks started to shrink in

2014. A hurried diversification strategy, including into services and software for television broadcasters, and cloud computing, did not help. Revenues fell from 250bn SEK in 2015 (then \$29.5bn) to about 200bn SEK in 2017. Early that year Ericsson's main shareholder, the Wallenberg family, brought in a new chief executive, Börje Ekholm. He has vowed to reduce costs, kill off unprofitable service contracts and sell "non-core" businesses. He wants to refocus on 5G, the next generation of wireless technology.

As a result, Ericsson and Nokia now look much alike. They have the same number of employees (about 100,000), make similar-sized profits in their networks business (gross margins of 30-40%) and have similar market capitalisations. But differences remain, which seem to favour Nokia. It is with some justification that Mr Suri calls his firm "the Western alternative to Huawei"—its product portfolio is broader than Ericsson's, and includes gear for fixed networks. Some also consider Nokia more innovative: it inherited Bell Labs, a respected laboratory where the transistor was invented, from Alcatel Lucent. Mr Suri has big plans to use artificial intelligence to make Nokia more efficient, for instance in drafting offers to build smaller networks.

Yet the next few years could give Ericsson the edge. Some operators consider its 5G gear better than Nokia's. More important, while Nokia has overhauled itself, Ericsson has just started to restructure in earnest. Its plans look serious. Not all analysts trust that the affable Mr Ekholm, who says such things as "I'm a big believer in evolution," is tough enough to transform Ericsson. But the firm also has a new big activist shareholder, Cevian, whose co-founder, Christer Gardell, is nicknamed "the butcher" for his way of shaking up companies. It owns 9% of Ericsson's class B shares.

For both firms, much will depend on the uptake of 5G. Both bosses are realistic about the outlook. They do not expect a sudden spike in 5G

investment; instead, new networks will be rolled out gradually in the coming years. And then there is Huawei. It is a formidable, but not unbeatable competitor, says Mr Ekholm: “Let’s focus on what we can control: being innovative.” Mr Suri, for his part, expects that Nokia’s products will appeal to clients wary of trusting a Chinese supplier: “Security and privacy are embedded in our brand.”

Such arguments will go down well in America and other countries worried about Chinese eavesdropping devices in telecoms equipment. Yet if this is not enough to revive growth, talk about more mergers will be inescapable. Neither of the current bosses will discuss grand ambitions. Mr Suri wants to buy lots of small tech firms to strengthen his business in software to manage networks; Mr Ekholm says a large-scale merger has no place in his strategy. There is also talk of Samsung, the South Korean tech giant, buying at least part of Ericsson. A marriage of Ericsson and Nokia, sometimes raised as a possibility, is the least probable of all. A combined firm would have a monopoly in America, forcing operators there to look for a second supplier, such as Samsung.

Pressure will also grow on the European Union, which is in charge of telecommunications law, to lighten the regulatory burden for network operators. Politicians may even start calling for protectionist measures. “If Ericsson and Nokia in Europe benefited from the same support as Huawei and ZTE in China, they’d be fine,” says Pierre Ferragu of Bernstein Research, while acknowledging that such protectionism would make European telecoms less competitive in the long run.

A better approach would be to remember what made the European mobile industry strong in the first place, says Bengt Nordstrom of Northstream, a telecoms consultancy. When 2G (or GSM, as it was called back then) was introduced in the late 1980s, many European countries and operators signed up to a memorandum of understanding, agreeing on such things as the

radio spectrum used, the services to be offered and when to launch them—a co-operation which is lacking today. A similar effort could now boost Nokia and Ericsson. No one these days worries about toxic success—rather of managing recovery. ■



电信设备

电话塔PK橡胶靴

爱立信和诺基亚现在正面交锋，高下如何？

“成功是毒药。”诺基亚董事长李思拓（Risto Siilasmaa）说。窗外，雪花在风中飞舞。十年前诺基亚帝国开始倾塌，从中应当汲取什么教训？李思拓强调要警惕盛极而衰。鼎盛时期的诺基亚是一头巨兽：2005年前后其市值已超过2900亿美元，到2007年诺基亚手机销量已占到全球的40%。然而，硬件上的绝对优势反倒让诺基亚对软件掉以轻心，酿成败局。现在，诺基亚的市值为330亿美元。

倒没有哪个爱立信的高管会如此感慨，不过这家瑞典公司的经历却与诺基亚惊人地相似。爱立信是诺基亚在欧洲的一大竞争对手，其总部位于诺基亚总部以西约400公里的斯德哥尔摩附近。七八年前，爱立信提供了全球40%的移动基础设施，其市值在400亿美元以上。而现在，这两个数字都只有过去的一半左右。

而且，两家公司再度成为了直接竞争对手，这让人们不免要评估一番谁更胜一筹。另一个问题是欧洲各国政府是否会助它们一臂之力。欧洲大陆的移动和通信网络设备制造商曾经一统天下，现在却被美国和中国公司甩在后头，爱立信和诺基亚是硕果仅存的几家之一。如果两家公司继续萎缩，那么全球收入最高的35家科技公司中就只剩施耐德电气一家欧洲公司了。

诺基亚一直都是重塑自我的大师。它创立于1865年，最初是一家纸浆厂。在公司的一个小型博物馆里，一双橡胶靴凸显了它丰富多彩的历史。不过诺基亚屡屡化险为夷也靠了一些运气。2013年微软以72亿美元收购诺基亚垂死挣扎的手机业务，出手之慷慨令人震惊。这一大笔现金再加上出售HERE地图业务换来的28亿美元“从根本上拯救了诺基亚”，李思拓说。这些钱让公司得以自我改造。诺基亚以小型网络设备业务为基础，以并购为主要手段实现快速扩张。2013年它出资22亿美元买断了西门子在合资企业

诺基亚西门子通信公司（NSN）的股份。两年后，它通过换股以170亿美元完成了对美法合资公司阿尔卡特-朗讯（Alcatel Lucent）的收购。

过去，电信设备领域里的合并多以失败告终，因为在减少产品种类以提高效率的同时要留住客户是极其困难的。但诺基亚开展大笔交易的时候，技术正在发生变化。通信网络不再主要依赖物理连接，而是更多地由软件定义，这使得合并产品线变得更加容易。同样重要的是，诺基亚的总裁拉吉夫·苏里（Rajeev Suri）不受董事会的制约，可以独立反思公司战略。自2009年以来，在诺基亚西门子老板这个没人想干的职位上，他已经证明了自己的能力。

如果说胶靴代表了诺基亚的历史，那么位于瑞典首都斯德哥尔摩的电话塔（如图）则是爱立信的象征。它曾服务5000多条线路，直到1913年停用。爱立信在1876年创立之初就是一家电信设备制造商，因此当十几年前以华为为首、还有中兴等中国供应商崛起为劲敌之时，爱立信坚持保卫自己的市场份额再自然不过。它还扩大了运营客户通信网络的业务。短期来看，这一策略行之有效。当其他西方公司输给中国公司且被迫合并时，爱立信却扩大了市场份额。

然而，这些努力都未能改善盈利。2007年底利润骤降时，爱立信的股价下跌了近三分之一。2014年，随着移动网络领域的投资开始缩减，它的处境更是岌岌可危。公司仓促制定了一项多元化战略，包括为电视广播公司提供服务和软件并涉足云计算，但无济于事。公司收入从2015年的2500亿克朗（当时相当于295亿美元）降至2017年的约2000亿克朗。同年年初，爱立信的大股东瓦伦堡家族任命了新的首席执行官鲍毅康（Börje Ekholm）。鲍毅康承诺要削减成本，废除无利可图的服务合同，并出售“非核心”业务。他希望重新将重点放在新一代无线技术5G上。

结果，爱立信和诺基亚现在看起来非常相似。他们拥有相同规模的员工队伍（约10万人），在通信网络业务上的利润不相上下（毛利率为30%至40%），市值也旗鼓相当。但差异仍然存在，而且诺基亚似乎更占优势。苏里将他的公司称作“西方的华为”不无道理。诺基亚的产品组合比爱立信

更广泛，还包括固定网络设备。还有人认为诺基亚更具创新性。诺基亚从阿尔卡特-朗讯手里继承了贝尔实验室，这是一个受人敬仰的实验室，晶体管就诞生于此。苏里有利用人工智能让诺基亚变得更高效的远大计划，比如用人工智能草拟为客户建立小型通信网络的方案。

不过，几年后爱立信可能反超。一些运营商认为爱立信的5G设备强过诺基亚的。更重要的是，当诺基亚完成全面改革之时，爱立信的重整才刚刚正式开始。它的计划看上去经过了深思熟虑。并非所有分析师都相信平易近人的鲍毅康能使出强硬手段让爱立信脱胎换骨——他可是以“渐变论的忠实信徒”自居的。但是爱立信新近有了一个维权大股东Cevian投资公司，其联合创始人克里斯特·加德尔（Christer Gardell）因其整顿公司的手段而得名“屠夫”。Cevian拥有爱立信9%的B股。

对两家公司来说，5G的应用都事关重大。两位总裁对前景都持务实的态度。他们并不指望对5G的投资会激增，相反，他们认为新的通信网络将在未来几年逐步推出。此外它们还要面对劲敌华为。鲍毅康表示，华为很难对付，但并非不可战胜，“我们还是把注意力放在我们可以掌控的事情上吧，那就是创新”。对苏里而言，他希望诺基亚的产品能够吸引那些对中国供应商心存警惕的客户，因为“安全和隐私深深烙印在我们的品牌之中”。

在美国和其他担心中国的电信设备带有窃听装置的国家，这种论点会赢得人心。但是，如果凭这一点还不足以令两家公司恢复增长，人们必定会揣测将发生更多并购。两位现任老板都不愿谈论宏图大志。苏里意欲收购大量小型科技公司，加强诺基亚在通信网络管理软件方面的业务；鲍毅康表示他的战略中没有大规模收购。还有传言称，韩国科技巨头三星会收购至少爱立信的一部分。间或还有爱立信可能与诺基亚合并的传言，但这发生的可能性最小。如果两家合二为一，那将垄断美国市场，迫使那里的运营商寻找第二家供应商，比如三星。

主管电信法规的欧盟也会承受更大压力，被要求减轻通信网络运营商的监

管负担。政客们甚至可能会开始呼吁采取保护主义措施。“如果爱立信和诺基亚在欧洲能获得华为和中兴在中国那样的支持，他们的日子会很好过。”盛博公司（Bernstein Research）的皮埃尔·费拉居（Pierre Ferragu）表示。但他同时也承认，长远来看，这种保护主义做法会让欧洲的电信公司更缺乏竞争力。

电信咨询公司Northstream的本特·努德斯特伦（Bengt Nordstrom）表示，更好的办法是牢记当初欧洲移动通信产业何以发展得如此强大。上世纪80年代末2G网络技术（当时称作GSM）推出时，很多欧洲国家和运营商签署了谅解备忘录，在诸如所用无线电频谱、提供的服务以及服务推出的时间等事宜上达成一致，而这种合作正是如今所缺乏的。类似的努力在今天也可能振兴诺基亚和爱立信。如今没人担心成功之毒，只会一心重振旗鼓。





Buttonwood

All in the best possible taste

Investing in the finer things of life

BONDS, shares and Treasury bills are all very well, but in the end they are just pieces of paper. They are not assets you can hang on the wall or display to admiring neighbours. Many rich people like to invest their wealth in more tangible form; property, of course, but also collectibles such as art, fine wine and classic cars.

Is that wise? Elroy Dimson, Paul Marsh and Mike Staunton of the London Business School (LBS) have run the numbers for their annual analysis of the financial markets in the Credit Suisse global investment-returns yearbook. Some of these assets have done rather better than others (see chart). Fine wine delivered the best returns; surprising to cynics who might assume that, in the long run, the value of wine vanishes as it turns into vinegar. Really old wine often has historical resonance. A bottle of Chateau Lafite Rothschild from 1787 was sold for \$156,450 in 1985 because it was thought to belong to Thomas Jefferson.

Estimating the returns from these assets, after costs, is tricky. Indices covering art or musical instruments are much less comprehensive than those covering shares. There may be an upward bias inherent in collectible returns, as successful works are more likely to survive.

Transaction costs, if valuables are sold at auction, may be 30-40%. But these are the kind of assets that tend to be held for many decades (and passed between generations) so the annual cost burden may compare reasonably with equities, which are traded much more frequently.

Then there are the costs of insurance. If people want to keep a Stradivarius at home, theft is a big risk; robbery with violins is a serious crime, after all.

But tax is a potential advantage for collectibles. Financial assets come with income streams that have historically been taxed at marginal rates of 40% or more. Art and stamps generate no income stream and incur tax only when they are sold. The academics calculate that, after tax, collectibles have generated higher returns than equities for British investors since 1900.

On top of that, investors may get an “emotional return” out of owning these assets, which may be as much a hobby as an investment. Anyone who has met an owner of a classic car will know they can display spaniel-like devotion to their vehicles.

What about the largest asset that many people hold—their home? The total value of global property was around \$228trn at the end of 2016, against \$170trn for equities and bonds. The academics are highly sceptical of a recent paper* that claimed housing has enjoyed equity-like real returns with less risk. They think this is an example of Twyman’s law: “If a statistic looks interesting or unusual, it is probably wrong.”

In terms of rental income, they say the study made “heroic” estimates of the effect of agency fees and voids (periods when the property is empty). When it comes to the level of house prices over the decades, the LBS academics say that a number of downward adjustments need to be made. The most significant is that the quality of the housing stock has improved. Over the past century homeowners have spent a great deal of money on extensions, central heating, indoor plumbing and so on. When all the adjustments have been made, the real return on housing has probably been less than on equities but more than on government bonds.

Perhaps the most surprising finding in the yearbook is that gold and silver

have both done worse than cash and bonds over the past 118 years, despite high inflation during much of that period. In fact, gold performed best in real terms (although only as well as Treasury bills) when there was sharp deflation. Gold did substantially outperform T-bills during high-inflation periods, but this hedge comes at a long-term cost.

In the long run, equities have been the best-performing asset class, with a global real return of 5.2% since 1900. But that does not mean investors should assume those high returns will continue.

The prospective return on shares is equal to the real return on riskless assets (such as T-bills) plus a risk premium. That premium is now around 3.5% a year, the LBS trio think. As the real return on T-bills is currently negative, that suggests a real return on equities of around 3%. The LBS academics made a similar forecast about low returns in 2000. The real return on shares since then has been 2.9%. If the professors are right again, more investors will be tempted by Bordeaux and Bugattis.

* The Rate of Return on Everything 1870-2015 by Òscar Jordà, Katharina Knoll, Dmitry Kuvshinov, Moritz Schularick and Alan Taylor ■



梧桐

各有好滋味

投资精奢品

债券、股票、国债都很好，但说到底都只是些纸片，不是可以挂在墙上或者陈列出来让邻居羡慕的资产。许多富人喜欢把财富投资在更看得见摸得着的东西上：房产自不必说，此外还有艺术品、好酒、老爷车等藏品。

这是否明智？在《瑞士信贷全球投资回报年鉴》（Credit Suisse global investment-returns yearbook）中，伦敦商学院（LBS）的学者埃尔罗伊·迪姆森（Elroy Dimson）、保罗·马什（Paul Marsh）和迈克·斯丹顿（Mike Staunton）给金融市场做了一番年度分析统计。他们发现上述资产中，有的比其他的表现好不少（见图表）。好酒的回报最高。这会让那些愤世嫉俗之人吃惊，他们原本可能会说，葡萄酒放久了就变成了醋，还能值几个钱？但陈年佳酿往往具有历史价值。1985年，一瓶1787年的“拉菲罗斯柴尔德古堡”葡萄酒（Chateau Lafite Rothschild）以156,450美元的价格售出，因为据信那是美国第三任总统托马斯·杰斐逊的藏酒。

要估算这些资产的净回报是件难事。追踪艺术品或乐器投资市场的指数远不及股票市场指数那么全面。藏品的回报可能天然会被高估，因为能留下来的多为精品。

贵重藏品如果在拍卖会上出售，交易成本可能占到30%至40%。但这些资产往往数十年不易主，或是在家族内代代相传，所以分摊下来，每年的成本负担可能与交易频率高得多的股票差不多。

还有保险费用。如果在家中收藏一把古董级的斯特拉迪瓦里小提琴（Stradivarius），被偷的风险会很大——毕竟偷盗小提琴已被列为重罪。

但藏品在税赋方面可能有优势。一直以来，金融资产带来的收入流要面对

40%或以上的边际税率。艺术品和邮票不产生收入流，只有在出售时才要缴税。据上述三位学者的计算，1990年以来收藏品为英国投资者带来的税后收益高于股票。

此外，投资者可能因拥有这些资产而获得一份“情感回报”，因为这些资产不仅是投资，也是爱好。见识过老爷车收藏家的人都知道，他们对爱车的感情就像西班牙猎犬对主人那样诚挚。

作为许多人拥有的最大资产，房产的情况又如何？截至2016年底，全球房地产总值约为228万亿美元，股票和债券则为170万亿美元。三位学者高度质疑最近一篇论文*称房产的实际回报与股票相当但风险较低的论调。他们认为这是一个泰曼法则（Twyman's law）的例子：“假如一项统计看起来有趣或不同寻常，那可能就是错误的。”

在租金收入上，他们认为此研究对中介费用及空置期的影响做出了“过于乐观”的估计。至于近几十年的房价水平，三位学者表示需要做一些向下调整。最明显的一点是存量住房的品质提升了。过去一个世纪，房主在房屋扩建、中央供暖、室内管道等方面投入了大量资金。计算所有调整后，房产的实际收益可能低于股票，但高于政府债券。

这部年鉴中最令人诧异的发现也许是，黄金和白银在过去118年的投资收益表现均不如现金和债券，尽管这期间大部分时间通胀都处于高位。事实上，黄金在出现急剧通缩时实际收益最佳（但也只达到国债的水平）。在高通胀时期，黄金的表现确实明显优于国债，然而这一对冲手段需要付出长期成本。

长远来看，股票一直是表现最好的资产类别，自1900年以来，全球股票实际回报率为5.2%。但投资者不能就此以为高回报会持续下去。

股票的预期回报等于无风险资产（如国债）的实际回报加上风险溢价。三位学者认为，目前风险溢价约为每年3.5%。由于当前国库券的实际回报率为负，意味着股票的实际回报率约为3%。三位学者在2000年时就作过类似的低回报预测。此后股票的实际回报率一直为2.9%。假如诸位教授再次

预测正确，更多投资者将难挡诱惑，转投波尔多红酒和布加迪名车的怀抱。

* 《1870至2015年间各类资产回报率》，奥斯卡·若尔达、卡塔琳娜·诺尔、德米特里·库夫希诺夫、莫里茨·舒拉里克、阿兰·泰勒合著 ■



Monetary policy

Travel bulletin

Cab rides raise questions about the flow of information from the New York Fed

AS COMPUTING power has grown, it has become easier to uncover information hidden inside datasets that seem totally unconnected. Some recent studies have used this approach to reveal business-related information flows. One linked the movements of 18th-century share prices with the arrival of ships bringing news. Another looked at the relationship between business activity and the movements of corporate jets. A third mined White House visitor logs for the names of executives and examined their companies' subsequent stockmarket returns.

A paper in this vein published on March 5th pores over a dataset released by New York City's government covering more than 1bn cab rides between 2009 and 2014. David Finer, a graduate student at University of Chicago's Booth School of Business, analysed trips connecting the headquarters of big banks and the Federal Reserve Bank of New York. He extracted trips starting at commercial banks and at the New York Fed that converged on the same destination around lunchtime, and those directly from banks to the New York Fed late in the evening.

The number of such journeys rose sharply around the dates of meetings when interest rates were determined by the Federal Reserve's monetary-policy committee in Washington. (The New York Fed plays an outsized role in setting and administering American monetary policy. Its president is a permanent member of the Fed's rate-setting committee and sits over the trading desk that puts policy into effect.) The jump in journeys was especially marked in 2012, when the committee decided to extend quantitative easing, the purchase of securities with newly-created money.

The policy had a profound impact on financial markets. There was even a noticeable change in the data that matched the timing of an office relocation by Goldman Sachs.

Mr Finer builds on a provocative paper by Anna Cieslak of Duke University, and Adair Morse and Annette Vissing-Jorgensen of the University of California at Berkeley. They asserted that information on monetary policy could be used to profit from stockmarket movements, and that such information had leaked from the Fed. Mr Finer's "assumptions are flawed and misleading", the New York Fed responded. "It is simply not credible to imply that an increase of a few taxi rides by unknown passengers between densely populated areas of the city—business, transportation and hospitality hubs—increased the risk of inappropriate communication."

The data do have obvious shortcomings. They do not show who was in the taxis, and departure and arrival points are accurate only to within 100 feet. Even if private bankers and New York Fed staff did meet and discuss policy, they may have broken no law. Many of the journeys were outside the "blackout" periods during which communication between Fed officials and bankers is strictly forbidden.

But the tortuous way the Fed's policymakers release information, through an initial announcement, then weeks later the release of minutes and years later transcripts, means that a direct meeting with its officials can be extremely useful. The Fed has acknowledged that merely having a discussion can lead to accidental disclosure. And even lawful private discussions that transfer government information of value raise questions about fairness. ■



货币政策

出行公告

计程车搭乘数据引发了对纽约联储泄露信息的质疑

由于计算能力的提高，从貌似毫无关联的数据集中发掘出隐藏的信息已变得愈发容易。近期的一些研究就是采用这种方法来揭示与商务有关的信息流动。一项研究显示，18世纪的股价变动与轮船到港带来新消息存在关联。另一项探究了商业活动与公务机行踪之间的关系。还有一项研究仔细查看了白宫的访客记录，看其中有哪些高管的名字，并探查这些人所在公司随后的股市收益。

上月5日发表的一篇论文也属此类。它仔细分析了纽约市政府公布的一个数据集：2009至2014年间超过10亿次的计程车搭乘信息。作者大卫·芬纳（David Finer）是芝加哥大学布斯商学院的研究生，他分析了来往于大银行总部和纽约联邦储备银行之间的行程。从中他提取了在午餐时间分别从商业银行和纽约联储出发，再到同一地点汇合的行程，以及在晚间从银行直接前往纽约联储的行程。

在位于华盛顿的美联储货币政策委员会举行议息会议的那几天，这类出行的次数急剧上升。（在美国货币政策的制定和执行上，纽约联储的影响力举足轻重。其主席是美联储利率制定委员会的永久成员，同时也是负责货币政策执行的公开市场交易委员会的成员。）2012年，这类出行出现特别明显的增长。那一年，美联储货币政策委员会决定扩大量化宽松即使用新发行货币购买证券的举措。这项政策对金融市场产生了深远的影响。数据中有一处明显变化，恰与高盛总部迁址的时间重合。

芬纳的研究是由另一篇颇具争议的论文延伸而来。杜克大学的安娜·西斯拉克（Anna Cieslak）、加州大学伯克利分校的阿黛尔·摩尔斯（Adair Morse）和安奈特·维辛-约根森（Annette Vissing-Jorgensen）在那篇论文中指出，有人可以利用货币政策相关信息从股市的波动中获利，而美联储

泄露了这类信息。纽约联储回应称芬纳的“假设存在缺陷，且有误导性”。“只因为身份不明的乘客搭乘计程车来往于城中的商业、交通及服务中心等人口稠密区域的次数增多了一些，就推测这增加了产生不当信息交流的风险，很难让人信服。”

这些数据确实存在明显的不足。它们并不能显示是谁在乘坐计程车，而且出发和到达地点只精确到100英尺以内。就算私人银行家确实与纽约联储的员工碰面并讨论货币政策，他们可能也并未触犯法律。而且这些行程中有很多是在严禁美联储官员与银行人士沟通的“静默期”之外发生的。

然而美联储的政策制定者公布信息的方式太过迂回——先是发布声明，几周之后发布会议纪要，几年之后才公布完整的会议记录。这就意味着如果能与美联储官员直接会面将会极有帮助。美联储承认，仅仅是一番讨论也可能在不经意间泄露信息。而且，就算是在合法的私下讨论中传递了有价值的政府信息，也会引发公平性的问题。 ■



Pollution

Plastic surgery

To solve the polymer problem, look east

IT IS everywhere, as visible as it is vilified. From car parts to crisp packets, plastic has suffused the Earth, and beyond—in 1969 Neil Armstrong planted a nylon Stars and Stripes on the moon. More than 8bn tonnes has been produced since the 1950s, enough to wrap the continents in clingfilm four times over. Only 9% was recycled; 60% was dumped, mostly in landfills, too often in the natural world. Untold tonnes end up as irretrievable ocean flotsam, which sunlight and salt fragment into microscopic pieces that attract toxins and may be gulped by creatures that become seafood.

Plastic weighs heavily on the mind, too. Nine in ten Europeans worry about its impact on ecosystems; three in four fret that it can harm their own health. In Britain hatred of plastic unites the right-wing *Daily Mail*, the leftie *Guardian*, and the queen, who has banned plastic straws from her castles. But hold on. The little scientists know about plastic suggests that although it is the most noticeable pollutant, it is far from the most harmful. Using less is at best a partial solution. A better answer is to collect more—especially in Asia.

The effects of plastic on nature and human health are hard to gauge. Most polymers are chemically inert. That makes them durable. It also makes them less likely to be a health risk to humans and beasts. As a pollutant, their impact is much lower than less tangible menaces. By one estimate, the environmental and social costs of plastic run to \$139bn a year, chiefly from the greenhouse gases produced in its production and transport. The figure for farming is \$3trn. Fertiliser run-off alone causes \$200bn-800bn worth of damage to the ocean, compared with \$13bn from plastic marine litter. Then

look at the alternatives. A cotton tote bag must be used 131 times before its carbon footprint improves on that of a throwaway carrier bag.

This does not stop plastic from being a problem. But bans and penalties on plastic bags in rich countries may be better for the conscience than for the environment. Prohibition makes sense in poor places like Bangladesh and Kenya that lack proper waste-management systems. It is less useful in tidy France where rubbish collection works smoothly. It would be more effective for rich countries to shore up their recycling industries. They may have little choice in any case. In January China stopped receiving imports of recyclable plastic waste. Because it took half the total traded around the world, that has left hillocks of the stuff piling up in the West.

A carbon tax may spur recycling, which is less energy-intensive than producing virgin plastic. Mandating minimum recycled content in plastic containers, as California has since 1991, is also a useful tool. Governments could exempt second-hand polymers from value-added tax; after all, the tax has already been paid on the fresh source material.

But by itself, the West will not solve the problem. Among the ten biggest plastic polluters, all but two are in developing Asia. Together, they account for two-thirds of the plastic spewed into the ocean. Of these, only China could afford Western-style waste-management in the near future. Others are just waking up to the problem; before plastic began piling up, it reasonably seemed less of a priority for governments. Bangladesh may be able to copy India which, despite its 1.3bn people, falls outside the top ten thanks to armies of ragpickers. The rest, like Vietnam or Thailand, may be too wealthy for *raddiwallahs*, yet too poor for sophisticated rubbish collection. The rich world should focus its attention—and resources, including charity—on chivvying them along. That is the surest way to stem the plastic tide. ■



污染

塑料“整容”

解决白色污染，需要关注东方

它无处不在，显而易见，也备受诋毁。从汽车零件到薯片包装袋，塑料已经充斥地球，以及地球以外的地方——早在1969年，尼尔·阿姆斯特朗就在月球上插上了尼龙质地的星条旗。20世纪50年代以来，全球已生产超过80亿吨的塑料制品，足以将各大洲用保鲜膜覆盖四次。只有9%的塑料制品得以回收，60%都成了垃圾，大多都倾倒在垃圾填埋场，往往就被丢弃在自然环境中。无数吨塑料最后变成了无法清理的海洋漂浮垃圾，在日光和盐分的作用下破裂成会吸附毒素的微小碎片，可能会被海洋生物吃掉，最终又上了我们的餐桌。

塑料也让人们深感忧虑。九成欧洲人担心塑料对生态系统的影响，四分之三的人担忧塑料会危害自己的健康。在英国，对塑料的深恶痛绝让右翼的《每日邮报》、左翼的《卫报》和女王在塑料问题上站在了同一阵营。女王已经禁止在她的城堡内使用塑料吸管。不过先打住。科学家对塑料的浅薄认识表明，它虽然是最引人注目的污染物，但远不是最有害的。少用塑料最多只能解决一部分问题。更好的解决办法是加大回收力度，尤其是在亚洲。

塑料对自然和人类健康的影响很难衡量。大多数聚合物在化学性质上是惰性的，所以不易分解，也不太可能对人类和动物的健康构成风险。作为污染物，它们的影响远远小于那些不那么显眼的威胁。据估计，塑料的环境和社会成本每年总计为1390亿美元，主要来自生产和运输过程中产生的温室气体。农业的环境和社会成本高达3万亿美元。单是化肥地表径流就会对海洋造成2000至8000亿美元的损失，而塑料海洋垃圾带来的损失为130亿美元。再来看塑料的替代品，棉制手提袋必须要使用131次以上才能比一次性购物袋的碳足迹更小。

尽管如此，塑料仍然是个问题。但富裕国家对塑料袋的禁用和惩罚措施可能更多只是安抚了良心，而不是改善了环境。在孟加拉国和肯尼亚等缺乏完善的垃圾管理系统的贫困地区，禁用塑料确实有用。在干净的法国，由于垃圾收集运转顺畅，这种做法就没那么大的作用了。对于富裕国家，提升本国回收行业会更有成效。不过它们可能也没什么选择了。今年1月，中国停止了可回收塑料废物的进口。此举一出，西方国家的塑料垃圾堆积如山，毕竟之前全球一半的出口废弃塑料都是由中国接收的。

收取碳排放税可能会刺激回收利用，因为回收比生产新塑料耗能少。规定塑料容器中再生塑料的最低含量也很有效，加州从1991年起就这么做了。政府可以对回收利用的聚合物免征增值税——毕竟已经对原生塑料征过税了。

但是，西方单靠自身无法解决问题。十大塑料污染国中有八个是亚洲的发展中国家。在所有倾入海洋的塑料中有三分之二来自这些国家。它们当中只有中国在不久的将来有财力采取西方的废物管理方法。其他国家才刚刚开始认识到这个问题——在塑料垃圾开始堆积之前，政府不那么重视似乎合情合理。尽管印度有13亿人口，但拾荒大军使得印度不在塑料污染国前十之列。孟加拉国或许可以模仿印度的做法。而越南或泰国等其他国家可能既没有穷到有那么多人要以拾荒为生，又负担不起复杂的垃圾收集系统。富裕世界应该对这些污染大国多加关注、多投入包括慈善机构在内的资源，督促它们开展行动。这是遏制塑料垃圾大潮最可靠的方法。 ■



Management consulting

Firm direction

McKinsey's new boss has repair work to do, and must tackle the tech sector

THE Jesuits, the US Marines and the Freemasons: McKinsey has been compared to them all, at one time or other. The firm prides itself on being the most prestigious management consultancy, sending out its bright, young footsoldiers to advise executives and policymakers on tricky strategic issues. It is everywhere, counselling 90 of the top 100 firms (as ranked by *Forbes* magazine). Among its many government assignments it is helping Britain to leave the EU, Lebanon to fix its economy and the Saudis to wean themselves off oil.

Occasionally the company needs new leadership itself. On February 25th the result of a long election process was made public. Kevin Sneader, the Scottish chairman of McKinsey's Asia unit, will replace Dominic Barton as managing partner—the top job. He inherits a thriving business. The firm remains by far the biggest of the premium consultancies (see table). Over the past decade, annual revenues have doubled to \$10bn; so too has the size of the partnership, to more than 2,000.

The firm has also overhauled its own operations in many respects. Mr Barton claims that half of what it does today falls within capabilities that did not exist five years ago. It is working to ensure that customers turn to McKinseyites for help with all things digital. It has had to make acquisitions in some areas: recent purchases include QuantumBlack, an advanced-analytics firm in London, and LUNAR, a Silicon-Valley design company. It is increasingly recruiting outside the usual business schools to bring in seasoned data scientists and software developers.

Staying relevant to big tech firms is not easy, however. McKinsey has kept plenty of older ones as clients, such as Hewlett Packard, but it has a lot more to do to crack new tech giants and unicorns (private startups worth more than \$1bn). In general, management consultancies have made fewer inroads into firms such as Facebook and Google. That is partly because consultants typically help struggling firms cut costs; they have less appeal to firms already on the cutting edge. Cash-rich tech firms also tend to prefer keeping things in-house rather than bringing in consultants. They compete with McKinsey in some ways, too. Amazon has become the largest recruiter at some business schools, and the firm's own consultants are lured away by tech firms' generous pay packages.

McKinsey's response is to try to gain a foothold earlier on in tech firms' life-cycles. It is targeting medium-sized companies, which would not have been able to afford its fees, by offering shorter projects with smaller "startup-sized" teams. As it chases growth, the firm is also doing things it used to eschew as being insufficiently glamorous. In 2010 it moved into business restructuring and it has also set up a global strategy "implementation" practice. That is a far cry from the days when its consultants stuck mainly to blue-sky thoughts in their ivory towers. Mr Barton has also overseen a shift towards a results-based fee model, bringing the firm into line with its nearest competitors, the Boston Consulting Group and Bain & Company.

As McKinsey takes on more people and practices, cracks in its distinctive "One Firm" ethos, and its reputation for discretion, might start to show. It is under investigation in South Africa for working with Trillian, a local consulting firm owned by an associate of the controversial Gupta family, on a contract worth hundreds of millions of dollars for Eskom, a state-owned utility. The firm says it never worked for the Guptas, but admits to "errors of judgment", particularly in starting work with Trillian before its internal due diligence was complete. The fallout so far has been limited to South Africa, with a few local clients, including Coca-Cola's local unit and some banks,

saying they will not give McKinsey any new work.

Events in South Africa may be an aberration, rather than a consequence of rapid growth. But the tension between profit and principle is not new. It manifested itself most clearly when Rajat Gupta, a former managing partner, was convicted of insider trading in 2012. Can McKinsey continue to grow rapidly while keeping its key asset—its reputation as a trusted adviser—intact? Now there is a question worthy of the world's best consultants. ■



管理咨询

明确的指引

麦肯锡的新老板有些修补工作要做，还必须和科技行业打交道

耶稣会、美国海军陆战队、共济会——在不同的时候，人们曾把麦肯锡和这三者相提并论。作为最负盛名的管理咨询公司，麦肯锡颇感自豪。它派出聪明年轻的干将，为高管和政策制定者提供建议来解决棘手的战略问题。它无处不在，为《福布斯》100强企业中的90家做过咨询。它还为多国政府出谋划策，例如帮英国脱欧，帮黎巴嫩修复经济，帮沙特摆脱对石油的依赖。

有时候这家公司自己也需要新的领导。2月25日，在经过漫长的选举后，结果出炉了。麦肯锡亚洲区董事长、苏格兰人施南德（Kevin Sneader）将取代鲍达民（Dominic Barton）担任全球总裁——公司的最高领导人。他继承的是一个欣欣向荣的公司。麦肯锡仍是顶级咨询公司中规模最大的一家（见表）。过去十年间公司年收入增加了一倍，达到100亿美元；合伙人的规模同样翻番，超过了2000人。

公司还从许多方面彻底改革了自己的业务运作。鲍达民称，目前开展的业务中有一半在五年前是没有能力做的。公司正在努力确保客户在所有数字化问题上都会向麦肯锡求助。它不得不在一些领域做出收购：最近买下的公司包括伦敦的高阶分析公司QuantumBlack和硅谷的设计公司LUNAR。以往它多从商学院招人，现在则越来越多地引进资深数据科学家和软件开发人员。

不过，和大型科技公司建立业务并不容易。麦肯锡的客户中仍有着大量像惠普这样的老牌科技公司，但要拿下新的科技巨头和独角兽公司（价值超过10亿美元的私营创业公司）还要下不少功夫。总的来说，管理咨询公司进军Facebook和谷歌这类公司的成果不多。这在一定程度上是因为咨询顾问通常都是帮助陷入困境的公司削减成本，对于已经处于领先地位的公司

它们的吸引力不大。现金充裕的科技公司也倾向于在公司内部解决问题，而不是引入咨询顾问。它们在某些方面也与麦肯锡竞争。亚马逊已经成为一些商学院最大的招聘者，而且麦肯锡的咨询顾问也会被科技公司用高薪挖走。

麦肯锡的应对方法是力图在科技公司生命周期的早期获得立足点。它现在瞄准了以前付不起咨询费的中型企业，以较小的“创业公司规模”的团队为这些企业提供较短期的服务项目。为了追求增长，公司也在从事一些以前因觉得不够光鲜而回避的业务。2010年，它启动业务重组，还建立了全球战略“落实”体系。这与公司之前的形象差距很大——过去，咨询顾问们蹲在自己的象牙塔里，死守着大多不切实际的设想。鲍达民还监督公司向按成果收费的模式转变，让公司与实力最接近的竞争对手波士顿咨询集团（Boston Consulting Group）和贝恩公司（Bain & Company）保持一致。

随着麦肯锡招募越来越多的员工、开展越来越多的业务，它那“同一家公司”的独特理念以及审慎的声誉可能会逐渐显现出漏洞来。公司正在南非接受调查，它和当地咨询公司Trillian合作赢得了一份价值数亿美元的合同，为国有的南非国家电力公司（Eskom）提供服务，而Trillian的所有者是当地颇具争议的古普塔家族（Gupta family）的一名合伙人。麦肯锡表示自己从没有为古普塔家族工作过，但承认“判断失误”，尤其是内部尽职调查还未完成就开始与Trillian合作。到目前为止，此事件的影响仅限于南非，包括可口可乐南非子公司和一些银行在内的几家当地客户表示不会给麦肯锡任何新工作。

南非事件可能是一时失手，而非快速增长的结果。但利润与原则之间的矛盾并不是什么新问题。麦肯锡前全球总裁顾磊杰（Rajat Gupta）在2012年被判犯有内幕交易罪，就充分体现了这种矛盾。麦肯锡能否在保持快速增长的同时保护好自己的关键资产——“可信赖的顾问”这一声誉？这个问题值得请世界上最好的咨询顾问来回答了。 ■



A requiem for the factory

When giants ruled the world

An insightful history of giant factories, which may turn out to be their epitaph

WHEN it was built in 1721 beside the River Derwent, in Britain's East Midlands, Lombe's silk mill became something of a tourist attraction. Daniel Defoe, one of its many visitors, described its "vast bulk" as "a curiosity of a very extraordinary nature". Employing some 300 people, mostly children in ghastly conditions, the mill was not large by modern standards. But it is widely regarded as the first successful mechanised factory, an innovation that over the next 100 years transformed the way people lived and worked.

Lombe's mill is the natural starting-point for Joshua Freeman's lively chronicle of the factory, which as the title of his book "Behemoth" implies, concentrates on the largest specimens of their time. Mr Freeman, a historian at Queens College in New York, travels from Britain's textile mills, which centralised tasks that were previously carried out in homes and small workshops, to monster steel and carmaking factories in 20th-century America, Europe and the Soviet Union. His journey ends in southern China at Foxconn's city-sized plant, which makes iPhones and other electronic gadgets.

Mr Freeman rolls up his sleeves and delves into the nitty-gritty of manufacturing. He successfully melds together those nuggets with social history, on the shop floor and beyond the factory walls, from union battles to worker exploitation and, in the case of Foxconn, suicides. Consider, for example, his account of one of the most famous factory bosses of all.

Henry Ford launched his Model T in 1908, turning the car from a luxury into

a mass-manufactured product. Ford's original factory, just outside Detroit, used standardised parts and fitted them to vehicles as they travelled along a moving assembly line. By 1914 this cut the labour time needed to assemble a Model T from 12.5 hours to 93 minutes. Before long the nearby River Rouge complex became the centre of a vertically integrated empire, designed to produce everything required to make a car.

The Model T, however, soon became obsolete. As Mr Freeman describes, this exposed the weakness of the Ford system: it is extremely expensive and slow to switch a giant factory from one product to another. In 1927 Ford halted production and laid off 60,000 workers, causing a social crisis in the Detroit area. After six months 15,000 machine tools had been replaced and 25,000 others rebuilt, so that the Rouge was ready to make the new Model A. At its zenith the factory employed 100,000 people. But it was a brutal place to work, with employees subject to harsh discipline and tyrannical foremen. "A man checks 'is brains and 'is freedom at the door," one Rouge worker complained.

As the switch from Model T to Model A plunged Ford into loss, Alfred P. Sloan, president of General Motors, presciently observed that carmakers would need to "adopt the 'laws' of Paris dressmakers". That meant bringing out new models more often. The shortening of product cycles and the fickle nature of modern markets has duly seen manufacturing atomise into smaller, nimbler, more specialist factories. The Rouge, for instance, lives on, but with just 6,000 workers making pick-up trucks.

Some see offshoring to low-wage countries, particularly in Asia, as the mega-factory's last hurrah. Yet long supply chains and distant plants are leaving producers vulnerable to rapid changes in their home markets, so production has been trickling back. Meanwhile new materials and manufacturing methods, such as 3D printing, are demolishing the economies of scale that giant factories have relied on. Although Mr Freeman

is not ready to write off his behemoths, he has probably written their obituary. ■



工厂安魂曲

巨人统治的年代

一段发人深思的巨型工厂历史，可能会成为它们的墓志铭

一七二一年，在英国东米德兰的德温特河畔，洛姆比水力缫丝厂（Lombe's silk mill）建成投产，一时间仿佛一道观光景点。丹尼尔·笛福（Daniel Defoe）是众多参观者之一，他形容缫丝厂“规模巨大”，是“非凡奇景”。工厂雇有约300名员工——大多是在恶劣条件下劳作的儿童，以现代标准来看规模并不大。但人们普遍视之为第一家成功的机械化工厂。在之后的100年里，机械化创新彻底改变了人们的生活和工作方式。

在约书亚·弗里曼（Joshua Freeman）撰写的这部生动的工厂编年史中，洛姆比缫丝厂自然而然成为了开篇。正如书名《巨兽》（Behemoth）所示，本书聚焦于各个时期最典型的超大工厂。费里曼是纽约皇后学院（Queens College）的历史学家，他从英国的纺织厂（这些工厂把之前分散在家庭和小作坊内的工作集中起来）谈到20世纪美国、欧洲、苏联的巨型钢铁及汽车制造厂，最后以制造iPhone等电子产品的富士康在中国华南地区规模堪比城市的工厂园区作结。

弗里曼深入探究制造业的基本事实，下了一番苦功。他成功将种种宝贵信息与社会历史熔于一炉，从车间内到工厂外，从工会抗争到工人受剥削的问题，还有富士康工人自杀事件，均有触及。来看一看他对最有名的一位工厂老板的描述。

亨利·福特在1908年推出T型车，把汽车从一种奢侈品变为大批量制造的产品。福特最初在底特律近郊的工厂使用标准化零件，在流水线上装配汽车。到1914年，这种做法把一辆T型车的组装时间从12.5小时缩短至93分钟。不久，可以生产汽车制造所需一切产品的胭脂河工厂（River Rouge complex）在附近建成，成为福特这个纵向一体化帝国的中心。

然而，T型车很快便成为了明日黄花。正如弗里曼所描述，这暴露出福特生产体系的弱点：一家巨型工厂转产新产品要付出巨大的成本，耗费漫长的时间。1927年，福特停产，裁员六万人，在底特律地区造成社会危机。六个月后，胭脂河工厂为制造新款A型车更换了15,000台机床，又改造了另外25,000台。在顶峰时期，工厂雇用了十万名员工。但这是一个严苛的工作场所，员工要面对严厉的管理和专制的领班。“进了厂门你就得放下脑子和自由。”胭脂河工厂的一位工人抱怨说。

从T型车转产A型车令福特陷入亏损，与此同时通用汽车的总裁阿尔弗雷德·斯隆（Alfred P. Sloan）颇有先见之明地指出，汽车制造商要“借鉴巴黎制衣商的‘法则’”，也就是说要更频繁地推出新车型。产品生命周期缩短，加上现代市场需求变幻莫测，已使制造业细分为更小、更灵活、更专业的工厂。例如，胭脂河工厂至今仍在营运，但只有6000名制造皮卡的工人。

一些人认为，大型工厂的最后一搏是离岸外包给低工资国家，特别是亚洲国家。然而，供应链长，工厂远，令制造商难以应对本国市场的快速变化，所以，生产已逐渐回流。与此同时，3D打印等新材料和制造方法正在拆解巨型工厂一直依赖的规模经济。弗里曼倒是还没表示这些“巨兽”行将就木，但很可能已经为它们写好了讣告。 ■



Listening underwater

Sing a song of sonar

Technology is transforming the relationship between people and the oceans, says Hal Hodson

IN THE summer of 1942, as America's Pacific fleet was slugging it out at the battle of Midway, the *USS Jasper*, a coastal patrol boat, was floating 130 nautical miles (240km) off the west coast of Mexico, listening to the sea below. It was alive with sound: "Some fish grunt, others whistle or sing, and some just grind their teeth," reads the ship's log.

The *Jasper* did not just listen. She sang her own song to the sea—a song of sonar. Experimental equipment on board beamed chirrups of sound into the depths and listened for their return. When they came back, they gave those on board a shock. The *Jasper*'s charts said she was in 3,600 metres (2,000 fathoms) of water. But the time it took the soundwaves to bounce back said the bottom of the ocean was just 450 metres below the ship's hull.

The instruments were not wrong. The interpretation was. The *Jasper*'s crew had found a new ecosystem so dense with aquatic life it appeared to their rudimentary sonar to be solid—a "phantom bottom" to the ocean. Unlike the sea's true floor, it moved, its billions of inhabitants rising en masse to feed at night, then sinking away from predators during the day. This "deep scattering layer"—named for the way it was found by the scattering of sound waves—is not local to Mexico. Present in all the oceans, it is one of the largest ecosystems in the world. Its daily rise and fall is their heartbeat, an unseen spectacle of planetary extent.

That such a mass of animals should go undiscovered for so long shows quite how inscrutable the sea has always been. The subsurface ocean is

inhospitable to humans and their machines. Salt water corrodes exposed mechanisms and absorbs both visible light and radio waves—thus ruling out radar and long-distance communication. The lack of breathable oxygen severely curtails human visits. The brutal pressure makes its depths hard to access at all.

The discovery of the deep scattering layer was a landmark in the use of technology to get around these problems. It was also a by-blow. The *Jasper* was not out there looking for deepwater plankton; it was working out how to use sonar (which stands for Sound Navigation And Ranging) to spot submarines, and thus help to keep ships like those at Midway safe.

Sonar research has been mostly military ever since, as have various other forms of high-tech ocean sensing. But the new sensorium allowed an exploration of the ocean's depths that became crucial to science and commerce. Sea-floor surveys undertaken in the 1950s and 1960s discovered a chain of underwater mountains snaking through the oceans like the seam on a baseball. This discovery helped transform the controversial notion of continental drift into the far more powerful and explanatory theory of plate tectonics. Modern industrial fishing and offshore oil and gas benefited in similar ways: seeing the seas and their contents mattered.

In the past decade, remote underwater observation has moved to a new level as sonar technology has become more advanced. Computers have become powerful enough to turn the apparent gibberish that is created by numerous sound sources at various frequencies into high-resolution “sound pictures” of underwater objects. And smaller, cheaper electronic components using less power—a gift from the smartphone boom which kickstarted progress in drones, robotics and small satellites—are now putting to sea. They may be just as transformative there as in the skies and in space.

All this change promises to bring about a transformation in the way humans interact with the oceans. For most of history, people have had a hunter-gatherer relationship with the seas. That approach no longer works. If overfishing continues at the current rate, the seas will run out of fish. One response to this would be to decry the technological change that has made such overfishing possible. Another is to ask how the latest technology can be used in ways that improve things, undoing the damage of the past and making the old hunting ground a new realm, one that is more productive and more sustainable.

One crucial change brought about by the new technology is a reduction in the number of people involved. Until recently, using sonar was an expensive business, requiring a ship with a crew, towing equipment through the depths behind it. Now underwater drones (such as the one pictured being launched) can move around as fast as ocean currents flow, which means they can go wherever they want and stay there if needed. They can communicate acoustically, with each other or with a mother ship. Their lithium-ion batteries—one of those technologies smartphones have greatly improved—can provide power for days.

By removing the expense of keeping humans alive on or under the sea, these technologies vastly expand the volume of the ocean which can be monitored and measured, whether it be for fishery management or weather prediction. They enable the better study of icebergs, underwater volcanoes and every living creature under the sea. And drones will soon be able to transfer data on all of this instantly back to shore from the middle of the ocean, over newly built internet infrastructure.

“When data start to inform decisions, very interesting things happen,” says Bilal Zuberi, a partner at Lux, a venture-capital firm. These things include investment in infrastructure. Mr Zuberi envisions herds of wind turbines moving around the seas autonomously, grazing on winds which offer the

most power. The possibility of mining previously inaccessible seabeds may become a reality. So may the farming of fish in the open ocean. As befits their origins, the new technologies have military implications, too, as improved undersea surveillance makes it harder for submarines to hide, thus denting their second-strike capabilities.

Jacques Cousteau, a French conservationist, called in 1971 for a shift in how humans see the oceans. “We must plant the sea and herd its animals...using the sea as farmers instead of hunters,” he said. “That is what civilisation is all about.” It has taken half a century and a technological revolution, but the means of realising Cousteau’s vision are now here. This quarterly will examine the technologies that are enabling this virtual settlement of the seas, and the impact it will have. It will also examine the perils such changes could bring.

Modern civilisation has not shown much restraint in the use of technologies which make extracting resources from the earth or the seas easier, as the current overfishing crisis shows. The new developments will make it even simpler to drill or mine or fish in ways that could seriously damage the environment.

But the choice is not between taking these risks and taking no risks. It is about judging those risks against the capacity for wise regulation to reduce the risks already being taken—and to lessen the harm already being done to the seas, their inhabitants and those who rely on them. That capacity for good is also one that the new technologies will increase. ■



聆听水下世界

高唱声纳之歌

本专刊作者哈尔·霍德森（*Hal Hodson*）认为，技术正在改变人类和海洋的关系

一九四二年夏天，美国太平洋舰队正在中途岛战役中与敌军一决高下，海岸巡逻艇碧玉号（*USS Jasper*）漂浮在距墨西哥西海岸240公里处，聆听它下方海洋的声响。一首欢腾的交响乐传来。“一些鱼在咕噜咕噜地哼哼，另一些在吹哨子或唱歌，还有一些在磨牙。”航海日志写道。

碧玉号不只在听，她自己也向大海唱出了一首歌——声纳之歌。船上的实验设备向大海深处持续传送短促的高音，而后等待回响。当回声抵达时，船上的人大吃一惊。碧玉号的航海图显示她所在水域有3,600米深，而从声波折返的耗时来看，船体再往下450米就是海底了。

仪器没有测错，错的是人们的解读。碧玉号的船员们发现的是一个新的生态系统，其中的水生生物如此之密集，使得当时仍然粗陋的声纳设备误认为它是固体——这就是“魅影海床”。不同于真实的海床，它是移动的：它的数十亿居民在夜间集体向上游动来捕食，白天向下游动以逃离它们的捕食者。这个“深海散射层”（得名于它因散射声波而被发现这一点）并非墨西哥独有。它在所有海洋中都存在，是世界上最大的生态系统之一。每天的升降仿佛海洋的心跳，是整个地球上前所未见的奇观。

这么久以来如此庞大的动物群落都未被发现，海洋一贯的神秘莫测由此可见一斑。洋面以下的世界对人类和机器都不友好。盐水腐蚀暴露在外的机械设备，吸收可见光和无线电波，使得雷达和长距离通信统统失效。缺乏可呼吸的氧气严重限制了人类对海洋的探测。强大的水压使得海洋深处完全无法进入。

深海散射层的发现是利用技术克服上述问题的一个里程碑。它也是一个偶然的收获。当时碧玉号并不是在那里寻找深水浮游生物，而是在探索如何

使用声纳（英文sonar，是“声音导航和测距”的首字母缩写）来发现潜艇，有助于保证像中途岛战役中部署的那些船只的安全。

自那时起，声纳研究就一直以军事用途为主，其他各式各样的高科技海洋传感也一样。但这种新的探测系统让人类得以探索海洋深处，成为科学和商业中至关重要的部分。在上世纪五六十年代开展的海底勘探发现了一连串水下山脉，它们像棒球上的接缝那样在海洋中蜿蜒而行。这一发现帮助原本颇具争议的大陆漂移说发展成为板块构造理论，其效力和解释力都要强得多。现代工业化捕鱼以及海上石油和天然气勘探也同样获益：看得见海里有什么非常重要。

过去十年里，声纳技术的发展使得远程水下观测达到了一个全新的水平。计算机已经变得足够强大，把各种频率的众多声源所组成的“胡言乱语”转变为一幅高分辨率的水下世界“声音图景”。此外，更小、更便宜、耗电更少的电子元件也被投放到海洋中——这是智能手机的蓬勃发展带来的礼物，它们已经推动了无人机、机器人和小型卫星的发展。现在它们可能会像改变天空和太空那样改变海洋。

所有这些变化都将改变人与海的互动。在历史上大部分时期，人类都和海洋保持着狩猎采集的关系。但这种做法行不通了。如果以目前的速度继续过度捕捞，海洋中的鱼类就将灭绝。一种应对方式是谴责那些让过度捕捞成为可能的技术变革。另一种方法则是思考如何能利用最新的技术来改善现状，消除已造成的破坏，并使旧的狩猎场焕发新生——成为一个更高产、更可持续的领地。

新技术带来的一个关键变化是减少了参与的人数。直到最近，使用声纳都是一项昂贵的业务：需要一艘配备船员的船来拖着设备在深海中穿行。现在，水下无人机（如图中那台正在被部署的无人机）的移动速度可以达到洋流速度，这意味着它们可以去往任何想去的地方，并在有需要时停留在那里。它们可以用声音在彼此间及与母船之间通信。它们的锂离子电池——因智能手机而获重大改进的技术之一——可以持续供电多日。

省去了让人类在海上或海下维生的开支，这些技术大大扩展了可监测的海洋范围，无论是为了管理渔业还是预测天气。它们让人类得以更好地研究冰山、水下火山和每一种海洋生物。而无人机很快就能通过新建的互联网基础设施将所有这些数据从海上即时传到岸上。

“当数据开始引导决策，就会发生非常有趣的事。”风险投资公司Lux的合伙人比拉尔·祖贝里（Bilal Zuberi）说。比如对基础设施的投资。祖贝里想象将有成群结队的风力涡轮机在海上自主移动，哪里风最大就去哪里。在从前无法靠近的海底采矿也可能成为现实。此外还可能在开放海域中养鱼。新技术也将影响自己的发展源头——军事，这是因为改进的海下监视手段使得潜艇更难隐藏，削弱了它们的反击能力。

法国环保主义者雅克·库斯托（Jacques Cousteau）在1971年呼吁人类改变对待海洋的态度。“我们必须在海洋中栽种植物和驯养动物……做海洋的农场主而非狩猎者，”他说，“这才是文明。”在经历了半个世纪和一场技术革命之后，我们终于拥有了实现库斯托设想的手段。本期季刊将审视正在促成这一海洋虚拟居所的技术及其影响，也将考察这些变化可能带来的危险。

正如眼下过度捕捞的危机所显现的，现代文明在利用技术从地球或海洋开采资源上缺乏节制。新的技术发展还将让钻井、挖矿或捕鱼变得愈加容易，其方式可能严重破坏环境。

但我们要做的抉择并非冒险或完全不冒险，而是在两件事之间做权衡：风险有多大？又有多少能力通过明智的监管来控制风险、减少已经对海洋、海洋生物以及依赖它们的人造成的损害？毕竟，新技术也将提升做好事的能力。 ■



Undersea mining

Race to the bottom

Mining the ocean floor is about to go mainstream

PATANIA ONE sits in a large shed on the outskirts of Antwerp. Green and cuboid, with an interior steel frame, rubberised treads and pressure-resistant electronic innards, it is about the size of a minivan. In May 2017 it became the first robot in 40 years to be lowered to the sea floor in the Clarion Clipperton Zone (CCZ), about 5,000 metres beneath the Pacific ocean near where the *Jasper* did her pioneering sonar work. There it gathered data about the seabed and how larger robots might move carefully across it, sucking up valuable minerals en route.

The CCZ is a 6m square-kilometre (2.3m square-mile) tract between two of the long, straight “fracture zones” which the stresses of plate tectonics have created in the crust beneath the Pacific. Scattered across it are trillions of fist-sized mineral nodules, each the result of tens of millions of years of slow agglomeration around a core of bone, shell or rock. Such nodules are quite common in the Pacific, but the CCZ is the only part of the basin where the International Seabed Authority (ISA), which regulates such matters beyond the Exclusive Economic Zones (EEZs) of individual countries, currently permits exploration. Companies from Japan, Russia, China and a couple of dozen other countries have been granted concessions to explore for minerals in the CCZ. The ISA is expected to approve the first actual mining in 2019 or 2020.

This could be big business. James Hein of the United States Geological Survey and colleagues estimated in a paper in 2012 that the CCZ holds more nickel, cobalt and manganese than all known terrestrial deposits of those metals put together. The World Bank expects the battery industry’s demand

for these, and other, minerals to increase if the transition to clean energy speeds up enough to keep global temperatures below the limits set in the Paris agreement on climate.

One of the firms attracted by this vast potential market is DEME, a Belgian dredging company which has already proved resourceful in seeking out new businesses: installing offshore wind farms now provides it with revenues of nearly €1bn (\$1.2bn) a year. Korea, Japan and China all have state-run research projects looking to dredge nodules from the deep sea with robots: “It really is a race,” says Kris Van Nijen, who runs DEME’s deep-sea mining efforts. At the moment his firm is setting the pace. It has learned a lot from the exploits of Patania One (pictured), such as how hard you can push bearings rated to 500 atmospheres of pressure and how deep treads sink into the deep-sea ooze for a given load.

The idea of mining the CCZ is not new. The Pacific’s mineral nodules were discovered by *HMS Challenger*, a British research vessel that first dredged the abyssal depths in the 1870s. Lockheed Martin, an American defence contractor, tried prospecting the CCZ in the 1960s. Its caterpillar tracks were not reliable enough to operate at such depth, so the company imagined two Archimedes screws to drag its vehicle through the mud. (Lockheed’s deep-sea mining expertise was later used in a CIA operation to recover a Soviet submarine which sank in the CCZ in 1968.) At the time there was hyped speculation that deep-sea mining would develop rapidly by the 1980s. A lack of demand (and thus investment), technological capacity and appropriate regulation kept that from happening. The UN Convention on the Law of the Sea (UNCLOS), which set up the ISA, was not signed until 1982. (America has still not ratified it, and thus cannot apply to the ISA for sea-floor-mining permits.)

Mr Van Nijen and his competitors think that now, at last, the time is right. DEME is currently building Patania Two, or P2, in an Antwerp shipyard.

It will be deployed to the Pacific in 2019. Where P1 was basically a deep-sea tractor, P2 is a full-blown prototype. A sweeping nozzle mounted on its front (which gives it the look of a combine harvester) will suck up tonnes of nodules every minute; the power it needs to do so will flow down a thick umbilical from a mother ship above. In commercial production, a similar cord will pump a slurry of nodules and dirt back up to the ship—an impressive bit of engineering. For the time being P2 will just keep some of the nodules in a container on its back for later inspection.

In order to satisfy the ISA, this new machine does not just have to show it can harvest nodules; it also has to show that it can do so in an environmentally sensitive way. Its harvesting will throw up plumes of silt which, in settling, could swamp the sea floor's delicate ecosystem. A survey of CCZ life in 2016 found a surprising diversity of life. Of the 12 animal species collected, seven were new to science. To help protect them, the mining field will be ringed with buoys, monitoring any plumes of silt that are bigger than DEME had predicted. The operations will also be monitored by a German research ship, funded by the EU.

If P2 succeeds, it will be time for P3, which will be the size of a small house. It will have two drone escorts, one to move ahead of it and one behind. They will monitor how much silt it disturbs, and will shut down the operation if necessary. Thus, P3 will be able to steer along the seabed autonomously. DEME will then build a customised surface vessel, ending up in about 2025 with a new kind of mining operation, at a total cost of \$600 million.

The CCZ is not the only sea floor that has found itself in miners' sights. Nautilus, a Canadian firm, says it will soon start mining the seabed in Papua New Guinea's EEZ for gold and copper, though at the time of writing the ship it had commissioned for the purpose sits unfinished in a Chinese yard. A Saudi Arabian firm called Manafai wants to mine the bed of the Red Sea, which is rich in metals from zinc to gold. There are projects to mine iron

sands off the coast of New Zealand and manganese crusts off the coast of Japan. De Beers already mines a significant proportion of its diamonds from the sea floor off the coast of Namibia, although in just 150 metres of water this is far less of a technical challenge.

If the various precautions work out, the benefits of deep-sea mining might be felt above the water as well. Mining minerals on land can require clearing away forests and other ecosystems in order to gain access, and moving hundreds of millions of tonnes of rock to get down to the ores. Local and indigenous people have often come out poorly from the deals made between miners and governments. Deep-sea mining will probably produce lower grade ores, but it will do so without affecting human populations.

It will also deliver those ores straight on to ships which can move them directly to processing plants on any coast in the world, including those using solar or wind power, thus reducing the footprint of mineral extraction even more. Having seen the destruction wrought by mining on land, undersea miners are working doubly hard to plough a different furrow. ■



海底采矿

力争下游

海底采矿将变成主流产业

Patania One被放置在比利时安特卫普市郊区的一间大库房内。这套设备是一个绿色长方体，配有内部钢框架、橡胶履带和抗压的内部电子设备，体积和一辆面包车差不多。2017年5月，它成为40年来第一台被沉入克拉里昂-克利珀顿区（以下简称CCZ）海底的机器人，作业地点位于太平洋水下约五千米处，靠近“碧玉号”开创声纳探测的位置。它在那里收集有关海床的数据，了解更大号的机器人要如何小心地四下移动，并一路上把宝贵的矿产吸进体内。

CCZ是一块600万平方公里的区域，位于因板块构造应力而在太平洋下地壳中形成的两个“断裂带”之间。这里散布着数以万亿计拳头大小的矿物结核，每个都是包裹在骨头、壳或岩石外经过数千万年的缓慢积聚形成的。这种矿物结核在太平洋里相当常见，但CCZ是太平洋海盆里唯一获国际海底管理局（以下简称ISA）这一管理各国专属经济区（EEZ）以外事项的组织准许勘探矿产的区域。来自日本、俄罗斯、中国和其他几十个国家的公司已获准在CCZ勘探矿产。预计ISA将在2019年或2020年批准首次实际开采。

这有可能是笔大生意。美国地质调查局的詹姆斯·海因（James Hein）及其同事在2012年的一篇论文中估计，CCZ的镍、钴和锰储量比这些金属所有已知陆地矿床的总和还要多。世界银行预计，如果向清洁能源过渡的速度足以使全球气温低于巴黎气候协议规定的限值，那么电池行业对这些和其他矿物的需求将会增加。

这一巨大的潜在市场吸引了许多公司，比利时的疏浚公司DEME是其中之一。这家公司在寻找新业务方面已展现出雄才伟略：安装海上风力发电场目前为它带来每年近10亿欧元（12亿美元）的收入。韩国、日本和中国都

有国家级研究项目利用机器人从深海采掘矿物结核。“这真是一场竞赛。”DEME深海采矿部门的负责人克里斯·范尼坚（Kris Van Nijen）说。目前他所在的公司是这场竞赛的领军者。它从使用Patania One（如图）的过程中获得了很多经验，比如额定压力为500个大气压的轴承能承受多大推力，以及在特定负载下，履带会陷入海床的淤泥中多深。

在CCZ采矿不是什么新鲜的主意。太平洋里的矿物结核是由英国皇家海军舰艇“挑战者号”（HMS Challenger）发现的，这艘科研考察船最早在19世纪70年代探索了海底深渊。美国防务承包商洛克希德·马丁在上世纪60年代尝试勘探CCZ。它的卡特彼勒履带还不够可靠，无法在这样的深度工作，所以公司设计了两个阿基米德螺旋泵来拖着它的设备穿过淤泥。（洛克希德的深海采矿专业技术后来被中央情报局用于打捞1968年在CCZ沉没的一艘苏联潜艇。）当时有关深海采矿将在80年代飞速发展的猜测甚嚣尘上。但是，缺乏需求（因而也缺乏投资）和技术能力以及适当的监管使得这并未成为现实。直到1982年，设立ISA的联合国海洋法公约（UNCLOS）才被签署。（美国至今尚未批准这项公约，因此不能向ISA申请海底采矿许可）。

范尼坚和他的竞争对手们认为现在时机已经成熟。DEME目前正在安特卫普的一个造船厂里打造Patania Two（P2）。它将于2019年被投放到太平洋里。P1说白了就是一艘深海拖拉机，P2则是一台完整的原型。安装在它前部的扫描式吸嘴（这使它长得像联合收割机）每分钟会吸进大量矿物结核。操作所需的电力将通过一根粗大的脐带缆从上方的母船上输送下来。在商业生产中，一根类似的脐带缆会把含矿物结核和泥土的泥浆再泵回船上——可谓工程壮举。目前来说，P2只会把一些矿物结核保存在它背部的一个容器里，供日后检查研究。

为满足ISA的要求，这台新机器不仅要证明它可以“收割”矿物结核，还须显示它会小心操作而不影响环境。它一路收割扬起的淤泥沉降时可能会“压垮”脆弱的海底生态系统。2016年对CCZ的生物调查发现了令人惊叹的生物多样性。在收集到的12种动物样本中有七种都是科研人员前所未见的。为保护它们，采矿场将用浮标环绕，监测任何比DEME的预测更庞大

的淤泥流。由欧盟资助的一艘德国科研船也将监测这些操作。

如果P2取得成功，P3就要登场了。它会像一套小房子那样大，有两艘无人驾驶潜艇为其护航，前后各一。它们将监测它搅动了多少淤泥，在必要时关停操作。这样，P3将能在海床上自主行进。然后DEME将建造一艘定制的水上舰船，最终在2025年左右启动一种新型的采矿作业，总成本为六亿美元。

CCZ并非唯一的海底采矿目标。加拿大鹦鹉螺公司（Nautilus）表示，它很快就将启动在巴布亚新几内亚的专属经济区海底开采黄金和铜矿，尽管在截至本文发稿时，它为此目的而委托建造的船还躺在中国一家造船厂里尚未完工。沙特阿拉伯的Manafai公司想要在红海采矿，那里富含锌和金等各种金属。还有一些项目在新西兰沿海开采铁矿砂，在日本沿海开采锰结壳。戴比尔斯（De Beers）生产的钻石有很大一部分是从纳米比亚沿海的海底开采而来，尽管它作业的位置只有150米深，还远远算不上一项技术挑战。

如果各种预防措施达到预期效果，深海采矿的益处在陆地也可能感受得到。在陆地上采矿可能需要夷平森林和其他生态系统才能入手，也可能需要移除数亿吨的岩石才能接触原矿石。当地人和土著往往难以在矿商和政府的交易中维护自己的利益。深海采矿出产的矿石品位可能较低，但不会干扰人类生活。

它还会把这些矿石直接运到船上，把它们径直输送到位于世界上任何海岸的加工厂里，包括那些使用太阳能或风能的加工厂，从而进一步减少采矿的碳足迹。在目睹了陆地采矿带来的破坏后，海底开采者正加倍努力地耕耘一条不一样的犁沟。 ■



Herding fish

Net gains

Open-ocean fish farming is becoming easier

AN UNUSUAL object arrived off the coast of Norway last September. Roughly the weight of the Eiffel Tower and enclosing a volume greater than St Peter's Basilica in Rome, its polyhedral frame measures 68 metres from top to bottom and over 100 metres in diameter. Parked 5km offshore, it looks like a partly submerged bright-yellow Ferris wheel tipped on its side, with a white control tower at its hub. Locals took it for a flying saucer as it passed South Africa on its way from the shipyard in China where it was built. (The picture here shows it before it was submerged.) Yet to come are its occupants: 1.5m baby salmon.

Ocean Farm 1, as the structure is known, is the first of six experimental fish farms ordered by SalMar, a Norwegian firm, at a total cost of \$300 million. InnovaSea, an American firm, makes large open-ocean aquaculture nets called SeaStations, which are currently used off the coast of Panama and Hawaii, but Ocean Farm 1 is “by far the largest open-ocean fish farm in the world,” says Thor Hukkelas, who leads research and development on aquaculture at Kongsberg Maritime, a Norwegian engineering company. Mr Hukkelas’s team provided Ocean Farm 1’s sensor system: 12 echo sounders mounted on the bottom of the frame, high-definition cameras dangled into the water at different depths, oxygen sensors and movable, submerged feeding tubes.

Fish farming plays an increasingly central role in the provision of sufficient amounts of protein to Earth’s population. People eat more fish globally than beef, and farmed fish account for almost half of that amount (see chart). Many wild fisheries are already at or past their sustainable capacity, so

efforts to make fish farming more productive are vital.

Ocean Farm 1 aims to automate what is an expensive and difficult business, and to solve two key problems that occur in near-shore aquaculture: that there is not enough space and that it is too polluting. The excrement from millions of salmon can easily foul up Norway's fjords, and their shallow, relatively still water is a breeding ground for sea lice. In the open ocean the water is deeper and better oxygenated. The currents are stronger and so better able to sweep away excrement.

Near-shore farms normally spread feed on the water's surface and allow it to sink, but Ocean Farm 1 has 16 valves at varying depths, through which feed can be pushed. By putting it farther down in the cage it is able to keep the salmon in deeper water. The salmon are fine with this. The sea lice, which like the shallows, are not.

All of this means the number of fish can be increased. The Norwegian government wants to triple its aquaculture production by 2030 and quintuple it by 2050. "Scaling up of traditional aquaculture is not going to reach these high-growth ambitions," says Mr Hukkelas.

Kongsberg is gathering data from all the sensors on the farm to build a machine-learning model, called SimSalma, which learns the behaviour of the salmon in order to optimise their feeding. Currently, human operators on the structure decide when and where to feed the fish by examining the data. By 2019 Kongsberg plans to have automated this, pushing feed at optimum times and places and reducing human involvement. The success and expansion of such projects would represent a major step towards maintaining global fish stocks. ■



“牧”鱼

鱼满仓

在开放海域养鱼变得愈加容易

去年9月，一件奇奇怪怪的东西运抵挪威海岸。这个多面体框架和艾菲尔铁塔差不多重，围起的体积超过了罗马圣彼得大教堂，从上到下68米，直径100多米。它被放在离岸五公里处的水里，看上去好像一个半淹没的明黄色摩天轮向一侧倾斜，中央有一个白色控制塔。它在中国的一家造船厂建造，运来时途经南非，当地人以为它是飞碟。（下方的照片中它还没浸到水里。）它还在等待它的住户——150万条鲑鱼幼鱼。

这个框架名叫“海洋农场1号”，是挪威公司SalMar斥资三亿美元订购的六个实验养鱼场中的第一个。美国新海洋系统公司（InnovaSea）制造名为SeaStations的大型开放海域水产养殖网，目前在巴拿马和夏威夷沿海使用，但海洋农场1号是“全球迄今为止最大的开放海域养鱼场”，托尔·哈克莱斯（Thor Hukkelas）说。他是挪威工程公司康士伯海事（Kongsberg Maritime）的水产养殖研发主管，他的团队为海洋农场1号提供传感器系统，包括安装在框架底部的12个回声探测器、悬挂在水下不同深度的高清摄像机、氧传感器，以及浸在水中的可移动饲管。

在向地球人口提供足量蛋白质这件事上，鱼类养殖正在发挥日益关键的作用。全球范围来说，人们吃鱼多过吃牛肉，而养殖鱼几乎贡献了鱼类消耗总量的一半（见图表）。许多野生渔业已经处于或超过可持续能力的临界值，因此提高养鱼效率至关重要。

海洋农场1号的目标是把一项昂贵而又困难的业务自动化，并解决近岸水产养殖中存在的两个主要问题：空间不足，污染太大。数百万条鲑鱼的粪便很容易污染挪威峡湾，水流相对静止的浅水区是海虱的滋生地。在开放海域中，水更深，氧气更充足，水流也更急，更易冲走粪便。

近岸养鱼场通常会把饲料撒向水面让它们下沉，但海洋农场1号有16个装置在水下不同深度的阀门，用以推送饲料。把饲料投放在笼中更靠下的位置可让鲑鱼待在深水。这对鲑鱼不是问题，但喜欢浅水区的海虱就适应不了了。

所有这些变化意味着鱼的数量会增加。挪威政府希望到2030年将其水产养殖产量增加两倍，到2050年增长四倍。“扩大传统水产养殖的规模无法达到这些高增长目标。”哈克莱斯说。

康士伯海事正在收集这个农场里所有的传感器数据，以创建一个名为SimSalma的机器学习模型，它会学习鲑鱼的行为以优化饲养方式。目前，农场的人类操作员会分析数据来决定何时和在什么位置喂鱼。康士伯海事计划到2019年将这一步自动化，在最佳时间和位置推送饲料，减少人员参与。这类项目的成功和扩张将会是向维持全球鱼类资源迈出的重要一步。 ■



Measuring the seas

Gliders on the storm

From sharks to ice shelves, monsoons to volcanoes, the scope of ocean monitoring is widening

IN NOVEMBER 2016 a large crack appeared in the Larsen C ice shelf off Antarctica (pictured). By July 2017 a chunk a quarter of the size of Wales, weighing one trillion tonnes, broke off from the main body of the shelf and started drifting away into the Southern Ocean. The shelf is already floating, so even such a large iceberg detaching itself did not affect sea levels. But Larsen C buttresses a much larger mass of ice that sits upon the Antarctic continent. If it breaks up completely, as its two smaller siblings (Larsens A and B) have done over the past 20 years, that ice on shore could flow much more easily into the ocean. If it did so—and scientists believe it would—that ice alone could account for 10cm of sea-level rise, more than half of the total rise seen in the 20th century.

The dynamics of the process, known as calving, that causes a shelf to break up are obscure. That, however, may soon change. Ocean Infinity, a marine-survey firm based in Texas, is due to send two autonomous drones under the Larsen C shelf in 2019, the first subglacial survey of its kind. “It is probably the least accessible and least explored area on the globe,” says Julian Dowdeswell, a glaciologist at the University of Cambridge who will lead the scientific side of the project.

The drones set to explore Larsen C look like 6-metre orange cigars and are made by Kongsberg—the same Norwegian firm that runs the new open-ocean fish farms. Called Hugin, after one of the ravens who flew around the world gathering information for Odin, a Norse god, the drones are designed to cruise precisely planned routes to investigate specific objects people

already know about, such as oil pipelines, or to find things that they care about, such as missing planes. With lithium-ion-battery systems about as big as those found in a Tesla saloon the drones can travel at four knots for 60 hours on a charge, which gives them a range of about 400km. Their sensors will measure how the temperature of the water varies. Their sonar—which in this case, unusually, looks upwards—will measure the roughness of the bottom of the ice. Both variables are crucial in assessing how fast the ice shelf is breaking up, says Dr Dowdeswell.

The ability to see bits of the ocean, and things which it contains, that were previously invisible does not just matter to miners and submariners. It matters to scientists, environmentalists and fisheries managers. It helps them understand the changing Earth, predict the weather—including its dangerous extremes—and maintain fish stocks and protect other wildlife. Drones of all shapes and sizes are hoping to provide far more such information than has ever been available before.

Saildrone, a Californian marine-robotics startup, is looking at the problem of managing fish stocks. Its tools are robot sailing boats covered with sensors which it builds at something more like a factory than a shipyard on the island of Alameda in San Francisco Bay. These 7-metre, half-tonne vessels—it has so far built 20 of them, one of which is shown on the cover of this quarterly—are designed to ply the seas autonomously, using carbon-fibre wings as their sails. The wing has a fin attached to it which keeps it trim to the wind at all times. Its on-board computer (which has a GPS-equipped autopilot), its sensors and its radio get their modest 30 watts of power from lithium-ion batteries topped up by energy from solar panels whenever the sun is out.

One of the first hubs deploying these drones is at Dutch Harbor on Amaknak

Island in Alaska; at any given time three of the boats based there are off monitoring a large pollock fishery in the Bering Sea, something they can do autonomously for up to a year before returning for maintenance. They gather data using echo-sounders designed by Simrad, a subsidiary of Kongsberg. Because each species of fish reflects different frequencies of sound in its own way (often because their swim bladders resonate differently) a sonar which emits a wide range of frequencies, as the wideband Simrad devices do, can tell what is a pollock and what is not.

The drones supplement the fisheries' main survey ship, which counts the pollock at the beginning of every season in order to determine how many fish can be caught. Their data give it a better sense of where to look. Sebastien de Halleux, Saildrone's chief operating officer, says they also find more pollock, providing a count 25% higher than that of the official survey vessel. This may be because the drones cause less disturbance and drive fewer fish away. In time he thinks the drones might go beyond helping the existing system and do the job on their own, which would be a lot cheaper.

Pollock are good to eat, and if fisheries are managed sustainably they will remain so in perpetuity. But they are hardly the most exciting fish to monitor. That honour must surely go to the great white shark. Jayson Semmens, a marine biologist at the University of Tasmania in Australia, is using a new generation of sensor tags to study the behaviour of these fearsome fish in more detail than was possible before—not to protect people, as shark attacks are very rare, but to build a scientific understanding of their metabolism. He uses accelerometer data from a tag the size of a grain of rice, attached to the shark's fin with a clamp, to calculate the energy it expends when it breaches out of the water.

The tags are too small to have enough power to send their data straight back to base. But they do not need to be retrieved directly from the shark (which is probably just as well). Their attachments dissolve over the course of their

life, so in time they float free, rising to the surface and emitting a simple signal that allows them to be found. Armed with the data they record, Dr Semmens can calculate the fish's total energy needs, and thus how much prey a single shark requires. That can be used to gain an understanding of the flow of energy through the food chain, which is basic to understanding the dynamics of the ecosystem. The flow of energy through terrestrial ecosystems is comparatively easy to study; marine ones are more mysterious.

A tiny sensor that measures a shark's metabolism seems remarkable—but at heart it is no more so than a modern phone. “The accelerometer I use to measure great white shark activity,” says Dr Semmens, “is the same one you use to turn your smartphone into a lightsabre.” Such tiny tags, which can also measure the temperature and pressure of the surrounding water, are a big step up from the bulky tags of yesteryear, which would provide a single acoustic frequency that allowed researchers to follow the fish if they were close enough. And they are improving rapidly. “People are talking about tags which sample blood from animals underwater,” says Dr Semmens.

The same technology can be used for environmental monitoring as well as pure science. Dr Semmens has tagged several endangered Maugean skate in Tasmania’s Macquarie harbour with somewhat larger sensors—they weigh 60 grams, instead of 10—that measure heart rate and the dissolved oxygen content of the water. Parts of the harbour are becoming anoxic—deprived of oxygen—because of large-scale near-shore salmon farming. The data from the skate show how much of this is going on, and how much harm it is doing. That makes it easier to argue for changes that boost conservation efforts.

One of the biggest benefits of better measured seas is the possibility of getting to grips with dramatic weather events. The top 3 metres of the oceans hold more heat energy than the entire atmosphere. How much of that

energy escapes into the air, and when and where it does so, drives the strength and frequency of storm systems. And there is ever more energy to do that driving. The average surface temperature of the seas has risen by about 0.9°C (1.6°F) in the past hundred years, according to America's National Oceanic and Atmospheric Administration. This means that, since the 1980s, about a billion times the heat energy of the atom bombs dropped on Hiroshima and Nagasaki has been added to the ocean—roughly an atomic explosion every few seconds.

Yet even as the amount of energy the oceans hold has risen, the details of its transfer to the atmosphere remain unknown for large swathes of the ocean. This is particularly important when it comes to understanding something like the South Asian monsoon. The rains are driven by the huge size of the Bay of Bengal and the amount of fresh water that pours into it from the Ganges and Brahmaputra river systems. Because this buoyant fresh water cannot easily mix with the denser salty water below it, the surface gets very warm indeed, driving prodigious amounts of evaporation. Better understanding these processes would improve monsoon forecasts—and could help predict cyclones, too.

To this end Amala Mahadevan of Woods Hole Oceanographic Institute (WHOI) in Massachusetts, has been working with the Indian weather agencies to install a string of sensors hanging down off a buoy in the northern end of the Bay of Bengal.

A large bank of similar buoys called the Pioneer Array has been showing oceanographers things they have not seen before in the two years it has been operating off the coast of New England. The array is part of the Ocean Observatories Initiative (OOI) funded by America's National Science Foundation. It is providing a three-dimensional picture of changes to the Gulf Stream, which is pushing as much as 100km closer to the shore than it used to. “Fishermen are catching Gulf Stream fish 100km in from the

continental shelf," says Glen Gawarkiewicz of WHOI. These data make local weather forecasting better.

Three other lines of buoys and floats have recently been installed across the Atlantic in order to understand the transfer of deep water from the North Atlantic southwards, a flow which is fundamental to the dynamics of all the world's oceans, and which may falter in a warmer climate.

Another part of the OOI is the Cabled Array off the coast of Oregon. Its sensors, which span one of the smallest of the world's tectonic plates, the Juan de Fuca plate, are connected by 900km of fibre-optic cable and powered by electricity cables that run out from the shore. The array is designed to gather data which will help understand the connections between the plate's volcanic activity and the biological and oceanographic processes above it.

A set of sensors off Japan takes a much more practical interest in plate tectonics. The Dense Oceanfloor Network System for Earthquakes and Tsunamis (DONET) consists of over 50 sea-floor observing stations, each housing pressure sensors which show whether the sea floor is rising or falling, as well as seismometers which measure the direct movement caused by an earthquake. When the plates shift and the sea floor trembles, they can send signals racing back to shore at the speed of light in glass, beating the slower progress of the seismic waves through the Earth's crust, to give people a few valuable extra seconds of warning. Better measuring of climate can save lives over decades; prompt measurement of earthquakes can save them in an instant. ■



测量海洋

风暴中的滑翔器

从鲨鱼到冰架，从季风到火山，海洋监测的范围正在扩大

二零一六年11月，南极洲的拉森C冰架上出现了一条大裂缝（如图）。到2017年7月，大小相当于四分之一个威尔士、重达1万亿吨的一块冰从冰架主体上脱落，开始漂进南大洋。冰架本身是漂浮的，所以即使是这样一座大冰山脱落也不会影响海平面高度。但是，拉森C支撑着坐落在南极大陆上的一块比它大得多的冰。如果拉森C完全解体，就像它的两个小兄弟（拉森A和B）在过去的20年里发生的那样，那块岸上的冰就更容易流入海洋。如果此事成真——科学家们相信它会的——仅这一块冰就可以让海平面上升10厘米，超过20世纪总上升高度的一半。

这个冰架崩裂的过程叫做“崩解”，其动力学成因尚不清楚。然而，这一点可能很快就会改变。总部位于得克萨斯州的海洋调查公司海洋无限（Ocean Infinity）将于2019年把两台自主无人机送入拉森C冰架下，首次进行此类冰下调查。将领导该项目科研部分的剑桥大学冰川学家朱利安·道德斯韦尔（Julian Dowdeswell）说：“这可能是地球上最难前往和探索最少的地区。”

将探索拉森C的无人机看起来像是六米长的橙色雪茄，由康斯伯格（Kongsberg）制造——这家挪威公司还经营着新的开放水域养鱼场。无人机名叫“福金”（Hugin）——得名于北欧神话里在世界各地飞来飞去为战神奥丁（Odin）收集信息的乌鸦之一。它们将沿着精确计划的路线巡航，调查人们已经了解的特定物体（如石油管道），或是寻找他们关心的东西（如失踪的飞机）。这些无人机中的锂离子电池系统与特斯拉轿车中的差不多大，充一次电可以四节的速度行驶60小时，行程可达约400公里。它们的传感器将测量水温的变化。其声纳系统（和通常情况不同的是，这里它朝上发射）将测量冰底的粗糙度。道德斯韦尔博士说，这两个

变量对评估冰架崩裂的速度至关重要。

能够看到海洋中从前看不到的区域以及其中的东西，这种能力不仅仅对矿商和潜艇有用。它对于科学家、环保主义者和渔业管理者都很重要。这可以帮助他们了解不断变化的地球，预测天气（包括危险的极端事件），维护鱼类资源和保护其他野生动物。各种形状和尺寸的无人机有望提供比过去多得多的此类信息。

加州海洋机器人创业公司Saildrone正在研究管理鱼类资源的问题。它所用的工具是覆盖着传感器的机器人帆船，在旧金山湾区阿拉米达岛上一家看起来更像是工厂的造船厂里建造。这些船长七米，重半吨，迄今为止已经建成20艘，其中一艘展示在本期技术季刊的封面上。它们将定期在海中自主航行，使用碳纤维翼作帆。翼上有一个鳍片，可以让帆随时保持迎风。船载计算机（有配备GPS的自动驾驶仪）、传感器和无线电耗能仅30瓦，由锂离子电池供电，并在出太阳时由太阳能电池板为其充电。

部署这些无人机的首批枢纽之一是位于阿拉斯加州阿马克纳克岛的荷兰港，在任何时候都有从那里派出的三艘船在监测白令海中一个大型狭鳕渔场。它们可以自主实施监测长达一年，之后才需要回港进行维护。它们使用康士伯（Kongsberg）的子公司Simrad设计的回声探测器来收集数据。因为每种鱼都会以不同的方式反射不同频率的声音（通常是因为它们的鳔共振频率不同），发射宽频率范围的声纳设备（如宽带Simrad设备）可以分辨出目标物是否狭鳕。

无人机可作为渔业主调查船的补充。这类船会在每个季节开始时计算狭鳕的数量，以确定可以捕多少鱼。无人机的数据让主船更清楚应该去看哪里。Saildrone的首席运营官塞巴斯蒂安·德阿略（Sebastien de Halleux）表示，无人机还发现了更多鳕鱼，数量比官方调查船高25%。这可能是因为无人机造成的干扰较小，吓跑的鱼也少些。他认为随着时间推移，无人机可能不止是给现有系统帮忙，而是会自行完成这项工作，这将大幅节省成本。

狭鳕很好吃，如果渔业得到可持续管理，它们将能永久维持下去。但要论监测起来最激动人心的鱼可轮不到它。这项荣誉必然归于大白鲨。澳大利亚塔斯马尼亚大学的海洋生物学家杰森·塞门斯（Jayson Semmens）使用新一代传感器标签，以过去做不到的详尽程度来研究这些可怕的鱼的行为。这不是为了保护人们——毕竟鲨鱼袭击非常罕见，而是要建立对其新陈代谢的科学认识。他把一粒米大小的标签用一个夹子夹在鲨鱼鳍上，并使用它产生的加速度计数据来计算鲨鱼出水时消耗的能量。

这些标签太小，不足以将数据直接发送回基站。但是我们并不需要直接把它们从鲨鱼身上取回来（不过这么做或许也可行）。夹子在使用过程中会逐渐溶化，所以过一段时间标签就会自由漂浮，升到水面并发出一个简单的信号以便被人们发现。凭借它们记录的数据，塞门斯博士可以计算出鲨鱼的总能量需求，从而得知一条鲨鱼需要多少猎物。这可以用来了解能量如何通过食物链流动，而这是了解生态系统动态的基础。通过陆地生态系统的能量流动相对来说比较容易研究，海洋生态系统更加神秘。

测量鲨鱼新陈代谢的微型传感器看似非同寻常——但说到底它并不比一台现代手机更厉害。“我用来衡量大白鲨活动的加速度计和你用来把智能手机变成光剑的那个是一样的。”塞门斯说。这种微小的标签也可以测量周围水体的温度和压力，相对于过去庞大的标签来说是一大进步——过去的那种会产生单一声频，当鱼群足够近时，研究人员可以跟踪它们。标签进步的速度也很快。塞门斯说：“人们现在谈论的是为水下动物采血的标签。”

同样的技术也可以用于环境监测以及纯科学。塞门斯在塔斯马尼亚的麦考瑞港为几条濒危的塔斯马尼亚谷鳐装上了大一些的传感器——它们重60克，而不是10克——可测量心率和水中的溶解氧含量。由于大规模的近岸鲑鱼养殖，这个海港的部分区域已变得缺氧。鳐鱼的数据显示了情况有多严重以及正在造成多大的损害。这使得人们更有理据来提倡变革，促进环保。

更好地测量海洋的最大好处之一是可能掌控重大的天气事件。海面下三米

内的海水中储存的热量比整个大气都要多。这些能量中有多少逃逸到空气中，以及在何时何地发生，都影响着风暴系统的强度和频率。而且产生这种影响的能量还越来越多。根据美国国家海洋和大气管理局的数据，过去一百年中，平均海面温度上升了约 0.9°C (1.6°F)。这意味着，自上世纪80年代以来，海洋中增加的热能相当于在广岛和长崎投下的原子弹的十亿倍——差不多每隔几秒就发生一次核爆。

然而，即使海洋储存的能量已经增加，大部分海洋区域向大气转移能量的细节仍然未知。这对于理解南亚季风等尤为重要。孟加拉湾的庞大面積以及从恒河和布拉马普特拉河系统注入的淡水量推动着降雨。由于轻浮的淡水不容易与下面厚重的咸水混合，水面变得非常暖和，带来了巨大的蒸发量。更好地理解这些过程可以改善季风预报，也可以帮助预测旋风。

为此，马萨诸塞州伍兹霍尔海洋研究所（WHOI）的阿玛拉·马哈德万（Amala Mahadevan）一直在与印度气象机构合作，在孟加拉湾北端的一个浮标上安装一串传感器。

过去两年间，一大批被称为“先锋阵列”的类似浮标在新英格兰沿海作业，已经向海洋学家展示了前所未见的事物。该阵列是美国国家科学基金会资助的海洋观测计划（OOI）的一部分。它提供了墨西哥湾流变化的三维图像，显示湾流离海岸的距离比过去近了多达100公里。WHOI的格伦·加瓦基维茨（Glen Gawarkiewicz）说：“渔民在大陆架靠内100公里的地方捕获了墨西哥湾流的鱼。”这些数据也改进了当地的天气预报。

人们最近在大西洋上安装了三条新浮标和浮子，以便了解深水从北大西洋向南转移的情况。这一洋流情况对全世界所有海洋的动态都至关重要，并且可能会随着气候转暖而衰退。

OOI的另一部分是俄勒冈沿海的电缆阵列。它的传感器遍布世界上最小的地壳构造板块之一——胡安·德富卡板块，并通过900公里的光纤电缆连接，由来自岸边的电力电缆供电。该阵列旨在收集数据来帮助了解板块火山活动与其上方生物及海洋动态之间的关系。

日本沿海的一套传感器对板块运动的关注要有实际意义得多。地震和海啸的密集海底网络系统（DONET）由50多个海底观测站组成，每个观测站都配备了显示海底是否上升或下降的压力传感器，以及测量地震引起的直接移动的地震仪。当板块移动、海底震颤时，它们能以玻璃中光速向海岸传回信号，快过通过地壳传播地震波这一较慢的过程，为人们赢得几秒钟宝贵的警报时间。更好地测量气候可以在几十年间挽救生命；迅速测量地震救人只需要一瞬间。 ■



Ocean internet

Sailing the wired seas

An internet infrastructure is being built to span the oceans

THE first use the modern world made of the oceans' depths was to run telegraph cables across them. That opened up a new era of intercontinental communication and spurred a new scientific interest in the abyss. Both enterprises have prospered: single cables now carry as much as 160 terabits across the Atlantic every second; oceanographers have mapped and drilled into the ocean floor around the world. But they have not come together. It is now very easy to get vast amounts of data from one side of an ocean to another; but it is hard to get even modest amounts of data out from the ocean itself. A new infrastructure is needed to enable sensors at sea to transfer their data back to land.

Sebastien de Halleux of Saildrone, the firm whose drones keep an eye on Alaska's pollock, dreams of doing much more than that. Saildrone recently increased its build-rate from one a month to one a day; by 2021 Mr de Halleux wants to have a thousand of his little craft sailing the seas. A full Helen of Troy's-worth sounds extravagant. But it is important to put it into context. First, smartphone components make such boats cheap; Mr de Halleux thinks he can build the whole fleet for less than the cost of one research vessel (roughly \$100m). Second, the ocean is very big. Divide its surface into 1,000 pieces and each one is still the size of Japan. That is quite a lot of ground for a single little boat to cover.

There is already one research network considerably larger than this. An international collaboration called Argo has a regularly replenished fleet of nearly 4,000 untethered buoys (see map) which divide their time between the surface and the depths, drifting at the whim of the currents. Over ten-

day cycles they sink slowly down to about 2,000 metres and back up, measuring temperature and salinity as they go. Their data have revolutionised oceanographers' understanding of their subject. But the network is still sparse—one float for every Honduras-sized patch of ocean.

Though restricted to the surface, Saildrone's craft are much more ambitious. They will not just monitor temperature; they will track fish and pick up pollutants, analyse carbon-dioxide and oxygen concentrations in the water, record the height of the waves and the speed of undersea currents, feel variations in the magnetic field and more. There are already markets for some of these data: weather forecasters, fisheries managers, oil and gas companies. For others the scheme has a "Field of Dreams" approach: build the data set and they will come.

Saildrone has so far raised \$29m for this work. Ion Yadigaroglu, managing partner of the Capricorn Group, one of the investors, compares the company to Planet, a satellite company in which Capricorn has also invested. Planet has used smartphone technology and Silicon Valley agility to produce a constellation of over 100 small satellites. They provide images of every spot on Earth every day, allowing all sorts of new insights and monitoring possibilities. "Planet is a scanning platform for the Earth," he says. "Saildrone wants to be a scanning platform for the oceans."

Planet, though, has been able to build a network of ground stations to get its daily terabits of data down from the satellites passing overhead and out to customers. For Saildrone, where the data start off on the surface, the equivalent would be to build its own satellite network. This it cannot afford to do, so, like Argo, it uses satellite services provided by others. And these are expensive.

Argo can afford such satellite services because its floats produce relatively

little data—a quick spurt every ten days or so. Saildrone boats produce far more, and so currently have to throw almost all of it away. Mr de Halleux says the drones' filtering algorithms cut the data down by a factor of 60 before transmission. If the company knew exactly what data the market would put most value on that might be acceptable. But with data never routinely gathered before it does not know.

Systems are also needed to get data out of the depths and up to the surface. Eamon Carrig, co-founder of Autonomous Marine Systems (AMS), based in Massachusetts, seeks to meet that need, providing "power, communications and bandwidth for other projects". His "datamarans", which also rely on wind for free propulsion using a solid "wing" sail, are smaller and cheaper than those built by Saildrone. They are designed to deploy sensors and buoys for third parties, such as Argo, and also to act as relays for things which can communicate only through sound.

Jayson Semmens of the University of Tasmania, who tracks sharks with tiny sensors, says that what he would really like to do would be to "track animals that never break the surface, and find a way to exfiltrate data from them". Among other things, live data from underwater animals would allow conservation biologists to manage ecosystems directly, instead of making decisions based on historical averages. It might be possible to get such data swiftly from fish to shore using a local network of AMS drones equipped with acoustic modems as an intermediary.

Other schemes exist for allowing connectivity to pop up as and when needed and swim away when all is done. Jeff Smith of Riptide Autonomous Solutions, a drone company also based in Massachusetts, is working with POSYDON, a programme run by DARPA, to build a system of small torpedo drones which will swim out and create a temporary acoustic communications chain in any area of the ocean that needs it, bouncing information from drone to drone.

The more of such systems there are, the wider the range of research which will be possible—especially if standards now being developed allow all the different systems to talk to each other. New buoys could add to the data Argo provides in particular places of interest without the need for a research ship to schlep out and deliver them. New types of buoy could be added, too. Last year Paul Allen, a co-founder of Microsoft, announced that he would spend \$4m on 33 new Argo floats which could go down far deeper than the current ones, profiling temperature, pressure and salinity to a depth of 6,000 metres.

What is most needed, though, is a new generation of satellite internet to get data from the surface to the shore. Happily this seems to be on the way. Various companies are racing to deliver high-bandwidth internet to the entire surface of the Earth using hundreds of small, cheap satellites in low orbits. SpaceX, Elon Musk's rocket business, launched its first prototypes on February 22nd. The main beneficiaries are likely to be people in areas not served by current infrastructure. But to serve all those parts of the world, these services need to serve all the oceans, as well.

With satellite connectivity available at the surface, and acoustic systems deployed as and when needed below, there would be one more thing needed to complete the picture: a map of the ocean floor. Valuable in itself, it would also be a great help to underwater vessels trying to navigate or to prospect for minerals. Being able to compare what sonar shows below you with a map stored on board would make things a lot easier.

The best overall maps of the ocean floor to date have been made from space. Large underwater features like mountains and trenches exert a gravitational influence on the water above them, subtly changing the shape of the surface. Orbiting altimeters can measure those small excursions from mean sea level, and computers can use that data to infer what the sea-floor topography responsible for it looks like. This has produced maps with an

average horizontal resolution of 5km—good for getting the gist of things, but little help to a drone trying to find its way.

Maps made with modern sonar systems towed behind research ships are better, but currently cover only 10% of the ocean floor at high resolution. Jyotika Virmani, an oceanographer working at XPRIZE, a non-profit outfit which gives awards for technological progress, is trying to improve this. Nineteen teams from around the world have entered the competition she is running to map the sea floor without using any human-piloted craft at all. The first round of the competition asked the teams to map 100 square kilometres of seabed to a five-metre resolution in under 16 hours. Next year the second round will ask for the same resolution over 250 square kilometres in a day. Ms Virmani is hoping the whole seabed will be mapped to a resolution of 100 metres or better by 2030.

That will not be an end to the mysteries of the deep. But it will mark a new era in their exploration. With easier communications from any point of the surface, a clearer idea of what lies below each of those points, and ever better sensors populating the volume in between, the oceans will be much better known. This will not make them any less marvellous. But it should make it easier to preserve their marvels. ■



海洋互联网

启航连线海域

互联网基础设施正在跨越海洋

现代世界对海洋深处的首次利用就是在其中铺设电报电缆。这开启了洲际交流的新时代，也激发了科学对深渊的新兴趣。这两方面都发展迅速：现在单条光缆每秒可传输高达160太比特穿越大西洋；海洋学家已经测绘并钻探了世界各地的海底。但两者没能融合。现在要把海量数据传到大洋彼岸非常简单，但要从海洋本身获得哪怕不多的数据也非易事。人们需要新的基础设施才能把海上传感器收集的数据传回陆地。

塞巴斯蒂安·德阿略（Sebastien de Halleux）的Saildrone公司用无人机监视阿拉斯加狭鳕，但他的梦想远不止于此。最近，这家公司计划制造海上无人机的速度从一个月一台加快到了一天一台——德阿略希望到2021年会有一千艘这样的“小船”在海中航行。像争夺海伦的特洛伊战争那样千帆竞渡听起来很奢侈，但了解这么做的背景很重要。首先，智能手机部件使得这种船很便宜：德阿略认为他能够以低于一艘考察船造价（约1亿美元）的成本建造整个船队。其次，海洋非常大。如果将海洋表面分成1,000块，每块仍有一整个日本这么大。这足够一艘小船忙活的。

比这个无人机网络大不少的研究网络已经有了。一个名为Argo的国际合作组织会定期补充其由近4,000个无链浮标（见地图）组成的队伍，它们时浮时沉，随波逐流。在十天的周期里，它们会慢慢下沉到大约2000米后再上浮，一路测量温度和盐度。它们收集的数据彻底改变了海洋学家对其研究对象的理解。但这个网络仍然很稀疏——每片洪都拉斯大小的海洋只有一个浮标。

虽然限于海面作业，但Saildrone的小船的雄心要大得多。它们不只会监测温度，还会追踪鱼类并拾取污染物，分析水中的二氧化碳和氧气浓度，记

录海浪高度和海底洋流速度，感受磁场变化等等。其中一些数据已经有了市场：天气预报员、渔业经理、石油和天然气公司。对于其他人来说，这个项目有着和电影《梦幻成真》（Field of Dreams）相同的路数：建好了数据集，他们自然会来。

迄今为止，Saildrone已为这项工作筹集了2900万美元。投资者之一摩羯座集团（Capricorn Group）的执行合伙人艾恩·雅迪加洛格鲁（Ion Yadigaroglu）将Saildrone与摩羯座投资的另一家卫星公司Planet相比较。Planet已经运用智能手机技术和硅谷的灵敏度生产了一百多颗小型卫星。它们每天提供地球上每个地点的图像，从而提供各种新的见解和监测可能性。“Planet是地球的扫描平台，”他说，“Saildrone希望成为海洋的扫描平台。”

不过，Planet已经建立了一个地面站网络，以便将飞过天际的卫星上每天产生的几太比特数据传下来再传给客户。对于在海面上产生数据的Saildrone来说，相应的方法就是要构建自己的卫星网络。这它可负担不起，因此它和Argo一样都使用他人提供的卫星服务，花费不菲。

Argo可以负担得起这样的卫星服务，因为它的浮标产生的数据相对较少——每隔十天左右来一拨。Saildrone的船产生的数据要多得多，因此目前不得不将它们几乎全部扔掉。德阿略说，无人机的过滤算法在传输之前将数据减少到了60分之一。如果公司确切地知道市场最看重哪些数据，这或许可以接受。但由于以前从未有定期收集的数据，这也无从谈起。

还需要某些系统来把数据从海洋深处传送到海面上。总部位于马萨诸塞州的“自主海洋系统”公司（Autonomous Marine Systems, AMS）的联合创始人伊蒙·卡瑞格（Eamon Carrig）就试图满足这一需求，“为其他项目提供电力、通信和带宽”。他的“datamaran”也使用实心“翼”帆来依靠风力自由推进，但比Saildrone的船更小、更便宜。它们的目的是为Argo等第三方部署传感器和浮标，还可以作为中继站来传输仅能通过声音通信的内容。

塔斯马尼亚大学的杰森·塞门斯（Jayson Semmens）使用微型传感器跟踪

鲨鱼，他说自己真正想做的事情是“追踪永不出水的动物，并找到方法从中榨取数据”。仅提一点：水下动物的实时数据可以让保护生物学家直接管理生态系统，而不是根据历史平均值做出决定。利用装载了声学调制解调器的AMS无人机本地网络作为中介，也许可以迅速把这些数据从鱼身上传到岸上。

还有其他一些方案，可以在需要时“现身”提供连接，完成任务后再游走。另一家位于马萨诸塞州的无人机公司“裂流自主解决方案”（Riptide Autonomous Solutions）的杰夫·史密斯（Jeff Smith）正在与美国国防部高级研究计划局（DARPA）运行的深海定位导航系统（POSYDON）合作建立一个小型鱼雷无人机系统。该系统会在任何有需要的海洋区域游出并建立临时声学通信链，在一架架无人机之间传递信息。

此类系统越多，可能开展的研究课题就越多——如果目前尚在开发中的标准能让所有不同的系统彼此联络就更是如此。部署更多浮标可以让Argo在特定场所提供更多数据，免得考察船兴师动众。还可以添加新的浮标类型。去年，微软联合创始人保罗·艾伦（Paul Allen）宣布，他将花费400万美元购买33个新的Argo浮标，它们的下潜深度远超现有浮标，可采集直至6000米深处的温度、压力和盐度资料。

然而，最需要的是新一代的卫星互联网来把数据从海面传到岸上。令人高兴的是这似乎快要实现了。若干公司正在竞相利用数百个低轨卫星来为整个地球表面提供高带宽互联网。伊隆·马斯克的火箭业务SpaceX于2月22日推出了第一款原型机。主要受益者可能是那些现有基础设施服务未能覆盖的地区的人们。但要想服务全世界，这些服务也需要服务于所有的海洋。

当海面上连接了卫星，而海面下能在有需要时部署声学系统后，还差一件事：海底地图。它不但本身很有价值，对试图巡航或寻找矿物的水下船舶也很有帮助。如果能把声纳显示的下方情况与储存在船上的地图相比较，事情就会容易得多。

迄今为止，最好的整体海底地图都是从太空绘制的。山脉和沟壑等大型水

下特征会对其上方的水产生重力影响，略微改变海面的形状。环绕地球的高度计可以测量平均海平面上的这些小偏差，计算机可以利用这些数据来推断造成此种影响的海底地形。这已经制成了平均水平分辨率5公里的地图——足以把握大局，但对于在海底探路的无人机则没有多大帮助。

利用考察船后拖曳的现代化声纳系统绘制的地图更好，但目前仅有10%的海底拥有高分辨率图像。在专门颁发技术进步奖项的非营利机构XPRIZE工作的海洋学家约提卡·维尔马尼（Jyotika Virmani）正努力改善这一点。来自世界各地的19支队伍参加了她组织的比赛，绘制海底地图而不使用任何载人船只。比赛的第一轮要求队伍在16小时内将100平方公里的海底地图绘制到5米的分辨率。明年的第二轮将在一天内要求在250平方公里范围达到这一分辨率。维尔马尼希望到2030年，整个海底地图的分辨率将达到100米或更高。

这并不会是深海奥秘的终结。但它将标志着一个深海探索的新时代。有了海面上任何地点更轻松的通信、对每个位置下方世界的进一步了解，以及更好的传感器来填充两者之间的部分，人类对海洋的认识将大大提升。这并不会让海洋的神奇削减分毫，却应该会让保护这种神奇变得容易一点。





Economic and financial indicators

Economic outlook

The Economist's latest poll of forecasters, March



经济与金融指标

经济前景

《经济学人》3月对各家预测机构的最新调查



Human evolution today

Natural selection has not stopped

But it no longer favours braininess

MODERN life is so cushy that some wonder if human evolution has stopped. Unlikely, reply biologists, for family sizes (and therefore numbers of descendants) still vary. A study just published in the *Proceedings of the National Academy of Sciences* uses a new statistical method to examine how genetic contributions to certain human traits correlate with how many children a person has. The data came from the UK Biobank, which contains genetic and medical data from half a million people. Positive values mean an association with successful reproduction; negative ones the opposite. Intriguingly, this analysis suggests genetic contributions to intelligence and educational achievement are currently disfavoured by natural selection. In evolutionary terms, it seems, humans are now brainy enough. ■



今天的人类进化

自然选择并未停止

.....但它不再偏爱头脑了

现代生活如此安逸，一些人不禁怀疑人类进化是否已经停止。生物学家表示这不大可能，因为家庭规模（以及因此带来的后代数量）仍大小各异。刚刚发表在《美国国家科学院院刊》（*Proceedings of the National Academy of Sciences*）上的一项研究采用了一种新的统计方法，检验与某些人类特质有关的遗传因素与一个人拥有的子女数量之间的相关性。这些数据来自英国生物样本库（UK Biobank），库存有50万人口的基因和医疗数据。正值表示与成功繁殖相关联，负值则相反。有趣的是，这项分析显示，目前自然选择并不偏向与智力和教育成就有关的遗传因素。从进化的角度看，人类似乎已经足够聪明了。 ■



Initial public offerings

Proof of life

America's public markets are perking up. Can it last?

FOR years, discussions of America's public markets have usually featured a lament for their dwindling appeal. According to Jay Ritter of the University of Florida, the number of publicly listed companies peaked in 1997 at 8,491 (see chart). By 2017 it had slumped to 4,496. True, many of the companies that went public in the internet's early days should never have done so. But the decline worries anyone who sees public markets as the best way for ordinary investors to benefit from the successes of corporate America.

The mood right now is more buoyant. Bankers and lawyers who usually chat with journalists in their offices are on the road hunting for business, offering only snatched interviews from airports in cities that they are unwilling to disclose. "There are plenty of signs that IPO activity is about to surge," says Kathleen Smith of Renaissance Capital, a research firm.

The line-up of listings spans countries and industries. The biggest offering in America so far this year has been that of PagSeguro Digital, a Brazilian e-commerce platform. Among those started trading recently was Dropbox, a file-sharing service. If rumour is right, Lyft, a ride-sharing app, may soon follow. Earlier this month Spotify, a Swedish music-streaming service, made its debut on the New York Stock Exchange in an unusual "direct listing". It will issue no new shares and raise no money, but simply begin trading its current shares. It will thereby avoid underwriting fees and its owners will be free of the "lockup" period that restricts disposals after conventional IPOs.

A wave of Chinese IPOs is also on the way. iQiyi, often called China's Netflix, launched on the NASDAQ, whose headquarters is the neon-clad

centre of Times Square, late last month. Optimism abounds that Tencent Music (China's Spotify), Meituan-Dianping (China's Yelp) and Ant Financial (China's PayPal/Visa/MasterCard) will follow. The biggest prize would be the IPO of Xiaomi, a Chinese smartphone manufacturer that is being courted by stock exchanges in Hong Kong as well as New York.

Not long ago tumbling oil prices turned investors off energy companies. That has changed now that prices are off their lows and firms have become more efficient. Five energy companies have floated so far this year, putting the sector behind only health care, which had ten, most of them in biotechnology. Elsewhere Zscaller, an internet-security firm founded just a decade ago, is expected to list soon with a value in excess of \$1bn.

A partial spin-off by AT&T of Vrio, its Latin American direct-television operation, may be the first of a series. Siemens has announced a similar plan for its large health-care unit in Frankfurt. Even banks, not long ago a dead zone, are getting in on the act; two recently filed to go public.

The main reason for all this activity is fizzy prices. Shares have been hitting record highs, and investors have done even better from IPOs than from the market as a whole. An index compiled by Renaissance of companies that have gone public within the past two years, with various adjustments to take account of size, has risen by a third over the past year, half as much again as the S&P 500. Despite concerns about inflated valuations, that fuels enthusiasm for more listings. Some think that recent changes to the tax code, which lowered the top rates and reduced the benefits of debt, may be another factor.

The question is whether one quarter a revival makes. It is easy to see how the effervescent mood in New York could quickly go flat. Stockmarkets could tumble, scaring IPO candidates off. Two hotly anticipated IPOs—of Aramco, a huge Saudi oil company, and Airbnb, a short-term accommodation

site—have been delayed until at least next year. The climate for Chinese firms in America is becoming less welcoming. Competition from other exchanges is hotting up. Hong Kong is abandoning its longstanding opposition to dual-class shares in order to grab a bigger share of Asia's tech listings. Singapore is on track to do the same.

Underlying these concerns is an older one—that the vast and varied costs of first bringing shares to market, and then remaining public, are just too high. These costs include bankers' and lawyers' fees, the risk of class-action litigation, the need to reveal commercially sensitive information that could benefit rivals, and the prospect of fights with corporate raiders who want juicier returns for shareholders and social activists who want executives to pay heed to their values. Added to all these are public reporting and tax requirements that private companies can often avoid.

Mr Ritter attributes much of the decline in the number of companies that are listed to the difficulty of being a small public company. This, he thinks, is reflected in the actions of venture capitalists, who once sought public listings when they wanted to exit their investments and now overwhelmingly choose private sales. He remains a diligent collector of evidence supporting the notion that listing requirements have become more burdensome over time.

For example, he notes that the prospectus for Apple Computer's public offering in 1980 ran to a mere 47 pages and listed no risk factors, despite its novel product, inexperienced leaders and formidable competitors. The prospectus for Blue Apron, a meal-delivery company that listed last year, weighed in at 219 pages, with 33 devoted to risks, presumably intended to pre-empt litigation. One of those risks was the possibility that Blue Apron would not "cost-effectively acquire new customers".

The difficulties of becoming public and the decline in overall listings was

cited as a crucial issue by Jay Clayton in his confirmation hearing last year to be chair of the Securities and Exchange Commission (SEC). In office Mr Clayton has not been especially forceful. Still, lawyers and bankers say the SEC's act has improved. Its internal mechanisms clank along a bit more smoothly. All companies are now allowed to file their initial applications confidentially, thus delaying any exposure of financial and strategic information to competitors until just before an IPO (investors are less happy because they do not have as much time in which to carry out research).

Even so, firms are staying private for longer. In 2000 the median age of companies at listing was five years; in 2016 it was ten years and six months. That suggests more needs to be done to lighten the burden of going public, if the current flurry of listings is to last. ■



首次公开募股

生机勃发

美国股市重新活跃起来。这个势头能否持续？

多年来，谈起美国的股市，人们常哀叹它们的吸引力在减弱。据佛罗里达大学的杰伊·里特尔（Jay Ritter）统计，美国上市公司数量在1997年达到顶峰，为8491家（见图表），到2017年跌到4496家。的确，很多在互联网早期上市的公司当初就不该走这一步。但是，任何人若是把股市视为普通投资者从美国企业的成功中获益的最佳途径，都会为这种衰落而担忧。

眼下市场的情绪活跃了起来。银行家和律师通常都是在自己的办公室里接待记者，如今为了找生意正各处奔走，只能在机场挤出点时间来接受采访，也不肯透露自己正身处哪个城市。“很多迹象都显示接下来会有一大批IPO（首次公开募股）活动出现。”研究公司复兴资本（Renaissance Capital）的凯瑟琳·史密斯（Kathleen Smith）表示。

这些上市公司来自多个国家，涵盖多个行业。美国今年以来规模最大的IPO来自巴西电商平台PagSeguro Digital。近日刚上市的公司中，一家是提供文件共享服务的Dropbox。如果传言属实，拼车应用Lyft或许很快也要上市。瑞典流媒体服务商Spotify本月初以“直接上市”这一不同寻常的方式在纽约证券交易所亮相。Spotify不发行新股，也不融资，只是开始交易现有股票。这样的操作会令公司免于支付承销费用，其股东也不用像采取传统的IPO形式那样要受禁止股票销售的“锁定期”限制。

一批中国企业也即将进行IPO。常被称作“中国的Netflix”的爱奇艺上月底在纳斯达克上市，这个交易机构的总部就设在霓虹闪烁的时代广场中心。很多人乐观地认为，腾讯音乐（中国的Spotify）、美团点评（中国的Yelp）和蚂蚁金服（中国的PayPal/维萨/万事达卡）随后也会踏上上市之路。中国智能手机制造商小米的IPO是最大的一块香饽饽，香港和纽约的证券交易所都热情地向它抛出了橄榄枝。

不久之前，油价暴跌令投资者对能源公司兴趣尽失。如今油价已从低点反弹，能源企业的效率也有所提升，投资者的态度已发生转变。今年到目前有五家能源公司上市，数量仅次于医疗保健部门。后者今年到目前共有十家公司上市，多为生物技术公司。在其他领域，十年前才创立的互联网安全公司Zscaller预计很快将上市，估值超过10亿美元。

AT&T旗下拉美电视直播业务Vrio实行了部分分拆，接下来或许会有更多企业开展分拆上市。西门子也宣布了类似计划，旗下大型医疗部门分拆后会在法兰克福上市。就连不久前还一片沉寂的银行也参与到上市活动中。近期有两家银行申请上市。

上市活动如此活跃，主要原因是价格走势强劲。股价已创下历史新高，而投资者从IPO中获利之丰甚至超过了市场总体水平。复兴资本编制了一项指数，追踪过去两年内上市的公司，并采取多项调整以将公司规模计入考量。过去一年来该指数已上涨三分之一，比标普500的涨幅高出一半。尽管估值虚高令人担忧，但高估值又激发了更多的上市活动。近期的税法改革降低了最高税率、减少了负债节税收益，一些人认为这或许是引发IPO热潮的又一个因素。

问题是一个季度的回暖是否会带来真正的、持久的复苏。不难想见，弥漫在纽约的振奋情绪说不定很快又会消散。股市可能会暴跌，令有意IPO的公司却步。沙特石油巨头沙特阿美（Aramco）和短租网站爱彼迎（Airbnb）的IPO受到热切关注，但都至少要推迟至明年。美国对中国企业的态度也不如以往友好。来自其他证券交易所的竞争也愈演愈烈。香港交易所对双重股权结构长期持反对态度，但如今已开始取消这一限制，以期吸引更多亚洲科技公司赴港上市。新加坡交易所也可能这么做。

潜藏在这些担忧之下的是一个老问题：从首次将股票推向市场，再到保持上市状态，企业要承担种种高昂的成本，负担实在不轻。它们需要支付银行人员和律师的费用，应对集体诉讼的风险，透露可能令竞争对手得利的敏感商业信息。它们可能还得与形形色色的人斗争，比如要求以更丰厚的回报回馈股东的“公司掠夺者”，以及要求公司高管关注某些价值取向的社

会活动人士。此外，公司还要公布业绩，满足各种税收要求，而私营企业往往可以绕过这些。

里特尔认为，上市公司数量下降的主因是小型上市公司处境艰难。他认为这从风险投资家的活动中就能看出来：从前他们想退出投资时都会谋求上市，如今他们绝大多数都选择私人销售。他努力搜寻证据来证明上市要求给企业造成的负担日益沉重。

例如，他注意到1980年苹果电脑公司公开募股时，招股说明书只有47页，而且没有列出任何风险因素，尽管当时苹果的新奇产品前途不明，公司领导人又经验欠缺，而且还面临强大的竞争对手。相较之下，去年上市的食材速递公司“蓝围裙”（Blue Apron）的招股说明书中长达219页，其中风险因素就占了33页，大概是为了先发制人，避免诉讼。其中有一项是蓝围裙可能不会“以符合成本效益的方式开发新客户”。

美国证券交易委员会（SEC）主席杰伊·克雷顿（Jay Clayton）去年在确认他任命的听证会上指出，企业上市难、上市公司数量总体下降的问题至关重要。他就任后并未展现出特别强悍的姿态，不过律师和银行业人士表示证监会的操作还是有所改进，其内部机制的运作稍微顺畅了些。现在，所有企业都获准以机密的形式申请上市，从而推迟向竞争对手透露自己的财务和战略信息，直到IPO之前的最后一刻（投资者就没那么开心了，因为他们做研究的时间变少了）。

即便如此，企业还是迟迟不上市。2000年上市公司创立年限的中位数是五年，2016年这个数字是十年零六个月。由此看来，如果想让目前这波上市热潮持续下去，需要花更多功夫为企业上市减负。■



Foreign investment in Europe

Capital control

Chinese buyers of infrastructure and technology firms face more scrutiny

“WE ARE not naive free traders. Europe must always defend its strategic interests,” said Jean-Claude Juncker, the president of the European Commission, last year as he introduced plans to screen foreign investment into the European Union. America has had such rules since the 1970s; they are set to tighten further. The EU used to be more relaxed about acquisitions by foreigners. Now it too is toughening up.

The target is China, whose firms have been on a shopping spree (see chart). Purchases of fripperies such as football clubs and hotels have been curbed by the Chinese authorities, but investment continues to flow into technology and infrastructure, notes James Zhan of the UN Conference on Trade and Development (UNCTAD).

Several European countries, including Germany and Italy, have extended investment-screening rules beyond energy and transport infrastructure to cover technology deemed important for public security, for example in telecoms. Chinese involvement in building Hinkley Point C, a nuclear-power plant, led Britain to tighten its rules. In February France’s government blocked the sale of its share of Toulouse airport to a Chinese consortium, which would have gained a majority stake.

European lawmakers suspect that purchases by private Chinese investors are an extension of their government’s “Made in China 2025” strategy, which aims at overtaking Western innovation, says Franck Proust, a French member of the European Parliament. Attitudes have soured most in Germany. A turning-point came in 2016, says Cora Jungbluth of Bertelsmann

Stiftung, a think-tank, when a Chinese firm acquired KUKA, a German robotics firm, for €4.5bn (\$5bn). Critics fumed that, even as Chinese companies gained Western know-how, German ones were facing discrimination in China. Last year Germany, with France and Italy, pushed for an EU-wide regime that could block acquisitions in sectors where European firms did not have reciprocal access in China.

Mr Juncker's proposals, which are now before the European Parliament, are more timid. They allow the commission to issue non-binding opinions on foreign acquisitions, and encourage EU members to share information on the possible effect on public security. They represent progress, says Mr Proust, considering that more than half of EU members do not even have a framework in place to assess such deals. But he would prefer something harder-edged.

Not every EU member feels this way. China's Belt and Road Initiative, which involves it underwriting billions of dollars of infrastructure investment along the old Silk Road linking it with Europe, is regarded by some southern and central European countries as a source of much-needed investment. Other EU countries worry that such eagerness could be exploited to divide the continent. Awkwardly, austerity measures imposed as a condition of bail-outs during the euro crisis contributed to Chinese influence. Privatisations intended to help stabilise wobbly public finances mean that the Chinese state now controls Piraeus, a Greek port, and owns the largest stake in Portugal's electricity grid.

The Nordic countries and the Netherlands meanwhile argue that stricter rules on Chinese investment could inflame trade tensions, even as the global trade environment worsens. Business groups fear that tighter screening could be used as a cover for protectionism. International organisations, including UNCTAD, warn that it could scare off investors and harm economic growth. A less starry-eyed approach to foreign investment

brings risks, too. ■



外国对欧投资

资本管制

收购基础设施和科技公司的中国买家面临更多审查

“我们不是天真的自由贸易主义者。欧洲必须始终捍卫自身的战略利益。”欧盟委员会主席容克（Jean-Claude Juncker）去年在发布欧盟区内外国投资审查计划时这样表示。美国自上世纪70年代以来就有这类规定，而且势必进一步收紧。欧盟过去对外国收购的态度要放松些，如今也变得强硬起来。

此次矛头指向中国，中国企业一直在大肆收购（见图表）。联合国贸易和发展会议（UNCTAD，简称“贸发会议”）的詹晓宁指出，中国政府已经在遏制中国企业收购那些华而不实的目标，如足球俱乐部和酒店等，但中方投资仍在持续流入科技和基础设施领域。

包括德国和意大利在内的几个欧洲国家已经扩大了投资审查规定的覆盖范围，在能源和交通基础设施之外，又纳入了被认为对公共安全具重要意义的科技领域，例如电信业。中国参与兴建英国欣克利角C核电站（Hinkley Point C）导致英国收紧其规则。2月，法国政府拒绝把自己在图卢兹机场的股份出售给一家中国财团，避免了该财团获得机场的多数股权。

欧洲议会的法国籍议员弗兰克·普鲁斯特（Franck Proust）说，欧洲的议员们怀疑，中国私人投资者的收购行为是中国政府“中国制造2025”战略的延伸，这个战略的目标是在创新方面超越西方。德国人态度的变化最为明显。智库博德曼基金会（Bertelsmann Stiftung）的柯拉·容布卢特（Cora Jungbluth）表示，转折点出现在2016年，当时一家中国企业以45亿欧元（50亿美元）收购了德国的机器人公司库卡（KUKA）。批评人士愤愤不平地指出，在中国企业获得西方技术的同时，德国企业却在中国面临歧视。去年，德国联合法国和意大利在欧盟推动一项制度，意欲在那些欧洲公司在华未获得对等准入的领域阻止中国企业收购。

容克的提案比较谨小慎微，目前已提交欧洲议会审议。提案准许欧盟委员会对外国收购提出无约束力的意见，并鼓励欧盟成员国就公共安全可能受到的影响共享信息。考虑到半数以上的欧盟成员国甚至还没有一个评估此类交易的框架，普鲁斯特认为这些提案是一项进步。但他还是希望看到更犀利的提案。

并非每个欧盟成员国都这样认为。中国提出了“一带一路”倡议，计划在连接中国和欧洲的古老丝绸之路沿线投资数十亿美元用于基础设施建设，这被一些急需投资的中南欧国家视作一个资金来源。其他欧盟国家则担心这种急切的心情可能会被利用来分裂欧洲大陆。令人尴尬的是，在欧元危机期间作为纾困条件的紧缩措施反而帮助中国扩大了影响。私有化意在帮助稳定当时摇摇欲坠的公共财政，如今却让中国国企控制了希腊的比雷埃夫斯港（Piraeus），并且在葡萄牙电网持有最多股份。

与此同时，北欧各国和荷兰认为，在全球贸易环境日益恶化之时，对中国投资采取更严格的规定可能会加剧贸易紧张。商业团体担心，更严格的审查可能被用来掩护保护主义。包括贸发会议在内的国际组织警告说，这种做法可能会吓跑投资者，阻碍经济增长。对于外国投资更审慎的态度也有风险。■



China's supply chains

Collateral damage

In a trade war, Asia's small open economies would be caught in the crossfire

CHINA is the stated adversary in Donald Trump's incipient trade war. But 30% of the value of the goods China exports to America is added elsewhere. If the row escalates, countries entwined in Chinese supply chains will suffer.

In absolute terms, Japanese suppliers will fare worst. Japan is the country that exports most to firms in China that export onwards to America. But relative to economic size, such suppliers are a bigger part of several small, open Asian economies (see chart). Between 1% and 2% of some countries' total output is shipped first to China and then on to America. If Chinese exports to America were to fall by 10%—an extreme but not impossible scenario—it could knock 0.1-0.2 percentage points off their economic growth.

China's competitors in industries that have been threatened with tariffs, namely aerospace, machinery and IT, however, would benefit. There are many of these in Mexico, Germany and Japan. Tariffs also encourage companies to switch their investment plans. When Ronald Reagan forced Japan to restrict its car exports to America in 1981 he (unintentionally) boosted Japanese investment in Thailand's fledgling car industry. Manufacturing has already started to shift from China to other, cheaper countries in the region. Tariffs on goods made in China would speed this up.

If the Chinese retaliate, an early target will be America's farm exports. Brazil, the world's second-largest producer of soyabeans behind America, would be happy to pick up the extra business. But America's and China's competitors

should not cheer from the sidelines. A trade war would damage the world's two largest economies and hit global growth. That would be bad for everyone. ■



中国的供应链

附带损害

在贸易战中，亚洲的小型开放经济体将被卷进争端

特朗普的贸易战初露端倪，矛头直指中国。但是中国出口到美国的货物中，30%的价值是在其他地方创造的。如果争端升级，与中国供应链紧密相连的国家将受拖累。

按绝对值来看，日本供应商的前景最不妙。日本是向那些对美出口的在华企业出口最多的国家。但相对于经济规模来看，在亚洲几个小型开放经济体中，这类供应商所占的比重更大（见图表）。一些国家总产出的1%至2%首先输送到中国，之后再转往美国。如果中国对美出口下降10%——一种极端但并非不可能的情况——那么这些国家的经济增长率可能会减少0.1至0.2个百分点。

然而，在航空航天、机械和信息技术等一直受到关税威胁的行业里，中国的竞争对手将获益。许多这样的竞争对手来自墨西哥、德国和日本。关税也会促使企业改变投资计划。1981年，里根迫使日本限制对美汽车出口，（无意中）推动了日本投资刚起步的泰国汽车工业。制造业已经开始从中国转移到该地区其他劳动力成本更低廉的国家。对中国制造的商品加征关税将加速这一进程。

如果中国展开报复，一个早期目标将是美国的出口农产品。位居美国之后的世界第二大大豆生产国巴西会很乐意捡到这桩额外的生意。但是，美国和中国的竞争对手不该在旁边看好戏。贸易战会损害世界上两个最大的经济体，进而打击全球经济增长。这对每个人都不是什么好事。■



Schumpeter

Citizens of somewhere

A golden age of companies having fistfuls of different passports is over

WHEN it comes to companies and their passports, there is a flutter of activity in the air—and a reek of hypocrisy. Last month Qualcomm, an American-domiciled tech giant which does 65% of its business in China, booked most of its profits last year in Singapore, and pays little tax at home, successfully lobbied the Trump administration to block a hostile takeover on the ground that its independence was vital to ensure American strategic supremacy over China. The predator was Broadcom. It is listed in America but domiciled in Singapore, where it gets tax perks. On November 2nd, four days before its bid, it announced a burning desire to shift its legal base to the home of the brave.

In Europe, Unilever, which a year ago demanded that the British authorities help it fend off an unwelcome takeover by Kraft Heinz because it was a national treasure, is shifting its sole base to the Netherlands (at present it is split between London and Rotterdam). The consumer-goods firm says it wants to simplify its structure. But it has been an outspoken critic of London's open takeover regime, and is probably relieved to shelter behind more protective Dutch rules. In Asia, Alibaba, a Chinese internet giant that has its domicile in the Cayman Islands, its principal office in Hong Kong and its listing in New York, has been invited by China's government to float its shares "at home" in Shanghai, an offer it cannot refuse.

It is easy to view these events as just more examples of companies being opportunistic, cynical or both. But in fact a bigger trend is afoot—corporate flag-waving. After years of having more than one identity (rather like fictional spies having a safe-deposit box full of passports) companies are

electing, or being forced, to show more allegiance to a particular country.

For three decades, a golden era for globalisation, the trend has gone the opposite way. Companies have unbundled their nationality from operations in the pursuit of efficiency or strategic advantage. The slicing and dicing of identity has occurred in at least half a dozen dimensions.

Take, for example, the frequent difference between where firms put their legal headquarters, where they put their de facto headquarters and where their decision-makers reside. When Anshu Jain was co-chief executive of Deutsche Bank between 2012 and 2015, it was often said that the German lender was run from London. ArcelorMittal, a steel firm based in Luxembourg with French, Belgian, Indian and Indonesian roots, is run by the Mittal family, who live in Britain. Jean-Pascal Tricoire, the boss of Schneider Electric, a French industrial firm with global interests, is based in Hong Kong.

The tax residence of firms is similarly unmoored. Apple is run from California but routes its foreign profits through Ireland, where it says key subsidiaries reside. Nor do regulators need to be physically close to their charges. HSBC, a global bank based in London, relies on profits from subsidiaries supervised in Hong Kong. Companies create intellectual property abroad; foreign pharma firms do most research in America. Then there is the final dimension of nationality: where a firm's shares are listed. Dozens of Chinese internet companies are quoted in New York. In 2011 Prada, an Italian fashion house, chose Hong Kong over Milan.

This unbundling of nationality had a powerful logic. A firm might achieve a higher valuation by listing its shares in one country, get a lower tax bill by domiciling subsidiaries in another, and offer a better quality of life for its executives in a third. In some cases having multiple passports also allowed firms to win the support of more than one government, or undertake

mergers that would have otherwise raised nationalistic hackles. Renault-Nissan-Mitsubishi has taken this idea to an extreme, operating as an alliance of firms with their own corporate governance that are linked by cross-shareholdings and some common management.

Today it is still possible to find firms keen to transcend nationality. On March 14th Prudential, an insurer that operates in Asia and America, said it would spin off its European unit, maintain its domicile in London but no longer be supervised by British regulators. SoftBank, a Japanese telecoms and tech firm, has set up a \$100bn investment fund that is domiciled in London but mainly invests in Asia and America. But the overwhelming trend is for companies to shed their multiple passports, for three reasons.

First, some shareholders argue they are too expensive to maintain. BHP Billiton, a mining firm with listings in Sydney and London, has come under attack from an activist fund to simplify its structure. Analysts gripe that Renault's alliance is too fiddly to value. Second, some firms are seeking the protection of one government—as in the case of Qualcomm and, perhaps, Unilever. Third, as a more protectionist climate takes hold, governments want firms to locate more activity “at home”. A recent example is Saudi Aramco, which was due to list in London or New York, but is now most likely to float its shares only at home. One reason is to help catalyse Riyadh's development as a financial centre.

The end of the golden age of corporate cosmopolitanism may make some governments feel more secure. But it could become a zero-sum game, where each country squabbles to get a bigger slice of a fixed pie. For the world's great corporate entrepôts, this is bad news. As nationality becomes rebundled, fewer firms will place particular functions away from their headquarters.

The most intriguing question is whether it is good for companies to be

tethered to one place. Now that it is a ward of Uncle Sam, Qualcomm may be unable to cut back on pointless research or relocate jobs from America. Unilever may find the Netherlands cosy but Dutch sensibilities on pay restrictive. And being more protected ultimately breeds complacency. Multinationals may come to miss the days when they could stride the planet, belonging to everyone and no one at the same time. ■



熊彼特

某国公民

企业揣着大把“护照”的好日子到头了

谈到企业和它们的“护照”，连空气都开始骚动，一股虚伪的气息扑面而来。上个月，高通成功游说特朗普政府阻止了对它的一桩恶意收购，理由是其独立自主对于确保美国在战略上压制住中国至关重要。这家注册地在美国的科技巨头有65%的业务都是在中国开展，去年大部分的利润都登记在新加坡，在美国只缴纳很少的税。想要收购它的是博通，这家公司在美上市，注册地却在新加坡——在那里它能享受税收优惠。去年11月2日，也就是它出价收购高通的前四天，它宣布迫切希望能将自己的法定总部迁往美国。

在欧洲，联合利华于一年前搬出国宝级企业的身份要求英国当局伸出援手，阻止卡夫亨氏对它展开收购。如今联合利华已开始将其唯一总部迁往荷兰（目前它在伦敦和鹿特丹设有双总部）。这家消费品公司的说法是想简化经营结构，不过它向来都直言不讳地批评英国对于收购的开放态度。在更具保护主义色彩的荷兰规则的庇护下，它可能会感到宽心。在亚洲，中国互联网巨头阿里巴巴的注册地是开曼群岛，主要办事处设在香港，并在纽约上市，如今中国政府已邀请它在“自己家里”的上海上市——这是阿里无法拒绝的盛情。

人们很容易认为这些事件不过再一次佐证了企业不是投机取巧就是愤世嫉俗，或两者兼而有之。但事实上一个更大的趋势正在显现——企业展现爱国热情。多年来它们拥有不止一个身份，活像小说中有满满一保险箱护照的间谍。如今它们开始向特定的国家展示更多的忠诚——或是出于主动选择，或是不得已而为之。

在历时30年的全球化黄金期，这个潮流是反向而行的。为追求效率或战略优势，企业不再把自己的“国籍”与业务经营地捆绑在一起，它们会至少创

造出五六重身份。

例如，企业常常将法定总部、事实上的总部以及公司决策者的居留地安排在不同的地方。2012年至2015年安舒·贾殷（Anshu Jain）担任德意志银行的联合CEO期间，常听到的一个说法是这家德国银行实际是由伦敦办公室在运营。安赛乐米塔尔（ArcelorMittal）是一家有着法国、比利时、印度及印度尼西亚“血统”的钢铁企业，总部在卢森堡，由居住在英国的米塔尔家族运营。法国工业企业施耐德电气的业务遍及全球，其老板赵国华（Jean-Pascal Tricoire）的办公地点在香港。

企业的税收居所也同样飘忽不定。苹果在加州运营，但公司的海外利润却是经由爱尔兰中转——苹果称那里是其主要子公司的所在地。监管机构与监管对象的所在地也无需彼此临近。全球性银行汇丰的总部设在伦敦，利润主要靠香港管辖下的各子公司贡献。很多企业在海外创造知识产权，比如外国制药公司的大部分研究工作就在美国开展。企业的最后一重国籍是它的上市地点。许多中国互联网企业都在纽约挂牌上市。2011年，意大利时装品牌Prada放弃米兰，选择在香港上市。

分拆国籍的做法有强大的合理性。一家公司在某个国家上市可能会获得更高的估值，在另一个国家注册子公司可以缴更少的税，把高管安顿在第三个国家能让他们享受更优质的生活。在某些情况下，拥有多本护照还能让企业获得不止一国政府的支持，原本可能引发强烈民族主义情绪的并购交易也得以实现。雷诺-日产-三菱联盟就把这套方法发挥到了极致：企业以联盟的形式运作，各自在保持独立治理的同时又通过交叉持股和一定程度上的共同管理连接在一起。

时至今日，仍可以看到企业迫切想要超越单一国籍的案例。3月14日，在亚洲及美国开展业务的保险公司英国保诚（Prudential）表示将分拆其欧洲部门，注册地虽会留在伦敦，但不再受英国监管部门的监管。日本电信及科技公司软银设立了一个1000亿美元的投资基金，注册地在伦敦，但主要投资于亚洲和美国。但是，一个压倒性趋势是企业纷纷抛弃多重国籍，这有三个原因。

首先，一些股东认为维持多重国籍的成本太高。在悉尼及伦敦上市的矿业公司必和必拓（BHP Billiton）遭到一家维权基金的挞伐，被要求简化运营结构。分析师抱怨雷诺所在的联盟太过繁琐，难以估值。其次，一些公司正在寻求某个政府的保护，高通便属于此类，联合利华可能也一样。第三，随着保护主义氛围日益浓厚，各国政府希望企业将更多经营活动留在“家中”。近期的一个例子是沙特阿美（Saudi Aramco），它原本预计会在伦敦或纽约上市，但如今看来最有可能只在本国上市，原因之一是要帮助利雅得发展成为金融中心。

企业四海为家的好日子行将结束，这也许会让一些政府感到更加踏实。但这也可能演变成一场零和游戏：各国你争我抢，试图从一个大小不变的蛋糕中分走更大的一块。这对世界各大企业集散地来说是个坏消息。随着企业重新归拢自己的国籍，将特定职能安排在总部之外的公司将会变少。

最有趣的问题是，企业被拴在一个地点对它们自身是否有利。高通既然成了山姆大叔的监护对象，可能就无法削减没什么用的研究工作或把职位从美国迁到别处。联合利华也许会觉得荷兰很舒适安全，但荷兰人对薪酬的敏感度又让它束手束脚。受到更多保护最终也会导致企业故步自封。跨国公司可能会开始想念从前昂首阔步行走于全球、自己属于所有人又不属于任何人的日子。 ■



Oil futures

Crude gambit

China vies for more clout in the global oil market

TRADITIONALLY, to count as an oil power a country had to be a big producer of the black stuff. China is the world's biggest importer but still wants to break into that exclusive club. On March 26th it launched a crude futures contract in a bid to gain more clout in the global market. Some think that, if successful, the yuan could start to displace the dollar in oil trading. For now, though, that is fanciful.

A previous attempt by China to introduce oil futures, in the early 1990s, failed because of unstable pricing. This time regulators prepared methodically. To ward off speculators, notorious in Chinese markets, they made the storage of oil very expensive. Volumes were light in the first few days of trading—less than a tenth of the averages for similar contracts in New York and London. But all went smoothly. It was a good, if modest, start.

China has two goals. The basic one is to help its companies hedge against volatility. Chinese refiners and traders have struggled to manage currency risks because of capital controls. An onshore contract that lets them lock in the future price of oil in yuan is thus appealing, says Michal Meidan of Energy Aspects, a research firm.

More ambitiously, China hopes to create a standard for oil pricing as a rival to Brent in Europe and West Texas Intermediate in America—a standard that reflects its own supply and demand. For that to happen it needs to attract overseas participation. So, in a first for commodities in China, the contract, hosted on the Shanghai International Energy Exchange, is open to foreigners. Trading runs until 2.30am Chinese time, to overlap with daytime

in America and Europe. Glencore and Trafigura, two of the world's biggest commodity traders, got into the action on the contract's debut.

Nevertheless, the same restrictions that make it hard for domestic firms to trade abroad will deter foreigners from going deeply into China's market. To gain access to it they must open special onshore bank accounts. And they cannot use their profits for any other investment in China.

One group of producers who might in theory be tempted are those under American sanctions. For Iran, Russia and Venezuela, trading oil in yuan would wean them off dollar-based earnings and so help them steer clear of American banks. But they chafe under sanctions precisely because they want to be free to spend their cash as they see fit. So long as China quarantines its financial system from the rest of the world, talk of a petroyuan replacing the petrodollar will be premature. ■



原油期货

粗陋原油战术

中国力争在全球原油市场施展更大的影响力

传统上来说，一个国家要称得上石油大国，得是这种黑乎乎的东西的生产大国才行。中国是世界最大的石油进口国，不过还是想挤进石油大国这个小圈子。3月26日，中国推出了一份原油期货合约，力图在国际原油市场上获得更大的影响力。一些人认为，如果中国此举取得成功，人民币或许会逐步取代美元在石油交易中的地位。不过就目前来看，这是异想天开。

中国曾在上世纪90年代初推出过原油期货，因定价不稳而失败。这一次，中国的监管部门开展了周密的筹备工作。为阻止中国市场上恶名昭著的投机分子炒高油价，监管部门大大提高了石油的存储成本。最初几个交易日交易量较少，还不到纽约及伦敦同类合约平均交易量的十分之一，不过一切进展顺利。虽然没有大放异彩，但不失为一个良好的开端。

中国有两个目标，基本的目标是帮助中国公司对冲油价波动的影响。由于资本管制，中国的炼油厂和贸易商很难控制外汇风险。因此，一份能让它们以人民币锁定未来油价的境内合约就很有吸引力，能源研究公司Energy Aspects的米哈尔·梅丹（Michal Meidan）表示。

另一个目标更具野心。中国希望设置一个石油定价基准，能与欧洲的布伦特原油和美国的西德克萨斯中间基原油分庭抗礼，并反映自身的供求关系。要实现这一点，就要吸引海外的参与者。因此，这份在上海国际能源交易中心挂牌交易的合约也对外开放，这在中国大宗商品中还属首次。交易时间持续到中国的次日凌晨2:30，与美国和欧洲的白天重叠。全球两大大宗商品交易商嘉能可（Glencore）和托克（Trafigura）在合约推出伊始就参与了进来。

然而，让中国企业难以开展境外交易的限制同样也会阻碍境外公司深入中国市场。要进入中国市场，它们必须开设特殊的境内银行账户，所获利润

也不能用来在中国进行其他投资。

从理论上讲，那些正受到美国制裁的石油生产国也许会对这份合约感兴趣。对伊朗、俄罗斯和委内瑞拉来说，用人民币交易会令它们的收益逐步摆脱对美元的依赖，从而帮助它们绕过美国的银行。但这些产油国之所以为制裁而恼火，正是因为想随心所欲地花自己的钱。只要中国依旧让自己的金融体系与世隔绝，说“石油元”会取代“石油刀”就还是言之过早。 ■



China's economy

The undead

Dinny McMahon's predictions might yet prove too gloomy

THE zombies that appear in Chinese legends are not quite the same as their Western counterparts. They feast on blood, not brains, and hop about rather than staggering forwards. The differences extend to economics. Chinese officials, like their Western peers, openly fret about zombie companies—insolvent firms kept alive by banks—but are far less willing to kill them off. This small excursion into the world of the undead is one of many gems in Dinny McMahon's new book, a vivid account of China's economic problems, from debt to falsified data.

Mr McMahon, a veteran financial correspondent in China, most recently with the *Wall Street Journal*, wears his knowledge lightly, whether discussing ghost stories or balance sheets. His book, "China's Great Wall of Debt", is notable for two reasons. It is one of the clearest and most thorough statements of an argument often made about the country: that its government has relied on constant stimulus to keep growth strong, an addiction that is bound to backfire. Second, he comes closer than any previous writer to covering the Chinese economy as Michael Lewis, the hugely popular author of "The Big Short", might do. His analysis is informed but accessible, animated by anecdotes and characters, some colourful, some verging on tragic.

In a chapter on government meddling, he introduces a hedge-fund analyst who accused a publicly listed Chinese silver-mining company of fraud. Police arrested him, kept him awake for three days and jailed him for two years; he was ultimately found guilty of "impairing business credibility". In a chapter on the deadweight of state-owned companies, Mr McMahon

visits a factory owned by Erzhong, a machinery-maker that built the world's biggest hydraulic press forge, used for pounding out metal. But the forge, based on Russian designs from the 1980s, is outdated and the country oversupplied. These days retired workers harvest vegetables planted on unused land along the factory's walls. In a chapter on financial bubbles, Mr McMahon tracks the boom and bust in Moutai, China's most prized brand of *baijiu*, a grain-based spirit, through the story of an auctioneer.

As with any financial mess, there is plenty of blame to go around for these excesses. Reckless investors, greedy lenders and lax regulation have all played a part. But Mr McMahon shows that China's political system is at the heart of the dysfunction. Short of tax revenues, local governments treat land as free money, expropriating it cheaply and then selling it at inflated prices. Since the promotions of officials are traditionally based on economic growth, they are encouraged to spend public money first and ask questions later. Implicit guarantees make for financial distortions. Few think big state-owned banks will ever be allowed to fail or that large state-owned firms will ever be pushed into bankruptcy.

Yet for all the undeniable weaknesses in China's economy, the central argument of the book is debatable. In his introduction Mr McMahon explains that he will neither delve into the government's efforts to clean up bad loans nor examine bright spots such as the tech sector. That makes sense as a way to keep the narrative sharp. Nevertheless, the clean-up and the bright spots matter. Over the past year the government's economic priority has been to defuse debt risks. It has made some headway, not least by thinning the ranks of zombie factories. Meanwhile the blossoming of the tech sector is one example of how China retains the ability to transcend its past mistakes.

Mr McMahon is among the most compelling of the many analysts who conclude that China's economic miracle will end painfully. But until now

such forecasts have served as inadvertent testaments to the country's resilience. Despite so much in its economy that looks so deeply rotten, China may yet emerge from its boom stronger than the doomsayers predict. ■



中国经济

僵而不死

迪尼·麦克马洪的预言可能还是太过灰暗了

中国传奇故事中的僵尸和西方的僵尸大不相同。中国的僵尸喜欢吸血而不是吃大脑，跳跃前进而不是蹒跚而行。这些差异也延伸到了经济领域。中国官员与其西方同行一样，会公开表达对僵尸企业（资不抵债、依靠银行贷款维持的公司）的担忧，但相比之下却非常不愿意断其活路。对这一僵而不死之域的涉足是迪尼·麦克马洪（Dinny McMahon）的新书的诸多亮点之一。这本书生动讲述了中国经济从债务到数据造假的各种问题。

麦克马洪是驻中国的资深财经记者，前几年曾供职于《华尔街日报》，无论是探讨僵尸企业还是资产负债表都深入浅出，不故弄玄虚。他的著作《巨债长城》（China's Great Wall of Debt）值得关注的原因有两点。关于中国，一个常见的观点是其政府一直依靠不断的刺激措施来保持经济的强劲增长，但这种上瘾般的做法必然会适得其反。《巨债长城》对该观点的陈述属于最明确、最全面的那一类。其次，麦克马洪对中国经济的描绘比以往任何作家都更接近超级畅销作家、《大空头》（The Big Short）作者迈克尔·刘易斯（Michael Lewis）的风范。他的分析依据充分，却也通俗易懂，书中的轶事和人物让内容活泼生动，一些丰富多彩，一些近乎悲剧。

在关于政府干预的一章中，作者介绍了一位对冲基金分析师，他控告一家中国银矿上市公司存在欺诈行为。警方逮捕了他，三天没让他睡觉，又把他关押了两年，最终他被判“损害商业信誉罪”。在关于国企成为累赘的一章中，作者访问了机械制造企业二重集团的一间工厂。二重集团生产世界上最大的用于锻造金属的模锻液压机，但这种基于上世纪80年代俄罗斯设计的液压机已经过时，在中国市场上已供过于求。如今，退休工人在工厂围墙边的空地上栽种蔬菜。在关于金融泡沫的一章中，作者通过一个拍卖师的故事追溯了中国最负盛誉的白酒品牌茅台酒的兴衰史。

像任何金融乱局一样，这些过度行为可归咎的因素有很多。鲁莽的投资者、贪婪的放贷机构和松懈的监管都起到了一定的作用。但麦克马洪表明，中国的政治体制是这种失调的核心原因。缺少税收的地方政府将土地视为摇钱树，以低廉价格征收后再高价售出。官员晋升历来都以经济增长数字作依据，所以他们往往会先把公家的钱花掉，再来问问题。隐性担保导致金融资源错配。很少有人认为国家会让大型国有银行倒闭或大型国企破产。

然而，尽管中国经济存在不可否认的缺陷，本书的中心论点仍值得商榷。麦克马洪在前言中解释说，他不会深入探究政府清理坏账的努力，也不会探讨科技行业等亮点。这么处理确实可以保持整个论述鲜明有力。不过，清理坏账的努力和亮点行业的发展事关紧要。过去一年中，政府经济工作的重点就是化解债务风险。这项工作取得了一些进展，尤其是减少了僵尸工厂的数量。与此同时，科技行业的强盛也是一个例证，显示出中国依然有能力超越过去的错误。

很多分析人士都认为中国的经济奇迹将会痛苦地结束，麦克马洪是其中最具说服力者之一。但到目前为止，这类预测却无意中反证了中国的韧性。尽管其经济有太多方面都看似严重腐坏，但中国从过热中走出时的姿态仍可能比末日论者的预测更强劲。 ■



Economic and financial indicators

Global mergers and acquisitions

Mergers and acquisitions announced so far this year have been worth \$1.1trn,

Mergers and acquisitions announced so far this year have been worth \$1.1trn, according to Dealogic, a data provider. This is 42% more than the value of deals made in the first three months of 2017 and is set to be the strongest first-quarter result on record. Improving global growth and rising business confidence provide an explanation, as does the reduction in the American corporate-tax rate. The biggest deal so far this year is the acquisition by Cigna, an American insurer, of Express Scripts, a pharmacy-benefit manager, for \$70bn. Regulatory hurdles remain, though. AT&T's \$108bn bid for Time Warner, announced back in 2016, still awaits completion pending the outcome of a court case. ■



经济与金融指标

全球并购活动

今年以来，已公布的并购交易总额达1.1万亿美元

数据提供商Dealogic的统计显示，今年以来，已公布的并购交易总额达1.1万亿美元，比2017年头三个月高出42%，预计会是有记录以来第一季度并购交易额最高的一次。这要归因于全球经济增长加速和商业信心提升，美国企业税率降低也是个原因。今年到目前为止最大规模的一宗并购是美国保险公司信诺（Cigna）以700亿美元收购药品福利管理公司快捷药方（Express Scripts）。不过监管障碍仍然存在。AT&T在2016年出价1080亿美元收购时代华纳，至今尚未完成，仍在等待反垄断诉讼案的审理结果。





Tesla

Driving to the next circle of hell

Elon Musk's car company is heading for a cash crunch

"WE ARE sad to report that Tesla has gone completely and totally bankrupt." So tweeted Elon Musk, boss of the electric-car company, on April 1st. He even posted a picture of himself supposedly drunk and inconsolable as proof. It was meant as an April Fool's Day joke, but the gag backfired. It is uncomfortably close to the truth. America's leading manufacturer of electric vehicles is under pressure. Mr Musk is fighting battles on many fronts and they all exacerbate his main threat: a financial squeeze that could eventually push Tesla over the edge.

Even Tesla's shareholders, who are rarely put off by bad news, are jittery. Its shares have fallen by 16% since the end of February, most steeply after a Tesla using the firm's Autopilot software crashed into a roadside barrier in California on March 23rd, killing the driver and raising questions about the safety of its system for semi-autonomous driving. The crash is being investigated by the authorities.

The pile-up of woes continued on March 28th when a judge in Delaware decided to let a shareholder lawsuit proceed against Mr Musk and Tesla's board over an alleged breach of duty involving the firm's \$2.6bn takeover in 2016 of SolarCity, a troubled solar-energy firm run by Mr Musk's cousins. And on March 29th the firm announced a recall of around 123,000 older vehicles that may be susceptible to corrosion of a bolt that affects steering and parking. Such recalls are common among the world's other carmakers. But in Tesla's case it reinforces a view that the company is much better at developing the whizzy technology that underpins its cars than at mastering the humdrum business of making them in quantity.

Until recently Tesla made only small numbers of expensive long-range battery-powered cars. Its Model S saloon starts at \$74,500 and its Model X sport-utility vehicle is pricier still. But Mr Musk has bet the future of his firm on mass-producing cheaper cars. The new Model 3, a smaller saloon costing as little as \$35,000 with a range still exceeding 220 miles, has attracted over 400,000 deposits of \$1,000 each from eager customers. Much of his firm's expected future revenue and its lofty valuation (it stands at roughly \$49bn today, even after the share-price falls) depends on rapidly scaling up production.

Alas, Tesla has repeatedly failed to meet its own targets (see chart). In July 2017 Mr Musk claimed that his firm would be cranking out 20,000 Model 3s per month by December of that year. In fact, it managed to produce fewer than 2,500 in the entire final quarter of 2017. He vowed to produce 2,500 Model 3s a week by the end of March, rising to 5,000 a week by the end of June. Despite superhuman efforts by workers and managers (Mr Musk is personally supervising production of the new model and claims to be sleeping at the factory), on April 3rd Tesla confirmed that it is producing only around 2,000 Model 3 saloons a week.

Expectations were so low among analysts and investors that Tesla's flagging share price rebounded after that announcement. Glossing over the fact that it has yet again failed to hit its promised target, the company boasted that the Model 3 assembly line is now providing "the fastest growth of any automotive company in the modern era." If Tesla's production growth rate continues, it claimed, "it will exceed even that of Ford and the Model T."

Such bluster does not withstand scrutiny. Tesla is struggling with bottlenecks in the production of battery packs at its "gigafactory" in Nevada as well as with assembly of the Model 3 at its car plant in Fremont, California. The central problem is that Mr Musk has overcomplicated the

already difficult task of making a mass-market car. Rather than relying on the time-tested manufacturing methods used by established rivals, who still use people to do tasks that machines are as yet unsuited for, he wants his car factory to be a hyper-automated “machine that makes machines”, bristling with robots and keeping human involvement to a minimum.

Employees at the Fremont plant describe a chaotic workplace in which Silicon Valley ideals of nimble innovation and robotic automation clash with the unglamorous realities of car-making, from the safe use of forklift trucks on the shop floor to the dexterous insertion of plastic parts in car interiors. Max Warburton at Bernstein, an equity-research firm, argues that the big global carmakers have realised—owing to bitter experience with overzealous previous attempts at automation—that a sensible mix of man and machine produces the most efficient car-assembly for the time being.

Even if Mr Musk’s dream of turning his factory into an “alien dreadnought” of automated mass production really points to a better way of making cars, he could run out of money before proving his case. Tesla lost over \$2bn in 2017. Well before it confirmed the latest missed production target, investors worried about the firm’s cash-burn rate in 2018. In addition to the \$2bn or so of capital that may be required to expand production of the Model 3, Tesla has some \$1.2bn in convertible debt maturing by early next year. On March 27th Moody’s, a credit-rating agency, downgraded Tesla’s debt, cautioning that the firm “will likely need to raise additional capital during the second half of 2019”. Jefferies, a bank, predicts that Tesla will need \$2.5bn to \$3bn this year.

Tesla maintains that there is no imminent cash crunch. In a statement released on April 3rd, the firm insisted that it “does not require an equity or debt raise this year, apart from standard credit lines.” Others think the moment of truth could come much sooner, perhaps in the summer. Whenever it arrives, the question is in what kind of environment Tesla will

raise money. Rising interest rates, a wobbly share price and a continued inability to meet its own production goals would all conspire to make it harder for the firm to find capital. It does not help that General Motors, Volkswagen and other big rivals are making massive investments in EVs.

Many shareholders retain their belief in Mr Musk's ability to overturn conventional wisdom. But many short-sellers are still betting on the firm's demise and fixed-income investors, who tend to be more interested in getting their money back than changing the world, are becoming antsier. The price of Tesla's junk bonds is well below the level at which they were issued last year. In another tweet early this month, Mr Musk summed it up this way: "Car biz is hell." This time he wasn't joking. ■



特斯拉

驶向下一层地狱

伊隆·马斯克的汽车公司将面临现金危机

“我们很难过地告诉大家，特斯拉已经彻底破产了。”4月1日这家电动汽车公司的老板伊隆·马斯克发了这样一条推文，甚至还贴出自己一张看似喝醉且伤心欲绝的照片作为证据。这本来只是个愚人节的玩笑，但却好像要一语成谶了。这家美国电动车制造的领军企业正承受压力。马斯克多线作战，而各条战线都加剧了摆在他面前的主要威胁——最终可能将公司逼向绝境的资金紧缺。

连那些很少被坏消息吓退的特斯拉股东们都惴惴不安起来。自2月底以来，特斯拉的股价已经下跌了16%，最剧烈的下跌出现在3月23日后。那天一辆使用该公司Autopilot模式自动行驶的特斯拉汽车在加州撞上了道路中央的隔离带，导致司机死亡，引发了人们对其半自动驾驶系统安全性的质疑。有关部门还在调查这起事故。

屋漏偏逢连夜雨。3月28日，特拉华州一名法官允许特斯拉股东提起诉讼，控告马斯克及特斯拉董事会在2016年以26亿美元收购SolarCity时存在渎职行为。SolarCity是一家陷入困境的太阳能公司，由马斯克的表兄弟经营。3月29日，特斯拉宣布召回约12.3万辆旧型号汽车，这些车的螺栓可能容易受到腐蚀，影响转向和停车。此类召回在全球其他汽车制造商中常见，但对特斯拉而言，这次召回让人们更加相信，特斯拉在大批量生产汽车这项平凡的工作上远没有它在开发汽车创新技术上在行。

直到最近，特斯拉只生产了少量昂贵的长续航里程电动汽车。它的Model S轿车起价7.45万美元，SUV车型Model X价格还要更高。但马斯克已经将公司的未来押注在大批量生产廉价车型上。新推出的较小型轿车Model 3售价仅3.5万美元，但续航里程仍超过220英里，受到消费者追捧，已收到40多万笔1000美元订金。公司大部分的预期未来收入及其高估值（即使

在股价下跌后，其市值仍有约490亿美元）有赖于迅速扩大生产规模。

可惜的是，特斯拉一再未能实现自己的目标（见图表）。去年7月，马斯克声称将在当年12月之前实现每月生产2万辆Model 3。而事实上去年第四个季度公司在一整个季度里只生产了不到2500辆。他还立誓在今年3月底之前每周生产2500辆Model 3，到6月底之前增加到每周5000辆。尽管员工和管理层都付出了非凡的努力（马斯克亲自抓这款新车的生产，并自称住在工厂里），但4月3日特斯拉证实，公司现在每周只生产出了约2000辆Model 3。

分析师和投资者此前对特斯拉的预期是如此之悲观，这个产量数字公布后，特斯拉低迷的股价反倒有所回升。特斯拉无视自己再次未能兑现承诺目标的事实，夸口说Model 3的装配线正呈现“现代以来所有汽车公司中最快速的增长”。公司声称，如果特斯拉的产量继续保持增长，“甚至会超过福特T型车当初的扩张”。

然而这样的大话经不起推敲。特斯拉在内华达州的超级电池工厂（gigafactory）的电池组生产以及在加州费利蒙市（Fremont）汽车工厂的Model 3装配都遭遇了瓶颈。核心问题是马斯克将制造大众型汽车这一原本就艰巨的任务变得更加复杂。马斯克并不依赖老牌竞争对手所使用的那些经过了时间考验的制造方法，不想像它们那样仍然要靠人工完成那些机器还不能胜任的工作。他希望自己的汽车工厂成为一个超级自动化的“制造机器的机器”——到处都是机器人，将人类的参与度减至最低。

费利蒙工厂的员工描述了这样一种混乱的工作场景：一方面是推崇灵活创新和机械自动化的硅谷理念，一方面是汽车制造的乏味现实，两者格格不入。从在车间里安全使用叉车，到把塑料配件熟练灵巧地嵌入汽车内饰中，各种步骤中都呈现出这种冲突。股市研究公司盛博（Bernstein）的马克斯·沃伯顿（Max Warburton）指出，因为之前过度热衷于自动化而导致的惨痛经历，全球大型汽车制造商已经认识到，人力和机器的合理结合才是眼下最高效的汽车装配方法。

马斯克梦想将自己的工厂打造成实现自动化大规模生产的“外星无畏战舰”，然而即便这个梦想确实能带来更好的汽车制造方法，他也可能还没来得及证明自己就已经烧光了所有的钱。去年特斯拉亏损超过20亿美元。早在特斯拉最近一次确认未达生产目标之前很久，投资者就已经在为这家公司2018年的烧钱速度担忧了。除了扩大Model 3生产可能需要的约20亿美元资金之外，特斯拉还有约12亿美元的可转换债券将于明年初到期。3月27日，信用评级机构穆迪（Moody's）下调了特斯拉的债券评级，并警告该公司“很可能需要在2019年下半年筹集额外资金”。投资银行杰富瑞（Jefferies）预计特斯拉今年将需要25亿到30亿美元。

特斯拉坚称不存在迫在眉睫的现金危机。在4月3日发布的声明中，该公司断言“除了标准的信贷额度外，今年不需要进行股权或债务融资。”其他人则认为见分晓的时间可能会提早很多，或许就在今年夏天。不管它何时到来，问题都在于特斯拉将在何种环境下筹集资金。不断上升的利率、不稳定的股价，再加上持续未能实现生产目标，这些都会让公司更难融资。另外，通用、大众以及其他大型竞争对手正在电动车领域大举投资，这也让特斯拉的日子更不好过。

许多股东仍然相信马斯克有能力颠覆传统认知。但很多卖空者仍然下注公司会破产，而那些固定收益投资者也开始坐立不安，他们更在意的是拿回钱，而不是改变世界。特斯拉的垃圾债券的价格远低于去年发行时的水平。4月初，马斯克的另一条推特这样总结道：“汽车生意就是地狱。”这一次，他可不是在开玩笑。 ■



The scramble for battery minerals

Goblin metals

What if China corners the market in the cobalt needed for electric vehicles?

COBALT derives its name from Kobold, a mischievous German goblin who, according to legend, lurks underground. For centuries it vexed medieval miners by looking like a valuable ore that subsequently turned into worthless—and sometimes noxious—rubble. Once again it is threatening to cause trouble, this time in the growing market for batteries for electric vehicles (EVs), each of which uses about 10kg of cobalt. The source of mischief is no longer in Germany, though, but in China.

It is widely known that more than half of the world's cobalt reserves and production are in one dangerously unstable country, the Democratic Republic of Congo. What is less well known is that four-fifths of the cobalt sulphates and oxides used to make the all-important cathodes for lithium-ion batteries are refined in China. (Much of the other 20% is processed in Finland, but its raw material, too, comes from a mine in Congo, majority-owned by a Chinese firm, China Molybdenum.)

On March 14th concerns about China's grip on Congo's cobalt production deepened when GEM, a Chinese battery maker, said it would acquire a third of the cobalt shipped by Glencore, the world's biggest producer of the metal, between 2018 and 2020—equivalent to almost half of the world's 110,000-tonne production in 2017. This is likely to add momentum to a rally that has pushed the price of cobalt up from an average of \$26,500 a tonne in 2016 to above \$90,000 a tonne.

It is not known whether non-Chinese battery, EV or consumer-electronics manufacturers have done similar, unannounced deals with Glencore. But

Sam Jaffe of Cairn Energy Research Advisors, a consultancy, says it will be a severe blow to some firms. He likens the outcome of the deal to a game of musical chairs in which Chinese battery manufacturers have taken all but one of the seats. “Everybody else is frantically looking for that last empty chair.”

Mr Jaffe doubts the cobalt grab is an effort by Chinese firms to corner or manipulate the market for speculative ends. Instead, he says, they are likely to be driven by a “desperate need” to fulfil China’s ambitious plans to step up production of EVs.

Others see it more ominously. George Heppel of CRU, a consultancy, says that, in addition to GEM sweeping up such a sizeable chunk of Glencore’s output, China Moly may eventually ship its Congo cobalt home rather than to Finland, giving China as much as 95% of the cobalt-chemicals market. “A lot of our clients are South Korean and Japanese tech firms and it’s a big concern of theirs that so much of the world’s cobalt sulphate comes from China.” Memories are still fresh of a maritime squabble in 2010, during which China restricted exports of rare-earth metals vital to Japanese tech firms. China produces about 85% of the world’s rare earths.

Few analysts expect the cobalt market to soften soon. Production in Congo is likely to increase in the next few years, but some investment may be deterred by a recent five-fold leap in royalties on cobalt. Investment elsewhere is limited because cobalt is almost always mined alongside copper or nickel. Even at current prices, the quantities needed are not enough to justify production for cobalt alone.

But demand could explode if EVs surge in popularity. Mr Heppel says that, though most cobalt is currently mined for batteries in smartphones and for superalloys inside jet engines (see chart), its use for EVs could jump from 9,000 tonnes in 2017 to 107,000 tonnes in 2026.

The resulting higher prices would eventually unlock new sources of supply. But already non-Chinese battery manufacturers are looking for ways to protect themselves from potential shortages. Their best answer to date is the other “goblin metal” closely associated with cobalt, nickel, whose name comes from a German spirit closely related to Old Nick.

The materials most commonly used for cathodes in EV batteries are a combination of nickel, manganese and cobalt known as NMC, and one of nickel, cobalt and aluminium known as NCA. As cobalt has become pricier and scarcer, some battery makers have produced cobalt-lite cathodes by raising the nickel content—to as much as eight times the amount of cobalt. This allows the battery to run longer on a single charge, but makes it harder to manufacture and more prone to burst into flames. The trick is to get the balance right.

Strangely, nickel has not had anything like cobalt’s price rise. Nor do the Chinese appear to covet it. Oliver Ramsbottom of McKinsey, a consultancy, says the reason for this relative indifference dates back to the commodities supercycle in 2000-12, when Indonesia and the Philippines ramped up production of class-2 nickel—in particular nickel pig iron, a lower-cost ingredient of stainless steel—until the bubble burst. The subsequent excess capacity and stock build-up caused nickel prices to plummet from \$29,000 a tonne in 2011 to below \$10,000 a tonne last year.

As yet, the demand for high-quality nickel suitable for EVs has not boosted production. Output of Class-1 nickel for EVs was only 35,000 tonnes last year, out of total nickel production of 2.1m tonnes. But by 2025 McKinsey expects EV-related nickel demand to rise 16-fold to 550,000 tonnes.

In theory, the best way to ensure sufficient supplies of both nickel and cobalt would be for prices to rise enough to make mining them together

more profitable. But that would mean more expensive batteries, and thus electric vehicles. Only a goblin would relish such a conundrum. ■



电池用矿物争夺战

鬼怪金属

如果电动汽车所需的钴被中国垄断，该怎么办？

英语“钴”这个名称源自德语Kobold——传说中藏匿于地下又爱恶作剧的小妖怪。中世纪的几百年里，它害苦了矿工——它看上去很像贵重的矿石，结果却是一钱不值的碎石块，有时还有毒。如今，它可能又要制造麻烦了，这次是在增长中的电动车电池市场（每块电动车电池需要约10公斤钴）。不过，这次恶作剧的始作俑者不再是德国，而是中国。

众所周知，世界上一半以上的钴储量和产量都来自一个动荡危险的国家——刚果民主共和国。而不那么为人所知的是，制造锂离子电池不可或缺的负极所需的硫酸钴和氧化钴有80%是在中国提炼的。剩余20%中大部分在芬兰加工，但原料也来自刚果的一座矿山，而该矿山的多数股权由中国的洛阳钼业公司拥有。

中国电池制造商格林美在3月14日表示，将在2018年至2020年间采购全球最大钴生产商嘉能可（Glencore）产量的三分之一（接近去年全球11万吨钴产量的一半），人们不由得愈发担忧中国对刚果钴矿的操控。这将可能加快钴价复涨的势头，目前钴价已由2016年的平均每吨26,500美元上涨到每吨9万多美元。

是否还有其他中国之外的电池、电动车或消费电子制造商暗中与嘉能可达成了类似的交易则不得而知。但凯恩能源研究咨询公司（Cairn Energy Research Advisors）的萨姆·贾菲（Sam Jaffe）表示，有些公司会因格林美的交易遭受重创。他将这笔交易的结果比作“抢椅子”游戏：除一把椅子外，其余的都已被中国的电池制造商拿下。“其他所有人都在拼命争抢最后那把空椅子。”

贾菲不认为这场钴矿争夺战是中国企业企图通过垄断或操纵钴矿市场来投机。相反，他认为，中国有加速生产电动车的宏伟计划，这些企业很可能

是受到实现此计划的“急迫需要”的驱使。

其他人的看法更不乐观。咨询公司英国商品研究所（CRU）的乔治·亨佩尔（George Heppel）表示，除了格林美对嘉能可的产出展开大扫荡外，洛阳钼业最终可能将其在刚果的钴矿产运回中国而非芬兰，使得中国控制高达95%的钴化学品市场。“我们很多客户都是韩国和日本的科技公司，他们非常担忧全世界的硫酸钴竟有那么多出自中国。”人们对2010年的那场海上争端仍记忆犹新，那次事件后中国削减了对日本科技公司至关重要的稀土金属的出口量。中国的稀土产量占全球85%左右。

大多数分析师预计钴市场短期内不会疲软。未来几年刚果的钴产量可能会增加，但最近钴矿权利金暴涨五倍，可能会让一些投资商望而却步。而到其他地方投资也受到限制，因为钴几乎总是和铜或镍伴生。即使按目前的价格，对它的需求量也还不值得单独开采。

但如果电动车大受欢迎，钴的需求可能会激增。亨佩尔指出，虽然目前大部分钴都被用于智能手机电池和飞机发动机内的超级合金（见图表），但到2026年，电动车的钴用量可能会从2017年的9000吨跃增至107,000吨。

由此推高的价格最终将会打开新的供应源。但是，中国以外的电池制造商已在想方设法让自己免受可能的钴短缺之苦。目前它们想到的妙方是另一种“鬼怪金属”——钴的亲密战友镍。“镍”的英文名称源于德国一个与撒旦（Old Nick）密切相关的鬼怪。

电动车电池中最常用的负极材料是镍、锰和钴三元材料（NMC）以及镍、钴和铝三元材料（NCA）。因为钴的价格越来越高，也越来越稀缺，一些电池制造商已通过提高镍的含量（含量可达钴的八倍）来生产低钴含量的阴极。这令电池的续航时间变长，但制造的难度增加，也更容易自燃。关键是把握好比例。

奇怪的是，镍完全没有像钴那样涨价。中国人似乎也不觊觎它。咨询公司麦肯锡的奥利弗·拉姆斯博顿（Oliver Ramsbottom）表示，中国人对镍态

度相对淡漠，原因可追溯到2000年至2012年的大宗商品超级周期，期间印度尼西亚和菲律宾大量生产二级镍，尤其是用于生产不锈钢的低成本原料镍生铁，直到好景不再。随之而来的产能过剩和库存积压导致镍的价格从2011年的29,000美元一吨暴跌至去年的不到1万美元一吨。

迄今为止，对适用于电动车的高品质镍的需求还没有拉动生产。去年，用于电动车的一级镍产量仅为35,000吨，而镍的总产量为210万吨。但麦肯锡预计，到2025年，来自电动车的镍需求将增长16倍，达到55万吨。

理论上讲，确保镍和钴供应充足的最好办法是让价格上涨，直至令共同开采镍和钴更有利可图。不过那就意味着电池会更贵，因而电动车也会更贵。恐怕也只有鬼怪才喜欢这样的难题吧。 ■



Digitax in Europe

The old one-two

European regulators take a jab at tax-shy tech giants

IT IS a choice that would make Thomas Hobson proud. European officials last month unveiled plans for a quick and dirty tax policy to apply to big digital firms, in theory by the end of the year. The idea, promised since September, would ditch a tradition of taxing profits and instead let collectors in member states take a share, 3% for starters, of the firms' local revenues. There is a lively debate about where exactly the tech giants create taxable value. Is it where their programmers sit? Or the intellectual property? Or users? The firms have become so adept at tax avoidance that the European Commission is not going to hang around until the argument is settled.

Pierre Moscovici, the commissioner overseeing the proposals, was at pains to say on March 21st that the turnover tax would be an "interim" fix. He denied Americans are his targets. Between 120 and 150 companies would be affected, around half of them American and a third European. (Apple, Google and other American giants would surely get the biggest bills.) Only those with global revenues of more than €750m (\$920m), and EU revenues of more than €50m, would be covered. Earnings in the sights include those from ads and marketplaces.

Crucially, firms would pay taxes where they generate revenues, which are harder to sequester abroad with the sorts of intragroup loans and other accounting wheezes often used to book profits in lower-tax jurisdictions such as Ireland or Luxembourg. Regulators say that this practice helps explain why digital firms pay an estimated effective tax rate in Europe of just 9.5%, compared with 23.3% for bricks-and-mortar ones. The new tax could

raise €5bn a year.

France under President Emmanuel Macron has pushed hardest for the plan. But it hardly signals “the right environment for modern business” that Mr Moscovici brags about. Tax on revenues could backfire—it is unclear what a loss-making firm with whopping turnover is supposed to do, for example. Nor will the proposal easily become reality: tax changes in the EU require unanimity. France, Britain, Germany, Italy and Spain welcomed the plans. But they will have to strong-arm smaller, low-tax countries, which have most to lose. America, unsurprisingly, is also opposed. Steve Mnuchin, its treasury secretary, told the *New York Times* last month that gross taxes on internet companies are “not fair”.

Why push a reform that might hobble the sort of digital economy European officials call the future? Enter Hobson: doing so makes another proposal, announced by Mr Moscovici on the same day, look more appealing. His preferred outcome is for firms to pay taxes locally on a share of their digital profits, not revenues. To make that possible he says countries should pass laws to identify companies’“digital presence”. This would be defined as having online revenues worth €7m or more, 100,000 customers or more than 3,000 business contracts in any given country. The EU is fuzzier on how to determine what share of profits derives from these revenues.

That may be fleshed out by various obscurely named efforts to draw up global standards for taxing profits. The EU has an existing proposal, called CCCTB (don’t ask), for common rules for calculating firms’ taxable profits across Europe. However, such plans progress agonisingly slowly, perhaps because digital firms (and their army of lobbyists) prefer the lucrative status quo. The real gain from threatening a turnover tax might therefore be to speed up plans to tax profits better. ■



欧洲数字税 经典组合拳

欧洲监管机构给了偷税漏税的科技巨头一记刺拳

这道选择题的设计会给托马斯·霍布森（Thomas Hobson）脸上添光。上月，欧盟官员公布计划，将对大型数字企业实行临时税收政策，理论上会在今年年底实施。这个方案从去年9月开始冒头，意在抛弃对利润征税的传统做法，而改为让成员国税收部门对企业在当地的收入征税，一开始的税率为3%。人们还在激烈地争论科技巨头究竟是在何处创造了应税价值。是它们的程序员工作的地方？是它们创造知识产权的地方？还是它们的用户所在地？但是，这些企业的避税手段已经如此炉火纯青，欧盟委员会已经不打算等到这个问题有定论后再行动了。

负责这套提案的专员皮埃尔·莫斯科维奇（Pierre Moscovici）在3月21日极力表示这项营业税只是“权宜之计”，并否认针对美国公司。将有120到150家公司受到影响，其中约一半是美国公司，三分之一是欧洲公司。（苹果、谷歌和其他美国巨头必然会收到最大额的税单。）只有全球收入超过7.5亿欧元（9.2亿美元）且在欧盟的收入超过5000万欧元的企业才会被征税。应税收入包括来自广告和各类交易的收入。

关键在于企业将要在它们产生收入的地方缴税。企业常利用集团内部贷款和其他会计手段把利润登记到爱尔兰或卢森堡等低税率辖区，但它们不容易用这些招数把收入隐藏到国外。监管机构表示，运用这类避税手段使得数字公司在欧洲的实际税率仅为9.5%，而实体企业的税率为23.3%。新税制每年可以增加50亿欧元的税收。

马克龙领导下的法国在推动该计划上出力最多。但该计划不大可能创造出莫斯科维奇夸耀的“适合现代商业的环境”。对收入征税可能会适得其反。比如，目前还不清楚一家营业额惊人、但仍在亏损的公司该怎么做。这个提案也不会轻易成为现实，因为欧盟的税收改革需要全体成员国一致同

意。法国、英国、德国、意大利和西班牙对这一计划表示欢迎，但它们得逼迫那些税率较低的小国同意，而这些小国的损失最大。不出意外，美国也持反对态度。美国财政部长史蒂夫·梅努钦（Steve Mnuchin）上月对《纽约时报》说，对互联网公司按收入征税是“不公平”的。

欧洲官员们视数字经济为未来的发展方向，那他们为何还要推动一项可能会阻碍此类经济发展的改革呢？原来这是一道“霍布森选择题”即没有选择的选择：这样做是为了让莫斯科维奇在同一天宣布的另一项提案看起来更有吸引力。他更希望取得的结果是企业在当地按其数字利润的一定比例纳税，而不是按收入。为了实现这一目标，他认为各国应该立法来确定企业的“数字势力”。这将被定义为公司在某个特定国家有700万欧元或以上的在线收入、10万名客户或超过3000个商业合同。至于该如何确定这些收入中的利润比例，欧盟就没那么明确了。

欧盟可能会通过其他各种提案来进一步明确这个利润比例的问题。这些提案努力制定向利润征税的全球标准，它们往往有着令人费解的名号。欧盟已有一项名为CCCTB（别问是什么意思）的提案建议制定通用规则来计算企业在欧洲各地的应税利润。但这类计划进展之缓慢令人心焦——或许是因为数字公司（以及它们的说客大军）更喜欢目前这个获利丰厚的局面。因此，威胁要征收营业税的真正好处可能是令更有效地按利润征税的计划加快推进。 ■



Energy

Electric dreams

A post-oil world will be cleaner and safer. Getting there is the hard part

OIL shaped the 20th century. In war, the French leader Georges Clemenceau said, petroleum was “as vital as blood”. In peace the oil business dominated stockmarkets, bankrolled despots and propped up the economies of entire countries. But the 21st century will see oil’s influence wane. Cheap natural gas, renewable energy, electric vehicles and co-ordinated efforts to tackle global warming together mean that the power source of choice will be electricity.

That is welcome. The electricity era will diminish the clout of the \$2trn oil trade, reduce the choke points that have made oil a source of global tension, put energy production into local hands and make power more accessible to the poor. It will also make the world cleaner and safer—reassuringly dull, even. The trouble is getting from here to there. Not just oil producers, but everyone else, too, may find the transition perilous.

Oil and electricity are a study in contrasts (see our special report). Oil is a wonder fuel, packed with more energy by weight than coal and by volume than natural gas (both still the main sources of electricity). It is easy to ship, store and turn into myriad refined products, from petrol to plastics to pharmaceuticals. But it is found only in specific places favoured by geology. Its production is concentrated in a few hands, and its oligopolistic suppliers—from the Seven Sisters to OPEC and Russia—have consistently attempted to drip-feed it on to the market to keep prices high. Concentration and cartelisation make oil prone to crises and the governments of oil-rich states prone to corruption and abuse.

Electricity is less user-friendly than oil. It is hard to store, it loses its oomph when shipped over long distances, and its transmission and distribution require hands-on regulation. But in every other way, it promises a more peaceful world.

Electricity is hard to monopolise because it can be produced from numerous sources of fuel, from natural gas and nuclear to wind, solar, hydro and biomass. The more these replace coal and oil as fuel for generation, the cleaner it promises to be. Given the right weather conditions, it is abundant geographically, too. Anyone can produce electricity—from greener-than-thou Germans to energy-poor Kenyans.

True, the technologies used to produce electricity from renewable resources, and the rare earths and minerals that some, including solar panels and wind turbines, rely on, could be subject to protectionism and trade wars. China, which produces 85% of the world's rare earths, sharply tightened export quotas in 2010 with OPEC-like zeal. America and the European Union have slapped tariffs on Chinese solar-panel imports. Yet the vital substances involved in generating and storing electricity are not burned up like oil. Once a stock of them exists it can for the most part be recycled. And, even if today's output is concentrated, for most materials the planet has undeveloped deposits or substitutes that can thwart a would-be monopolist. Rare earths, for example, are not rare—one of them, cerium, is almost as common as zinc.

Electricity also rewards co-operation. Because renewables are intermittent, regional grids are needed to ship electricity from where it is plentiful to where it is not. This could replicate the pipeline politics that Russia engages in with its natural-gas shipments to Europe. More likely, as grids are interconnected so as to diversify supply, more interdependent countries will conclude that manipulating the market is self-defeating. After all, unlike gas, you cannot keep electricity in the ground.

An electric world is therefore desirable. But getting there will be hard, for two reasons. First, as rents dry up, authoritarian oil-dependent governments could collapse. Few will miss them, but their passing could cause social unrest and strife. Oil producers had a taste of what is to come when the price plunged in 2014-16, which led to deep, and unpopular, austerity measures. Saudi Arabia and Russia have temporarily stopped the rot by curtailing production and pushing oil prices higher, as part of an “OPEC+” agreement. They need high prices to buy time to wean their economies off oil. But the higher the oil price, the greater the incentive for energy-thirsty behemoths like China and India to invest in renewable-powered electrification to give themselves cheaper and more secure supplies. Should the producers’ alliance crumble in the face of a long-term decline in demand for oil, prices could once again tumble, this time for good.

That will lead to the second danger: the fallout for investors in oil assets. America’s frackers need only look at the country’s woebegone coalminers to catch a glimpse of their fate in a distant post-oil future. The International Energy Agency, a forecaster, reckons that, if action to limit global warming to below 2°C accelerates in coming years, \$1trn of oil assets could be stranded, ie, rendered obsolete. If the transition is unexpectedly sudden, stockmarkets will be dangerously exposed.

The tension is inescapable. On the one hand government policy should press forward with the transition as fast as it can. On the other, a rapid transition will cause upheaval. Expect the big consumers, especially India and China, to force the pace. ■



能源

电力梦想

后石油时代的世界将更清洁安全。难题在于如何抵达那里

石油塑造了20世纪。在战争时期，石油如法国前领导人乔治·克列孟梭（Georges Clemenceau）所言，“和鲜血一样重要”。在和平年代，石油业主宰了股市，为专制政权提供了资金，支撑起整个国家的经济。但在21世纪，石油的影响力将逐渐减弱。廉价的天然气、可再生能源、电动汽车，以及协同应对全球变暖的努力意味着未来首选的动力来源将是电力。

这样的变化很受欢迎。电力时代将削弱价值两万亿美元的石油贸易的影响力，减少令石油成为全球紧张局势源头的咽喉点，使能源生产本地化，让穷人更容易获得能源。电力还会让世界变得更清洁、更安全——甚至让人安心到颇感沉闷。难题在于如何进入电力时代。不止石油生产国，其他所有国家都可能发现这一转变路途艰险。

石油和电力差异鲜明。石油是一种奇妙的燃料，与同等重量的煤炭和同等体积的天然气相比，石油蕴含的能量更多（煤炭与天然气仍是电力的主要来源）。石油便于运输和储存，并可加工成无数精炼产品，从汽油到塑料再到药品，不一而足。但只有在地质条件适宜的地方才能找到石油。石油开采集中在少数企业和国家手中。石油的寡头供应方——从石油“七姊妹”到欧佩克和俄罗斯——一直试图通过限产来保持高价。资源集中和联合垄断容易造成石油危机，产油国政府也容易滋生腐败、滥用权力。

电力不像石油那样使用方便。它储存困难，长距离传输会有能量损失，而输配电需要细致具体的监管。但从所有其他方面来看，电力将带来一个更和平的世界。

电力很难垄断，因为可用于发电的能源很多，有天然气、核能、风能、太阳能、水力和生物质。这些能源越多替代煤和石油来发电，电能的清洁度就越高。天气条件合适的话，电能可以说是无处不在。不论是最重视绿色

环保的德国人，还是能源匮乏的肯尼亚人，谁都可以自己发电。

诚然，可再生能源发电技术，以及包括太阳能电池板和风力涡轮机在内的部分这类技术所依赖的稀土和矿物，可能会受到贸易保护主义和贸易战的影响。2010年，稀土产量占世界85%的中国大幅收紧出口配额，用力程度不亚于欧佩克限产的劲头。美国和欧盟已对从中国进口的太阳能电池板征收关税。不过，发电和储电所用到的重要物质不像石油那样会耗尽。一经开发出来，它们大部分都可以回收再利用。而且，即使今天这些物质的生产是集中的，对于其中大多数来说，地球上还有未开发的矿藏或替代品，可以阻止任何国家或企业垄断市场。例如，稀土元素其实并不稀有，有一种名为铈的稀土几乎和锌一样常见。

电力还会鼓励合作。由于可再生能源发电时断时续的特点，需要区域性的电网将电力从电充裕的地方输送到匮乏的地区。这可能会重现俄罗斯利用输欧天然气玩弄的“管道政治”。但更有可能的是，由于电网之间相互连接以实现供电方式多样化，更多相互依存的国家会得出这样一个结论：操纵市场于己不利。毕竟，和天然气不同，电不能存在地下不用。

因此，一个用电的世界令人期待。但要实现这个目标并非易事，有两方面原因。首先，由于石油租金收入枯竭，依赖石油的专制政府可能会垮台。虽然没什么人会怀念它们，但它们的倒台可能会引发社会动荡和冲突。

2014至2016年间油价暴跌时，石油生产国已经吃到了苦头，这导致政府采取了不受欢迎的深度紧缩措施。作为“欧佩克+”协议的一部分，沙特阿拉伯和俄罗斯通过减产和推高油价暂时控制住了恶化的局面。它们需要高油价来赢得时间让国家经济摆脱对石油的依赖。但是，油价越高，中国和印度等能源消耗大国就越有动力投资可再生能源发电，以确保自己有更便宜也更稳定的能源供应。面对石油需求的长期下降，产油国的联盟一旦瓦解，油价可能再度大跌，而这一次将永不再反弹。

这将导致第二个危险：对石油资产投资者的冲击。美国的页岩油生产商只要看看本国那些满脸愁容的煤矿主，就可以一窥自己在遥远的后石油未来中的命运。国际能源署预测，如果将全球变暖限制在2°C以下的行动在未

来几年内加速，可能会有一万亿美元的石油资产被搁浅淘汰。如果转型比预期更突然，股市将面临巨大风险。

矛盾不可避免。一方面政府政策应该尽快推动转型，而另一方面，快速转型又会引发动荡。预计能源消费大国——特别是印度和中国——将加快这一进程。 ■



China

The East is green

China's strength in clean-energy technology is growing rapidly

WHEN IT COMES to energy, no country generates such bittersweet superlatives as China. It is the world's largest consumer of coal and the second-largest of oil, after America. It has the largest power-generation capacity, by a wide margin. It also produces more carbon dioxide than any other country.

China is hoping to deal with this over-dependence on fossil fuels partly by rebalancing the economy away from energy-intensive industries. But it also leads the world in clean energy. In recent years, through a combination of subsidies, policy targets and manufacturing incentives, it has spent more on cleaning up its energy system than America and the EU combined. Last year alone it shelled out \$132bn, according to Bloomberg New Energy Finance (BNEF), a consultancy.

The International Energy Agency (IEA) says China has one-third of the world's wind power, a quarter of its solar capacity, six of the top ten solar-panel manufacturers and four of the top ten wind-turbine makers. It sells more electric vehicles than the rest of the world combined. It also leads the world in construction of nuclear power plants. In December it gave the go-ahead for what is expected to be the world's largest carbon-trading scheme.

Given China's thirst for energy, the combined impact of these advances in renewables is still relatively small. Non-fossil-fuel energy, chiefly hydro and nuclear, accounts for only 12% of its total energy mix. And China is far from self-sufficient. That is why, for the next decade at least, China's main energy-related geopolitical concern will be the need to secure fossil fuels.

This is already evident in the plethora of deals that its state-owned companies are doing with oil and gas producers in the Middle East and Russia, both to finance new projects and to help develop them. But China is also reaching out to America.

Zou Ji of the Energy Foundation, a think-tank, says the immediate priority for China's energy policymakers is to curb the dirtiest uses of coal, especially heating urban homes with it. For this, America's shale revolution may be a blessing, he says. By adding large quantities of liquefied natural gas (LNG) to global markets, it has made it cheaper and easier for China's coastal areas to switch from coal to gas. Last year the country's LNG imports grew by 50%.

Increasingly China is looking to America to help it diversify its sources of supply. In February China National Petroleum Corporation, a state behemoth, signed the first ever long-term contract to buy LNG from an American supplier, Texas-based Cheniere Energy. Mr Zou says that more energy interdependence between China and America, particularly in the LNG market, could be good for relations between the two superpowers, especially if it helps reduce America's trade deficit with China.

Eventually, China's increasing production and use of renewables, batteries and electric vehicles (EVs) are also likely to have geopolitical consequences, even if that is not the government's primary aim. China could benefit in three ways.

First, by being able to produce more of its own energy, it will reduce its reliance on fuel imports that may be vulnerable to global instability. Second, its "soft power" will be strengthened. This is already evident in its leadership role in the Paris climate agreement. Third, and perhaps most important, the development of clean-energy technologies—especially batteries and EVs—could put it firmly in the vanguard of the energy

transition, ahead of America and Europe, and provide a new impetus for economic growth.

Currently the race is wide open. No country has an unassailable lead. Whether clean-energy technology becomes a source of healthy competition or geopolitical friction will depend largely on global trade. If it becomes bogged down in protectionism, trade wars and cyber-crime, everyone will lose. But that need not happen.

So far, many in the West have been sceptical about China's role in renewable-energy technology. The country's solar industry is thought to have piggybacked on Germany's generous renewable-energy subsidies and has benefited from massive government support. In 2012 the European Commission launched anti-dumping and anti-subsidy investigations of Chinese solar-panel imports. The following year the two sides reached a settlement, followed by the imposition of minimum prices. In 2014 America slapped import duties on Chinese solar-panel imports. In January the Trump administration imposed more tariffs on imported solar panels, most of which come from China.

The Chinese have bungled some of their own renewable-energy policies, building large-scale projects in remote locations without the transmission lines to support them. Some Western experts argue that China lacks adequate regulatory structures for a smooth transition to clean energy. And in 2010 the Chinese authorities halted most exports of rare earths, raising fears about their stranglehold on the supply of minerals critical to green-energy technology.

However, such criticisms risk underplaying the sheer entrepreneurial zeal that the Chinese put into clean energy, and their growing ambition to decentralise as well as decarbonise the energy supply. Both may give China

a dominant position in developing the energy technologies of the future.

For instance, the world's biggest solar-panel manufacturer, Shanghai-based Jinko Solar, is a relative newcomer that started only 11 years ago. Since 2013 it has quintupled global production to a mighty 10 gigawatts (GW) a year and doubled its global market share to 10%. Gener Miao, its head of sales, explains that the firm has succeeded by internationalising its marketing efforts and relentlessly investing in technology. Support from the Chinese government now mostly goes on early-stage research projects, he claims.

Another case in point is one of China's biggest wind-turbine developers, Envision, also from Shanghai. It has invented turbines that operate at low wind speeds so they can be placed close to urban centres, rather than in the country's remote northwest. But the company views the turbines merely as a cash cow for a bigger ambition: to create a global "energy internet", or operating system, that helps companies manage locally produced, or "distributed", energy assets such as turbines and solar panels, electric vehicles, battery storage and commercial electrical appliances. Launched in 2016, Envision says the system already manages more than 100GW of renewable assets globally (more than America's entire wind capacity).

China is also upgrading its regulatory structure. Sophie Lu of BNEF says that distributed solar energy accounted for almost one-third of the 53GW of new solar capacity installed in China last year. This surprised everyone because until recently all renewable energy had been installed in remote areas on a utility scale. The aim is to spur reform of China's gargantuan power company, State Grid. "The government is using technology, innovation and power-market reform to break the monopoly of the grid," says Ms Lu.

In future the main bone of contention may be the new technologies developed to make renewable energy and storage ever more cost-

competitive. Some American experts fret that by giving a low priority to renewable energy, the Trump administration may put America's industry at a disadvantage in relation to China's. Since President Trump decided to pull out of the Paris agreement, he appears to have jettisoned America's pledge to double the \$6.4bn the government is due to spend on energy innovation by 2020. China pledged \$7.6bn, so it may soon take the lead. Equally telling, research by Devashree Saha and Mark Muro of the Brookings Institution, a think-tank, shows that patents and venture-capital investment in clean-energy technologies in America recently peaked. Patenting, they said, was increasingly done by foreign firms, especially Chinese ones.

If China's growth in clean-energy technology leads to more protectionism, along the lines of the Trump administration's move in January against imports of solar panels, clean tech could become a trade battleground. The same could happen if China denies Western energy technology a meaningful place in its markets (as it has done with American internet firms) or restricts access to its rare earths. But technology also provides scope for collaboration. If America, the EU and China can build that into the transition to renewables, energy geopolitics will start to look a lot more promising. ■



中国

东方绿

中国在清洁能源技术方面的实力在迅速增强

提到能源，没有哪个国家像中国这样拥有喜忧参杂的各种世界第一。中国是世界最大的煤炭消费国，也是仅次于美国的第二大石油消费国。中国的发电装机容量远超其他国家。但它排放的二氧化碳同样也比别人多。

中国希望在一定程度上通过调整经济结构向非能源密集产业转移来解决过度依赖化石燃料的问题。但中国在清洁能源方面也走在世界最前列。近年来，通过各种补贴、政策目标以及制造业激励措施，中国在推进能源系统绿色化方面的支出超过了美国和欧盟的总和。根据咨询公司彭博新能源财经（BNEF）的数据，仅去年一年，中国就为此花费了1320亿美元。

国际能源署（IEA）称中国拥有全世界三分之一的风力发电能力和四分之一的太阳能发电能力；世界十大太阳能电池板制造商有六家在中国，十大风力发电机制造商有四家在中国。中国的电动车销量超过了世界其他地区的总和。中国在建核电站数量居世界第一。去年12月，中国政府批准启动全国碳排放交易体系，预计这将是全球最大的碳交易系统。

考虑到中国对能源的巨大需求，这些可再生能源发展的综合影响仍相对较小。以水电和核能为主的非化石燃料仅占其总能源构成的12%。而且中国还远未实现自给自足。这就是为什么至少在未来十年里，中国在能源方面的地缘政治主要关注点将是保证化石燃料的供应。

这一点在中国国有企业与中东、俄罗斯的石油及天然气生产商进行的大量交易中已表现得很清楚。这些交易有的是为新项目融资，有的是帮助开发新项目。但中国同时也将目光投向了美国。

智库能源基金会的邹骥指出，中国能源政策制定者的当务之急是遏制高污染用煤，尤其是城市住宅的煤炭供暖。对此，他认为美国的页岩气革命或

许是天赐良机。得益于美国在全球市场增投的大量液化天然气，中国沿海地区的煤改气变得更容易，成本也变得更低。去年，中国液化天然气的进口量增长了50%。

中国越来越寄希望于美国帮助它实现能源供给多样化。今年2月，国企巨头中石油首次签署了从美国供应商购买液化天然气的长期合同，对方是总部位于德克萨斯的切尼尔能源公司（Cheniere Energy）。邹骥表示，中美在能源方面相互依赖的程度加深，在液化天然气市场上尤其如此，这可能有利于两个超级大国之间的关系，特别是如果这有助于减少美国对中国的贸易逆差的话。

中国在可再生能源、电池和电动车上日益增长的产量及使用量最终也可能产生地缘政治方面的影响，即使这并非中国政府的首要目的。中国可能从三方面获益。

首先，如果能自产更多能源，中国就会减少对燃料进口的依赖，而燃料进口易受全球不稳定的影响。其次，中国的“软实力”将得到加强。这一点已经从中国在《巴黎气候协定》中的领导角色上得到了印证。第三，也可能是最重要的一点，清洁能源技术的发展——尤其是电池和电动汽车——可以让中国领先于欧美，稳居能源转型的最前沿，并为经济增长提供新动力。

目前来看，竞争胜负难料。没有哪个国家享有难以撼动的领先地位。清洁能源技术引发的是健康竞争还是地缘政治摩擦，很大程度上取决于全球贸易。如果清洁能源技术陷入贸易保护主义、贸易战以及网络犯罪的泥沼，那么各方都会是输家。不过这种情形是可以避免的。

到目前为止，西方不少人对中国在可再生能源技术中所起的作用持怀疑态度。他们认为，中国的太阳能产业参照了德国慷慨的可再生能源补贴，并受益于政府的大力支持。2012年，欧盟委员会启动了针对中国太阳能电池板进口的反倾销和反补贴调查。第二年，双方达成和解，随后实施了最低限价。2014年，美国对中国太阳能电池板征收进口关税。今年1月，特朗

普政府对主要来自中国的进口太阳能电池板征收了更多的关税。

中国在自己的可再生能源政策上有过一些失误，比如，在没有配套输电线路的情况下，在偏远地区建造大型项目。一些西方专家认为，中国缺乏完善的监管体制实现向清洁能源的平稳过渡。2010年，中国政府叫停了大部分的稀土出口，引发人们担忧中国会垄断对绿色能源技术至关重要的矿物供应。

不过，此类批评恐怕低估了中国人在清洁能源上巨大的开拓热情，以及他们在分散能源供应和脱碳方面日益增长的雄心。这两点都可能让中国在发展未来能源技术方面取得主导地位。

例如，总部位于上海的世界最大的太阳能电池板制造商晶科能源成立仅11年，相对来说是业界的“小字辈”。自2013年以来，该公司的全球年产量已增长到原先的五倍，达到10GW，全球市场份额也翻了一番，达到10%。该公司的销售负责人苗根解释说，公司的成功得益于国际化的营销和对技术的不断投资。他称现在政府的支持主要集中在前期的研究项目上。

另一个典型的例子是远景能源，它是中国最大的风力发电机研发企业之一，同样来自上海。远景发明了可以在低风速下运行的发电机，这样它们就可以被安装在市中心附近，而不是中国偏远的西北地区。但远景只是把风力发电机当作一棵“摇钱树”来支持自己更大的目标——创建一个全球性的“能源物联网”，即能源操作系统，帮助企业管理本地生产的“分散式”能源资产，如风力发电机与太阳能电池板、电动汽车、电池储能及商用电器等。该系统于2016年推出，远景表示，它已经在全球范围内管理着超过100GW的可再生能源资产（超过美国的风电总装机容量）。

同时，中国也在升级转型其监管架构。彭博新能源财经的吕天菲表示，去年中国新增太阳能发电装机容量53GW，其中分散式太阳能发电接近三分之一。这让所有人都感到惊讶，因为直到不久前，所有可再生能源还都是安装在偏远地区的公用事业规模的系统。这一改变旨在促进中国庞大的电力公司国家电网的改革。“政府正在利用技术、创新以及电力市场改革打

破国家电网的垄断。”吕天菲表示。

今后，竞争的焦点可能是让可再生能源及其存储更具成本竞争力的新技术。美国的一些专家担心，特朗普政府不重视可再生能源，可能会让美国的相关产业落后于中国。自从决定退出《巴黎协定》以来，特朗普似乎已经放弃了美国的承诺，即到2020年，在原来64亿美元能源创新投入的基础上将此数字再翻一番。而中国已承诺投资76亿美元，因此可能很快就会领先。智库布鲁金斯学会的德瓦施瑞·萨哈（Devashree Saha）和马克·穆罗（Mark Muro）的研究显示了同样的问题，美国清洁能源技术的专利和风险投资不久前已经见顶。他们表示，越来越多的专利来自外国公司，尤其是中国公司。

如果中国在清洁能源技术上的发展招致更严重的保护主义，就像今年1月特朗普政府针对进口太阳能电池板的举措那样，那么清洁能源技术可能会成为贸易战的战场。如果中国不让西方能源技术在其市场上占据一席应有之地（就像中国对美国互联网公司所做的那样）或者限制其稀土资源的出口，同样的情况也会发生。但技术也能带来合作。如果美国、欧盟和中国能够在向可再生能源转型的过程中建立合作，那么能源地缘政治的前景将更显光明。 ■



Free exchange

Moral hazard

Economists cannot avoid making value judgments, however much they might wish to

AMID the name-calling and bluster that mar many fights between economists are a few common tactics. Belligerents may attack the theory used to support a claim, or the data analysis used to quantify an effect. During the debate over President Donald Trump's tax bill, to take a recent example, economists bickered over which side had more credibly calculated the economic effect. They did not, for the most part, argue about whether it was morally acceptable to pass a regressive tax reform after years of wage stagnation and rising inequality. To do so would strike many economists as entirely un-economist-like. Yet economics has not always been so shy about moral philosophy. As well as "The Wealth of Nations", Adam Smith wrote a "Theory of Moral Sentiments". Great 20th-century economists like Paul Samuelson and Kenneth Arrow also took questions of values very seriously. Their successors would do well to take several pages from their books.

Modern economists have attempted to strip value-judgments out of their policy analyses. Policies are judged on how they are likely to affect economic variables such as income and its distribution, and how those changes would affect overall welfare. If the models suggest that one policy choice—a top tax rate of 40%, say, rather than 50%—leads to greater welfare than another, that is usually good enough for an economist.

This approach is enormously valuable. It disciplines thinking, produces useful information and makes it easier to build professional consensus about what is known and which questions remain unanswered. Though cost-benefit analysis is not perfect, is often the best route to getting informed experts to agree.

Used in isolation, however, it can lead to trouble. In a paper presented at the annual conference of the American Economic Association (AEA) in January, Matthew Weinzierl, of Harvard University, notes that the world is too complicated to be modelled with anything like perfect accuracy. Many knock-on effects from policy shifts are unknowable beforehand. He suggests that in the absence of perfect foresight, policymakers could turn to social principles or rules that have evolved over time. These may reflect accumulated knowledge about some choices' unintended consequences. He gives an example. Governments might choose to increase redistribution based on evidence that high inequality creates feelings of envy, and envy reduces the welfare of the non-rich by making them feel worse. Yet survey evidence suggests that people are largely opposed to redistribution that is motivated by envy. Validating envy through tax policy could prove socially corrosive, in a way that economists' models fail to capture.

Put differently, Mr Weinzierl contends that economists should take moral concerns more seriously. That is something close to professional heresy. At the AEA conference Alvin Roth, a Nobel prizewinner, delivered a lecture on his life-saving work in the field of market design. To donate an organ, one must share a blood-type with the recipient. Someone who would be willing to donate a kidney to a friend or family member might be stymied by a difference in blood-type. Mr Roth circumvented this problem by developing matching markets, in which one person donates to a compatible stranger and in turn receives another stranger's compatible organ for use by the donor's ailing loved-one. Such swap groups can include scores of donors and recipients, who might otherwise have died awaiting a transplant.

Yet demand for healthy organs vastly outstrips supply. Were it legal to buy and sell organs, many more people might donate, helping to alleviate the deadly shortage. Moral qualms generally discourage governments from legalising the trade. This is an example of what Mr Roth calls a "repugnant market", one which is constrained by popular distaste or moral unease.

Repugnance, he laments, tilts the political playing field against ideas that unlock the gains from trade. He recommends that economists spend more time thinking about such taboos, but mostly because they are a constraint on the use of markets in new contexts.

These social rules also contain insights. In a paper discussing the organ trade Nicola Lacetera, of the University of Toronto, argues that there may be important reasons for moral objections to repugnant activity, and costs to abandoning such objections. Though studies show that telling people that payment encourages organ donations increases support for legalising payments, other examples work in the opposite way. Giving women information about the health and safety benefits of legalising prostitution seems to reduce support for legalisation—perhaps because women worry about the consequences of applying a cost-benefit approach to areas relating to their status within society.

Not all economists avoid ethical considerations entirely. Jean Tirole, another Nobel prizewinner, devoted a chapter of his recent book, “Economics for the Common Good”, to “the moral limits of the market”, for example. He says economists should respect society’s need to set its own goals, then help devise the most efficient ways to attain them. But, as Beatrice Cherrier of the Institute for New Economic Thinking argued in an essay addressing Mr Roth’s lecture, these questions are fundamental to economics. The hard sciences deal much better with the ethical implications of their work, she says. And moral concerns affect human behaviour in economically important ways, as Mr Roth found to his frustration. To be useful, economists need to learn to understand and evaluate moral arguments rather than dismiss them.

Many economists will find that a dismal prospect. Calculations of social utility are tidier, and the profession has fallen out of the habit of moral reasoning. But those who wish to say what society should be doing cannot

dodge questions of values. ■



自由交流

道德风险

经济学家无法避免价值判断，不论他们意愿如何

在经济学家之间的诸多论战中时有破坏性的谩骂与叫嚣，其中有几个常见路数。论战者要么攻击用以支持某个主张的理论，要么攻击用以量化某项成效的数据分析。比如近期在有关特朗普税改法案的争论中，经济学家就哪一方计算出的经济效益更可信打起了口水仗。不过，在经历多年的工资停滞和不平等加剧之后，他们对通过一项开倒车的税收改革在道德上是否可接受倒没有多少争论。很多经济学家觉得讨论这种问题一点都不像个经济学家。然而经济学对道德哲学并不总是避而远之。亚当·斯密不仅著有《国富论》，还有《道德情操论》（Theory of Moral Sentiments）。像保罗·萨缪尔森（Paul Samuelson）和肯尼斯·阿罗（Kenneth Arrow）等20世纪伟大的经济学家也非常重视价值问题。他们的后继者如果能翻一翻他们的论著，会大有裨益。

现代经济学家试图在分析政策时撇开价值判断。评判政策好坏的标准是看它们可能如何影响诸如收入和收入分配之类的经济变量，以及这些变化会如何影响总体福利。如果模型显示一项政策（比如最高40%而不是50%的税率）能比另一项带来更大的福利，这对经济学家来说通常就足够好了。

这种方法很有价值。它让思维有条理，产生有用的信息，让人们更容易就哪些问题业已解决、哪些仍然悬而未决达成专业共识。虽然成本效益分析并不完美，但却往往是行家们达成共识的最好方法。

然而，孤立使用这种分析会导致麻烦。1月，哈佛大学的马修·维兹尔（Matthew Weinzierl）在美国经济学会（AEA）年会上提交的论文中指出，世界非常复杂，不可能用完全精准的模型来反映。政策转变带来的许多连锁反应事先并不可知。他建议，在无法精确预见时，政策制定者可以求助于长期演变形成的社会原则或规则。这些原则可能反映出对于某些抉

择的意外后果累积的认知。他举了个例子。高度不平等引发嫉妒，而嫉妒让非富裕群体感觉更糟，继而降低他们的幸福感，针对这种情况，政府可能选择加强再分配。然而，民调证据显示，人们大多反对因嫉妒而引发的再分配。通过税收政策来肯定嫉妒会对社会产生破坏作用，而这一点是经济学家的模型无法捕捉的。

换句话说，维兹尔主张经济学家更重视道德层面的考量。从专业角度看，这近乎离经叛道。在本届AEA会议上，诺贝尔奖得主阿尔文·罗斯（Alvin Roth）发表了有关利用市场设计来拯救生命的演讲。器官捐献者必须与受捐者血型匹配。一些想给朋友或家人捐献肾脏的人可能因血型不同而受阻。罗斯通过开发配型市场解决这个问题。配型市场中，一人将器官捐给配型合适的陌生人，这样他就可以得到另一个陌生人配型合适的器官，移植给自己那患病的挚爱之人。这样的交换群体可以吸纳大批的捐赠者和受捐者，否则受捐者有可能还没等到移植器官就死亡了。

然而对健康器官的需求远远超过了供给。如果买卖器官合法的话，可能有更多人捐赠，从而有助于缓解致命的短缺。道德上的顾忌普遍阻止了政府将器官交易合法化。这个例子就是罗斯所称的“令人反感的市场”，它受制于公众的厌恶或道德上的不安。罗斯叹息道，这种厌恶使得政客趋向于反对从器官交易中获益的种种主张。他建议经济学家花更多的时间思考这样的禁忌，但他如此建议主要是因为这些禁忌制约了将市场运用于新的环境。

在这些社会规则中还蕴含着深层次的信息。多伦多大学的尼古拉·拉切泰拉（Nicola Lacetera）在一篇讨论器官交易的论文中提出，在对那些令人厌恶的行径所持的道德异议的背后，可能存在重要的原因，而对这类异议置之不理可能也有代价。尽管研究表明，告知民众“付费会促进器官捐献”能提高对有偿捐献合法化的支持，在其他一些例子中起到的作用却是相反的。让妇女知道卖淫合法化带来的健康和安全方面的好处，似乎减少了对卖淫合法化的支持——也许是因为妇女对在事关她们社会地位的领域采用成本效益分析的后果有所担心。

并非所有经济学家都完全回避伦理上的思考。比如，另一位诺贝尔奖得主让·梯若尔（Jean Tirole）在他最近的著作《公共利益经济学》（Economics for the Common Good）中用了一整个章节讨论“市场的道德底线”。他指出，经济学家应该尊重社会确定自身目标的需要，进而帮助制定最有效的方法来实现这些目标。而新经济思维研究所（the Institute for New Economic Thinking）的贝特丽丝·谢里耶（Beatrice Cherrier）在一篇探讨罗斯演讲的文章中指出，这些问题 是经济学的基础。她指出，自然科学在处理自身的伦理影响时所做的要好得多。而道德顾虑对人类行为的影响在经济上有重大的表现——罗斯在他的研究中就很沮丧地发现了这一点。要经世济民，经济学家需要学会理解和评估道德层面的思辨，而非置之不理。

很多经济学家会发现这难以做到。对社会效用做这样那样的计算会更加明晰，而且经济学界已经丢掉了道德思辨的习惯。但是那些还想指导社会运行的人不能回避价值问题。 ■



Economic and financial indicators

Economic outlook

The Economist's latest poll of forecasters, April



经济与金融指标

经济前景

《经济学人》4月对各家预测机构的最新调查



Airlines in China

Now boarding

Chinese carriers are the coming force in air travel

ANYONE who doubts the ambitions of China's airlines need only look over the plans for Daxing International Airport, which will serve Beijing after it opens in late 2019. It will be the world's biggest airport by far, with eight runways and room for 100m passengers a year. The new facilities are needed to serve a fast-growing appetite for air travel. The three Chinese carriers that will dominate the passenger traffic passing through Daxing's cavernous halls are all in rapid ascent. And that has rivals everywhere complaining about the sorts of subsidies that have fuelled airlines since the dawn of commercial aviation.

China's airlines are adding passengers at a rate not seen since Emirates, Etihad and Qatar Airways started to attract customers to their Gulf hubs, handily placed between Europe and Asia, with a winning combination of cheap fares and superior service. Between 2010 and 2017 passenger numbers on China's three biggest carriers grew by 70%, to 339m (see chart). That growth has translated into some financial high-flying. At the end of March China Southern, Asia's biggest airline, and China Eastern both reported record annual profits. Air China's share price fell after it announced that it had only made its best profits since 2011.

As China's carriers expand, their Gulf rivals, which for a decade have seen passenger growth of over 10% a year, are languishing. Slower expansion—or in Qatar's case, shrinkage—has hit profits hard. It is natural to expect China's carriers to eclipse those from the Gulf, says Will Horton of CAPA, a consultancy. Those Gulf airlines rely on long-haul passengers connecting in their hubs. China's carriers are built on more solid foundations of fast-

growing local demand. A total of 549m passengers took to the air last year, compared with 184m in 2007. The International Air Transport Association (IATA), a trade group, predicts that China will overtake America as the world's biggest aviation market by 2022, and will go on to hit a total of 1.5bn passengers by 2036.

Much of that growth is on international routes. Over the past decade airlines in mainland China have opened over 100 new long-haul routes. These flights mainly serve an increasing urge among Chinese for foreign travel. The number of tourists going abroad, mostly by plane, has rocketed in the past decade, from 41m a year to over 130m. As a result, Chinese airlines are gobbling market share, says Dave Emerson of Bain & Company, a consultancy. Between 2011 and 2017 the capacity on Chinese planes flying between China and America rose from 37% to 61%, reckons OAG, a flight-data firm.

The battle to fly the Chinese around the globe is not the front that most concerns the world's other big international airlines, however. The Gulf carriers took business from American and European airlines by getting the world to fly through their hubs. Chinese airlines are also now making the most of their location, and the largesse of the state, to offer connections to destinations beyond their home market.

Chinese regulators limit competition on domestic routes, allowing airlines to make healthy profits to cross-subsidise loss-making international routes chosen to reward allies such as Cuba. China's smaller cities also give handouts to airlines (around \$1.3bn in 2016) to launch new long-haul routes from their airports. All this has created more seats than locals can fill. So the carriers are selling them cheap to foreign travellers looking for a long-haul bargain, explains Mr Horton. The Chinese authorities encourage the practice. They are, for example, loosening immigration checks on

connecting travellers and giving some visa-free access to China for six days.

This is hitting regional rivals hardest. Many Asian carriers were struggling long before the threat from Chinese airlines arose. Carriers such as Malaysia Airlines had allowed costs to run out of control, thanks to poor management and political meddling. But since the visa rules changed, even comparatively well-run airlines, such as Cathay Pacific, have had to contend with a sea of red ink. Airlines globally may be enjoying an era of record profitability but earnings per passenger for those in Asia have slumped by a sixth since 2015, according to IATA.

Airlines in America and Europe have less at stake, even if many are already nursing losses on their Chinese operations. But coming on top of competition from low-cost rivals and the Gulf carriers, the arrival of the Chinese acts as another spur to calls for protectionism. America's three biggest carriers want the "open-skies" agreements that enable the Gulf carriers to fly to America revoked. In Europe, Air France-KLM and Lufthansa have been lobbying for a proposed reform of Regulation 868, which would allow the EU to impose sanctions on foreign airlines that get state subsidies.

These tactics will not work on China, warns Andrew Charlton of Aviation Advocacy, a consultancy. Unlike the Gulf states, China is an emerging superpower. It has the power to hit competitors where it hurts. Last June it fined Emirates 29,000 yuan (\$4,270) and banned it from expanding in China for six months on trumped-up charges over safety lapses. A trade war over flying rights will hit the West harder than China, which is fast becoming a sizeable exporter of tourists.

Foreign airlines may yet get some respite. The growth in international passengers on Chinese carriers is already slowing, from a breakneck pace of 33% in 2015 to a merely rapid 12% forecast for this year. Many politicians are starting to ask whether some of the subsidies are value for money. And

Chinese regulators are belatedly liberalising the domestic market by giving up their control of fares, potentially leaving carriers with less spare cash to subsidise foreign operations. Some smaller airlines are already hitting financial trouble. Hainan Airlines, the country's fourth-largest carrier, looks wobbly and its owner, HNA Group, is struggling to pay creditors.

And foreigners have ways to fight back. Qantas and Singapore Airlines, for example, are keen to use ultra-haul-long direct flights to attract business travellers keen not to have a layover. The take-off of Chinese airlines looks unstoppable. That does not make them invincible. ■



中国航企

开始登机

中国航空公司正成为世界航空业的新势力

对中国航空公司的雄心壮志有所怀疑的人，只消看看北京大兴国际机场的规划。该机场将于2019年下半年投用，届时无疑将是世界最大的机场：八条跑道，年旅客吞吐量可达一亿人次。建造这座新机场是为了满足航空旅行快速增长的需求。穿梭于它那巨穴般的机场大厅内的客流将主要由中国三大航空公司消化。这些公司目前都发展迅猛。这导致各地的竞争对手纷纷抱怨自民航服务开启以来推动了航空公司发展的各类补贴。

前些年，阿联酋航空、阿提哈德航空及卡塔尔航空凭借低廉的票价和卓越的服务，成功为它们地处欧亚结合部的便捷的海湾枢纽机场吸引到大批旅客。目前中国航空公司旅客激增的速度是自那时以来未见的。2010年至2017年间，中国三大航空公司的旅客量增加了70%，达到3.39亿（见图表）。财务业绩随之一路攀升。3月底，南方航空（亚洲最大的航空公司）和中国东方航空双双录得破纪录的年度盈利。中国国航在宣布只取得了自2011年以来的最佳盈利后股价下跌。

中国航空公司扩张之际，它们那些在过去十年间旅客年增长超过10%的海湾对手势头开始减退。扩张的放缓严重冲击了盈利，卡塔尔航空更是出现了收缩。咨询机构亚太航空中心（CAPA）的威尔·霍顿（Will Horton）表示，人们很自然地会认为中国航空公司将赶超其海湾同行。海湾航空公司依赖在枢纽机场中转的长途旅客，而中国航空公司立足于快速增长的本地需求之上，基础更为稳固。去年民航运输量达到5.49亿人次，而2007年为1.84亿人次。行业组织国际航空运输协会（IATA）预计，到2022年中国将超越美国成为世界最大的航空市场，而且会继续扩张，到2036年总旅客量将达到15亿人次。

这一增长大部分来自国际航线。过去十年间，中国大陆的航空公司新开辟

了100多条长途航线。这些航班主要是为满足国人增长迅猛的出国游需求。这十年中，出国游客（主要搭乘飞机）数量激增，从每年4100万人次上升至超过1.3亿人次。结果就是中国航企正在吞噬市场份额，贝恩咨询公司的戴夫·艾默生（Dave Emerson）说。据航空数据公司OAG的估算，2011年至2017年期间，中美航线上中国班机的运力占比从37%上升到了61%。

然而，争夺飞往全球各地的中国旅客并非世界其他大型国际航空公司最关心的问题。海湾航空公司吸引全球旅客经由其枢纽机场转机，借此抢夺了欧美航空公司的生意。中国的航空公司现在也在充分利用自己的地理位置和政府补助，为本国市场以外的目的地提供转机服务。

中国的监管机构限制国内航线竞争，让航空公司获得稳健的利润，以交叉补贴为回馈古巴等盟国而亏损的国际航线。中国一些小城市也会向航空公司提供补贴（2016年约为13亿美元），让它们推出从这些城市的机场始发的长途航线。这些举措令飞机座位数量增加，超过了本地旅客的需求。所以航空公司会把座位低价出售给寻求廉价长途机票的外国旅客，霍顿解释道。中国有关部门也鼓励这种做法，例如，它们开始放松对转机旅客的出入境审查，并对部分旅客实施六天过境免签政策。

这对亚洲的竞争对手冲击最大。在中国航空公司进逼前，亚洲的许多航空公司已苦苦挣扎多时。管理不善及政治干预导致马航等航空公司成本失控。而自签证政策更改后，连国泰航空等相对经营有方的航空公司也不得不面对满目亏损。据IATA统计，全球范围来看，航空公司也许正经历创纪录的盈利时代，但亚洲航空公司的每位旅客平均收益自2015年以来已下滑了六分之一。

尽管许多欧美航空公司在中国的经营已渐现亏损，但它们受到的威胁相对较少。然而，在已经承受来自廉价航空和海湾航空公司竞争的情况下，中国航空公司的崛起成为了又一个激发保护主义的因素。美国三大航空公司希望撤销美国的“开放天空”协议，限制海湾航空公司对美航线。在欧洲，法航-荷航集团及汉莎航空一直在游说修改“868条例”，使欧盟可以对获得

国家补贴的外国航空公司实施制裁。

这些措施对中国没什么用，咨询公司航空倡议（Aviation Advocacy）的安德鲁·查尔顿（Andrew Charlton）提醒道。有别于海湾国家，中国是新兴超级大国，有能力在反击竞争对手时直击要害。去年6月，中国监管机构以莫须有的安全事件为由，向阿联酋航空罚款29,000元（4270美元），且六个月内禁止在中国扩展业务。就航权展开贸易战的话，西方所受的打击将甚于中国，毕竟中国正迅速成为游客出口大国。

但外国航空公司也许仍有喘息的机会。中国航空公司的国际旅客增长速度已经放缓，从2015年的“猛增”33%降至今年预期只能算“快速”的12%。许多政客开始质疑给予航空公司的某些补贴是否值得。而中国的监管机构也终于放开国内市场，放弃票价管制，这可能导致航空公司用于补贴海外航线的闲置资金减少。一些规模较小的航空公司已出现财务困难。中国第四大航空公司海南航空目前显得有点步履不稳，其母公司海航集团正面临偿债难关。

而且外国同行也有反击之道。例如，澳洲航空和新加坡航空都热衷利用超长途直达航班来吸引不喜欢中转停留的商务旅客。中国航空公司的“起飞”看来势不可挡，但不足以使其立于不败之地。■



US-China trade

Drawing the battle lines

The nature of America's gripes with China makes a deal hard to imagine

AFTER weeks spent threatening tariffs on an ever-greater share of Chinese imports, President Donald Trump seems to be in a more conciliatory mood. On April 10th a speech by the Chinese president, Xi Jinping, prompted him to tweet a prediction: “We will make great progress together!”

Many besides Mr Trump share that hope. If China offers him a deal that he is willing to sign, a trade war may still be averted. Or sense may prevail, as it did last month, when American allies such as Canada and Mexico were exempted from tariffs on steel and aluminium. But such optimism shades into naivety. China hawks in the American administration have long seethed over aspects of the relationship with China that rarely feature on Mr Trump’s Twitter feed. Those problems predate his presidency. And they do not look easy to resolve.

The rules-based system of international trade works best for problems that are clearly defined, and when it is easy to judge the success or failure of a remedy. Tariffs, and laws that discriminate against foreign firms, are classic examples. Some of the Trump administration’s gripes with China, published in a 182-page report on March 22nd, fall into this category. (The report was the result of an investigation into China’s trade practices under Section 301 of the Trade Act of 1974, which grants the right to threaten tariffs if unfair practices are uncovered.)

For example, it claims that Chinese law discriminates against American companies by undermining their freedom of contract in several ways. Chinese firms can negotiate with each other over the terms of technology-

licensing agreements, but foreign licensees must bear all the risk of others suing for intellectual-property infringements. Joint ventures must grant the Chinese partner the right to use the foreign partner's technology even after their agreement has expired. Such complaints will be considered by the World Trade Organisation (WTO) and judged against the commitments China made when it joined in 2001.

But resolving America's other gripes will be harder—whether in the WTO or as part of a bilateral deal. Some are not to do with China's written laws, but with its unwritten rules and informal procedures. Upon joining the WTO (and a further eight times since 2010) China's government pledged not to make handing over technology a condition for market access. But the Americans say Chinese officials continue to pressure firms to do so.

Such a claim is hard to prove—all the more so, given the opacity of China's regulatory processes. And experience suggests that any deal would be devilishly difficult to enforce. The Chinese authorities can say that contracts involving technology transfer were signed voluntarily. They can make life hard for any foreign company that dares say otherwise. Robert Atkinson of the Information Technology and Innovation Foundation, an American think-tank, accuses the Chinese of playing rope-a-dope, allowing the American administration to exhaust itself in ultimately futile complaints. He thinks that it should give up on the rules and focus instead on results, for example by arranging for American firms to inform it “off the record” of Chinese infractions. But any such flexible, unclear arrangement would be fiercely resisted by the Chinese.

Half of the Section 301 report concerns Chinese investment in America. The Americans take issue with Chinese firms' acquisitions of American ones, such as Lexmark, a printing company, in 2016, and Mattson Technology, which produces equipment for making semiconductors, in 2015. In both

cases the purchase price was well above market value. The Chinese maintain that these were fair transactions on the free market; the Americans suspect that they were directed and supported by the Chinese government in a bid to dominate strategic sectors. Any mutual agreement to curb such purchases would have to outline a legitimate role for the state. But China's model of state-directed capitalism makes it hard to distinguish between public and private affairs.

At the heart of the disagreement is China's industrial policy. The Americans suspect the Chinese government of enticing their firms with the promise of a vast consumer market, only to use regulatory pressure to strip them of their bargaining power and expose them to the theft of intellectual property by forcing them into joint ventures. They spy a plot to undercut and eventually surpass American industry.

The Section 301 report relays the story of SolarWorld, a maker of solar panels that claims its trade secrets were stolen. The result was that cheap Chinese competitors flooded the market, costing it more than \$120m in sales and revenue. The Americans worry that unless the Chinese government changes its ways, other American industries will soon lose out to China, too.

But what the Americans see as unfair the Chinese see as the path to development. From their point of view, bringing in American firms is a roaring success. A study analysing joint ventures in China in 1998-2007 found that they boosted both the Chinese partner and the industry in which it was active. Ventures with American firms were more fruitful than those with firms from Hong Kong or Japan.

During his speech on April 10th, Mr Xi repeated old promises to cut tariffs and relax investment restrictions in some sectors. The American vision is of more sweeping change. According to Bloomberg, a news service, secret bilateral talks broke down after the Americans demanded an end to Chinese

subsidies for high-tech industries. It is hard to imagine a deal that reconciles these fundamental differences. That leaves a choice—between an agreement that is shallow and fragile, or conflict. ■



中美贸易

拉开战线

从美国对中国种种不满的特性来看，协议很难达成

在连续数周威胁对更多中国进口商品加征关税之后，特朗普的情绪似乎有所缓和。4月10日习近平发表的一则演讲促使特朗普发布推文预测：“我们将共同取得重大进展！”

除了特朗普以外，还有许多人抱有同样的希望。如果中国向特朗普提出一项他愿意签署的协议，贸易战或许仍可避免。理智也有可能占据上风，就像上个月针对钢铁和铝的关税政策给了加拿大和墨西哥等美国盟友豁免待遇那样。但这种乐观会渐渐变成天真。美国政府中的对华鹰派对中美关系的方方面面积怨已久，而这些很少出现在特朗普的推文里。这些问题在他就任总统之前就已存在，而且看起来并不容易解决。

基于规则的国际贸易体系最适于解决界定明确、且容易判断某种解决办法是成是败的问题。关税以及歧视外国公司的法律都是典型的例子。特朗普政府中部分人士对中国的不满也属于这类，这些不满以一份182页报告的形式于3月22日发布。（该报告是根据《1974年贸易法》第301条对中国贸易行为进行调查的结果，依照该条款，如果发现有不公平的做法，美国政府有权威胁征收关税。）

例如，报告称中国的法律以几种方式侵害了美国公司的合同自由，对它们构成了歧视。中国的企业彼此间可以就技术许可协议的条款谈判，但外国的被许可方必须承担被他人起诉侵犯知识产权的所有风险。合资企业必须给予中方使用外方技术的权利，即便双方协议到期，这一条仍然有效。世界贸易组织（WTO）会仔细考量此类投诉，并根据中国2001年加入世贸组织时做出的承诺进行评判。

但是美国的其他抱怨解决起来要更困难，无论是在WTO的机制下还是作为

双边协议的一部分。有些不满无关中国的成文法律，而是与一些不成文规定和非正式程序有关。中国政府在刚加入WTO时承诺不会将技术转让作为市场准入的条件（自2010年以来又承诺过八次）。但美国人说，中国官员持续向企业施压，要求它们这样做。

这样的说法很难证实，在中国监管程序不透明的情况下就更是如此。经验也表明，任何协议执行起来都会极其困难。中国当局可以说涉及技术转让的合同是企业自愿签订的。它们也能让任何敢发出不同声音的外国公司日子不好过。美国智库信息技术与创新基金会（Information Technology and Innovation Foundation）的罗伯特·阿特金森（Robert Atkinson）指责中国以逸待劳，让美国政府在到头来徒劳无功的投诉中耗尽精力。他认为美国政府应该放弃寄希望于规则，转而关注结果，例如安排美国公司私底下告知自己中国的违规行为。但任何这类灵活、不明确的安排都会遭到中国人的强烈抵制。

301条款报告中有一半的内容是关于中国在美国的投资。美国人对中国公司收购美国公司持有异议，例如2016年收购打印公司利盟（Lexmark），2015年收购半导体生产设备制造商Mattson Technology。这两笔交易的收购价格都远高于市场价值。中国人坚称两者都是自由市场上的公平交易；美国人则怀疑是中国政府主导和支持了这两笔交易，目的是要主导战略性产业。任何限制此类收购的共同协议将必须确定政府的合法作用。但中国采取的是国家主导的资本主义模式，这让公共事务和私人事务很难区分开来。

分歧的核心是中国的产业政策。美国人怀疑，中国政府以一个巨大的消费市场为大饼引诱美国公司，结果却利用监管压力剥夺这些公司的谈判能力，还迫使它们成立合资企业，导致其知识产权遭窃。美国人发现了一个图谋削价竞争并最终超越美国产业的阴谋。

301条款报告转述了太阳能电池板制造商SolarWorld的故事。该公司称自己的商业机密被盗，结果就是中国竞争对手的廉价产品充斥市场，致使SolarWorld的销售和收入损失超过1.2亿美元。美国人担心，除非中国政府

改变做法，否则其他美国产业也会很快输给中国。

但是，美国人认为的不公平在中国人眼中却是发展的途径。在他们看来，引入美国公司是一个巨大的成功。一项对1998年至2007年中国合资企业的研究发现，中方及其所在的行业都因合资企业得到了提升。与和香港或日本公司合作相比，与美国公司成立合资企业更富成效。

在10日的演讲里，习近平重申了在某些行业削减关税、放宽投资限制的旧有承诺。美国期望的是更彻底的变革。彭博消息称，在美国要求中国停止补贴高科技产业后，秘密的双边会谈破裂。很难想象有什么协议能调和这些根本分歧。结果就只能是二选一：要么是一个既肤浅又脆弱的协议，要么是冲突。 ■



Schumpeter

Getting a handle on a scandal

Corporate crises drive the media and politicians wild. But do they damage shareholder value?

A POPULAR riff doing the rounds in tech circles is that, if data are the new oil, then Facebook's Cambridge Analytica fiasco is the equivalent of Deepwater Horizon. That was the name of an oil platform that exploded in April 2010, coating the Gulf of Mexico and the reputation of BP, the firm responsible, in a toxic slick.

Yet just how damaging are "Deepwater" incidents for firms and their owners over time? Perhaps they cease to matter after the initial burst of media purgatory, grovelling by executives, celebratory cant from competitors and politicians' grandstanding.

To answer this, Schumpeter has looked at eight of the most notable corporate crises since 2010, including those at Uber and Wells Fargo. The evidence shows that these episodes were deeply injurious to the companies' financial health, with the median firm losing 30% of its value since its crisis, when compared with a basket of its peers. Facebook should beware.

When a scandal first breaks, executives at the top of a firm and securities analysts outside it are often myopic, viewing it as a public-relations blip that will not alter a firm's operations or its competitive position. In the case of Facebook, 44 of the 48 Wall Street analysts who cover it still rate it a "buy", according to Bloomberg. Many have downplayed the scandal, even though Facebook's shares have dropped by 18% since the news broke on March 17th.

Of course, speculators and the media do frequently overreact to bad news. Credit Suisse, a bank, analysed 5,400 instances of American firms' shares

dropping by over 10% in one day, between 1990 and 2014. On average the shares regained two-thirds of the lost value within the subsequent 90 days. But big corporate scandals are in a different league. They capture the public imagination and lead to heat from politicians and regulators. Infrequent and idiosyncratic, they defy easy analysis.

Consider two infamies from the 1980s. In 1982 Johnson & Johnson had to withdraw 31m bottles of the painkiller Tylenol from shops after seven people were poisoned in Chicago. Seven years later, the *Exxon Valdez*, a ship run by Exxon, struck a reef in Alaska's Prince William Sound and spilled 11m gallons of oil. Yet both firms' share prices recovered within a few weeks, and today they remain among the world's most valuable companies.

Since the 2008-09 financial crisis, plenty has changed. Social media mean that news of scandals spreads faster than ever and often in an exaggerated fashion. But consolidation has muted competition in many industries and made firms bigger and more resilient. Western governments may be willing to protect or bail out big firms, not just banks, because they worry about job losses.

The eight firms in the sample have all been seared by scandal. All were large before their calamity, with a market value of at least \$15bn. Their problems were different, but all led to a media scrum and prompted politicians and regulators to intervene. In all but one case, the firm's boss left as a result. The figures measure returns in dollars, including dividends (for Uber, reports of private market valuations are used).

As well as BP, the infamous eight include another energy firm, Petrobras, a Brazilian giant at the centre of the "car-wash" corruption scandal that erupted in 2014. Two firms beginning with "V" are included for their antics in 2015: Volkswagen, which admitted fiddling emissions tests, and Valeant, a drugs firm accused of price gouging and publishing inaccurate accounts.

Wells Fargo is included for a mis-selling scandal that blew up in 2016, as is Uber, where the wheels came off in 2017. The last two firms are Equifax, a credit bureau which last year said hackers had gained access to data on 143m clients, and United Airlines, which set new lows for airline conduct when it asked security staff to remove a passenger from an overbooked flight, who was injured in the process.

After their crises struck all these firms suffered an absolute drop in their share prices. At the lowest point the median share price was down by 33%, although it took anywhere from two weeks to two years for different firms to reach this nadir. In most cases the companies have clawed back the absolute losses they suffered. However, what matters is their relative performance compared with a basket of industry peers over the same time period. On this basis the median firm is worth 30% less today than it would have been had the scandals not happened. For the eight the total forfeited value is a chunky \$30bn.

Fines and legal costs explain only a small part of this. A big scandal distracts management, leads to other kinds of painful regulatory scrutiny and, if a firm has a stretched balance-sheet, forces it to shrink. BP has spent years trimming its budgets while its longtime rival, Shell, stole a march on it by buying BG, a gas firm. Wells Fargo faces a cap on its size imposed by the Federal Reserve. Equifax may become more heavily regulated. Uber has lost market share to a reinvigorated domestic competitor, Lyft.

Two firms out of the eight come out relatively well. For Petrobras, the explanation is that its share price had already sunk before the car-wash affair began in earnest, reflecting cost overruns that were an augury of the epic mismanagement that the scandal revealed. Volkswagen is the only standout. It got hit by a huge \$30bn bill for fines, product recalls and legal costs for “dieselgate”, but reacted to its crisis by putting in place an efficiency drive and a big bet on new car models. Even so, it and the other six

listed firms in the sample are valued on low multiples of profits compared with their peers, suggesting that investors remain nervous.

The aftermath of a scandal is unpredictable. In Facebook's case the absence of established laws and regulations covering social media make it even harder than normal to predict how harsh the backlash will be. Its biggest advantage is its strong balance-sheet, which has \$42bn of net cash. Its weakness is a management team that seems keen to downplay the severity of what has just happened. Recent experience suggests that is a mistake. ■



熊彼特

丑闻处理

企业危机令媒体和政客疯狂，但它们会损害股东价值吗？

科技业界广为流传的一个说法是，假如数据是新的“石油”，那么Facebook在“剑桥分析”那儿栽的大跟头就相当于当年的墨西哥湾漏油事件。名为“深水地平线”（Deepwater Horizon）的石油钻探平台在2010年4月爆炸，泄露的厚厚一层“毒油”覆盖了墨西哥湾海面，也让涉事的英国石油公司蒙羞。

然而随着时间推移，这类“深水”事件对企业及其股东的损害究竟有多大？也许，在最开始的媒体炮轰、高管谦卑道歉、对手幸灾乐祸、政客借题发挥过后，事件的影响就逐渐消弭了。

为回答这个问题，本专栏研究了自2010年以来八宗最受瞩目的企业危机，包括优步和富国银行的丑闻。证据表明，这些事件严重影响了涉事企业的财务健康。与同行相比，危机发生后这些公司的中位数市值损失为30%。Facebook要当心了。

丑闻爆发之初，公司高管和外部证券分析师们往往目光短浅，觉得这只是个公关小插曲，不会影响公司的运营或竞争地位。据彭博报道，针对Facebook事件，48名华尔街分析师中仍有44人将其评级定为“买入”。许多人对此丑闻不以为意，尽管自3月17日消息曝光以来，Facebook的股价已跌去18%。

当然，投机者和媒体往往对坏消息反应过度。瑞信银行分析了1990年至2014年期间美国企业5400次股价在一天内下跌超过10%的情况。平均来说，这些企业在之后的90天内恢复了三分之二的损失价值。但大公司丑闻却另当别论。它们备受公众揣测，引来政客和监管机构关注。这类事件相对少见又特殊，分析起来颇具难度。

以上世纪80年代的两宗丑闻为例。1982年，芝加哥有七人服用强生公司生产的止痛药泰诺后中毒，强生公司不得不召回3100万瓶泰诺。七年后，由埃克森美孚公司运营的埃克森-瓦尔迪兹号油轮（Exxon Valdez）在阿拉斯加的威廉王子湾（Prince William Sound）触礁并溢出1100万加仑石油。然而，这两家公司的股价在几周内就收复失地，而且它们至今仍位列全球最高市值企业的行列。

自2008年至2009年金融危机爆发以来，许多事情已经发生改变。社交媒体的盛行让丑闻的传播速度比以往任何时候都更快，且往往被添油加醋。但企业合并令许多行业的竞争减弱，公司规模更大，也更有复原力。西方政府因为担心失业的问题，可能也愿意为银行之外的大公司提供保护或纾困措施。

本研究涉及的八家公司都受到丑闻拖累。在“灾难”爆发前，它们都是市值不低于150亿美元的大企业。虽然问题各不相同，但都引来媒体争相报道，促使政客和监管机构插手干预。其中七家公司均以总裁辞职收场。相关数据以美元计算回报，包括股息（有关优步的数据来自对私人市场估值的报道）。

除了英国石油公司外，这八家蒙羞的公司中另外还有一家能源企业——巴西的巨头企业巴西石油（Petrobras），它在2014年的“洗车”贪腐丑闻中成为众矢之的。两家名字以字母“V”开头的公司因为2015年爆出的不当行径位列其中：大众汽车（Volkswagen）和瓦伦特制药（Valeant）。前者承认排放测试造假，后者被指控哄抬药价和发布虚假财务信息。富国银行则是在2016年被爆出违规销售的丑闻。优步也因违规操作在2017年遭遇滑铁卢。剩下的两家公司是征信公司Equifax和美国联合航空公司（United Airlines），前者在去年披露自己的1.43亿客户资料被黑客窃取，后者则因超售机票并动用安保人员把一位乘客强行拖下飞机致其受伤，刷新了航空业操守下限。

危机袭来后，所有这些公司的股价均出现绝对下跌。股价中位数最多下降了33%，但滑落的速度不一，跌至低点所经历的时间从两周至两年不等。

在大部分情况下，这些公司最后都能收复绝对损失。然而，重要的是在同一时期它们相对于同业公司的表现。以此来衡量，中位数公司的市值相比假设未发生丑闻的情况下要低30%。八家公司损失的总价值高达3000亿美元。

罚款和法律支出只造成了损失的一小部分。大型丑闻会分散管理层的注意力，招致其他方面的严厉监管审查。如果涉事公司的资产负债表情况不妙，丑闻还会迫使它收缩资产规模。英国石油公司多年来一直在削减预算，而其老对手壳牌趁机抢先收购了英国天然气集团（BG）。富国银行面临美联储施加的资产规模限制。Equifax则可能受到更严格的监管。优步的市场份额有一部分已被再获融资的国内竞争对手Lyft夺取。

八家公司中有两家的情况相对较好。巴西石油在“洗车”事件被炒得沸沸扬扬之前，已经因为成本超支的问题（预示了后来丑闻揭露出的严重管理不善）而导致股价下跌。大众汽车在这些公司中一枝独秀。这家公司因“柴油门”上缴的罚金加上产品召回及法律费用，损失高达300亿美元，但通过实施效率驱动方案，并大力研发新车型，顺利渡过了危机。即便如此，大众与其他六家上市公司的利润乘数也还是低于同行水平，表明投资者仍放不下心。

一桩丑闻的后果是不可预测的。对于此次Facebook泄密事件，由于有关社交媒体的法律法规并不完备，要预测后果的严重性比一般情况还要更难。Facebook的最大优势是它那强大的资产负债表，其中净现金达420亿美元。它的弱点是管理团队似乎对事件的严重性一味轻描淡写。最近的经验表明这是错误之举。 ■



India's economy

Chugging along

India's economy is back on track. Can it pick up speed?

IT IS easy to be awed by the Indian railway network. The 23m passengers it carries daily travel, in total, over ten times the distance to the sun and back. It is just as easy to find it unimpressive. Delays are frequent and trains antiquated. It takes 14 hours to get from India's capital, Delhi, to its commercial hub, Mumbai. The equivalent trip in China—from Beijing to Shanghai, a similar distance—takes just over four hours.

Similarly, India's economy can be seen in two lights. Its long-term growth rate of 7% a year has proved far more dependable than the rail timetable. GDP has doubled twice in the past two decades. Yet deep poverty still lingers and jobs are scarce. And Indian growth has been left in the dust by the Chinese express (see chart).

After slow running for much of 2017, India is now near to full throttle. Growth of 7.2% in the three months to December put it ahead of China (which grew at a relatively leisurely 6.8%) and made it once again the world's fastest-expanding big economy. Expectations for the rest of 2018 are similar.

Fans of Narendra Modi, India's prime minister, credit structural reforms he has made over the past four years. The more plausible explanation is that Indian growth has returned to trend after a bout of political meddling. “Demonetisation” in late 2016, when most banknotes ceased to be legal tender overnight, squeezed growth to 5.7% in the first half of last year. New notes were printed, but last July, even as life was returning to normal, a new goods and services tax replaced hundreds of local and nationwide taxes,

once again throwing the economy into confusion.

At least the tax overhaul, which knits India into a single market for the first time, will eventually increase growth. Boosters speak of annual GDP gains of 8-10% in the years ahead. That would not be far short of China in its boom years.

Renewed economic vim would be welcomed by the government in the run-up to elections due by early 2019. Even at 7% growth, too few jobs are created to absorb roughly 1m new entrants into the workforce every month. More than 20m people recently applied for 100,000 railway jobs, as train drivers, technicians and porters. A third of 15- to 29-year-olds are not in school, training or jobs. Mr Modi's opponents have found that the theme of scarce employment opportunities has played well with voters. Faster expansion would help.

But predictions of Chinese-style growth seem over-optimistic in the absence of deeper economic reforms. Doing business in India has become easier in some ways, such as getting permits or bringing in foreign capital. But the labour market is as gummed up as ever. Private businesses find securing land for new factories near-impossible. Whole swathes of the economy, from coal and steel to banking and condom-making, remain at least partly under state control.

The hangover from a bout of over-exuberance dating from before the global financial crisis has left companies financially stretched and with enough production capacity to be able to delay capital expenditure. A few sectors are now contemplating investment—only to find that banks may be unable to provide finance. Loans written off or considered likely to turn sour are near a fifth of the loan book at state-owned lenders, which have about 70% of market share. The resulting losses have left banks short of capital for

fresh loans, though a planned bail-out and new bankruptcy code should, belatedly, help clear up the mess. Worse, a recently discovered fraud at a state lender, where rogue employees allegedly facilitated \$2bn of loans to a diamond merchant who is now nowhere to be found, has highlighted their weak governance.

Early in Mr Modi's premiership growth was helped by the tumbling price of oil, which India imports in vast quantities. But the price of crude, which fell from \$110 to \$30 a barrel during his first two years, has since rebounded to \$65. Any higher and some familiar problems, namely current-account deficits, budget shortfalls and high inflation, will make an unwelcome return. Yields on Indian government bonds have risen from 6.4% last summer to around 7.5%, indicating some increase in investor concern.

Although India's growth has depended less than, say, China's on exports, it has benefited from a buoyant global economy and an open trade environment. The latter may be changing. Indian IT firms are facing restrictions on their employees working in America, challenging their business model. And India itself has taken a protectionist turn, recently imposing tariffs on a wide range of products, from mobile phones to perfume, in an ill-conceived bid to encourage domestic production.

"India is a country that disappoints both optimists and pessimists," notes Ruchir Sharma of Morgan Stanley, a bank. Naysayers who expected political meddling to hit the economy hard underestimated its resilience. Like commuters whose train has finally pulled in, optimists feel their time has come. All aboard? ■



印度经济

缓行稳进

印度经济重回正轨。它能提速吗？

印度铁路网总是让人惊叹。它每天运送2300万乘客，这些乘客的总里程相当于地球和太阳间距离的十多倍。但它同样让人觉得乏善可陈。经常晚点，列车陈旧。从印度首都新德里到商业中心孟买要花14个小时。而在我国，从北京到上海这一对应的行程差不多远，却只需四个多小时。

同样，印度的经济也要一分为二地看。该国7%的长期年增长率比它的铁路时刻表靠谱得多。过去20年里，印度GDP翻了两番。然而，深度贫困挥之不去，工作岗位也很稀缺。而印度的经济增速也远远落后于中国“快车”（见图表）。

在2017年大部分的时间里印度经济运行缓慢，现在却几近全速前进。在截至去年12月的三个月里，印度经济增速达7.2%，超过了中国（增速为相对平缓的6.8%），再次成为全球增长最快的大经济体。市场对其今年剩余大半年的预期也大抵如此。

印度总理莫迪的支持者将这归功于他在过去四年里推行的结构性改革。而更合理的解释是，在一轮行政干预之后，印度的经济增长已经恢复平稳走势。2016年末的“废钞令”让大部分纸币一夜之间不再是法定货币，并将去年上半年的增长率挤压至5.7%。新钞被印刷出来，但去年7月，正当状况开始恢复正常时，一项取代数百项地方和全国性税收的新商品和服务税再次让经济陷入混乱。

无论如何，这场首次统一印度市场的全面税收改革最终将促进经济增长。支持者们说，在未来几年里，GDP年增长率将达到8%至10%。这与中国经济高速增长期的数字相差不大。

2019年初的大选在即，政府自然欢迎经济恢复活力。即便目前增长率为7%，新增的就业岗位还是太少，无法吸纳每月大约100万的新增求职者。最近，有2000多万人申请10万个铁路工作岗位，这些岗位包括火车司机、技工和搬运工等。15到29岁的人群中，有三分之一的人失学、失业或没有接受就业培训。莫迪的竞选对手发现，打“就业机会稀缺”这张牌在选民中效果不错。更快的经济发展对莫迪有利。

然而，在缺乏深层次经济改革的情况下，预测会出现中国式高速增长似乎过于乐观了。在某些方面，在印度做生意已经变得更容易，比如获得许可证或引进外资。但劳动力市场仍一如既往地糟糕。私营企业几乎无法为新工厂找到固定用地。从煤炭、钢铁，到银行甚至安全套制造，整个经济至少在一定程度上仍由国家控制。

起始于全球金融危机前的一波过度繁荣余波未平，企业财务吃紧，产能过剩延误资本支出。一些行业正打算投资，结果却发现银行可能无款可贷。被核销的贷款和疑似不良贷款接近国有银行贷款总额的五分之一，而国有银行约占70%的市场份额。由此造成的损失让银行没有足够的资金发放新贷款。目前计划中的一项紧急救助和新的破产法应该能帮助收拾乱局，但却姗姗来迟。更糟糕的是，最近披露的一桩国有银行欺诈案更加显现了银行治理的薄弱，据称无良的银行职员帮助一名钻石商人获得了20亿美元的贷款，而这名商人现在已无处可寻。

印度石油进口量巨大，石油价格的暴跌促进了莫迪任职之初的经济增长。在他任期的前两年原油价格从每桶110美元跌至每桶30美元，但之后已反弹至65美元。再往上走一点点，一些常见问题都将卷土重来，比如经常账户赤字、预算不足和高通胀等。印度政府债券的收益率从去年夏天的6.4%上涨到7.5%左右，表明投资者的担忧有所增加。

尽管印度的经济增长对出口的依赖低于中国这样的国家，但它受益于向好的全球经济以及开放的贸易环境。然而，后者也许正在发生变化。印度IT公司在美国工作的雇员面临限制，这对他们的商业模式来说是一个挑战。

而印度自己也转向了保护主义，最近对从手机到香水的大范围产品征收关税，试图以此鼓励国内生产，然而此举却不甚明智。

“印度是一个让乐观主义者和悲观主义者都失望的国家。”摩根士丹利的鲁奇尔·夏尔马（Ruchir Sharma）指出。那些认为政治干预会重创经济的消极派低估了印度经济的韧性。而乐天派则像那些终于等到火车进站的通勤者，认为自己的时代已经到来。问题是，每个人都上得了车吗?■



Economics degrees

Name game

Luring students with a new label

ECONOMISTS do not much like their discipline being dubbed the dismal science. Some American universities are paying more attention to the noun than to the adjective. The reason is not philosophical, but pragmatic. Foreign STEM graduates (the acronym stands for science, technology, engineering and mathematics) can get visa extensions for three years of practical training (ie, work). Those from other disciplines are allowed only a year.

Two more years working in America means more earnings. It also means a better chance of finding an employer willing to sponsor an application for an H-1B visa, the main starting-point for skilled foreign workers who hope to settle permanently. In 2012 the Department of Homeland Security expanded the list of STEM courses. Now any reasonably crunchy economics degree can count as STEM with a tweak to its federal classification code, from economics (45.0601) to econometrics and quantitative economics (45.0603).

Economics departments appear to be catching on. Yale and Columbia have both changed the code for their economics major in the past few months; five of the eight Ivy League Universities have now done so. Students at Pennsylvania and Cornell are agitating for a switch.

Universities are doubtless acting in response to increased demand for H-1B visas. Just 65,000 are awarded by lottery each year to holders of bachelor's degrees. Their chance of success has been at best 30% in recent years. In 2011 the 65,000 visa cap was hit only in November. In 2017 it was hit on April

7th, within a week of applications opening. Whether students are being taught economics or econometrics, they are getting a fine worked example in regulatory arbitrage. ■



经济学学位

名称游戏

新瓶旧酒吸引学生

经济学家不太喜欢人们将他们的学科唤作“沉闷的科学”。一些美国大学现在把注意力更多地放在这个名称的名词而非形容词上。其中原因并非哲学上的，而是实用性的。STEM专业（科学、技术、工程和数学的缩写）的留学生毕业后签证可延长三年以参加实践训练（即工作），其他专业的学生只有一年。

可以在美国多工作两年意味着更多的收入，也意味着更有机会找到愿意资助自己申请H-1B签证的雇主——这种签证是希望在美永久居留的外国技术型工人的主要起点。2012年，美国国土安全局扩展了STEM专业的清单。现在，任何用到正常程度的数学和统计方法的经济学学位都可以算作STEM专业，只要稍微改动一下联邦的学科分类代码，从经济学（45.0601）改成计量经济学和数量经济学（45.0603）就可以了。

经济专业院系貌似也都行动了起来。过去几个月里，耶鲁大学和哥伦比亚大学都改变了其经济学专业的代码；八所常春藤盟校中有五所都已经做了更改。宾夕法尼亚大学和康奈尔大学的学生正在焦急地期盼他们的学校做出同样的改变。

大学这样做无疑是面对H-1B签证需求增长的一种对策。每年获得学士学位的毕业生只能通过抽签争夺6.5万个签证，近年来他们被抽中的概率顶多只有30%。2011年时6.5万个签证到11月才发放完毕，而去年到4月7日也就是申请开放才一周就已满额。无论学生们学的经济学还是计量经济学，他们都学到了一个很好的监管套利的范例。■



Global health

Within reach

The case for universal health care is a powerful one—including in poor countries

BY MANY measures the world has never been in better health. Since 2000 the number of children who die before they are five has fallen by almost half, to 5.6m. Life expectancy has reached 71, a gain of five years. More children than ever are vaccinated. Malaria, TB and HIV/AIDS are in retreat.

Yet the gap between this progress and the still greater potential that medicine offers has perhaps never been wider. At least half the world is without access to what the World Health Organisation deems essential, including antenatal care, insecticide-treated bednets, screening for cervical cancer and vaccinations against diphtheria, tetanus and whooping cough. Safe, basic surgery is out of reach for 5bn people.

Those who can get to see a doctor often pay a crippling price. More than 800m people spend over 10% of their annual household income on medical expenses; nearly 180m spend over 25%. The quality of what they get in return is often woeful. In studies of consultations in rural Indian and Chinese clinics, just 12-26% of patients received a correct diagnosis.

That is a terrible waste. The goal of universal basic health care is sensible, affordable and practical, even in poor countries. Without it, the potential of modern medicine will be squandered.

Universal basic health care is sensible in the way that, say, universal basic education is sensible—because it yields benefits to society as well as to individuals. In some quarters the very idea leads to a dangerous elevation of the blood pressure, because it suggests paternalism, coercion or worse. There is no hiding that public health-insurance schemes require the rich

to subsidise the poor, the young to subsidise the old and the healthy to underwrite the sick. And universal schemes must have a way of forcing people to pay, through taxes, say, or by mandating that they buy insurance.

But there is a principled, liberal case for universal health care. Good health is something everyone can reasonably be assumed to want in order to realise their full individual potential. Universal care is a way of providing it that is pro-growth. The costs of inaccessible, expensive and abject treatment are enormous. The sick struggle to get an education or to be productive at work. Land cannot be developed if it is full of disease-carrying parasites. According to several studies, confidence about health makes people more likely to set up their own businesses.

Universal basic health care is also affordable. A country need not wait to be rich before it can have comprehensive, if rudimentary, treatment. Health care is a labour-intensive industry, and community health workers, paid relatively little compared with doctors and nurses, can make a big difference in poor countries. There is also already a lot of spending on health in poor countries, but it is often inefficient. In India and Nigeria, for example, more than 60% of health spending is through out-of-pocket payments. More services could be provided if that money—and the risk of falling ill—were pooled.

The evidence for the feasibility of universal health care goes beyond theories jotted on the back of prescription pads. It is supported by several pioneering examples. Chile and Costa Rica spend about an eighth of what America does per person on health and have similar life expectancies. Thailand spends \$220 per person a year on health, and yet has outcomes nearly as good as in the OECD. Its rate of deaths related to pregnancy, for example, is just over half that of African-American mothers. Rwanda has introduced ultrabasic health insurance for more than 90% of its people; infant mortality has fallen from 120 per 1,000 live births in 2000 to under 30

last year.

And universal health care is practical. It is a way to prevent free-riders from passing on the costs of not being covered to others, for example by clogging up emergency rooms or by spreading contagious diseases. It does not have to mean big government. Private insurers and providers can still play an important role.

Indeed such a practical approach is just what the low-cost revolution needs. Take, for instance, the design of health-insurance schemes. Many countries start by making a small group of people eligible for a large number of benefits, in the expectation that other groups will be added later. (Civil servants are, mysteriously, common beneficiaries.) This is not only unfair and inefficient, but also risks creating a constituency opposed to extending insurance to others. The better option is to cover as many people as possible, even if the services available are sparse, as under Mexico's Seguro Popular scheme.

Small amounts of spending can go a long way. Research led by Dean Jamison, a health economist, has identified over 200 effective interventions, including immunisations and neglected procedures such as basic surgery. In total, these would cost poor countries about an extra \$1 per week per person and cut the number of premature deaths there by more than a quarter. Around half that funding would go to primary health centres, not city hospitals, which today receive more than their fair share of the money.

Consider, too, the \$37bn spent each year on health aid. Since 2000, this has helped save millions from infectious diseases. But international health organisations can distort domestic institutions, for example by setting up parallel programmes or by diverting health workers into pet projects. A better approach, seen in Rwanda, is when programmes targeting a particular

disease bring broader benefits. One example is the way that the Global Fund to Fight AIDS, Tuberculosis and Malaria finances community health workers who treat patients with HIV but also those with other diseases.

Europeans have long wondered why the United States shuns the efficiencies and health gains from universal care, but its potential in developing countries is less understood. So long as half the world goes without essential treatment, the fruits of centuries of medical science will be wasted. Universal basic health care can help realise its promise. ■



全球医疗

力所能及

实施全民医保的理由是强有力的一一包括在贫穷国家

从许多方面来看，世界从没像现在这样健康。自2000年以来，5岁之前夭折的儿童数量下降了近一半，至560万。人们的预期寿命提高了5岁，达到71岁。接种疫苗的儿童比以往任何时候都多。疟疾、肺结核和艾滋病正节节败退。

不过，取得的进步与医疗具有的潜力之间的差距却可能是前所未有的大。世界上至少有一半的人无法获得世界卫生组织认定的最基本的医疗服务，包括产前保健、经杀虫剂处理过的蚊帐、宫颈癌筛查，以及预防白喉、破伤风及百日咳的疫苗。有50亿人得不到安全的基本外科手术治疗。

那些能得到医疗服务的人往往要支付高昂的费用。超过八亿人将家庭年收入的10%以上用于看病；近1.8亿人的这一比例超过25%。而他们得到的医疗服务质量往往很糟糕。对印度和中国农村诊所的问诊研究表明，只有12%到26%的患者得到了正确的诊断。

这是严重的浪费。实现全民基本医疗保健这一目标合理、可负担，也切实可行，即使在贫穷国家也是如此。没有全民医保，现代医学的潜力会被浪费掉。

打个比方，全民基础教育是合理的，因为它对个人和社会都有好处。全民基本医疗也是一样的道理。然而对于某些人群，这一主张却会让他们血压飙升，因为这意味着家长式管理、强迫，甚至更糟的事。无可讳言，公共医疗保险计划需要富人补贴穷人，年轻人补贴老人，健康的人补贴病人。全民医保计划必须采取办法迫使人们缴费，比如通过税收，或强制他们购买保险。

但全民医保有一个强原则性的左派的理由：为了充分实现自身潜力，可以

合理假定人人都想要健康的体魄。全民医保可以实现这一点，而且它有利于经济增长。得不到治疗、治疗费用昂贵以及疗效糟糕都会带来巨大的代价。病弱者难以接受教育或有效率地工作。如果土壤中到处是携带疾病的寄生虫，那么土地就无法开发。多项研究表明，对健康有信心的人更有可能创办企业。

全民基本医疗在经济上也可负担。一个国家无需在变得富裕之后再建立基本的全面医疗保障。医疗保健是劳动密集型产业，而报酬低于医生和护士的社区卫生工作者可以在贫穷国家发挥很大的作用。贫穷国家在医疗方面的支出已很可观，但往往很低效。例如，在印度和尼日利亚，超过60%的医疗支出来自患者自付费用。如果将这些钱和患病的风险汇聚起来，就可以提供更多的服务。

全民医保的经济可行性不止是粗略的假设。几个开创性的实例证明这一方案是行得通的。智利和哥斯达黎加的人均医疗支出约是美国的八分之一，但预期寿命却差不多。泰国的人均医疗支出为每年220美元，但效果和经合组织国家相差无几。例如，泰国的孕产妇死亡率只有非裔美国妇女的一半略多。卢旺达为超过90%的国民建立了非常基础的医疗保险，婴儿死亡率已从2000年的千分之一百二十降至去年的千分之三十不到。

全民医保也很实用。它可以防止“搭便车”者把不参保的成本转嫁给参保人群——比如把急诊室挤得水泄不通或是传播传染病。全民医保并不一定意味着“大政府”，私营保险公司和供应商仍然可以发挥重要作用。

实际上，这种实用的做法恰是低成本革命所需要的。以医疗保险计划的设计为例。许多国家先赋予一小群人获得大量福利的资格，期望在稍后扩展至其他人群。(玄妙的是，公务员总是受益者。)这既有失公平又效率低下，还可能催生出反对将保险扩大到其他人的选民群体。更好的选择是覆盖尽可能多的人，即便能提供的服务有限，比如墨西哥的“大众医疗保险”（Seguro Popular）计划那样。

少量的支出大有可为。医疗经济学家迪恩·贾米森（Dean Jamison）领导

的研究发现了200多种有效的干预措施，包括免疫接种和基本手术等受忽视的手段。这些措施总共会让贫穷国家每人每周的支出增加1美元，但能让那里过早死亡的人数减少超过四分之一。这笔增加的资金约一半应当用于初级保健中心而非城市医院——城市医院目前获得的投入超过了它们所应得。

再来看每年用于医疗救助的370亿美元。自2000年以来，它已帮助数百万人免于感染传染病。但国际卫生机构可能会因为设立并行的计划或将卫生工作者分流到它看好的项目中而干扰国内机构的运作。卢旺达实践了一种更好的方式，让针对特定疾病而制定的项目不限于治疗这种疾病本身而能惠及更多人。一个例子就是抗击艾滋病、结核病和疟疾全球基金（The Global Fund to Fight AIDS, Tuberculosis and Malaria）对社区卫生工作者的资助，让他们既能治疗艾滋病患者，也能诊治其他病患。

长久以来，欧洲人一直在琢磨为何美国不接受全民医保对效率及健康的提升，但全民医保在发展中国家的潜力却不太为人了解。只要世界上还有一半的人无法获得必需的治疗，几百年的医学成果就会被浪费。全民基本医疗有助于实现医疗的潜力。 ■



Economic and financial indicators

Renewable energy

New investment in renewable energy globally increased by 2% last year, to \$280bn

New investment in renewable energy globally increased by 2% last year, to \$280bn, still 13% below the record set in 2015. Developing economies accounted for the lion's share of the spending, with China making up 45% of the global total. Most renewables investment in China is in solar power. It installed 53 gigawatts of capacity last year. European investment fell by 36% because of big declines in Britain and Germany. The closure of subsidy programmes helped drive down investment in Britain; Germany was affected by a shift to auctions for onshore wind power. Mexico's renewable-energy sector is booming, partly in response to a government target for 13.9% of power generation to be green by 2022. ■



经济与金融指标

可再生能源

去年，全球可再生能源新增投资为2800亿美元，较前年增加2%

去年，全球可再生能源新增投资为2800亿美元，较前年增加2%，不过仍比2015年创下的最高记录低13%。发展中经济体的投资占比最大，其中中国占据了去年全球可再生能源投资的45%。中国大部分的投资都集中在太阳能，去年新增装机容量53GW。欧洲可再生能源投资下降了36%，原因是英国和德国的投资大幅减少。英国投资减少是因为削减了一些补贴项目，德国则是受陆上风电拍卖的影响。墨西哥可再生能源领域发展迅速，一定程度上是为响应政府设定的到2022年清洁能源发电占比13.9%的目标。 ■



Semiconductor manufacturers

Shifting silicon

TSMC is poised to become the world's most advanced chipmaker

MORRIS CHANG is preparing for retirement. After 30 years in the role, the founder of Taiwan Semiconductor Manufacturing Company (TSMC), the island's largest firm, will step down as chairman in June. He will hand the reins over to the current co-CEOs, C.C. Wei and Mark Liu, the former becoming sole CEO and the latter chairman. Later that month the company will ship new semiconductors manufactured with its latest technology. For the first time the world's most powerful chips will be made by TSMC, not by Intel, its American rival.

Intel and TSMC are different sorts of company. Intel is an integrated device manufacturer (IDM). It both designs and manufactures chips. TSMC is a “foundry”, making chips for designers without factories, or “fabs”, which cost a fortune. TSMC's latest fab will cost \$20bn. The Taiwanese company pioneered this model and is its dominant exponent. In 2017 it had 56% of the foundry market, according to Trendforce.

Intel led the pack in squeezing more computing power onto chips. The company turned Moore's law—which states that computing power doubles every two years at the same cost—into a self-fulfilling prophecy. To do so they shrunk “nodes”, the width of the channel etched into silicon chips. The narrower the channel, the more computing power can be squeezed in. Intel currently makes chips using a ten-nanometre (billionth of a metre) node. TSMC's new ones are made with a seven-nanometre node. TSMC's rise to technological leadership is reflected in its valuation. In 2017, for the first time, its market capitalisation exceeded Intel's.

How the company surpassed the king of chipmaking is hotly debated. It is hard and expensive to shrink nodes. Smaller firms have stopped trying. One reason may be that by 2017 TSMC was investing close to \$3bn (8% of revenues) on research and development. Mr Liu claims TSMC spends more on node technology than Intel and Samsung, another IDM, combined.

The answer may also lie in the strength of the foundry model itself. Intel is renowned for making computer processors and Samsung for smartphone chips. TSMC serves both customers. It is ready to provide chips for new technologies as they arise. In 2017 crypto-currency miners brought in revenues of \$1bn. Their rise was one “we truly did not anticipate,” says Mr Liu. As he puts it, the firm’s top five customers always account for roughly half of revenues, but the names change. This variety helps TSMC to innovate.

Chipmaking also now requires a close partnership between manufacturers and designers. Mr Liu describes this in painterly terms. “A decade ago a customer would design a simple pattern and the factory would make it for them. But current designs have many shades and colours.” That may benefit large entrenched players. Whereas switching from one foundry to another was once trivial, now companies work within the TSMC “ecosystem” for years before chips are manufactured. Crypto-currency firms like Bitmain, a Chinese hardware manufacturer, which has been collaborating with TSMC for three years, are among hundreds of companies it works with. To switch fabs requires companies to duplicate R&D invested in TSMC’s technology.

High switching costs may not be a product of technological complexity alone. GlobalFoundries, a smaller American competitor, argues that TSMC is deliberately increasing these costs, using loyalty rebates, exclusivity clauses and penalties. It has asked the EU to investigate. TSMC says the claims have no merit.

For now, TSMC is in a sweet spot. It uses steady revenues from firms like Apple, which are unwilling to switch to IDM firms like Samsung that are also competitors, to fund R&D that other foundry firms cannot match. This sharpens its technological edge, which in turn attracts new customers. Whether this can continue is unclear. Moore's law is running out of steam. Beyond the next cycle of shrinking nodes the future is less certain. As Mr Chang prepares to leave, investors will hope Messrs Liu and Wei are chips off the old block. ■



半导体制造商

升级硅片

台积电将成为世界上最先进的芯片制造商

张忠谋正在为退休作准备。这位台湾最大企业台湾积体电路制造公司的创始人在担任董事长30年后，将于6月卸任。他将把公司的控制权交给现任的联席CEO魏哲家和刘德音：魏哲家将单独担任CEO，刘德音任董事长。6月底，公司运用最新技术生产的新型半导体芯片将会出货。世界上最强大的芯片将首次由台积电制造，而不是出自其美国竞争对手英特尔。

英特尔和台积电是不同类型的公司。英特尔是整合元件制造商（IDM）。它既设计芯片又制造芯片。台积电是芯片代工厂，为那些自己没有工厂的芯片设计公司制造芯片。芯片工厂造价高昂，台积电的新工厂将耗资200亿美元。这家台湾企业开创了芯片代工这一模式，也是这种模式最强大的倡导者。据集邦（Trendforce）的数据，2017年该公司占据了芯片代工市场56%的份额。

在把更多计算能力压缩进芯片这方面，英特尔曾经引领群雄。该公司把摩尔定律（即在同样成本下，计算能力每两年翻倍）变成了一个自证预言。为此，芯片制造商们缩小“制程”，即刻蚀进硅片的线宽。线越窄，可压缩进芯片的计算能力越多。英特尔目前使用10纳米（1米的十亿分之一）制程来制造芯片。台积电的新芯片则采用7纳米制程。台积电跃升为技术领军者反映在它的市值上。2017年，它的市值首次超过了英特尔。

这家公司是如何超越芯片制造之王的？这引起了激烈的争论。要缩小制程非常困难，而且成本很高。那些规模较小的公司已经停止了尝试。截至2017年台积电已在研发上投资近30亿美元（其收入的8%），这可能是它称王的原因之一。刘德音声称，台积电在制程技术上的投入超过英特尔和另一家整合原件制造商三星的总和。

原因可能还在于芯片代工模式本身的优势。英特尔以制造计算机处理器著称，三星因生产智能手机芯片闻名，而台积电同时服务这两类客户。它随时做好准备为新技术提供芯片。2017年，加密货币挖矿公司为台积电带来了10亿美元的收入。它们的崛起“我们真没预料到”，刘德音表示。如他所言，公司前五大客户总会贡献收入的一半左右，但客户名字经常变化。这种变化帮助台积电不断创新。

如今的芯片制造还需要代工厂和设计公司建立密切的合作关系。刘德音用绘画来做类比。“十年前，客户会设计一个简单的花样，工厂会为他们生产。但如今的设计有很多不同的色调与色彩。”这可能会让老牌大企业获益。尽管从一家芯片代工厂转到另一家在过去只是微不足道的小事，但现在企业在生产出芯片之前要在台积电的“生态系统”中运作好几年。中国的硬件制造商比特大陆与台积电合作已有三年，它和其他加密货币公司都在台积电的数百家客户之列。想要转换工厂，企业就要重复那些业已投入到台积电技术中的研发工作。

高转换成本可能不单是技术复杂性的产物。美国竞争对手、规模较小的格罗方德半导体公司（GlobalFoundries）认为，台积电故意利用忠诚度回扣、排他性条款和惩罚措施来提高转换成本。该公司已经要求欧盟调查。台积电称这些指控毫无根据。

目前，台积电处于有利地位。苹果等客户不愿改用三星这样的整合元件制造商，因为它们也是竞争对手，这为台积电带来了稳定的收入，可用于资助研发，令其他芯片代工商无法企及。这加强了台积电的技术优势，转而又会吸引到新的客户。这种情况能否继续尚不明朗。摩尔定律快要过时了。下一个缩小制程的周期过后，未来将不那么确定。在张忠谋准备退休的当口，投资者希望刘德音和魏哲家能够复制他的成功。■



Supply chains

In algorithms we trust

AI is making companies swifter, cleverer and leaner

DELIVERING 25 PACKAGES by lorry or van might seem straightforward enough, but it is devilishly complex. The number of possible routes adds up to around 15 septillion (trillion trillion), according to Goldman Sachs, an investment bank. Integrating AI into the complex web of production and distribution—the supply chain—will have a bigger economic impact than any other application of the technology and affect a larger number of businesses, says Sudhir Jha of Infosys, a large IT company. McKinsey estimates that firms will derive between \$1.3trn and \$2trn a year in economic value from using AI in supply chains and manufacturing (see chart). Many firms are already using robots powered by machine learning to improve the running of their factories and warehouses. But AI will transform several other aspects of supply chains as well.

One is the unglamorous work of managing finances and paying suppliers. Just as Microsoft's Excel spreadsheets changed finance departments, AI will make routine back-office work more efficient, says Morag Watson, BP's chief digital-innovation officer. Some early adopters are starting to use AI to scan invoices and predict payments. Workday, a software firm, offers a financial-planning tool using AI to forecast which clients are going to pay late.

Another opportunity is to improve manufacturing through computer-vision systems that can inspect products on assembly lines and spot flaws. These systems are more accurate than humans, says Andrew Ng of Landing.AI, a startup that works with Foxconn, a big Taiwanese contract manufacturer, and others. Nvidia, a chipmaker, already uses computer vision to ensure that its chips are properly assembled.

Companies will also use AI to predict when their equipment might fail. This will benefit firms that operate large assets, such as airlines, oil firms, energy companies and industrial giants, where unexpected breakdowns come at a big cost. Companies can combine data on past performance with those generated by smart sensors on machinery (part of the much-hyped “internet of things”) to predict when a jet engine or a wind turbine is likely to fail, so they can do maintenance before that happens. America’s air force and defence department are working with C3 IoT, a startup, to scan maintenance logs and past technical problems for signs that aircraft are wearing out. Companies are also building “digital twins”—virtual representations of assets—to run simulations of how weather and other factors affect machinery.

Better predictions will improve inventory management and demand forecasting, too, freeing up cash and storage space. This is especially important for retailers, which often have very thin margins, says Chen Zhang, chief technology officer of JD.com, a Chinese e-commerce firm. In 2015 the cost to companies of overstocking was around \$470bn and of understocking \$630bn worldwide, according to IHL Group, a research firm. Amazon now has algorithms to predict demand for hundreds of millions of products it sells, often as much as 18 months ahead. Among the most difficult items are clothes, where the company must decide which sizes and colours to stock at which warehouses, depending on nearby buyers’ shapes and tastes, says Ralf Herbrich, Amazon’s director of machine learning.

Lineage, a firm that keeps food cold for clients such as grocers and restaurants, uses AI to forecast in what order items will arrive at and leave a warehouse, so that it can put the pallets in the right position. “I put the toothbrush by my sink because I use it three times a day, and my Christmas tree in the attic for a reason,” says Greg Lehmkuhl, Lineage’s boss, adding that using AI for smart placement has boosted efficiency by 20%.

AI is also helping firms track the movement of their goods. Most of the businesses in global shipping, from ports and lorries to container ships, have been technological laggards, so their customers never knew when their goods might show up. This is starting to change. Systems are getting better at routing items efficiently and predicting their arrival, and companies are investing more in them. To forecast arrivals, they can put sensors on shipments or design whole systems to use data like the GPS signals put out by lorries. Packages are also being routed more efficiently, with big potential gains. Jack Levis, director of process management for United Parcel Service (UPS), a package-delivery firm, says that for every mile that its drivers in America are able to reduce their daily route, the firm saves around \$50m a year.

Goldman Sachs expects AI to bring logistics costs down by at least 5%, which could generate additional profits of \$25bn over the next ten years. That would make a big difference in this cut-throat and low-margin business. It may also introduce new competitors who completely rethink old processes. “When you build a new jet, you don’t just put a jet engine on the Wright Brothers’ plane,” says Ryan Petersen of Flexport, a logistics startup. Many firms, including JD.com, are investing in AI-powered dronedelivery technology.

Now mighty Amazon is moving into the logistics business, piloting a service in Los Angeles for picking up packages from businesses and delivering them to customers, which puts it in direct competition with FedEx and UPS. The e-commerce giant has become “everyone’s competitor”, says Ibrahim Gokcen, chief digital officer of Maersk, a global shipping firm. “Everybody in the supply chain has a heightened awareness they have to up their game, in part because of the capabilities of Amazon,” says Rich Carlson of Savi, a smart-logistics startup. Amazon’s rivals may fret, but consumers will be pleased. ■



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人工智能正让企业变得更敏捷、明智，也更精于高效

用货车或面包车递送25个包裹看似简单，实际上却极为复杂。投资银行高盛表示，可选路线共约15亿亿亿（ 10^{24} 次方）条。大型IT公司印孚瑟斯（Infosys）的苏迪·贾（Sudhir Jha）说，把AI整合进生产和分销的复杂网络，也就是供应链，其经济影响将超过AI技术的任何其他应用，影响到的企业也更多。麦肯锡估计，企业在供应链和制造环节中运用AI所创经济价值将在每年1.3万亿至2万亿美元之间（见图表）。许多公司已经在使用机器学习驱动的机器人改善工厂和仓库的运作，但AI还会改变供应链的其他几个方面。

其一是财务管理和向供应商付款这项枯燥的工作。正如微软的Excel电子表格改变了财务部门那样，AI将提高事务部门日常工作的效率，英国石油公司（BP）的首席数字创新官莫拉格·沃森（Morag Watson）说。一些较早采用AI的企业已经开始使用AI扫描单据并预测付款。软件公司Workday提供的一种财务规划工具用AI预测哪些客户会延期付款。

另一个机遇是通过计算机视觉系统改进制造环节，这些系统可以检测装配线上的产品并发现瑕疵。它们的准确度比人类高，Landing.AI的吴恩达说。这家创业公司和台湾大型合约制造商富士康等企业合作。芯片制造商英伟达已经使用计算机视觉来确保自己的芯片组装正确无误。

企业也将使用AI来预测自己的设备何时会出现故障。那些运营大型资产的企业将因此受益，例如航空公司、石油公司、能源公司和工业巨头等，它们发生意外故障的损失很大。企业可以将历史性能数据和机器上的智能传感器（被大力炒作的“物联网”的一部分）产生的数据结合起来，预测喷气式发动机或风力涡轮机何时发生故障，然后先一步开展维修。美国的空军和国防部门正与创业公司C3 IoT合作，“扫描”维修记录和过去的技术问

题，找出飞机磨损的迹象。企业也在创建“数字双胞胎”——对实物资产的虚拟建模，以模拟天气等因素如何影响机器设备。

更好的预测也会改善库存管理需求预估，从而释放现金和存储空间。这对于利润率通常都很低的零售商来说尤其重要，中国电子商务公司京东的首席技术官张晨表示。根据调研公司IHL Group的数据，2015年，全球企业因库存积压造成的损失约达4,700亿美元，因库存不足损失6,300亿美元。亚马逊如今使用算法来预测用户对自己销售的数亿种产品的需求，通常可提前18个月之久。该公司的机器学习主管拉尔夫·埃尔布里克（Ralf Herbrich）说，服饰是最难预测的商品之一，公司必须根据附近买家的体型和喜好来决定在哪个仓库中储存哪种尺寸和颜色。

Lineage是一家为食品杂货店和餐馆等客户提供冷链物流的公司。它使用AI来预测各种商品到达和离开某个仓库的顺序，以便把装卸托盘放在正确的位置。“我的牙刷放在水槽边，因为我每天用它三回，而圣诞树放在阁楼上——这不是没有原因的。”Lineage的老板格雷格·莱姆库尔（Greg Lehmkuhl）说，并称利用AI来做智能布局已将效率提高了20%。

AI也在帮助企业追踪物流。从港口、货车到货柜船，国际运送的大部分业务在技术方面都很落后，所以它们的客户从不知道何时会收到货。这已经开始改变。系统在制定高效路线和预测抵达时间上越来越强大，而企业对这类技术的投资也在增加。为预测运抵时间，它们可以将传感器附在货物上，或者设计出一整个系统来利用货车发出的GPS信号等数据。包裹的运送路线也变得更高效，这将带来巨大的收益。包裹运送公司UPS的流程管理总监杰克·莱维斯（Jack Levis）说，公司的美国司机每人每天的行程若能减少一英里，公司每年可节省约5000万美元。

高盛预计AI能将物流成本降低至少5%，这可能在未来十年里创造出250亿美元的额外利润。这会给这个竞争惨烈、利润微薄的行业带来重大影响。它也可能带来彻底反思旧流程的新竞争对手。“当你建造一架新的喷气式飞机时，你并不只是简单地在莱特兄弟的飞机上装上一台喷气发动机。”物流创业公司Flexport的瑞恩·彼得森（Ryan Petersen）说。包括京东在内

的许多企业都在投资AI驱动的无人机送货技术。

强大的亚马逊正在进军物流业务，它在洛杉矶推出了一项试点服务，从商家那里提货后再送到顾客手中，这让它成为了联邦快递和UPS的直接竞争对手。这家电子商务巨头已成为“每个人的竞争对手”，国际航运公司马士基（Maersk）的首席数字官易卜拉欣·高克森（Ibrahim Gokcen）表示。智能物流创业公司Savi的里奇·卡尔森（Rich Carlson）说：“供应链中的每个人都已经更清楚地意识到必须自我提升，部分原因就在于亚马逊的能力。”亚马逊的竞争对手们可能会烦恼不已，但消费者会很高兴。■



Future workplaces

Smile, you're on camera

AI will make workplaces more efficient, safer—and much creepier

WALK UP A set of steep stairs next to a vegan Chinese restaurant in Palo Alto in Silicon Valley, and you will see the future of work, or at least one version of it. This is the local office of Humanyze, a firm that provides “people analytics”. It counts several *Fortune* 500 companies among its clients (though it will not say who they are). Its employees mill around an office full of sunlight and computers, as well as beacons that track their location and interactions. Everyone is wearing an ID badge the size of a credit card and the depth of a book of matches. It contains a microphone that picks up whether they are talking to one another; Bluetooth and infrared sensors to monitor where they are; and an accelerometer to record when they move.

“Every aspect of business is becoming more data-driven. There’s no reason the people side of business shouldn’t be the same,” says Ben Waber, Humanyze’s boss. The company’s staff are treated much the same way as its clients. Data from their employees’ badges are integrated with information from their e-mail and calendars to form a full picture of how they spend their time at work. Clients get to see only team-level statistics, but Humanyze’s employees can look at their own data, which include metrics such as time spent with people of the same sex, activity levels and the ratio of time spent speaking versus listening.

Such insights can inform corporate strategy. For example, according to Mr Waber, firms might see that a management team is communicating only with a couple of departments and neglecting others; that certain parts of a building are underused, so the space should be redesigned; that teams are given the wrong incentives; or that diversity initiatives are not working.

Hitachi, a Japanese conglomerate, sells a similar product, which it has cheerily branded a “happiness meter”. Employee welfare is a particular challenge in Japan, which has a special word, *karoshi*, for death by overwork. Hitachi’s algorithms infer mood levels from physical movement and pinpoint business problems that might not have been noticed before, says Kazuo Yano, Hitachi’s chief scientist. For example, one manufacturing client found that when young employees spent more than an hour in a meeting, whole teams developed lower morale.

Employers already have vast quantities of data about their workers. “This company knows much more about me than my family does,” says Leighanne Levensaler of Workday, a software firm that predicts which employees are likely to leave, among other things. Thanks to the internet, smartphones and the cloud, employers can already check who is looking at a document, when employees are working and whether they might be stealing company files and contacts. AI will go further, raising concerns about Orwellian snooping by employers on their workers. In January Amazon was granted a pair of patents for wristbands that monitor warehouse workers’ exact location and track their hand movements in real time. The technology will allow the company to gauge their employees’ productivity and accuracy. JD.com, the Chinese e-commerce firm, is starting to experiment with tracking which teams and managers are the most efficient, and using algorithms to predict attrition among workers.

The integration of AI into the workplace will offer some benefits to workers and might even save lives. Companies with a high-risk work environment are starting to use computer vision to check whether employees are wearing appropriate safety gear, such as goggles and gloves, before giving them access to a danger area. Computer vision can also help analyse live video from cameras monitoring factory floors and work environments to detect when something is amiss. Systems like this will become as “commonplace as CCTV cameras are in shops”, says Alastair Harvey of Cortexica, a firm that

specialises in building them.

Employees will also be able to track their own movements. Microsoft, the software giant, already offers a programme called MyAnalytics which puts together data from e-mails, calendars and so on to show employees how they spend their time, how often they are in touch with key contacts and whether they multitask too much. It also aggregates the data and offers them to managers of departments so they can see how their teams are doing. “It doesn’t have that ‘big brother’ element. It’s designed to be more productive,” insists Steve Clayton of Microsoft. The idea is that individuals’ data are not given out to managers, though it is not clear whether workers believe that. As part of a broader investment in AI, Microsoft is also starting to use the technology to translate the monthly question-and-answer session held by the company’s boss, Satya Nadella, for its workers worldwide, and analyse employees’ reactions.

It does not take much imagination to see that some companies, let alone governments, could take this information-gathering too far. Veriato, an American firm, makes software that registers everything that happens on an employee’s computer. It can search for signals that may indicate poor productivity and malicious activity (like stealing company records), and scans e-mails to understand how sentiment changes over time. As voiceenabled speakers become more commonplace at work, they can be used to gather ever more data.

This is of particular concern in authoritarian states. In China increasing numbers of firms, and even some cities, use cameras to identify employees for the purpose of giving them access to buildings. More troubling, the government is planning to compile a “social credit” score for all its citizens, pooling online data about them to predict their future behaviour.

All this may require a new type of agreement between employers and

employees. Most employment contracts in America give employers blanket rights to monitor employees and collect data about them, but few workers are aware of that. Mr Waber of Humanyze thinks these data should have better legal protection, especially in America (Europe has stronger privacy laws).

As more companies rely on outside firms to collect and crunch employee information, privacy concerns will increase, and employees may feel violated if they do not think they have given their consent to sharing their data. Laszlo Bock, who used to run Google's human-resources department and now heads a startup focused on work, reckons that "it's going to play out in a bad way before it plays out in a good way." ■



未来的工作场所

笑一个，给你录像呢

人工智能将使职场变得更高效、更安全——也更瘆人得多

在硅谷的帕洛阿托，登上一家素食中餐厅旁的陡峭楼梯，你就能看到工作的未来，或者至少是未来的其中一个版本。这是Humanyze公司在当地的办公室。这家提供“人员分析”的公司有好几个客户都位列《财富》500强（尽管它不愿透露是哪几家）。员工穿梭往来的办公室里充满了阳光和电脑，以及跟踪人员位置和互动状况的信标。每个人都佩戴着一张信用卡大小、火柴盒厚度的身份牌，其中配有一个麦克风来识别他们是否在交谈；蓝牙和红外传感器会监测他们的位置，还有一个加速度计来记录他们何时移动。

“商业的方方面面都在变得更以数据为导向。那么其中人的一面也没有理由不应这样做。”Humanyze的老板本·韦伯（Ben Waber）说。这家公司对待员工的方式和它对待客户差不多。员工身份牌中的数据与他们电子邮件和工作日历中的信息整合在一起，形成了一幅完整的图景，显示他们是如何度过工作时间的。Humanyze的客户只能看到团队级别的统计数据，但它自己的员工可以查看个人数据，包括与同性相处的时间、活动水平，以及讲话与倾听的时间比率等指标。

这些信息可以指导企业战略。例如，韦伯说，企业可能会从中发现某个管理团队只与几个部门沟通而忽视了其他部门；办公楼的某些部分未被充分利用，所以应该重新设计空间；团队的激励方式不当；多元化方案不起作用。

日本企业集团日立也销售类似的产品，它兴高采烈地将其标榜为“幸福测量仪”。在日本，员工的福祉问题尤为突出，甚至有专门的“过劳死”一词。日立首席科学家矢野和男表示，日立的算法可以从身体运动中推断出情绪级别，并指出之前没有注意到的业务问题。例如，一位制造业客户发

现，当年轻员工开会超过一个小时之后，整个团队的士气就开始下降。

雇主已经拥有关于员工的大量数据。“这家公司比我的家人更了解我。”软件公司Workday的利安·莱文塞勒（Leighanne Levensaler）说。这家公司会就哪些员工可能会离职等问题做出预测。有了互联网、智能手机和云，雇主已经可以检查谁在查看文档、员工在什么时候工作，以及他们是否可能在窃取公司文件和联系人资料。AI必将进一步发展，这引发了对于雇主奥威尔式窥探员工的担忧。今年1月，亚马逊获得了两项腕带专利，这些腕带可以监控仓库工人的确切位置并实时追踪他们的手部动作。该技术将使公司能够衡量员工的生产效率和准确性。中国电子商务公司京东正在开始尝试跟踪哪些团队和管理人员效率最高，并使用算法来预测员工流失。

将AI融入工作场所将为员工带来一些好处，甚至可以挽救生命。在一些带有高风险工作环境的公司里，在允许员工进入危险区域前，计算机视觉系统会检查他们是否佩戴了护目镜和手套等适当的安全装备。计算机视觉还可以帮助分析工厂车间和工作环境的实时监控视频，检测是否出现任何问题。像这样的系统将变得“像商店中的闭路电视摄像头一样普遍”，专门生产此类系统的Cortexica公司的阿拉斯泰尔·哈维（Alastair Harvey）说道。

员工也将能够跟踪他们自己的动向。软件巨头微软已经提供了一个名为MyAnalytics的程序，它将电子邮件、日历等数据汇总在一起，向员工展示自己的时间花在了哪里，与主要联系人联系的频率，以及是不是同时处理太多事情了。它还汇总数据并提供给部门经理，以便其了解团队的工作情况。微软的史蒂夫·克莱顿（Steve Clayton）坚称“它没有那个‘老大哥’的元素，而是为了提高效率”。其理由是个人数据并没有被发给经理，但员工是否相信这一点就不得而知了。作为对AI大规模投资的一部分，微软也开始利用该技术将公司老板萨提亚·纳德拉（Satya Nadella）的月度问答会翻译出来提供给全球员工，并分析员工的反应。

不难想见，一些企业，更不用说政府，可能会将这种信息收集做过头。美国公司Veriato制作的软件能够记录员工在计算机上发生的所有事情。它可以搜索可能意味着生产率低下和恶意活动（如窃取公司记录）的信号，并

扫描电子邮件以了解情绪随时间的推移如何变化。随着能够识别语音的音箱在工作中越来越普遍，它们可被用来收集更多数据。

这在威权国家尤其令人担忧。在中国，越来越多的公司乃至一些城市都使用摄像头来识别员工以准许他们进入某些建筑。更让人不安的是，政府计划为所有公民编制“社会信用”分数，汇集关于他们的在线数据以预测他们未来的行为。

所有这些都可能要求雇主和员工之间达成新的协议。美国的大多数雇佣合同都给了雇主全面的权利来监控员工并收集相关数据，但很少有员工知道这一点。Humanyze的韦伯认为，这些数据应该有更好的法律保护，特别是在美国（欧洲的隐私法更严格）。

随着越来越多的公司依靠外部公司收集和分析员工信息，关于隐私的担忧将会增加，并且如果员工不认为自己已经同意分享数据，他们可能会感到被侵犯。曾经主管谷歌人力资源部门的拉兹洛·伯克（Laszlo Bock）现在领导着一家专注于职场的创业公司，他认为“在一切变好之前，事情还会变坏。”■



The future

Two-faced

AI will mainly be good for business, but mind the pitfalls

MENTION ARTIFICIAL INTELLIGENCE, and most people will think of robots. But a more fitting image may be that of Janus, the Roman god of beginnings, transitions and endings, who has two faces looking in opposite directions. On one side are the positive changes that AI will bring, enabling people to achieve more, far more quickly, by using technology to enhance their existing skills. Recruiters will be able to pinpoint the best candidates more easily, and customer-service staff will be able to handle queries faster. Jobs that never existed before could be created. And getting machines to do routine work can make professional lives more fulfilling and stimulating.

Consumers, too, will benefit from AI-enhanced services such as personalised recommendations and faster and more efficient delivery, as well as from radical changes in industries like health care and transport that could lead to new drug discoveries and treatments and safer ways to move around.

Look the other way, though, and there are plenty of potential pitfalls. Technological change always causes disruption, but AI is likely to have a bigger impact than anything since the advent of computers, and its consequences could be far more disruptive. Being both powerful and relatively cheap, it will spread faster than computers did and touch every industry.

In the years ahead, AI will raise three big questions for bosses and governments. One is the effect on jobs. Although chief executives publicly extol the broad benefits AI will bring, their main interest lies in cutting

costs. One European bank asked Infosys to find a way of reducing the staff in its operations department from 50,000 to 500. This special report has shown that AI-enhanced tools can help pare staff in departments such as customer service and human resources. The McKinsey Global Institute reckons that by 2030 up to 375m people, or 14% of the global workforce, could have their jobs automated away. Bosses will need to decide whether they are prepared to offer and pay for retraining, and whether they will give time off for it. Many companies say they are all for workers developing new skills, but not at the employer's expense.

A second important question is how to protect privacy as AI spreads. The internet has already made it possible to track people's digital behaviour in minute detail. AI will offer even better tools for businesses to monitor consumers and employees, both online and in the physical world. Consumers are sometimes happy to go along with this if it results in personalised service or tailored promotions. But AI is bound to bring privacy violations that are seen as outrageous. For example, facial-recognition technology has become so advanced that it may be able to detect someone's sexual orientation. In the wrong hands, such technology could militate against fair and equal treatment. Countries with a record of surveillance and human-rights abuses, such as China, are already using AI to monitor political activity and suppress dissent. Law-enforcement officials around the world will use AI to spot criminals, but may also snoop on ordinary citizens. New rules will be needed to ensure consensus on what degree of monitoring is reasonable.

The third question is about the effect of AI on competition in business. Today many firms are competing to provide AI-enhanced tools to companies. But a technology company that achieves a major breakthrough in artificial intelligence could race ahead of rivals, put others out of business and lessen competition. This is unlikely to happen in the near future, but if it did it would be of great concern.

More likely, in the years ahead AI might contribute to the rise of monopolies in industries outside the tech sector where there used to be dynamic markets, eventually stifling innovation and consumer choice. Big firms that adopt AI early on will get ever bigger, attracting more customers, saving costs and offering lower prices. Such firms may also reinvest any extra profits from this source, ensuring that they stay ahead of rivals. Smaller companies could find themselves left behind.

Retailing is an illustration of how AI can help large firms win market share. Amazon, which uses AI extensively, controls around 40% of online commerce in America, helping it build moats that make it harder for rivals to compete. But AI will increase concentration in other industries, too. If, say, an oil company can use AI to pump 3% more efficiently, it can set prices 3% lower than those of a rival. That could force the competitor to shut down, says Heath Terry of Goldman Sachs. He thinks that AI has “the power to reshuffle the competitive stack”.

It is too early to tell whether the positive changes wrought by AI will outweigh the perils. But leading a company in the years ahead is sure to be more challenging than at any time in living memory. AI will require bosses to rethink how they structure departments, whether they should build strategic technologies internally or trust outside firms to deliver them, whether they can attract the technical talent they need, what they owe their employees and how they should balance their strategic interests with workers' privacy. Just as the internet felled some bosses, those who do not invest in AI early to ensure they will keep their firm's competitive edge will flounder.

Janus, the Roman god, contained both beginnings and endings within him. That duality characterises AI, too. It will put an end to traditional ways of doing things and start a new era for business and for the world at large. It will be pervasive, devastating and exhilarating all at the same time. Look

ahead. ■



未来

双面神

人工智能对商业益处多多，但也要当心陷阱

提到人工智能，大多数人会想到机器人，但更贴切的形象可能是雅努斯（Janus）——罗马神话中的开端、过渡和结局之神，他有前后两张面孔。一方面，人工智能会带来积极的变化，通过利用技术强化现有技能，人们可以做到更多，速度也大大加快。招聘人员可以更轻松地找出最佳候选人，客服人员也能更快地处理咨询。人们还能创造出前所未有的职业。让机器去做重复性工作可以让人的职业生活更加充实和有趣。

消费者也可从有人工智能助力的服务中受益，比如个性化的推荐和更快更高效的送货。医疗和运输等行业的根本性变革可能会带来新的药物和疗法，让出行更为安全。

然而换个角度来看，隐患也很多。技术变革总是会带来颠覆，但是人工智能的冲击可能会超过自计算机问世以来的任何事物，其破坏性也可能非同寻常。它既强大又相对便宜，传播速度将超过计算机，并触及每一个行业。

在未来的几年中，人工智能将给企业老板和政府提出三大问题。一是对就业的影响。尽管首席执行官们公开赞颂人工智能将带来广泛的好处，但他们的主要关注点在于削减成本。一家欧洲银行请印孚瑟斯想办法把它的运营部门员工从五万人减少到500人。本次特别报道已经显示，由人工智能增强的工具可以帮助削减诸如客户服务和人力资源等部门的员工。麦肯锡全球研究院估计，到2030年，多达3.75亿人（占全球劳动力的14%）的工作都可能被自动化。老板需要决定他们是否愿意提供再培训并为此支付费用，以及他们是否愿意占用工作时间来做这件事。许多公司都表示自己全力支持员工培养新技能，但不是由雇主支付费用。

第二个重要问题是，随着人工智能的推广，该如何保护隐私。互联网已经

能够非常详尽地追踪人们的数字行为。人工智能将为企业提供更好的工具来监控消费者和员工，无论是在线上还是现实世界。如果这能带来个性化的服务或有针对性的促销，消费者有时会乐于接受这一点。但人工智能必然会带来让人们无法容忍的侵犯隐私行为。例如，面部识别技术已经如此先进，也许能够检测出某人的性取向。如果落入坏人之手，这种技术可能会妨碍公平和平等待遇。一些素有监视和侵犯人权记录的国家（如中国）已经在使用人工智能来监测政治活动并打压异见。世界各地的执法人员将使用人工智能来发现罪犯，但也可能窥探普通公民。人们将需要新的规则来确保就何谓合理监测达成共识。

第三个问题是人工智能对商业竞争的影响。今天，许多公司正在竞相为企业提供人工智能助力的工具。但是，在人工智能方面取得重大突破的科技公司可能会在竞争对手间脱颖而出，让其他公司倒闭，从而减少竞争。这在近期还不太可能发生，但一旦发生则非常令人担忧。

更有可能的是，在未来数年内，人工智能可能会促使科技之外的那些本来市场活跃的行业出现垄断，最终会扼杀创新和消费者的选择权。率先采用人工智能的大公司将会变得更大，吸引更多的客户，节省成本并提供更低的价格。这样的公司也可以将由此产生的额外利润再拿来投资，确保自己领先于竞争对手。小公司可能会发现自己被甩在后头。

零售业就是一个人工智能帮助大企业赢得市场份额的例证。广泛使用人工智能的亚马逊控制着美国约40%的在线商务，这为它打造了一条令对手难以与之匹敌的护城河。但人工智能也会提高其他行业的集中度。如果一家石油公司能够利用人工智能把采油效率提高3%，就可以把价格定得比竞争对手低3%。高盛的希思·特里（Heath Terry）说，这可能会逼得竞争对手关门大吉。他认为人工智能“有能力让竞争格局重新洗牌”。

现在要判断人工智能带来的积极变化是否大过危险还为时尚早。但在未来，领导一家公司肯定比我们能记起的任何时候都要难。人工智能将要求老板重新思考如何组织部门，是应该在内部构建战略技术还是托付给外部公司来提供，是否能够吸引到所需的技术人才，应该给员工多少报酬，以

及如何在自己的战略利益和员工的隐私之间找到平衡。正如互联网击倒了一批老板一样，未能尽早投资人工智能以确保竞争优势的人将会陷入困境。

罗马的雅努斯神身上同时蕴含了开端和结局。人工智能也有这种二元性。它将结束传统的做事方式，开创商业和整个世界的新时代。它将无所不在、摧枯拉朽而又令人激动。往前看吧。 ■



Human resources

Hire education

AI is changing the way firms screen, hire and manage their talent

HUMAN RESOURCES (HR) is a poorly named department. It usually has few resources other than overworked staff, clunky technology and piles of employee handbooks. Hassled recruiters have to sort through reams of applications that vastly outnumber the jobs available. For example, Johnson & Johnson (J&J), a consumer-goods company, receives 1.2m applications for 25,000 positions every year. AI-enabled systems can scan applications far more quickly than humans and work out whether candidates are a good fit.

Oddly enough, they may also inject more humanity into hiring. According to Athena Karp of HiredScore, a startup that uses algorithms to screen candidates for J&J and others, only around 15-20% of applicants typically hold the right qualifications for a job, but they are rarely told why they were not hired, nor are they pointed to more suitable jobs. Technology is helping “give respect back to candidates”, she says.

Nvidia, a chipmaker, also gets more résumés than it can comfortably cope with, so it spent a year building its own system to predict which candidates are worth interviewing. It has recognised patterns that recruiters might not: for example, candidates who submit especially long résumés turn out to do less well than others, so those extra words will count against them. Hilton, a hotel chain, has shortened the average time it takes to hire a candidate from 42 days to five with the help of HireVue, a startup. It analyses videos of candidates answering questions and uses AI to judge their verbal skills, intonation and gestures. This can be especially helpful when the candidate comes from a different culture or speaks another first language, says Ellyn Shook, chief leadership and HR officer of Accenture, a consultancy with

435,000 employees that also uses HireVue.

Employers tend to hire candidates who are like themselves, which makes for undiversified workplaces. Orchestras, for example, used to be mostly male. Recruitment of female musicians went up only when they introduced “blind” auditions behind a screen. Algorithms can act as virtual screens, making hiring fairer. Pymetrics, a startup whose clients include companies such as Unilever, a consumer-goods giant, and Nielsen, a research firm, offers a set of games for candidates to play, usually at an early stage of the recruitment process, that ignore factors such as gender, race and level of education. Instead they test candidates for some 80 traits such as memory and attitude to risk. Pymetrics then uses machine learning to measure applicants against top performers and predict their suitability for a role. This can help candidates without conventional qualifications.

Another firm that is helping companies become more diverse is Textio, a startup that uses AI to improve job descriptions. For example, it has found that corporate jargon like “stakeholders” and “synergies” tend to drive away certain candidates, especially non-whites, and that women are less likely to apply for a job that is described as “managing” than “developing” a team. Tweaking job descriptions can get 25% more qualified people through the door and boost recruitment among minorities, says Kieran Snyder, Textio’s boss.

Recruiters often come across candidates who have good qualifications but are not the right fit for the particular position they are trying to fill. In the past, there was no way of redirecting them to other jobs as they became available. AI will make it possible to “repurpose candidates we have attracted before”, says Sjoerd Gehring, vice-president of talent acquisition for J&J. The health-care giant uses HiredScore, a startup, to grade candidates. When a vacancy opens up, the system automatically generates a shortlist of candidates that could be a good fit. This will bring big cost savings, says Mr

Gehring.

AI can also help with managing employees. HR professionals and recruiters at big firms cannot possibly know all their own talented workers across countries and departments, says Chris Louie of Nielsen. His company is using AI to improve internal mobility. Twine Labs, a startup that is working with Nielsen, suggests internal candidates for new roles, based on employee data and job requirements, taking in hundreds of variables. Around half the candidates it suggests are approved and promoted, says Joseph Quan, Twine Labs' boss. That is about the same success rate as for a human recruiter.

Another use for AI is to help employers reduce staff turnover. On average, replacing a worker takes around 20% of annual salary, sometimes much more. Workday, a software firm, has started to predict how likely employees are to leave. It looks at around 60 factors—such as pay, time between holidays taken and turnover in managers to whom the employee reports—and flags those at risk of quitting so companies can try to retain them.

Arena, a startup that works with hospitals and care-home companies, where turnover is high, considers retention even before it takes someone on. By using data from job applications and third parties to predict which applicants are likely to stay for more than a year, Arena has reduced its clients' median turnover by 38%, says Michael Rosenbaum, Arena's boss.

In future AI may also be used to determine pay. Infosys is looking into using AI to decide when to give employees a rise, based on their performance and their pay relative to that of colleagues. The technology will make pay fairer by taking biases and personality traits out of consideration, says Sudhir Jha, head of product management and strategy at Infosys. But there is a risk that workers will try to game the system.

All this points to a broader issue in AI: transparency. Companies will need to ensure that algorithms are being constantly monitored. In America, where it is illegal to discriminate against protected groups such as racial minorities, firms must be able to prove that they are hiring from these groups roughly in proportion to the population and are not introducing any bias, says Mr Rosenbaum. Startup bosses say they offer their clients transparency and regularly check their algorithms to make sure they are free of bias. But as AI becomes more prevalent, concerns will grow that algorithms could reinforce discrimination.

Recruitment is just one example of the technological disruption that AI will bring to the workforce. The number of recruiters will come down, because AI will handle many of the mundane tasks they used to do, and face-to-face interviews will become rarer. At Unilever only shortlisted candidates are now interviewed, after several rounds of AI-enabled screening and recorded interviews through HireVue. For the remaining recruiters, though, AI will make work easier and more interesting.

It may even help some of the workers it displaces. Accenture is rolling out a custom-built tool called Job Buddy which tells employees how vulnerable their job is to automation and predicts what training they might need so they can develop the right skills for the future. Ms Shook of Accenture says that around 80% of the people who have tried it are taking the advice it offers. But they may not have much choice. ■



人力资源

招聘教育

人工智能正在改变企业筛选、聘用和管理人才的方式

“人力资源”（HR）部这名字起得可不怎么样。它除了超负荷工作的员工、笨拙的技术和一堆堆员工手册之外一般就没什么资源了。心烦意乱的招聘人员必须要翻阅数量远超过空缺职位的大批简历。例如，消费品公司强生每年招聘的2.5万个职位要收到120万份申请。配备AI的系统会以比人快得多的速度审查申请，并确定候选人是否合适。

说来奇怪，它们还可能让招聘更为人性化。创业公司HiredScore利用算法为强生等公司筛选候选人，该公司的雅典娜·卡普（Athena Karp）说，通常只有约15%到20%的申请者拥有适合职位的资质，但很少有人告诉他们为什么不被录用，也没有人为他们指出更合适的工作。她说，技术的帮助“让候选人重拾尊严”。

芯片制造商英伟达收到的简历数量也超出了自己能从容处理的水平，因此它花费一年的时间来建立自己的系统，预测哪些候选人值得面试。它已经识别出了招聘人员可能未能发现的模式：例如，提交超长简历的候选人的表现会比其他人差，因此这些额外的文字将会给他们减分。在创业公司HireVue的帮助下，连锁酒店希尔顿雇用一位候选人的平均时间从42天缩短到5天。它分析考生回答问题的视频，使用AI来评判他们的口头表达能力、语调和手势。当候选人来自不同的文化或用非母语作答时，这个系统特别有用，埃森哲的首席领导和人力资源官艾琳·舒克（Ellyn Shook）说。这家拥有43,500名员工的咨询公司也在使用HireVue。

雇主们倾向于雇用和自己相像的候选人，这使得工作场所变得愈发同质化。例如，管弦乐团过去主要由男性组成，唯有当它们启用了从屏障后“盲选”之后，聘用的女音乐家比例才开始上升。算法可以充当虚拟屏障，使招聘更公平。创业公司Pymetrics拥有消费品巨头联合利华和研究公司

尼尔森等客户，它通常会在招聘早期阶段让候选人玩一套游戏。这套游戏无视性别、种族和受教育水平等因素，而测试候选人的约80种特点，如记忆力和对风险的态度。Pymetrics随后利用机器学习将申请者与业绩最优者做比较，并预测他们对于某个职位的适合度。这可以帮助传统上没有资格的候选人。

另一家帮助企业变得更加多元化的公司是Textio，这家创业公司使用AI来改善职位描述。例如，它发现像“利益相关方”（stakeholder）和“协同效应”（synergy）这样的企业行话往往会吓退某些候选人，尤其是非白人，并且女性不大爱申请被描述为“管理”而非“发展”一个团队的职位。Textio的老板基兰·斯奈德（Kieran Snyder）说，调整工作描述可以将前来应聘的合格人员数目提升25%，并提高少数群体的受雇水平。

招聘人员经常会遇到资质良好，但不适合所申请职位的候选人。过去，如果公司日后出现新的岗位空缺，并没有办法把这些人引导到新岗位上。AI将有可能“重新利用我们之前曾吸引到的候选人。”强生的人才招聘副总裁斯杰德·戈灵（Sjoerd Gehring）说。这家医疗保健巨头使用创业公司HiredScore给候选人打分。新岗位空缺出现后，系统会自动生成一份可能适合的候选人名单。戈灵说这将节约大量成本。

AI还能帮助管理员工。尼尔森的克里斯·路易（Chris Louie）说，大公司的人力资源专业人员和招聘人员不可能了解遍布各个国家和部门的所有人才。他的公司正在使用AI来改善内部流动性。与尼尔森合作的创业公司Twine Labs考虑数百个变量，根据员工数据和工作要求来为新职位推荐内部人选。Twine Labs的老板约瑟夫·权（Joseph Quan）说，其推荐的候选人中大约有一半获准晋升。这与人类招聘专员的成功率大致相当。

AI的另一个用途是帮助雇主减少员工流失。平均而言，更换一名员工的费用约为年薪的20%，有时还高得多。软件公司Workday已经开始预测员工离职的可能性。它会考虑大约60个因素，诸如工资、休假间隔，以及员工上司的换人频率，把有离职风险的人标记出来，以便公司尝试挽留他们。

创业公司Arena与医院和护理公司合作，这些地方的人员流失率很高。该公司甚至在雇人之前就会考虑留任的问题。Arena的老板迈克·罗森鲍姆（Michael Rosenbaum）说，通过使用来自工作申请和第三方的数据来预测哪些申请人可能会工作一年以上，Arena已将客户的员工流失率中位数降低了38%。

未来，AI也可能被用来确定工资。印孚瑟斯正在研究利用AI来决定何时给员工加薪，AI会基于员工的业绩表现和相对于同事的薪酬水平做出决策。该公司的产品管理和战略主管苏迪·贾（Sudhir Jha）表示，这项技术会把偏见和个性特征排除在外，从而使薪酬更加公平。但是也会有员工钻系统空子的风险。

所有这些都指向了AI中一个更普遍的问题：透明度。公司需要确保算法一直受到监测。罗森鲍姆说，在美国，歧视少数族裔等受保护群体是非法的，公司必须能够证明他们从这些群体中招聘的人员数量大致与人口成比例，且没有引入任何偏见。创业公司的老板们说，他们为客户提供透明度，并定期检查算法以确保其中没有偏见。但随着AI越来越普遍，人们会更加担心算法可能加剧歧视。

招聘只是AI为职场带来技术颠覆的一个例子。招聘人员会越来越少，因为AI将会接管他们先前所做的许多琐事，而面对面的面试也会越来越少。在联合利华，在经过几轮AI辅助筛选和HireVue的录像面试之后，只有入围的候选人才会进入现场面试。不过对于留在岗位上的招聘人员来说，AI会让他们的工作变得更轻松有趣。

AI甚至会帮到一些被它取代的工人。埃森哲正在推出一款名为“工作伙伴”（Job Buddy）的定制工具，它会告诉员工他们的工作受到自动化的威胁有多大，并预测他们可能需要哪些培训，以获得适应未来的技能。埃森哲的舒克表示，大约有80%的人尝试过它提供的建议。但他们可能没有太多选择。■



American law

Friends in high places

Citizens United was only one in a long sequence of corporate legal victories

THE *Citizens United* ruling in 2010 was one of the most controversial in the history of America's Supreme Court. The judges affirmed that corporations have a First Amendment right to spend their money to influence elections; the decision seemed to extinguish any hope of serious campaign-finance reform. As Adam Winkler's fascinating book recounts, this was only the latest in a long line of corporate legal victories.

The rights of corporations were not debated in the state conventions that ratified the constitution, nor were companies mentioned in the Federalist Papers, the essays largely written by Alexander Hamilton and James Madison. But corporations have repeatedly been able to exploit laws meant to benefit others. In 1819 a landmark Supreme Court decision regarding Dartmouth College limited the rights of states to interfere in businesses set up by charter; private contracts, it held, should be sacrosanct. That was followed by a jump in the creation of chartered corporations. They were viewed with suspicion by Andrew Jackson, the populist president, who thought they took rights away from the people and gave them to a few.

In 1882 Roscoe Conkling, one of the drafters of the 14th Amendment—designed to give equal citizenship to freed slaves—persuaded the Supreme Court that it had also meant to protect companies. He misrepresented the contents of a journal to help clinch the argument. Sure enough, between 1868 (when the amendment was adopted) and 1912, the justices decided 28 cases asserting the rights of African-Americans, almost all of which were lost. They decided 312 cases on the rights of companies, which succeeded in striking down minimum-wage and child-labour laws.

“For most of American history,” Mr Winkler remarks, “the Supreme Court failed to protect the dispossessed and the marginalised, with the justices claiming to be powerless in the face of hostile public sentiment.” By contrast “the court has insisted that broad public sentiment favouring business regulation must bend to the demands of the constitution.”

One tricky issue has recurred. Are companies citizens in the same sense as individuals? Or are they different entities with different rights and responsibilities? The *Citizens United* case was much criticised by Democrats for treating companies as people. But the politics of corporate personhood are complex. For much of American history, left-leaning activists argued in favour of it.

For example, in the 1930s the case of *Grosjean v American Press Company* involved Huey Long, the governor of Louisiana, who wanted to tax awkward newspapers. The Supreme Court said that “A corporation is a ‘person’ within the meaning of the equal-protection and due-process clauses.” It was the first time the Court had decreed that corporations had the right to freedom of speech under the constitution. Later extensions of corporate free-speech rights flowed from left-wing initiatives, too. In the 1970s a consumer-rights group linked to Ralph Nader tried to tackle the cost of prescription medicines. Pharmacists were forbidden from advertising their prices, making it difficult for patients to shop around. Mr Nader’s lawyers argued for the rights of customers to hear what the pharmacists had to say.

A focus on the rights of the listener, not the speaker, was at the heart of the *Citizens United* case. Nevertheless, commentators were right to see it as a striking victory for corporate rights. It was followed, in 2014, by the *Hobby Lobby* case, which gave the company an exemption from a federal rule requiring large employers to include birth control in their employees’ health plans. This established that businesses enjoyed religious freedom.

Critics such as Leo Strine, chief justice of Delaware's Supreme Court, have pointed out that, in aggregate, court rulings on corporate rights do not make sense. Companies are obliged to prioritise the profits they make for shareholders, rather than seeking to benefit employees or the wider community; that sits oddly with the notion that businesses also have political and religious freedom. The owners of Hobby Lobby affirm that their religious beliefs cannot be separated from the ethos of the business. But they might well insist on a strict boundary between themselves and the firm were a customer to fall in a store and sue them personally for damages.

Mr Winkler shows admirable command of detail in tackling a topic that ought to be at the heart of political debate. Anyone interested in American history, law or politics should read his book. ■



美国法律

强大靠山

联合公民案只是公司赢得的一长串法庭胜利之一

二〇一〇年对联合公民（Citizen United）诉联邦选举委员会一案的裁决是美国最高法院历史上最具争议的裁决之一。法官判定宪法第一修正案赋予了公司用金钱影响选举的权力——这一裁决似乎浇灭了对竞选筹款做出重大改革的任何希望。正如亚当·温克勒（Adam Winkler）的精彩著述所述，这只是公司获得的一长串法庭胜利中最新的一个。

各州批准宪法的会议没有就公司权利加以辩论，主要由亚历山大·汉密尔顿（Alexander Hamilton）和詹姆斯·麦迪逊（James Madison）撰写的《联邦主义文集》（Federalist Papers）也没有谈及公司。但公司却能够一再利用意在令他人受益的法律。1819年，最高法院关于达特茅斯学院的一项具有里程碑意义的裁决限制了各州干涉特许公司的权利。法院认为，私人契约应是神圣不可侵犯的。此案裁决之后，特许公司的成立呈迅速增长之势。民粹主义总统安德鲁·杰克逊（Andrew Jackson）对特许公司持怀疑态度，他认为这些公司从人民手中夺走了权利，转交给了少数人。

1882年，美国宪法第十四修正案（旨在赋予获得自由的奴隶平等的公民权）的起草人之一罗科斯·康克林（Roscoe Conkling）说服最高法院认定该修正案也意在保护公司。为使自己的观点确凿无疑，他曲解了一份审议记录的内容。果不其然，从修正案获得通过的1868年到1912年期间，高院大法官对28宗主张非裔美国人权利的案件做出裁决，几乎都判其败诉。他们还裁决了312件涉及公司权利的案件，成功废除了最低工资和童工法。“在美国大部分历史中，”温克勒评论道，“最高法院未能保护被剥夺者和边缘人群，法官们声称自己在面对敌对的公众情绪时无能为力。”然而在另一边，“法院却坚称，支持商业监管的广泛公众情绪必须服从于宪法的规定。”

一个棘手的问题再次出现。企业是与“个人”具有同等意义的“公民”吗？还是说，它们是一种不同类型的实体，具有与个体不同的权利和责任？联合公民一案因将企业视同于人而饱受民主党人的批评。但企业“人格化”中涉及的政治问题很复杂。在大部分美国历史中，左翼激进主义者都支持这种企业公民身份。

例如在上世纪30年代的格罗斯让诉美国新闻公司（Grosjean v American Press Company）一案中，路易斯安那州州长休伊·朗（Huey Long）想对批评他的报纸加征特别税。最高法院表示：“公司等同于平等保护和正当程序条款所保护的‘人’。这是最高法院首次裁定公司享有宪法赋予的言论自由权。后来由于左翼阵营的倡议，企业言论自由权得到了扩展。到了70年代，与拉尔夫·纳德（Ralph Nader）有关联的一个消费者权益组织试图解决处方药的价格问题。当时药房不得公告药品价格，让患者难以货比三家。纳德的律师主张消费者有权从药房得到必要信息。

关注于受众而非说话者的权利是联合公民案的核心。尽管如此，评论家们将此案视为公司权利的惊人胜利，他们是对的。随后在2014年的霍比罗比（Hobby Lobby）一案中，公司权再获胜利。该案裁决霍比罗比公司免于履行大企业要将节育纳入员工医疗保险计划的联邦规定。这确立了企业的宗教自由权。

特拉华州最高法院首席法官里奥·斯特林（Leo Strine）等批评者指出，总体而言，法院对公司权利的裁决不合理。公司的责任是优先考虑为股东创造利润，而不是力图让员工或更广泛的社群受益，说企业同样具有政治和宗教自由就很怪了。霍比罗比公司的所有人认定他们的宗教信仰与企业的精神不可分割。但是，如果有顾客在其店内摔倒，并对所有人个人投诉要求赔偿，他们可能会坚持说自己与企业之间有着严格的界限。

在处理这一应当成为政治辩论核心的话题时，温克勒对细节的掌控令人钦佩。任何对美国历史、法律或政治感兴趣的人都应该读读他的这本书。 ■



External providers

Leave it to the experts

A thriving ecosystem has sprung up to offer AI expertise and technical help

MANY TECH FIRMS' offices boast luxurious perks such as nap pods, massages and soda fountains that offer employees a choice of exotically flavoured sparkling water. Corporate bosses like to think that finding customised AI solutions is just as easy as selecting a fizzy drink with a hint of grapefruit. They are wrong. Buying AI takes time, can feel like hard work, and the results are often imperfect.

A number of vendors are scurrying to come to would-be users' aid. The leaders are the West's biggest providers of cloud storage: Amazon, Google and Microsoft. Cloud computing is a vast market worth \$300bn, and fiercely competitive. All three firms offer pre-trained models that corporate clients can use to build AI-enabled systems. For example, they all sell "vision" tools that enable customers to use computer vision to improve their existing services and build new ones. Uber, the ride-hailing firm, worked with Microsoft's toolset to design a system that scans drivers' faces to confirm their identity when they start a shift. C-Span, a television network, used Amazon's vision system to compile a database of politicians so it can quickly name them when they appear on screen.

A broad range of tools is available to help mainstream companies build anything from search and recommendation engines to speech-recognition and translation systems, customer-service bots and more. Jeff Dean, director of Google Brain, the search giant's AI-research arm, reckons there are 10m organisations in the world that "have a problem that would be amenable to a machine-learning solution. They have the data but don't have the experts on staff."

The potential corporate market for AI software, hardware and services is vast: around \$58bn by 2021, compared with \$12bn last year, according to IDC, a research firm. Amazon has a clear lead in the broader cloud market, with a 44% share of the total, compared with Microsoft's 7% and Google's 2.3%, but for AI tools the field remains wide open. Paul Clarke, chief technology officer of Ocado, an online grocer, says it can be good for clients to be promiscuous and use the best tools from each. He thinks it unlikely that any one of them will sweep the board.

Cloud providers try to differentiate their AI offerings in two ways: by ease of use, through a well-designed interface, and by offering better algorithms. Each of the tech giants draws on where its “strength is today”, says Joseph Sirosh of Microsoft. For example, Google offers an excellent tool which companies can use to create or redesign their own search engines, and has especially good engineering talent. Microsoft and Amazon have solid tools for voice recognition. Microsoft’s interface currently has the best design, says Pedro Domingos, a professor of computer science at the University of Washington and author of “The Master Algorithm”, a book about AI and business.

In future tech firms will develop more specialised hardware that will help companies crunch enormous data piles more quickly. Google has a lead in this area; it has built some remarkably powerful custom chips, called Tensor Processing Units (TPUs), and uses other customised accelerators to increase the processing speed of its data centres. The tech firms are also offering free open-source libraries to clients’ machine-learning experts that can be used to design AI-enabled programs. This is “not altruistic”, says Matt Turck of FirstMark Capital, a venture investor. Tech firms want to provide great tools in order to attract clients to their platforms and impress AI experts.

Microsoft has more experience than either Amazon or Google of catering to large firms’ software needs, so it is well placed to serve mainstream

companies in need of help with AI. But most such offerings still require a lot of customisation and technical work to make them useful, says Oren Etzioni of the Allen Institute for Artificial Intelligence, a non-profit research group.

The cloud providers are trying to fill the gap by offering consulting services. Google has opened an “Advanced Solutions Lab” that is part consulting service, part tech bootcamp. Whole teams from client companies can come to acquire machine-learning skills and build customised systems alongside Google engineers. Courses typically last from four weeks to several months. Demand has been “overwhelming”, says Vats Srivatsan of Google Cloud, who is now hoping to roll this out much more widely. That is a new departure for tech firms, which in the past have been strong on technical infrastructure but light on people.

The cloud providers will increasingly compete with management consultancies, which charge fat fees for helping clients navigate technological disruption. “The Googles, Amazons and Microsofts of the world may take over from the McKinseys, Boston Consulting Groups and Bains,” says Roy Bahat of Bloomberg Beta, a venture-capital firm. “Consultancies are built for two-by-two matrices. AI’s matrices are a million by a million.” In this race, consultancies with deep expertise in data and technology are better placed than those that focus on general strategy.

The generalists know they are vulnerable. McKinsey has been investing heavily to beef up its expertise in data, for example by buying QuantumBlack, an advanced-analytics firm, for an undisclosed sum in 2015. But many clients seek advice direct from tech firms, which are themselves pioneering users of AI. “All consultants do is listen to you and tell you back what you’ve already told them,” says Morag Watson of BP, an oil giant.

IBM is trying to bridge the gap between the tech wizards and the conventional consultants. “People think this will go the way the digital and

mobile revolutions went. I would argue the opposite. If people get their AI right, it's a great way to extend their incumbent advantage," says David Kenny, the boss of Watson, IBM's AI offering. Watson has been heavily marketed on television and enjoys strong name recognition, aided by its victory over human contestants in a game of Jeopardy in 2011. But its bespoke solutions for clients take lots of time to develop, running up hefty bills for consulting hours. "Watson is a branding concept that's being portrayed as a product," says Tom Siebel of C3 IOT, an AI startup. "You can't easily buy it, and you can't install it."

IBM also suffers from the same problem as any tech firm other than Google, Amazon and Microsoft: it finds it hard to get hold of the best talent. None of the top doctoral candidates in AI goes to work for IBM, says Mr Domingos of the University of Washington. The old saying that "nobody ever got fired for buying IBM" may no longer apply in the AI era.

Startups, too, are hoping to jump on the AI bandwagon. Many offer services like helping clean up and label data, and take on specific tasks that large tech firms are not yet offering, like helping firms recruit, scan job descriptions and improve customer service. For large companies it makes sense to outsource most of their AI work, except where it directly affects their strategic edge. For example, BP would not want to build AI tools to automate back-office or HR functions, but it would want to develop its own AI system for interpreting seismic imaging to detect oil, says Ms Watson.

If companies want to get products rolled out quickly, they have to work with multiple vendors, says Mr Lippert of MetLife. That may be good for startups, which can be nimble. But the incumbent tech firms' size, computing infrastructure, proprietary data and balance-sheets give them an unassailable advantage. "Right now everyone thinks they can win. The field will become considerably less democratic," predicts Martin Reeves of Boston Consulting Group. Having used AI to boost their own fortunes, the

incumbents will move on to selling the technology to customers who may become AI-fuelled giants in their own right. ■



外部提供者

留给专家

一个欣欣向荣的生态系统已经涌现，提供人工智能专业知识和技术帮助

许多科技公司的办公室都拥有豪华福利，例如小睡舱、按摩，以及可为员工提供各种奇异口味的气泡水的饮料机。企业老板们常以为找到定制的AI解决方案就和选择带点儿葡萄柚口味的碳酸饮料一样简单。他们错了。购买AI需要时间，可能还颇费力气，结果也往往不尽如人意。

若干供应商都急于为潜在用户提供帮助。领军者是西方最大的云存储供应商：亚马逊、谷歌和微软。云计算是一个价值3000亿美元的巨大市场，并且竞争非常激烈。这三家公司都提供预先训练好的模型，企业客户可以用它们来构建支持AI的系统。例如，它们都销售“视觉”工具，使客户能够使用计算机视觉来改善现有服务并构建新的服务。网约车公司优步利用微软的工具包设计了一个系统，可以在司机上岗时扫描其面部以确认身份。电视网络C-Span利用亚马逊的视觉系统编制了一个政治家数据库，当他们出现在屏幕上时可以迅速显示姓名。

市面上有各种各样的工具可以帮助主流企业构建任何东西：从搜索和推荐引擎，到语音识别、翻译系统、客户服务机器人等等。搜索巨头谷歌的AI研究部门“谷歌大脑”（Google Brain）的主任杰夫·迪恩（Jeff Dean）估计世界上有1000万个组织“面临着一个适合用机器学习解决的问题。他们有数据，但员工里没有专家。”

研究公司IDC称，AI软件、硬件和服务的潜在企业市场规模巨大：到2021年将达到约580亿美元，而去年还只有120亿美元。亚马逊在整体云计算市场中占有明显的领先优势，占到了44%，而微软和谷歌分别只占7%和2.3%。但在AI工具领域，市场仍有许多空白。网上食品杂货商Ocado的首席技术官保罗·克拉克（Paul Clarke）说，不忠于一家而是使用各家最好的工具对客户而言是件好事。他认为这些公司中的任何一家都不大可能横扫

整个市场。

云供应商试图通过两种方式来实现自己AI产品的差异化，要么是通过精心设计的界面来强调易用性，要么是提供更好的算法。微软的约瑟夫·西罗什（Joseph Sirosh）表示，每个科技巨头都会利用其“现有优势”。例如，谷歌提供了一个很好的工具，让公司可以创建或重新设计它们自己的搜索引擎，并且拥有特别出色的工程人才。微软和亚马逊拥有可靠的语音识别工具。微软的界面设计目前来看最为出色，华盛顿大学的计算机科学教授佩德罗·多明戈斯（Pedro Domingos）说，他也是关于AI和商业的《终极算法》（The Master Algorithm）一书的作者。

未来，科技公司还将开发更多专用硬件，帮助企业更快速地处理大堆数据。谷歌在这方面一马当先。它已经开发了一些非常强大的定制芯片，称为“张量处理单元”（Tensor Processing Units, TPU），并使用其他定制加速器来提高其数据中心的处理速度。科技公司还为客户的机器学习专家提供免费的开源库，可以用来设计支持AI的程序。风险投资公司FirstMark Capital的马特·图尔克（Mark Turck）表示，此举并非“大公无私”。科技公司希望提供强大的工具来把客户吸引到它们的平台上，并给AI专家留下深刻的印象。

要说满足大企业的软件需求，微软的经验比亚马逊或谷歌都要多，因此它在服务需要AI帮助的主流公司上占据主动。但是大多数这样的产品仍然需要大量的定制和技术工作才能发挥作用，非盈利研究组织艾伦AI研究所的欧伦·伊兹欧尼（Oren Etzioni）指出。

云供应商正试图通过提供咨询服务来弥合这个缺口。谷歌已经设立了一个“高级解决方案实验室”，它部分是咨询服务，部分是技术训练营。客户企业可把整个团队派来这里学习机器学习技能，并与谷歌工程师一起构建定制系统。课程通常持续四周到几个月。谷歌云平台的瓦茨·斯里瓦参（Vats Srivatsan）表示，需求一直“应接不暇”，现在他希望能够将其大规模推广。这对于科技公司来说是一个新的起点，过去它们在技术基础设施方面一直很强大，但在人的方面较薄弱。

云供应商将越来越多地与管理咨询公司竞争，后者收取高额费用来帮助客户应对技术颠覆。风险投资公司Bloomberg Beta的罗伊·巴哈特（Roy Bahat）表示，“谷歌、亚马逊和微软们可能会接过麦肯锡、波士顿咨询集团和贝恩们手中的业务。咨询公司是为了 2×2 矩阵而建立的。AI的矩阵是一百万乘一千万。”在这场竞赛中，对数据和技术有着深厚专业知识的咨询公司会比那些专注于通用战略的咨询公司更有优势。

通才们也知道自己很脆弱。麦肯锡一直在大力投资，以增强自己在数据方面的专业知识，例如它在2015年以未披露价格收购了高级分析公司QuantumBlack。但许多客户直接向技术公司寻求建议，这些技术公司本身就是AI的先驱用户。“咨询顾问所做的无非就是听你讲，然后再把你告诉他的告诉你。”石油巨头英国石油公司的莫拉格·沃特森（Morag Watson）说。

IBM正在尝试缩小科技奇才与传统顾问之间的鸿沟。“人们认为AI将带来类似于数字化和移动化的革命。我认为恰恰相反。如果AI用得好，那么这是扩展客户现有优势的好方法。”IBM的AI产品沃森（Watson）的主管大卫·肯尼（David Kenny）说。沃森在电视上得到大量宣传，品牌认知度高，2011年它在《危险边缘》（Jeopardy）中赢了人类选手更令它声名大噪。但是它为客户定制的解决方案需要大量的时间来开发，咨询时数会积累大笔费用。“沃森是一个被描绘成产品的品牌概念，”AI创业公司C3 IOT的汤姆·西贝尔（Tom Siebel）说，“你没法简单地买下它，也没法安装。”

IBM也面临除谷歌、亚马逊和微软之外的任何技术公司都面临的问题：很难获得最好的人才。华盛顿大学的多明戈斯说，AI专业的顶尖博士候选人没有一个去IBM工作。“没有人因为买了IBM的东西而被解雇”这句老话可能不再适用于AI时代。

创业公司也希望乘上AI的东风。许多公司提供诸如帮助清理和标记数据的服务，并承担大型科技公司尚未提供的特定任务，如帮助企业招聘、扫描职位描述和改进客户服务。对于大公司来说，将大部分AI工作外包出去是合理的，除非这直接影响到它们的战略优势。例如，沃特森说，英国石油

公司无意创建AI工具来将后台办公或人力资源职能自动化，但却想要开发自己的AI系统来解读地震成像，用于探测石油。

大都会人寿保险的利珀特（Lippert）说，如果公司想要让产品迅速推广，就必须与多家供应商合作。这对于灵活的创业公司来说可能是件好事。但成熟科技公司的规模、计算基础设施、专有数据和资产负债表都给了它们无懈可击的优势。“现在大家都认为它们能赢。这一领域的民主程度将大大降低。”波士顿咨询集团的马丁·里夫斯（Martin Reeves）预测道。在利用AI增加了自己的财富后，这些成熟企业将会把技术卖给客户，而这些客户本身也可能成为有AI助力的巨大。 ■



Customer service

Here to help

How AI can make businesses look more caring

“YOUR CALL IS important to us,” a recorded voice tells resigned customers as they wait endlessly to speak to a human agent. AI is starting to help companies improve the quality and consistency of their service in order to persuade customers that they do in fact care about them.

Ocado, a British online grocer, receives around 10,000 e-mails from customers every day and uses AI to detect the prevailing sentiment in them. It now replies to the most urgent ones first, and is planning to route complaints to agents with expertise in the relevant field. “Like other applications of AI, it’s about trying to make humans more efficient, not take them out of the process entirely,” says Paul Clarke, Ocado’s chief technology officer. Between 2017 and 2021 the share of customer-service interactions worldwide handled entirely by AI will rise fivefold, to 15%, and by 2019 at least 40% of such interactions will involve an element of AI, according to Gartner, a research firm.

AI will change customer service as much as the telephone did in its day. Before the phone started to spread in the early 20th century, companies handled customer inquiries by post or by visiting in person. Phones helped agents to become more productive, and AI will boost productivity even more dramatically, because it can handle large numbers of customer inquiries more quickly than humans can. This has become more important as communications channels have multiplied to take in e-mail, mobile messaging apps and social media. And consumers have got used to dealing with automated services. Surveys suggest that around 40% of American internet users would rather use digital customer services than speak to

someone on the phone.

Virtual agents are on the rise. Some 30% of companies now offer standalone “bots” that can answer questions and solve problems, although their range remains narrower than that of a human. Many of these use some AI. They are trained on logs and transcripts of past customer interactions, and as they are fed more data they become better at solving more complex queries. Such bots enable businesses to deal with many more inquiries without hiring extra people. China Merchants Bank, a commercial bank, uses a bot on the popular Chinese app WeChat to handle 1.5m-2m queries every day, a workload equivalent to around 7,000 human staff. Caesars, the hotel and casino group, offers a virtual concierge, Ivy, at two of its hotels, which answers guests’ queries by text, many of them automatically if the inquiry is simple to answer. This has reduced calls to the human-concierge desk by 30%.

AI will also enhance customer-service agents’ knowledge, performance and speed. Some companies are experimenting with “voice-printing” technology which recognises clients’ voices and alerts agents if a caller is impersonating someone else. This will be especially helpful in financial services.

One Australian bank is experimenting with a standalone smart voice-controlled speaker to listen in on agents’ conversations about loans. If the agent forgets something or makes a mistake, it jumps in. Some companies are also using AI to suggest responses to customer queries which a human agent can approve or adapt before sending. Over the past year this has allowed KLM, the Dutch flag carrier, to double the number of text-based customer inquiries it handles to 120,000 a week while increasing the number of agents by only 6%, says Dmitry Aksenov of Digital Genius, a firm that helps automate customer support.

A few companies have started offering AI-enabled services that listen to calls to judge agents' performance and send them suggestions for improvement in real time. One startup, Cogito, whose customers have included insurance firms such as Humana and MetLife, focuses on recognising "compassion fatigue" in agents. It takes in details such as how fast agents are talking and what words callers are using to detect emotion and gauge whether the interaction is going well. If there is a problem, it cues agents to act more empathetically. A tool like this can help large companies monitor their agents' performance, but the agents may also welcome the feedback. Call-centres have a turnover of 30-40% a year, partly because agents have had little help with improving their performance, says Joshua Feast, Cogito's boss.

Marty Lippert, head of technology for MetLife, reckons that in areas like customer service and human resources AI offers a return on investment of around 20%. Most companies buy AI services from outside providers, but firms with technical know-how often prefer to create their own. For example, a team at Uber, a ride-hailing firm, has built a system using AI to deal with e-mailed queries (there is no telephone option). It sends the agent ranked options for what to do next, which has cut the time it takes to resolve a complaint by around 10%.

One hope for AI is that it will free customer-service agents from routine tasks so they can sell customers other services and generate new revenue. KLM has been able to generate millions of dollars of extra sales since it started using AI because agents now have more time to help customers book upgrades and new flights, says Mr Aksenov of Digital Genius. But not all customers will appreciate more sales pitches.

AI will certainly change the way selling is done. Many firms are experimenting with developing AI-enhanced recommendation tools, like those used by Amazon and Netflix, to help salespeople with their jobs.

Google, Facebook and Amazon have been using AI to target consumers with ads and special offers online for years, with great success. Similar practices could spread to other businesses. For example, when sales staff at Goldman Sachs, an investment bank, take orders for corporate bonds, they can now see instant suggestions of bonds with similar risk profiles to pitch to their clients. Caesars uses AI to work out customers' potential daily spending, choose the clients who will receive personal phone calls and in what order, and decide what specific promotions to offer them. The company's boss, Mark Frissora, says that refining marketing to a "message of one" boosts customer loyalty over time.

Gartner, a research firm, expects the number of phone-based customer-service agents worldwide to decline by 10% by 2019. That would increase the workload of those who are left. But companies need to be careful not to dilute their interactions with customers too much. The rise of virtual communication has left them with fewer opportunities to establish deep relationships, so customer service will become ever more important.

Clever firms will use AI not just to improve existing services but to engineer new ones. Metro Group, a German retailer, is testing the use of computer vision at the checkout: the items in a basket are recorded by cameras and the shopper is charged accordingly. Amazon uses similar technology in a convenience store in Seattle. Timo Salzsieder, chief information officer of Metro Group, reckons these new unmanned, vision-enhanced checkouts can handle 50 customers per hour, more than double the number for a manned checkout.

Some insurers, including Ping An of China, use AI to let customers file a claim after a car accident. Instead of having to phone the insurance company and fill in lots of forms, customers take photos of the damage to their car and submit them through an app for a quick quote for repairs. Building a tool like this is a technological challenge, but getting in early is

a good idea. Services that make customers' lives easier will generate more customers, who will provide more training data to make the AI systems smarter. Ping An gets 15m claims a year and handles 30% of them on its app. "It takes an enormous amount of cost out of the system and puts customers in control," says Jonathan Larsen, Ping An's chief innovation officer. Such offerings also reinforce firms' direct relationship with their customers.

Conversely, voice-controlled smart speakers, as offered by Amazon, Google, Microsoft and Apple, could come between the companies and their targets. Some of these speakers host other firms' apps. For example, UPS has built a tool enabling customers to track their packages through Amazon's Alexa, which they might previously have done online or by phone. Companies worry they could be disintermediated, so that the firm that makes the speaker becomes the customer's primary relationship, says Paul Daugherty of Accenture, a consulting firm, and co-author of a new book, "Human + Machine: Reimagining Work in the Age of Artificial Intelligence". And, since voice-controlled speakers guide customers to a single answer rather than offering them multiple choices of firms to interact with, those that cannot or do not want to use these speakers may miss out on forming a relationship in the first place. Much will depend on how quickly voice speakers spread. Currently only about one in six American adults owns one, but that is already more than double the figure a year ago. And as speech recognition improves further, the appeal of speakers will grow, especially among youngsters. ■



客户服务

竭诚为您服务

人工智能如何能让企业看起来更关心它们的客户

“您的来电对我们很重要。”电话那头传来一个预先录制好的声音。顾客们除了没完没了地等待人工客服接听，别无他法。不过，人工智能已经开始帮助企业提高服务的质量和稳定性，以让客户相信自己是真的关心他们。

英国网上杂货店Ocado每天收到约一万封来自客户的电子邮件，它用AI探测这些邮件中的主导情绪。它现在会先回复最紧急的问题，并计划把客户投诉发送给具有相关领域专业知识的客服人员。“和人工智能的其他应用一样，这是为了提高人的效率，而不是把他们整个从业务流程中拿掉。”Ocado的首席技术官保罗·克拉克（Paul Clarke）说。据调研公司高德纳估计，2017年至2021年间，全球客服互动中完全由AI处理的比例将增加五倍，达到15%；到2019年，这类互动中的至少40%将用到某种AI元素。

AI给客服部门带来的变化将堪比电话在当年产生的影响。上世纪初电话开始普及之前，企业靠邮政系统或登门拜访来处理客户咨询。电话提高了客服人员的效率，而AI将更大幅地提高他们的生产率，因为它能比人更快地处理大量客户询问。如今交流的渠道更多了——电子邮件、手机聊天应用和社交媒体——这一点就愈发重要。而消费者也已习惯了面对自动化服务。调查显示，相比与真人通话，约40%的美国互联网用户宁愿使用数字客服。

虚拟客服正在快速发展。目前有约30%的公司提供能独立回答和解决问题的“机器人”，尽管它们处理问题的范围一直比人工客服要窄。其中有许多用到了一些AI技术。企业用客服人员与顾客的互动历史记录来训练这些机器人，随着提供给它们的数据越来越多，它们也越来越能够处理好更复杂的咨询。这些机器人让企业能够处理的咨询量大增却无需多雇人手。招商银行在流行的中文应用微信上用一个机器人每天处理150万至200万条查

询，相当于约7000名员工的工作量。赌场和酒店集团凯撒娱乐（Caesars）在它的两家酒店里提供了通过文本回答客人提问的虚拟礼宾员Ivy，如果问题简单的话它很多就自动回答了。这使得客人打给真人服务台的电话减少了30%。

AI也将增强客服人员的知识、表现和速度。一些公司正在尝试使用“声纹”技术识别客户的声音，在发现来电者假冒他人时发出警报。这对金融服务业尤有助益。

澳大利亚的一家银行正在测试一种独立使用的语音控制智能音箱，让它聆听客服和客户有关贷款的对话。如果客服忘记了什么或说错了，它就会做出干预。一些公司也在使用AI为客服人员提供回答问题的建议，他们可以选择直接发送这些答案或者微调后再发送。专门帮助企业实现客服自动化的数字天才公司（Digital Genius）的德米特里·阿克塞诺夫（Dmitry Aksenov）表示，过去一年里，荷兰的国家航空公司荷兰皇家航空（KLM）就用这种方法令它每周处理的客户文本咨询量增加了一倍，达到12万人次，与此同时客服人员仅增加了6%。

一些企业已开始提供一类由AI支持的服务，它们会聆听客服电话以评判客服人员的表现，并实时向他们发送改进建议。创业公司Cogito的客户包括哈门那（Humana）和大都会人寿（MetLife）等保险公司，其AI系统的工作重点是识别客服的“同情疲劳”。它会考察客服的语速、顾客的用词等细节来探测情绪，衡量互动是否顺利。一旦察觉问题，它会提示客服表现得更有同情心些。像这样的工具可以帮助大企业监控其客服人员的表现，但客服人员自身可能也会欢迎这类反馈意见。Cogito的老板乔舒亚·费斯特（Joshua Feast）说，客服中心每年的人员离职率为三到四成，部分原因是客服在改善自身业务方面得不到什么帮助。

大都会人寿的技术主管马蒂·利珀特（Marty Lippert）认为，在客服和人力资源等领域，AI的投资回报率约为20%。大多数公司都从外部供应商那里购买AI服务，但那些拥有技术知识的企业往往更愿意自行创建AI系统。例如，网约车公司优步的一个团队开发了一个使用AI处理电子邮件查询的系

统（这家公司没有电话客服）。它会向客服人员发送下一步该做什么的优选项排列，从而将解决一则投诉所需的时间缩短了约10%。

AI带来的希望之一是客服人员不用再处理常规问询，因而能腾出时间来向客户推销其他服务，创造新的收入。数字天才公司的阿克塞诺夫说，自开始使用AI以来，荷航的销售额增加了数百万美元，因为其客服人员现在有更多时间来帮助客户预订升级和新航班。不过，并非所有顾客都会喜欢更多推销。

AI势必会改变销售方式。许多企业都在尝试开发由AI增强的推荐工具，比如亚马逊和网飞使用的那些，以帮助销售人员提升业绩。多年来谷歌、Facebook和亚马逊已在使用AI提供针对特定消费者的定向广告和特殊优惠，取得了巨大的成功。类似的做法可能会传播到其他企业。例如，投资银行高盛的销售人员现在为客户下公司债券订单时，可以立即看到具有类似风险特征的债券而向客户做出推荐。凯撒娱乐用AI估算客人的日常消费水平，选择向哪些客人致电以及以何种顺序致电，并决定向他们提供哪种针对性的促销。公司老板马克·弗里索拉（Mark Frissora）表示，久而久之，将营销细化为“专入信息”的做法提升了客户的忠诚度。

调研公司高德纳预计，到2019年全球电话客服人员将减少10%。这将使得留在岗位上的人的工作量增加。但是，企业需要小心不要过多地稀释了自己与客户的互动。虚拟沟通的兴起减少了企业与客户建立深厚关系的机会，因此客户服务只会变得愈发重要。

明智的企业将不仅仅利用AI改进现有服务，还要打造出新服务。德国零售商麦德龙集团（Metro Group）正在收银台上测试计算机视觉技术：摄像头会记录下顾客篮子中的物品并相应收费。亚马逊在西雅图的一家便利店里使用了类似的技术。麦德龙的首席信息官蒂莫·萨尔兹泽达（Timo Salzsieder）估计，这些全新的视觉增强型无人结账系统每小时可为50名顾客结账，是人工收银员的一倍多。

包括平安保险在内的一些保险公司利用AI技术来帮助客户在车祸后提出索

赔。客户不必再打电话给保险公司并填写大量表格，而只需拍摄车辆损坏的照片，通过一款应用提交后迅速获得维修报价。创建这样一款工具是一项技术挑战，但尽早利用AI是明智的。能让客户的生活变得更轻松的服务将带来更多客户，而他们又将提供更多的数据来训练AI系统，让它变得更智能化。平安每年收到1500万个索赔申请，在其应用上处理其中的30%。“这节省了大量成本，并让客户自己掌控过程。”公司首席创新官乔纳森·拉森（Jonathan Larsen）表示。这类服务也加强了公司与客户的直接联系。

与之相反，由亚马逊、谷歌、微软和苹果提供的语音控制智能音箱却可能会妨碍企业和其目标客户的关系。一些音箱安装了其他公司的应用。例如，UPS已经创建了一个工具，让它的客户能通过亚马逊的Alexa来跟踪包裹——他们以前可能要通过网络或电话来做这件事。新书《人机融合：人工智能时代的劳动方式》（Human + Machine: Reimagining Work in the Age of Artificial Intelligence）的合著者之一、咨询公司埃森哲的保罗·多尔蒂（Paul Daugherty）说，企业担心自己遭遇“去中介化”，而音箱的制造商将和客户建立起首要关系。而且，由于语音控制音箱会给客户提供单一的答案，而不是多个公司的选项，那些不能或不想使用这些音箱的企业可能在一开始就错过了建立关系的机会。这在很大程度上要取决于这种音箱的推广速度。目前只有六分之一的美国成年人拥有这种音箱，但相比一年前已经增长了一倍多。而随着语音识别技术进一步完善，它们的吸引力会越来越大，对年轻人尤为如此。 ■



Artificial intelligence in business

GrAIt expectations

Artificial intelligence is spreading beyond the technology sector, with big consequences for companies, workers and consumers, says Alexandra Suich Bass

LIE DETECTORS ARE not widely used in business, but Ping An, a Chinese insurance company, thinks it can spot dishonesty. The company lets customers apply for loans through its app. Prospective borrowers answer questions about their income and plans for repayment by video, which monitors around 50 tiny facial expressions to determine whether they are telling the truth. The program, enabled by artificial intelligence (AI), helps pinpoint customers who require further scrutiny.

AI will change more than borrowers' bank balances. Johnson & Johnson, a consumer-goods firm, and Accenture, a consultancy, use AI to sort through job applications and pick the best candidates. AI helps Caesars, a casino and hotel group, guess customers' likely spending and offer personalised promotions to draw them in. Bloomberg, a media and financial-information firm, uses AI to scan companies' earnings releases and automatically generate news articles. Vodafone, a mobile operator, can predict problems with its network and with users' devices before they arise. Companies in every industry use AI to monitor cyber-security threats and other risks, such as disgruntled employees.

Instead of relying on gut instinct and rough estimates, cleverer and speedier AI-powered predictions promise to make businesses much more efficient. At Leroy Merlin, a French home-improvement retailer, managers used to order new stock on Fridays, but defaulted to the same items as the week before so they could start their weekend sooner. The firm now uses algorithms to take in past sales data and other information that could affect

sales, such as weather forecasts, in order to stock shelves more effectively. That has helped it reduce its inventory by 8% even as sales have risen by 2%, says Manuel Davy of Vekia, the AI startup that engineered the program.

AI and machine learning (terms that are often used interchangeably) involve computers crunching vast quantities of data to find patterns and make predictions without being explicitly programmed to do so. Larger quantities of data, more sophisticated algorithms and sheer computing power have given AI greater force and capability. The outcomes are often similar to what an army of statisticians with unlimited time and resources might have come up with, but they are achieved far more quickly, cheaply and efficiently.

One of AI's main effects will be a dramatic drop in the cost of making predictions, says Ajay Agrawal of the University of Toronto and co-author of a new book, "Prediction Machines". Just as electricity made lighting much more affordable—a given level of lighting now costs around 400 times less than it did in 1800—so AI will make forecasting more affordable, reliable and widely available.

Computers have been able to read text and numbers for decades, but have only recently learned to see, hear and speak. AI is an omnibus term for a "salad bowl" of different segments and disciplines, says Fei-Fei Li, director of Stanford's AI Lab and an executive at Google's cloud-computing unit. Subsections of AI include robotics, which is changing factories and assembly lines, and computer vision, used in applications from identifying something or someone in a photo to self-driving-car technology. Computer vision is AI's "killer app", says Ms Li, because it can be used in so many settings, but AI has also become more adept at recognising speech. It underlies voice assistants on phones and home speakers and allows algorithms to listen to calls and take in the speaker's tone and content.

Until now the main beneficiary of AI has been the technology sector. Most

of today's leading tech firms, such as Google and Amazon in the West and Alibaba and Baidu in China, would not be as big and successful without AI for product recommendations, targeted advertising and forecasting demand. Amazon, for example, uses AI widely, for tasks such as guiding robots in its warehouses and optimising packing and delivery, as well as detecting counterfeit goods and powering its speaker, Alexa. Alibaba, a Chinese rival, also makes extensive use of AI, for example in logistics; and its online-payments affiliate, Ant Financial, is experimenting with facial recognition for approving transactions. Sundar Pichai, Google's boss, has said that AI will have a "more profound" impact than electricity or fire.

Bosses of non-tech companies in a broad range of industries are starting to worry that AI could scorch or even incinerate them, and have been buying up promising young tech firms to ensure they do not fall behind. In 2017 firms worldwide spent around \$21.8bn on mergers and acquisitions related to AI, according to PitchBook, a data provider, about 26 times more than in 2015 (see chart). They are doing this partly to secure talent, which is thin on the ground. Startups without revenue are fetching prices that amount to \$5m-10m per AI expert.

As AI spreads beyond the tech sector, it will fuel the rise of new firms that challenge incumbents. This is already happening in the car industry, with autonomous-vehicle startups and ride-hailing firms such as Uber. But it will also change the way other companies work, transforming traditional functions such as supply-chain management, customer service and recruitment.

The path ahead is exhilarating but perilous. Around 85% of companies think AI will offer a competitive advantage, but only one in 20 is "extensively" employing it today, according to a report by MIT's *Sloan Management Review* and the Boston Consulting Group. Large companies and industries,

such as finance, that generate a lot of data, tend to be ahead and often build their own AI-enhanced systems. But many firms will choose to work with the growing array of independent AI vendors, including cloud providers, consultants and startups.

This is not just a corporate race but an international one, too, especially between America and China. Chinese firms have an early edge, not least because the government keeps a vast database of faces that can help train facial-recognition algorithms; and privacy is less of a concern than in the West.

There will be plenty of opportunities to stumble. One difficult issue for companies will be timing. Roy Bahat of Bloomberg Beta, a venture-capital firm, draws a parallel between now and the first dotcom boom of the late 1990s: “Companies are flailing to figure out what to spend money on.” If they invest huge sums in AI early on, they run the risk of overcommitting themselves or paying large amounts for worthless startups, as many did in the early days of the internet. But if they wait too long, they may leave themselves open to disruption from upstarts, as well as from rivals that were quicker to harness technology.

Some may have been misled by glowing media reports, believing AI to be a magic wand that can be installed as easily as a piece of Microsoft software, says Gautam Schroff of Tata Consultancy Services, an Indian firm. AI systems require thorough preparation of data, intensive monitoring of algorithms and a lot of customisation to be useful. Gurdeep Singh of Microsoft speaks of AI systems as “idiots savants”; they can easily do jobs that humans find mind-boggling, such as detecting tiny flaws in manufactured goods or quickly categorising millions of photos of faces, but have trouble with things that people find easy, such as basic reasoning. Back in 1956, when academic researchers held their first gathering to discuss AI, they were looking for a way to imbue machines with human-like “general”

intelligence, including complex reasoning. But that remains a distant aspiration.

The excitement around AI has made it hard to separate hype from reality. In the last quarter of 2017 public companies across the world mentioned AI and machine learning in their earnings reports more than 700 times, seven times as often as in the same period in 2015 (see chart). There are so many firms peddling AI capabilities of unproven value that someone should start “an AI fake news” channel, quips Tom Siebel, a Silicon Valley veteran.

Bosses must keep several time horizons in mind. In the near future AI will reshape traditional business functions such as finance, HR and customer service, according to Michael Chui of the McKinsey Global Institute, a think-tank within a consultancy. But over time it will also disrupt whole industries, for example by powering the rise of autonomous vehicles or the discovery of entirely new drug combinations. Whereas humans may have preconceptions about which product designs or drug combinations are likely to work best, algorithms are more likely to come up with novel solutions.

In private, many bosses are more interested in the potential cost and labour savings than in the broader opportunities AI might bring, says John Hagel of Deloitte, a consultancy. That is certainly not good for workers, but nor, ultimately, is it good for business. “If you just cut costs and don’t increase value for customers, you’re going to be out of the game,” he says. Some companies may not actually eliminate existing jobs but use technology to avoid creating new ones. And workers who keep their jobs are more likely to feel spied on by their employers. Some firms already use AI to comb through their workers’ communications to ensure that they are not breaking the law. Such practices will spread, raising privacy issues.

A longer-term concern is the way AI creates a virtuous circle or “flywheel” effect, allowing companies that embrace it to operate more efficiently, generate more data, improve their services, attract more customers and offer lower prices. That sounds like a good thing, but it could also lead to more corporate concentration and monopoly power—as has already happened in the technology sector. ■



商业中的人工智能

远大前程

人工智能的传播已超越技术领域，给企业、员工及消费者带来重大影响，本文作者亚历山德拉·苏伊希·巴斯观察认为

测谎仪并未在企业中广泛应用，但中国平安保险公司相信自己能探测谎言。这家公司让客户通过它的一款应用程序来申请贷款。未来的贷款人在视频中回答有关收入和还款计划的问题。视频会监测他们的大概50个细微面部表情，判断他们是否在说真话。这套人工智能（AI）驱动的程序帮助筛查出需要进一步审核的客户。

AI将改变的不仅仅是贷款人的账户余额。消费品公司强生和咨询公司埃森哲（Accenture）用AI查看应聘资料，筛选出最佳人选。AI帮助赌场和酒店集团凯撒娱乐（Caesars）估测客人的消费水平，提供个性化促销来吸引他们。媒体和金融信息公司彭博用AI扫描企业财报，自动生成新闻报道。移动运营商沃达丰（Vodafone）用AI监测其网络和用户设备，提前预警故障。各行各业的公司都在使用AI监控网络安全威胁和其他风险，比如心怀不满的员工。

相比依赖直觉和粗略的估算，更聪明也更快速的AI预测将帮助企业大幅提高效率。法国家居装饰零售商乐华梅兰（Leroy Merlin）的管理层以前每周五下新订单，默认的设置是重复前一周的订单，这样大家可以早点下班过周末。现在，公司用算法来斟酌历史销售数据和天气预报等其他可能影响销售的信息，以更有效地安排库存。据创建该算法的AI创业公司Vekia的曼纽尔·戴维（Manuel Davy）说，这帮助该公司将库存减少了8%，同时销售额却增长了2%。

AI和机器学习（这两个术语常被混用）用计算机处理查看海量数据，从中找出模式并做出预测，而不需要编程来作出明确的指示。更多数据、更复杂的算法和更高的计算能力已经赋予了AI更强大的能力。它得出的结果往往和一大批拥有无限时间和资源的统计师所得的差不多，但它远为快速、

便宜和高效。

AI的主要成果之一将是令做预测的成本大幅下降，新书《预测机器》（Prediction Machines）的合著者、多伦多大学的阿杰伊·阿格拉沃尔（Ajay Agrawal）表示。就像电力让照明变得便宜了许多——如今的照明成本比1800年时低400倍左右——AI会让做预测更便宜、更可靠、更普及。

计算机能阅读文本和数字已经有几十年了，但直到最近才学会了看、听、说。AI是一个综合性术语，就像是涵盖了不同领域和学科的“一碗色拉”，斯坦福大学人工智能实验室主管、谷歌云计算部门负责人李飞飞说。它的下属分支包括正在改变工厂和组装线的机器人技术，以及部署在各种应用程序中的计算机视觉——从识别照片中的人或物到无人驾驶汽车技术等。李飞飞说，计算机视觉是AI的“杀手级应用”，因为运用场合是如此之多，但AI在语音识别方面也已变得更加娴熟。它是配备在手机和家用音箱上的语音助理的技术基础，还让算法能够监听来电并识别说话者的语调和内容。

到目前为止，AI的主要受益者一直是技术部门。如果没有AI帮助实现产品推荐、定向广告和需求预测，那么当今大多数科技领军企业，比如西方的谷歌和亚马逊以及中国的阿里巴巴和百度，都不会发展到今天这般庞大且成功。举例来说，亚马逊广泛使用AI来完成各种任务，诸如在仓库中指示机器人工作、优化包装和运送、检测假货，支持其智能音箱Alexa等。它的竞争对手、中国的阿里巴巴也在物流等部门广泛运用AI，其在线支付分支机构蚂蚁金服正测试使用面部识别来核准交易。谷歌执行长桑达尔·皮查伊（Sundar Pichai）曾经说过，AI将产生比电或火“更深远”的影响。

然而各行各业的非科技公司老板们已经开始担心，AI可能会冲击甚至毁灭自己，因而他们纷纷收购看来颇有前途的年轻科技公司，以确保自己不落人后。据数据供应商PitchBook统计，2017年全球企业在AI相关并购上的支出约达218亿美元，比2015年增长约26倍（见图表）。它们这样做的部分原因是为获得目前仍相当稀缺的AI人才。尚未产生收入的创业公司为聘

请一名AI专家花费多达500万至1000万美元。

随着AI传播到科技行业之外，它将推动新企业的崛起，为成熟企业带来挑战。这已经在汽车产业里发生——AI催生了无人驾驶汽车创业公司和优步等网约车公司。但它也将改变其他企业的运作方式，改变供应链管理、客服和招聘等传统职能。

前路令人振奋却也危险重重。根据麻省理工学院的《斯隆管理评论》和波士顿咨询集团联合撰写的报告，约85%的企业认为AI将带来竞争优势，但只有5%的公司正在“广泛”地使用它。生成大量数据的大企业和金融等行业往往走在前头，常常建立自己的AI增强系统。但许多企业会选择与队伍不断扩大的独立AI供应商合作，包括云供应商、咨询公司和创业公司等。

这不仅是一项企业竞赛，也是一场国际竞逐——尤其在中美之间。中国企业有一个先发优势，这主要是因为中国政府拥有一个庞大的人脸数据库，可以用来训练面部识别算法。而且，与西方相比，中国人对隐私也不那么关切。

跌跤的机会很多。企业面临的难题之一是对时机的把握。风险投资公司Bloomberg Beta的罗伊·巴哈特（Roy Bahat）把眼下的状况比作上世纪90年代末的首个互联网泡沫期：“对于该往哪儿投钱，企业无所适从。”如果它们早早地在AI上投入巨资，就要冒对一文不值的创业公司过度依赖或为之浪费大笔金钱的风险，就像互联网早期许多公司的经历那样。但如果它们等得太久，又有可能把自己置于被市场新贵颠覆的境地，还可能被更快掌握了新技术的竞争对手冲击。

还有些企业可能被媒体天花乱坠的报道误导，以为AI就是一根魔法棒，像微软的软件一样容易安装，印度公司塔塔咨询服务（Tata Consultancy Services）的高塔姆·施罗夫（Gautam Schroff）说。AI系统需要全面细致地准备数据、深入地监测算法和大量的定制才能发挥用处。微软的格迪普·辛格（Gurdeep Singh）称AI系统为“白痴专家”——它们能轻易完成让人类望而却步的艰巨任务，比如检测制成品中的细小瑕疵，或给数百万张人脸

照片快速分类，但在那些对人类而言轻而易举的任务上（比如基本推理）却遇到麻烦。早在1956年学术研究人员举行首次AI研讨会时，他们就在寻找办法来赋予机器像人类那样的“一般”智能，包括复杂推理的能力。但直到今天，这仍是一种遥遥无期的向往。

AI引发的兴奋之情使得我们难以分辨炒作和现实。2017年最后一个季度，全球上市公司在它们的财报中提到AI和机器学习多达700多次，是2015年同期的七倍（见图表）。硅谷资深人士汤姆·西贝尔（Tom Siebel）开玩笑说，这么多公司在兜售尚未证实价值的AI技术，应该有人来开办一个“AI假新闻”频道了。

老板们须谨记几个时间段。根据咨询公司麦肯锡下属智库麦肯锡全球研究院的迈克尔·崔（Michael Chui）的说法，在不久的将来，AI将重塑企业的传统职能，比如财务、人事和客服。但随着时间的推移，它也将颠覆行业整体，比如通过推动无人驾驶汽车兴起和发现全新的药物组合等。人类对于哪种产品设计或药物组合可能取得最佳效果也许已有成见，而算法更可能提出全新的解决方案。

咨询公司德勤的约翰·哈格尔（John Hagel）说，私下里，很多企业老板更为关注AI能帮助节省多少成本和劳动力，而不是它带来的更广泛的机会。这对员工来说肯定不是好事，但最终也会对企业不利。“如果你只是削减成本而不增加为客户带来的价值，那你就会被淘汰。”他说。一些企业或许并不会削减现有岗位，但会利用技术来避免裁员。而那些保住了工作的工人更可能感到被雇主监视。一些公司已经在使用AI查看员工的聊天记录，以确保他们不违法。这类做法将日益普遍，从而引发隐私问题。

从更长远的视角看，我们要担忧AI将创造良性循环或“惯性轮”效应：它会使那些采纳它的企业更高效地运营，生成更多数据，改善服务，吸引到更多客户，提供更低的价格。这听起来像是一件好事，但它会导致更多企业整合和垄断——就像科技领域已经发生的那样。 ■



Unconsciousness

Going under

Tracking the brain's electrical activity can make anaesthesia safer

AROUND 1936 three neurologists at Harvard Medical School raided the medicine cabinet, filling their boots with morphine, barbiturates, ethers and even cobra venom. They injected those substances into (apparently) willing volunteers and cemented primitive electrodes to their scalps and earlobes. They also collared a drunk and wired him up. With pen and paper, they then recorded how the electrical signals in their volunteers' brains changed as the drugs began to take hold.

This kind of gonzo science might meet a touch of resistance from the institutional review board if proposed today, but the work of Gibbs, Gibbs and Lennox still stands. The trio showed, without meaning to, that sedatives lower the activity of the brain through several clear stages, and that each stage is observable in that organ's electrical readings. Their results have been refined over the years, of course, to the extent that Emery Brown, a successor of theirs at Harvard, now thinks, as he told the AAAS meeting, that statistical analysis of such electroencephalography (EEG) signals has become so good that it can be used to make anaesthesia safer and better.

The EEG of a conscious brain shows no striking features, just low-amplitude and seemingly uncorrelated ups and downs in the frequency of oscillations in the brain's electric field. That is because the brain's neurons are firing independently of one another as they go about the various tasks that render their owner conscious. Then (as the Harvard trio found) as the patient goes under the oscillations smooth out, deepening into a stark, uniform wave which vibrates ten times a second. The drug has tripped the neurons into singing from the same hymn sheet. Their unified song takes over from the

cacophony of a conscious brain, and the patient is out.

That, Dr Brown believes, gives anaesthetists a better way to assess how deeply someone is under than measuring blood pressure and heart rate. He regularly uses brain waves clinically. In a recent operation, for example, he was able to administer a third of the normal dose of an anaesthetic called propofol to an 81-year-old cancer patient, monitoring her brain waves to ensure that she was deeply under at all times. Indeed, he thinks he may be able to automate the whole process, and has designed a machine which adjusts the dose in response to brainwave changes.

He also believes that the potential for using EEG to understand unconscious brainwaves goes beyond the operating table. Sleeping pills, for instance, do not so much aid sleep as sedate their recipient. Dr Brown thinks insomniacs might be guided into true sleep through a more precise examination of their brain activity, and the application of commensurate drugs.

Moreover, true successor to Gibbs, Gibbs and Lennox that he is, Dr Brown reveals his own gonzo side when he says his understanding of EEG readouts is such that he believes he could safely place someone into, and then retrieve him from, a “locked-in” state—one in which a person is fully aware of his surroundings, but incapable of any movement or action. When your correspondent offered himself as a test subject, only partially in jest, Dr Brown flashed an arch grin, before sombrely explaining that such an experiment would be beyond the tolerance of modern review boards, too. ■



失去知觉

陷入昏迷

追踪脑电活动可以使麻醉更安全

大约在1936年，哈佛医学院的三位神经学家扫荡了药品柜，把大堆的吗啡、巴比妥类和醚类药物，甚至还有眼镜蛇毒，都塞进了汽车后备箱。他们把这些药物注射到（看起来是）心甘情愿的志愿者体内，再把简陋的电极贴到他们的头皮和耳垂上。他们还给一名醉汉带上颈圈接通电源。然后当药物开始起效时，他们用纸笔记录下志愿者脑电信号的变化。

如果是在今天，提议做这样疯狂的科学试验可能会遭到医学院伦理审查委员会的些许阻力，不过，吉布斯（Gibbs）夫妇和伦诺克斯（Lennox）的研究成果至今仍站得住脚。他们无意中证明了镇静剂对大脑活动的抑制分为几个明显的阶段，每个阶段都可以在脑电图中观察到。当然，多年来他们的结论也经过不断改进。现在，他们在哈佛的一位继承者埃默里·布朗（Emery Brown）在美国科学促进会（AAAS）会议上表示，对这种脑电（EEG）信号的统计分析已经做得非常之好，可以利用它们来使麻醉变得更安全有效。

当大脑意识清醒时，脑电图没有显著的特征，只能看到脑电场的振荡频率有着幅度很低、看起来互不关联的起伏。这是因为大脑的神经元在相互独立地放电，进行各种活动，从而使人保持清醒。然后（就像哈佛的三位学者发现的那样），当病人开始昏迷时，振荡趋于平滑，加深成为一个明显而均匀的波，每秒振动十次。药物触发了神经元步调一致地放电。它们奏响的单一乐章取代了大脑清醒时的各种杂音，病人陷入昏迷。

布朗认为，这给了麻醉师一种比测量血压和心率更好的方法来判定一个人的昏迷程度。他经常在临幊上使用脑电波。例如，在最近一次手术中，他要给一位81岁的癌症病人注射一种名为丙泊酚（propofol）的麻醉剂，他通过监测脑电波来确保她一直处于深度昏迷，结果只用了正常剂量的三分

之一。事实上，他认为他或许可以让整个过程都自动化，并已设计了一台能根据脑电波变化来调整剂量的机器。

他还认为，用脑电图来读懂无意识大脑的脑电波，可应用的范围超出了手术台。例如，安眠药的镇静作用大于助眠作用。布朗认为，通过更精确地检测失眠患者的大脑活动，并使用相应的药物，或许可以将患者导向真正的睡眠。

此外，作为吉布斯夫妇和伦诺克斯的忠实继承人，布朗也显现出了自己疯狂的一面。他说他相信脑电图读数可以达到这样的程度：他能安全地把一个人放进或抽离“闭锁”状态——一个人能充分意识到自己所处的环境，但不能做出任何动作或行动。当本报记者半开玩笑地提出自己来当试验对象时，布朗调皮地露齿而笑，接着严肃地解释说，这样的实验也是现代审查委员会不能容忍的。 ■



Currency wars

Tweeting the dollar down

America's president, but not its Treasury, names currency manipulators

MOST governments are happy when foreigners want their bonds, especially when those foreigners are long-term holders, like central banks. But America is different. It worries that some foreign governments buy its debt to keep the dollar pricey and their own currencies cheap. This “currency manipulation” gives other countries a competitive edge, raising their own trade surpluses and America’s deficit.

Brad Setser of the Council on Foreign Relations, a think-tank, sees an “arc of intervention” across Thailand, Singapore, Taiwan and South Korea that has slowed the dollar’s decline over the past nine months. America has reportedly persuaded South Korea to forswear currency manipulation in a “side-agreement” to their revised trade deal. And on April 16th President Donald Trump tweeted that “Russia and China are playing the Currency Devaluation game...Not acceptable!”

Mr Trump’s tweet was at odds with his Treasury Department’s assessment. Every six months it must tell Congress if any big trading partner is manipulating its currency. (Offending governments are scolded, followed by other chastisements if they do not mend their ways.) But its latest report, published on April 13th, refrained from branding anyone a manipulator.

The report did admonish China for its persistently large trade surplus in goods with America. But Russia was barely mentioned. The recent decline in its currency was, after all, prompted by the Treasury’s decision to strengthen sanctions.

Instead the report paid uncustomary attention to India, pointing out that

it has a large trade surplus in goods with America and that its central bank has intervened heavily in currency markets, with net foreign-exchange purchases worth 2.2% of its GDP. It was added to a “monitoring list” of countries warranting closer scrutiny.

The list itself does not bear much scrutiny, however. As well as India, it comprises China, Germany, Japan, South Korea and Switzerland. But India has no overall trade surplus and Germany has no currency of its own to manipulate. The list also ignores Thailand and Singapore, which have intervened over the past year to curb the rise in their currencies, according to Mr Setser.

These oddities are not entirely the Treasury’s fault. It is required to assess a country against three criteria: its trade surplus with America, its current-account surplus with the world and its intervention in currency markets. The first measure makes little sense, point out Fred Bergsten and Joseph Gagnon of the Peterson Institute for International Economics. In today’s global supply chains, countries like Singapore can sell materials to China that end up in products bought by America. Their direct exports to America may seem modest. But their indirect exports, embedded in goods sold by China, may be large.

The Treasury is also required to consider only America’s “major” trading partners. It thus limits its analysis to the largest dozen (plus Switzerland, the 15th-largest). That gives small, interventionist economies a free pass, notes Stephanie Segal of the Centre for Strategic and International Studies, another think-tank.

Within these broad limits the report’s authors enjoy substantial discretion. And the Treasury is considering broadening the definition of a “major” trading partner. It thus had leeway to prepare a more rigorous report if it had wished to do so. Instead, says Mr Setser, it wrote this report to be ignored.

Perhaps Treasury officials do not want to be drawn into Mr Trump's tariff tit-for-tat, suggests Mr Gagnon. The report waves the flag (invoking "fair and reciprocal" trade) but fires no bullets. It may be hard to cheapen the dollar, but it is easy to depreciate a report. ■



货币战争

“推”低美元

指认“货币操纵国”的不是美国财政部，而是美国总统

大多数国家的政府都乐见本国债券受外国投资者青睐，如果那些外国人是外国央行等长线投资者就更是如此了。但美国却不同。它担心某些外国政府购入自己的国债是为了推高美元、让本国货币保持在低位。这种“货币操纵”会给其他国家带来竞争优势，增加它们的贸易顺差，扩大美国的贸易赤字。

美国智库外交关系委员会（Council on Foreign Relations）的布拉德·塞瑟（Brad Setser）发现，过去九个月里，一道“干预弧线”出现在泰国、新加坡、台湾和韩国，延缓了美元的贬值。据称美国已通过美韩贸易协议修订版中的一份附带协议说服韩国放弃操纵货币。4月16日，特朗普发推文表示：“俄罗斯和中国正在耍货币贬值的把戏.....不可接受！”

特朗普的推文与美国财政部发布的评估结果存在矛盾。美国财政部每半年必须向国会提交报告，说明美国主要贸易伙伴是否有操纵货币之嫌。货币操纵国会受到批评，如果不改弦更张，美国将进一步施以惩罚。但美国财政部在4月13日发布的最新报告并没给谁贴上货币操纵国的标签。

报告确实就中国对美国长期的庞大商品贸易顺差提出了警告，但对俄罗斯几乎只字未提。毕竟，卢布最近大幅贬值是由美国财政部决定加大对俄制裁而引发的。

报告倒是不同寻常地关注了印度的情况，指出印度对美商品贸易顺差庞大，而且其央行重度干预货币市场，净外汇购买额占到了GDP的2.2%。印度被列为需进一步观察的国家，添至“监控名单”中。

但这份名单本身却经不起推敲。除印度外，名单中还有中国、德国、日本、韩国和瑞士。然而，印度整体上不存在贸易顺差，德国也没有自己的

货币可操纵。塞瑟表示，这份名单还漏掉了泰国和新加坡，这两个国家在过去一年都曾以干预措施遏制本国货币升值。

出现这些怪象，并不能全怪美国财政部。该部门需要根据三个标准来评估一个国家：对美贸易顺差、全球经常账户顺差、对货币市场的干预。彼得森国际经济研究所（Peterson Institute for International Economics）的弗雷德·伯格斯滕（Fred Bergsten）和约瑟夫·加格农（Joseph Gagnon）指出，第一项标准意义不大。在当今的全球供应链中，像新加坡这样的国家可以向中国出售原材料，而制成品最终售往美国。它对美直接出口额也许看似不大，但包含在中国出口商品中的间接出口可能就很大了。

而且，财政部只需考虑美国的“主要”贸易伙伴，所以其分析限于12个最大的贸易伙伴国（再加上第15大贸易伙伴瑞士）。这无疑给奉行干预主义的小型经济体发了免死金牌，另一个智库战略和国际研究中心（Centre for Strategic and International Studies）的斯蒂芬妮·西格尔（Stephanie Segal）指出。

在上述笼统设定的范围内，报告撰写人有大量自行裁量权。而且财政部正在考虑扩大“主要”贸易伙伴的定义。所以，如果财政部当时想要拟定一份更严格有力的报告，它是有操作空间的。但正相反，塞瑟说，它却拿出了一份不痛不痒的报告。加格农猜测，也许财政部官员不愿卷入特朗普的关税报复战。这份报告挥舞大旗，要求“公平互惠”的贸易，却没有真正开火。让美元贬值也许很难，让一份报告贬值却很容易。■



Data markets

Exchange value

New ways to trade some of the world's vast amounts of data

IN 2016, according to Cisco, an American technology group, the volume of data flowing through the internet each month passed a zettabyte, enough to fill some 16bn 64GB iPhones. By 2025 it will be many times greater. Immeasurably more data sit outside the public internet on company servers. Most of these data are valuable information, which means that people are keen to trade it.

Typically, data deals are at present worked out between someone holding the information and those who want to extract insights from it. For instance, Uber has deals allowing many cities to access data generated by its fleet of drivers. This helps city planners understand traffic flows.

Such deals can be clunky to set up, however. They tend to concentrate on datasets that hold obvious value. They may also involve data physically moving between one computer and another, which makes it vulnerable to abuse, as in the recent scandal surrounding Cambridge Analytica's use of Facebook data. New schemes, created as part of the crypto-currency boom, aim to change all that.

One of these, called Fetch, was announced on March 28th. It was founded by Humayun Sheikh and Toby Simpson, respectively an investor in and early employee of DeepMind, a British artificial-intelligence company that is part of Alphabet. Instead of sending blobs of data around the internet, Fetch allows an organisation to ask questions about datasets residing on another organisation's servers. The network will keep track of which datasets are used to answer these questions, allowing future queries to be directed to the

right place automatically. A local weather-forecasting group, say, might have its algorithm tap into performance data from a power grid to improve its predictions (the frequency at which electricity moves in cables is related to the air temperature).

Fetch, which plans to launch itself in 2019, is a non-profit organisation and sees itself as a custodian of this question-and-answer network. Payments to ask questions will be made in the form of digital tokens. Unlike some make-a-buck crypto schemes, Fetch says that its tokens will not be available for public purchase until it is up and running, and has demonstrated its value. Fetch's financial backer, Outlier Ventures, has bought future rights to these tokens rather than shares in the company. The idea is that as more organisations make their data searchable, and more people pay to ask questions with tokens, the value of the tokens will go up.

Another project, called IOTA, operates a similar scheme. Bosch, a German engineering giant, thinks that it could use IOTA to earn money from the data its domestic appliances generate. It has bought IOTA tokens through its venture-capital arm.

These new data markets face stiff challenges. Maintaining individual privacy and monitoring questions to prevent corporate leaks will be difficult. The cryptography securing the network needs to be airtight. Perhaps the biggest challenge will be convincing people to use them. The take-up of similar efforts, such as Solid, developed by the Massachusetts Institute of Technology, and Maidsafe, a Scottish data-sharing network, has been lacklustre. Nevertheless, Fetch says several large European firms are lined up to give it a go. And, like other digital currencies, IOTA's token value has soared and fallen. ■



数据市场

交换价值

交易巨量数据的新方法

美国科技集团思科称，2016年互联网的月数据流量超过了1ZB，足以填满约160亿部64G版iPhone的存储空间。到2025年，这个数字还会增长许多倍。公共互联网之外的企业服务器上的数据量更是大到难以估量。这些数据大部分都是有价值的信息，这让人们热衷于交易它们。

目前而言，数据交易通常在掌握信息的一方和想从信息中提取洞见的一方间展开。例如，优步和许多城市达成了协议，让政府访问其司机车队产生的数据。这有助于城市规划者了解交通流量情况。

但是，这类交易可能设计得很拙劣。它们一般只专注于具有明显价值的数据集。它们也可能涉及在计算机之间传输的数据，这容易导致数据被滥用，最近剑桥分析（Cambridge Analytica）滥用Facebook数据的丑闻就是个例子。加密货币的繁荣发展催生出新的方案，力图改变这一切。

于3月28日公布的Fetch就是其中之一。它由胡马云·谢赫（Humayun Sheikh）和托比·辛普森（Toby Simpson）创建，两人分别是Alphabet在英国的人工智能子公司DeepMind的投资者和早期雇员。Fetch并不是简单地在互联网上传输大量数据，而是让某个组织就保存在另一个组织服务器上的数据集提出问题。网络会跟踪回答这些问题时用到哪些数据集，将来的问询就可以被自动导向合适的数据集。例如，一家地方天气预报机构可能会用算法来分析来自电网的性能数据，改善自己的预测准确度（电缆中电流的频率与气温有关）。

Fetch计划在2019年启动。这是一个非营利性组织，自视为上述问答网络的管理者。提问的费用将以数字代币的形式支付。与其他一些只为圈钱的加密货币方案不同，Fetch表示，在它开始运作并证明自身价值之前，它的数字代币不能公开购买。Fetch的投资者Outlier Ventures已经购买了这

些代币的期权，而不是买入公司股份。这背后的逻辑是，随着越来越多的组织开放它们的数据以供搜索，以及更多人用代币付费提问，代币的价值将上升。

另一个名为IOTA的项目也采用类似的模式。德国工程巨头博世认为，它可以利用IOTA从其家用电器产生的数据中赚钱，并已经通过旗下的风险投资公司购买了IOTA的代币。

这些新的数据市场面临严峻的挑战。维护个人隐私以及监控提问以防公司泄露数据将很困难。确保这类网络安全的加密技术必须要无懈可击。也许最大的挑战在于说服人们使用这些技术。麻省理工学院开发的Solid和苏格兰的数据共享网络MaidSafe等类似技术的接受度一直较低。尽管如此，Fetch称几家欧洲大公司纷纷准备一试究竟。而且和其他数字货币一样，IOTA的代币价值也经历了大起大落。 ■



Rocket science

East of Eden

A small rocketry firm reckons New Zealand the world's best launch site

THE Mahia peninsula, on the east coast of New Zealand's North Island, has been a holidaymakers' haven for decades. It offers sandy beaches, hot springs and scenic trails. And, for those of a technological mindset, it also offers the world's first private orbital-rocket-launching base.

Launch Complex 1, as this base is known, sits at the tip of the peninsula and thus on the edge of the South Pacific ocean. Beyond it, the waters stretch uninterrupted by land for thousands of kilometres (see map). Few ships ply the area and few aircraft fly over it. A misfire or rocket stage falling into this wide expanse will thus inconvenience no one. Mahia is farther from the equator than most launch sites (lifting off from an equatorial pad extracts maximum additional velocity from Earth's spin), but that is also an advantage. The sacrifice of some spin-assisted lift makes it easier to reach certain sorts of useful orbit, such as those that pass over the poles.

The builder and owner of this paradise of rocketry is Rocket Lab, a firm which, though American (its headquarters are in Huntington Beach, California), was founded and is led by a New Zealander. By his own admission, Peter Beck, the Kiwi in question, has been obsessed with rockets since childhood. Now, he is close to turning that obsession into a successful business.

Rocket Lab's launch vehicle, a multi-stager called "Electron", underwent its first test in May 2017. Its second happened on January 21st, 16 days before the more widely publicised launch of a much bigger experimental vehicle, SpaceX's Falcon Heavy. Unlike the Falcon Heavy, though, which carried an

old sports car into space as a joke, the Rocket Lab test had a real payload, in the form of three small, commercial satellites. (It also carried a reflective, geodesic sphere dubbed the Humanity Star, which was visible to the naked eye when it passed over at night until it re-entered the atmosphere in March.) That second test having gone well, Mr Beck now deems the time for testing over. Electron's third outing, scheduled for sometime in a couple of weeks starting April 20th, will be a fully commercial flight.

On its launch pad an Electron stands 17 metres tall and has a diameter of 1.2 metres. The engines that power it are named after New Zealand's most famous physicist, Lord Rutherford, who discovered the atomic nucleus and much else. The first stage has nine Rutherford engines. The second has but one. These lift into orbit a third, "kick" stage that carries the payload. The kick stage is fitted with a different sort of rocket engine, Curie, which can be started, shut down and restarted as needed. That lets it manoeuvre the kick stage and thus dispatch different parts of the payload into different orbits.

Both Rutherford and Curie are made from components that have been 3D-printed from sintered metallic powder, rather than being cast and machined in the conventional way. This speeds things up. Rocket Lab's facility in California can produce a new engine from scratch in just a few days. The engines also use electric turbopumps, rather than the more conventional option of gas turbines, to push propellant into their combustion chambers. This eliminates the complex plumbing required to make a gas turbine work. The rocket itself is made of a carbon-fibre composite that is much lighter than the metal usually employed for rocket bodies. This reduces the launch mass, saving fuel.

Though 17 metres is pretty lofty (about the height of four stacked double-decker buses), it pales beside, say, the 70 metres of SpaceX's Falcon 9 launcher, the firm's current commercial offering. The two rockets, however,

are aimed at different markets. SpaceX's main businesses are lifting large, expensive satellites into orbit and carrying provisions to the International Space Station. Rocket Lab has its eyes elsewhere—on the fast-growing market for "CubeSats", which are small and cheap.

A CubeSat can be anything a customer wants to launch that will fit inside one of a number of standard cuboids. The CubeSats on board the launch in January were an Earth-imaging satellite and two weather and ship-tracking satellites. Those on the upcoming mission belong to various telecommunications companies.

Large communications satellites of the sort SpaceX deals with are usually boosted into what are known as geosynchronous orbits, 35,786km above the equator. These take 24 hours to complete, so that a satellite in such an orbit will appear to hover over the same point on Earth's surface. CubeSats, which generally operate in packs, occupy much lower orbits. Often, such orbits are sun-synchronous, meaning that a satellite passes over the same spots on Earth's surface at the same local times every day, which makes changes below easier to spot. Fleets of CubeSats can thus carry out large-scale monitoring. Sun-synchronous orbits pass almost over Earth's poles at altitudes of around 500km. Manoeuvring CubeSats into such orbits is Curie's job.

At the moment, customers who want to use an Electron to launch the most popular design of CubeSat, a 3U (which measures 10cm x 10cm x 30cm and weighs no more than 4kg), can do so for around \$240,000 (ie, \$60,000 a kilogram). That is a premium price; a trip to low Earth orbit is possible on a Falcon 9 and costs \$2,700 a kilogram. But Rocket Lab believes that it offers a premium service. Unlike its competitors' launchers, into which CubeSats are packed almost as an afterthought if there happens to be space available once the main payload is accounted for, its vehicle is dedicated to CubeSat launches.

The intention is that the location of Launch Complex 1, combined with the Curie-steered kick stage, will give customers a wide range of orbits to launch into. The complex is licensed to dispatch a rocket every 72 hours for the next 30 years. That proposed launch frequency means satellites can be got away quickly. Mr Beck claims that Rocket Lab's decision to build Launch Complex 1 is coincidental to his nationality. In his view Mahia really is the best available site. Time will tell if he is right. ■



火箭科技

伊甸之东

一家小型火箭公司视新西兰为全球最佳火箭发射地

几十年来，新西兰北岛东海岸的玛希亚半岛（Mahia Peninsula）一直是人们的度假天堂。那里有沙滩、温泉和风景优美的小径。而对科技迷而言，那里还有世界第一个私营运载火箭发射场。

它名为“一号发射场”，位于玛希亚半岛的岬角、南太平洋的边缘。在发射场之外是绵延数千公里的海洋，中间并无陆地阻隔（见地图）。少有船只行经这片海域，也少有飞机穿越其上空。火箭点火失败或是各级火箭落入这片宽阔的海洋也就不会影响任何人。从靠近赤道的平台发射火箭可最大限度利用地球自转的离心力获得额外的速度，而玛希亚半岛比大多数火箭发射场都离赤道更远。但这也是一个优势：牺牲一点离心推力，火箭反而更容易进入特定的有用轨道，比如经过地球两极上空的那些轨道。

这片火箭乐园的建设者和所有者是一家名为火箭实验室（Rocket Lab）的美国公司，总部位于加州的亨廷顿海滩（Huntington Beach），但公司的创始人兼CEO却是一个新西兰人。彼得·贝克（Peter Beck）说自己从小就对火箭着迷。现在，他离把这份痴转化为一门成功的生意已然不远了。

火箭实验室的运载火箭是一款名为“电子”（Electron）的多级火箭，在2017年5月完成首次测试，今年1月21日完成第二次测试——比SpaceX的运载火箭重型猎鹰（Falcon Heavy）这枚更受关注、规模也更大得多的实验火箭早16天升空。但有别于重型猎鹰把一台旧跑车送进太空的戏谑之举，火箭实验室的测试火箭运送的是真正的载荷——三颗小型商业卫星（另外还有一颗名为“人类之星”[Humanity Star]的反光多面球体卫星，它在3月坠入大气层烧毁，此前人们可以用肉眼在夜空中看到它）。第二次测试一切顺利，贝克现在认为测试阶段已告结束。“电子”火箭的第三次发射预定在4月20日之后的两三周内进行，这次将是一次真正意义上的商业发射。

在发射台上的一枚“电子”火箭高17米，直径1.2米。它的发动机以新西兰最著名的物理学家卢瑟福（做出了原子核等众多发现）的名字命名。“电子”的第一级火箭配有九台卢瑟福发动机，第二级只有一台。两者合力把带有载荷的末级火箭推进轨道。末级火箭配备了另一款火箭发动机——可按需启动、关闭及重启的“居里”发动机。这样就可以操控末级火箭，将载荷的不同部分送进不同的轨道。

火箭上的“卢瑟福”和“居里”发动机的部件都是通过3D打印以烧结金属粉末制成，而非常规的铸造和机械加工。这加快了制造过程。火箭实验室在加州的工厂仅用几天时间便可从头制造出一台新发动机。另外，这些发动机使用电动涡轮泵把推进剂注入燃烧室，而不是更传统的燃气涡轮，从而免去了燃气涡轮运转所需的复杂管道。“电子”火箭的本体由碳纤维复合材料制成，比常见的金属箭体轻得多。这就减轻了发射重量，节省了燃料。

虽然17米的高度已相当雄伟（大概相当于四台双层巴士叠放起来），但与SpaceX目前的商业运载火箭、高达70米的“猎鹰九号”相比还是逊色不少。但是，这两颗火箭瞄准的目标市场并不相同。SpaceX的主要业务是把造价高昂的大型卫星送进轨道以及向国际空间站运送补给。火箭实验室则着眼别处——体积小、价格低的“迷你卫星”这一快速增长的市场。

迷你卫星可以是客户想要发射的任何东西，只要能放入可成批运送的标准尺寸的方形运载器内即可。今年1月“电子”火箭发射的迷你卫星是一颗地球成像卫星和两颗气象及船舶追踪卫星。下一次发射的迷你卫星则分属几家电信公司。

SpaceX发射的那些大型通信卫星通常会被送入赤道上空35,786公里处的“地球同步轨道”。环绕这一轨道一圈需要24小时，所以在这类轨道上的卫星看起来像是悬停在地球表面同一点的上空。迷你卫星通常是多个一组运行，所在轨道的高度低得多。这些轨道往往与太阳同步，即处于其中的卫星每天在相同的当地时间经过地球表面的相同地点，这使得卫星更容易侦察地面上的变化。因此，可以通过部署大量迷你卫星开展大规模监测。太

阳同步轨道几乎正好经过地球两极上空，高度约为500公里。“居里”发动机负责把迷你卫星送进这样的轨道。

目前，若想用“电子”火箭发射最受欢迎的3U迷你卫星（尺寸为10厘米x10厘米x30厘米，重量不超过4公斤），客户约需要花费24万美元（即每公斤六万美元）。这个价格并不便宜——“猎鹰九号”也向近地轨道发射卫星，价格是每公斤2700美元。但火箭实验室认为自己提供的是一项高级服务。对手的火箭只在安置好主要载荷后有多余空间的情况下才顺带搭载迷你卫星，而火箭实验室的运载火箭是专门用来发射迷你卫星的。

火箭实验室的构想是，结合“一号发射场”的位置和“居里”发动机推动的末级火箭，让客户可以广泛地选择卫星轨道。该发射场获准在未来30年内每72小时发射一枚火箭。这一计划中的发射频率意味着卫星可很快升空。贝克称，火箭实验室建造“一号发射场”的决定与他的国籍只是一个巧合，他认为玛希亚半岛的确是最理想的地点。时间会证明他的决定是否正确。■



Insurance and the gig economy

Your policy is arriving in two minutes

How insurance policies are being adapted to fit freelance working

THE rise of the gig economy means not only workers, but those who insure them, are having to adapt. Take third-party liability insurance—the sort that would pay out if, for instance, a courier hit and injured a pedestrian. An employee driving a company van would be covered by a standard commercial-insurance policy. But “gig” couriers, working when they wish and using their own cars, must often insure themselves. Even if they have personal cover, it will not usually pay out for accidents that happen while they are driving for work.

Among the firms seeking to fill this gap is Zego, which sprang up to serve scooter couriers such as those working for Deliveroo, a food-delivery service. Deliveroo and its rivals require proof of insurance from couriers, but had no easy way to check it was valid. Couriers, meanwhile, were often loth to pay stiff premiums. Harry Franks, formerly of Deliveroo and co-founder in 2016 of Zego, spotted an opportunity and convinced insurers that a different model could be profitable.

Zego now brokers third-party liability insurance for couriers working in Britain for nearly a dozen different firms such as Amazon or Quiqup (it plans to expand to Ireland and Spain). Couriers pay by the working hour. Coverage starts when they activate the courier’s app on their phone, and stops when they sign off.

Many gig workers want to go beyond third-party coverage and buy coverage for themselves, for example against illness. For platforms, which insist their workers are independent contractors, not employees (and thus do not create

a liability for payroll taxes), providing such specialist insurance is a way to offer some of the perks normally associated with employment without having to concede that point.

A good example is the insurance that Uber, a ride-hailing company, now offers through Aon, an insurance broker, in many American cities. Drivers can choose to be covered against illness, disability and death for as little as \$0.04 for each mile they drive. Where it is offered, Uber has raised the rate it pays drivers by the same amount, making the resemblance to an employment benefit even stronger. For regulatory reasons, drivers must opt in. But a similar agreement between Uber and AXA, a French insurer, for Uber's food-delivery arm, UberEATS, in nine European countries gives all couriers accident, sickness and third-party liability coverage, with no need to opt in and no charge.

Uber's policy for its drivers in Ontario through Intact, a local insurer, and a similar offering from Lyft, Uber's rival, through Aviva, in Toronto, combine personal and third-party coverage. Both take a three-stage approach. The first kicks in when a driver launches the Uber (or Lyft) app. The second, with higher coverage, starts once a ride is accepted. The third runs from when passengers are picked up until they are dropped off. These schemes resemble commercial-fleet policies in structure, points out Mamta Kohli of Aviva, but differ in their sporadic nature.

Some gig-economy insurance schemes are more inventive still. A scheme from AXA for users of BlaBlaCar, a French long-distance car-pooling service, covers repairs and provides alternative transport if a car breaks down. Clutch, a car-subscription startup in America, has a commercial-insurance policy that covers users not only in any of its cars but also when they borrow a friend's car. This breaks the usual pattern of commercial policies being tied to specific vehicles, and of personal policies alone being tied to individuals.

Such innovation is not always easy for established insurers. Their software systems can be so ancient that policies have to be printed out with standard wording and modified with a typewriter, says Jillian Slyfield of Aon. Regulators can be slow to accept novel arrangements. And for a firm that pays by the hour and relies on workers having their own equipment, providing insurance can be an outsize expense. Ms Slyfield complains that some advertise coverage they do not in fact have.

In the longer term insurers face a more fundamental challenge: disintermediation. Airbnb, a platform for booking stays in private homes, has offered a “host guarantee” against theft and vandalism since 2011. Although it works like insurance, no specialist firm is involved. Airbnb makes payouts itself. Curtis Scott of Uber boasts that the firm is “perhaps the most educated purchaser of insurance ever”. It does a lot of the calculations for pricing and underwriting its insurance risk, and has a potential sales platform in the form of its app. For Uber and its peers, the next step could be to expand their gig offerings into insurance. ■



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您的保单将在两分钟后到达

如何调整保险服务以适应自由职业者的需要

零工经济的兴起意味着不只工人须因时而变，给他们提供保险的公司也一样。以第三方责任险为例，这种保险会在快递员撞伤行人等情况下做出赔付。如果快递员开的是公司的货车，标准的商业险会做出理赔。但如果快递员是自行选择工作时间、开自己的车的“零工”，他们往往必须自行投保。而即使他们买了个人险，这种保险通常也不会对他们在开车工作时发生的事故做赔付。

一些公司正力求填补这个空白，Zego是其中之一。这家新生公司服务的对象是送餐公司Deliveroo等企业的摩托车快递员。Deliveroo及其竞争对手要求快递员提供保险证明，但没有简单的方法来核查保单是否真实有效。而与此同时，快递员们往往不愿意支付昂贵的保费。曾供职于Deliveroo的哈利·弗兰克斯（Harry Franks）在2016年与其他人联合创办了Zego。他发现了其中的商机，并说服保险公司相信可以通过一种新的商业模式盈利。

Zego现在为亚马逊、快递公司Quiqup等十来家公司在英国的快递员选择及协商第三方责任险，并计划将业务扩展到爱尔兰和西班牙。快递员按工作时数购险，当他们在手机上激活一款快递员应用时保单开始生效，退出时终止。

除了第三方责任险，许多零工还想为自己也购买保险，例如健康险。对于那些坚称零工属于独立承包商而非雇员的平台（他们因此不用承担工资税），提供这种专门的保险给予了零工一些通常只有雇员才能享受的福利，又不必承认零工是雇员。

网约车公司优步目前通过保险经纪公司怡安（Aon）在许多美国城市为司机提供的保险就是一个很好的例子。司机可自行决定是否购买病残和死亡

险，费率低至每英里0.04美元。在提供这种保险的城市，优步相应提高了支付给司机的费率，这使得这种保险更像雇员福利了。出于监管的原因，司机须自行选择是否参保。而在优步和法国保险公司安盛（AXA）就优步的送餐业务UberEATS达成的类似协议中，为在欧洲九个国家的所有快递员都提供意外、疾病和第三方责任险，快递员自动获得这种保险，也无需花钱购买。

优步在安大略省通过本地保险公司Intact为司机提供的保险结合了个人保险和第三方责任险，优步的竞争对手Lyft通过英华杰保险集团（Aviva）在多伦多也提供了这样的保险。两家公司都采取了三层级保险的方法。当司机启动优步或Lyft的应用时，就会启动一级保险。第二级的保险金额更高，一旦接受乘客约车便生效。第三级保险从接到乘客一直覆盖到他们下车。英华杰的曼塔·克里（Mamta Kohli）指出，这些产品在结构上类似商业车队的保险，区别在于它们是不定期生效的。

有些针对零工经济的保险产品更有创意。安盛保险为法国长途拼车服务BlaBlaCar的用户提供的保险覆盖修车，并在车抛锚时提供替代交通工具。美国租车创业公司Clutch提供的一种商业保险不仅覆盖用户对该公司任何车辆的使用，也覆盖他们借用朋友的车。这打破了商业保险与特定车辆挂钩、个险与个人挂钩的一般模式。

对于老牌保险公司来说，这种创新并不总是那么容易实现。这些公司的软件系统非常老旧，甚至还得用标准文本打印保单，并用打字机修改，怡安的吉莉安·斯莱费尔德（Jillian Slyfield）说。监管机构对新颖产品的接纳速度可能很慢。对于按小时支付薪水且由劳动者自备工具的企业来说，提供保险可能是一笔过大的开支。斯莱费尔德抱怨说，一些公司宣称提供它们实际上并不能提供的保障。

从长远来看，保险公司面临着一个更为根本的挑战——去中介化。民宿出租平台爱彼迎自2011年以来针对盗窃和破坏行为提供了“房东保障”。尽管其操作与保险一样，却并未牵扯到专业保险公司，而是由爱彼迎自己理赔。优步的柯蒂斯·斯科特（Curtis Scott）夸口称，优步“也许是史上以来

对保险了解最深的投保人”。它对定价和承保风险做了大量计算，它的应用就是一个潜在的销售平台。对于优步及其同行来说，下一步可能是将它们给零工提供的保障扩展到保险业。 ■



Entrepreneurship

Red capitalism v red tape

Some American startups look east for inspiration

“WHEN you enter [the marketplace] with that level of hubris and arrogance, you don’t create trust.” So declared a member of San Francisco’s Board of Supervisors last month. He was upset about the sudden appearance of dockless electric scooters, rented via smartphone, all over the city. Several American startups are battling each other and the authorities to promote them. They are clean, cheap and convenient. The snag is that some users ride them wildly or dump them willy-nilly after use. On April 17th the city passed an ordinance requiring a permit to park scooters on its pavements.

Similar clashes have taken place elsewhere. Bird, a Californian startup that raised \$100m in venture-capital funding in March, launched its rental service for electrified scooters in September at its home base of Santa Monica. Since then, the beach town’s hipsters have completed over half a million rides on its scooters. Rather less keen were city officials, who filed a criminal complaint against Bird for operating without proper licences. The firm paid \$300,000 to settle the matter, pledging to change its practices and even share some revenue with the city. More conflict is likely elsewhere as firms roll out their services in cities like Austin and Washington, DC.

There are two lessons to be drawn from the scooter skirmishes. The first is that America remains a hotbed of entrepreneurial activity. The second, and less obvious, is that after years of seeing their leading technologies and business models stolen by Chinese imitators (a practice dubbed C2C, or “copy to China”), American entrepreneurs are starting to copy China’s trailblazers.

America still leads the global innovation race by most measures but China is catching up. That is one of the conclusions of the Global Startup Ecosystem Report, released on April 17th by Startup Genome and the Global Entrepreneurship Network, two groups that support entrepreneurs worldwide. China leapfrogged Japan last year to become the second-largest generator of quality international patents after America. Its venture-capital investments are soaring and it produces nearly as many “unicorns” valued at \$1bn or more each year as does the United States.

China is surging ahead of America in sectors ranging from mobile payments to messaging. Shared-mobility services provide another example. Though they will not admit this, the American scooter firms are borrowing business models developed by Mobike and Ofo, Chinese unicorns that pioneered dockless bicycle-sharing several years ago.

Hans Tung of GGV Capital, a venture-capital fund, has investments in both countries—including a stake in LimeBike, an American dockless bicycle and scooter startup based in Silicon Valley. Mr Tung observes that in China “the government is much more open to innovators experimenting, and then regulating afterwards.” That allows for more “learning by doing”. In contrast, he reckons that inventive American firms must slow down and negotiate with local officials first or get shut down quickly. “Copy to America” is harder than it seems. ■



创业

红色资本主义对阵繁文缛节

一些美国创业公司向东方寻求灵感

“如果你进入市场时这么傲慢自负，就不会建立信任。”上月，旧金山监事会（San Francisco's Board of Supervisors）的一位监事这样宣称。他对突然出现在旧金山大街小巷的大量无桩电动滑板车颇感不满。美国几家创业公司正在激烈竞争并与政府拉锯，以推广这种通过智能手机租用的滑板车。它们绿色、便宜又方便。麻烦在于一些用户行驶时横冲直撞，或是用完车后随意停放。4月17日，该市通过了一项法令，要求在人行道上停放共享滑板车须拥有许可。

其他地方也发生过类似的矛盾。3月获得1亿美元风投融资的加州创业公司Bird去年9月在其总部所在地圣莫尼卡市（Santa Monica）推出了电动滑板车租赁服务，至今这座海滨小城的潮人们已租用它的滑板车超过50万次。但市府官员们对它却很不感兴趣，他们对Bird提出了刑事诉讼，称它无照经营。该公司支付了30万美元和解，并承诺改变做法，甚至将与该市分享一些收入。随着这些公司的服务在奥斯汀和华盛顿特区等城市铺开，可能会发生更多的争端。

从这些滑板车之争中可以看出两点。第一，美国仍是创业活动的沃土。第二点不那么明显，那就是经过多年被中国模仿者窃取领先技术和商业模式（这种做法被称为C2C，即“复制到中国”）后，美国的创业者开始效仿起中国的先行者了。

按大多数衡量标准，美国仍在全球创新竞赛中领跑，但中国正迎头赶上。这是《全球创业公司生态系统报告》（Global Startup Ecosystem Report）的结论之一。该报告由创业基因（Startup Genome）和全球创业网络（Global Entrepreneurship Network）于4月17日发布，这两个组织向全世界的创业者提供支持。去年，中国的高质量国际专利申请数量超过日本，

升至世界第二，仅次于美国。中国的风险投资正在飙升，每年培育出市值超过10亿美元的独角兽公司数量几乎与美国持平。

从移动支付到聊天应用，中国在不少领域都领先于美国。共享出行服务就是又一个例子。几年前，中国的摩拜和Ofo小黄车率先推出了无桩共享单车。美国的滑板车企业正在借鉴这两家独角兽公司开发的商业模式，尽管它们不会承认这一点。

风投基金纪源资本（GGV Capital）的童士豪（Hans Tung）在中美两国均有投资，包括总部设在硅谷的美国无桩自行车和滑板车创业公司 LimeBike。他注意到，在中国，“政府对创新者开展试验的态度要开放得多，先试验再监管”。这样人们可以更多地“边干边学”。他认为，相形之下，美国的创新企业却必须放慢脚步，先和地方官员谈判，否则很快就会关门大吉。“复制到美国”要比看上去更难。 ■



Economic and financial indicators

Arm sales

Sales of arms and military services by the world's 100 biggest defence companies came to \$374.8bn last year

Sales of arms and military services by the world's 100 biggest defence companies came to \$374.8bn last year. Though sales rose by only 1.9%, that was the first annual increase since 2010, spurred by regional tensions and ongoing military campaigns. American and European companies dominate the industry, accounting for 82.4% of all arms sales, although domestic demand boosted sales by South Korean firms. Lockheed Martin was the world's largest arms company in 2016, with revenues from weapons sales of \$40.8bn (an increase of 10.7% on the year before). It was helped by more deliveries of its F-35 combat aircraft and the acquisition of Sikorsky, a helicopter-maker, at the end of 2015. ■



经济与金融指标

武器销售

去年，全球百强军工企业的武器和军事服务销售额达到3748亿美元

去年，全球百强军工企业的武器和军事服务销售额达到3748亿美元。区域紧张局势和正在进行的军事行动刺激了军售增长。尽管增幅只有1.9%，却是2010年以来首次较上一年实现增长。美国及欧洲的公司主导了军工行业，占据了82.4%的武器销售，不过韩国的军工企业也在国内需求的刺激下销售额大增。洛克希德·马丁（Lockheed Martin）在2016年是世界最大的军火公司，武器销售收入达到408亿美元，较上一年增长10.7%。这得益于公司交付了更多架F-35战斗机，以及在2015年年底对直升机制造商西科斯基（Sikorsky）的收购。 ■



China's economy

Life after digging

After a good run of growth, China braces for bumps

JUST a few years ago Wuhan, a sprawling metropolis in the middle reaches of the Yangtze River, exemplified China's economic woes. Municipal debt had soared. The most senior local official was known as "Mr Dig Up The City", a reference to his zeal for grandiose construction projects. A movie theme park, intended as a landmark, closed after failing to draw crowds. It would take nearly a decade, it was estimated, to sell all of Wuhan's vacant homes.

These days, the city of 11m stands as a monument to China's resilience. Its economy has accelerated even as the government has controlled debt more strictly. Five subway lines were opened or extended in the past two years alone; they are jammed in rush hour. Investment is pouring into semiconductor production, biotech research and internet-security companies. The glut of unsold homes is almost cleared.

China's economy, like Wuhan's, is in much better shape than it was in late 2015. Then, the country was reeling from a stockmarket crash, suffering from capital outflows and accumulating debt at an alarming rate. But figures reported on April 17th showed growth of 6.8% in the first three months of 2018 compared with the same period a year ago. In nominal terms growth was above 10%. China's total debt-to-GDP ratio has stabilised, a sign that the risk of financial crisis has faded (see chart).

The improvement in China's fortunes can be traced to three factors. First, the government has started to tackle several ingrained problems. After a long period of overproduction of steel and coal, a campaign to close unused

capacity restrained output and pushed up prices. To reduce the property overhang, local governments bought millions of unsold homes from developers and gave them to poorer citizens.

Financial regulators have taken aim at banks' murky off-balance-sheet loans, and at heavily indebted borrowers such as property developers. Wang Tao of UBS, a Swiss bank, notes that these efforts have given investors more confidence. Chinese shares listed in Hong Kong have risen in value by a third over the past two years. The government has also helped arrange behind-the-scenes rescues of troubled firms. One was in Wuhan. The big local steel company, bleeding cash, merged with its much stronger counterpart in Shanghai in 2016. The combined entity is profitable.

A second factor is that China's economy is maturing. Growth is bound to slow as China gets richer, but structural changes are also making growth more stable. Thanks in part to a falling working-age population, which peaked in 2011, incomes are growing faster than the overall economy. This, in turn, is rebalancing the economy. Excessive reliance on investment is giving way to consumption. And heavy industry is yielding to services, which now account for more than half of GDP, up from a third two decades ago.

At the same time, China is reaping returns on some big investments of the past decade, such as high-speed rail in densely populated areas. Qin Zunwen, a government economist in Wuhan, says that although local debt shot up, it was almost all tied to infrastructure—half a dozen subway lines, bridges spanning the Yangtze River, elevated expressways—that is now being used. “Yes, it’s much more than we had in the past,” he says. “Has it exceeded our needs? No.”

The final factor has been luck. Robust growth in America and Europe has given Chinese firms a lift. After falling in 2016, exports have rebounded.

The rise in global commodity prices has filtered into stronger industrial revenues in China, boosting miners and metal producers. That has helped them service their debts. And it has made the task of deleveraging for the wider economy less daunting. Outflows of hot money have been curbed by tighter capital controls. China has also benefited from a weak dollar since the start of 2017, which has increased the yuan's appeal.

The coming few quarters are likely to be bumpier, however. The biggest immediate worry is President Donald Trump. The American administration has announced tariffs on about \$50bn of Chinese exports and may soon triple that. Exports to America are only a fraction of Chinese GDP, but a trade war between the world's two biggest economies could wreak havoc on sentiment and supply chains.

The downsides of the campaign to control debt might also become more apparent. Last year regulators focused on the financial system, clamping down, for instance, on borrowing to buy bonds. This year their focus has shifted to government funding. That will have a more direct impact on the economy. China has tried before to rein in profligate local officials, but they have found ways around the rules. A popular recent trick has been to disguise debt in public-private partnerships. Policy this time seems stricter. Subway construction has been halted in cities whose finances were too weak. Tighter liquidity could also weigh on investment. Credit growth is the weakest since 2015.

Over the past decade China's leaders have revved up investment whenever the economy has slowed beyond their comfort zone. But Xi Jinping, the powerful president, has often said that the quality of growth matters more than the quantity. Officials in Wuhan seem to be getting the message. At recent meetings they have stressed the importance of fostering innovation, cleaning up the environment and keeping a lid on debt. The test is whether they will still be singing that same tune as growth turns down. ■



中国经济

挖城之后

中国经济取得出色的增长，接下来要准备迎接困难

就在几年前，位于长江中游、地域宽广的大都市武汉还是中国经济困境的一个缩影。政府债务飙升，市委书记因为热衷大型建设项目收获外号“满城挖”。由于吸引不到游客，曾被寄希望成为地标的一座电影主题公园关门大吉。要卖掉武汉所有的空置住房估计需要近十年。

如今，这座拥有1100万人口的城市见证了中国的韧性。在政府更严格地控制债务的同时，该市经济却加速发展。仅过去两年就有五条地铁线开通或延长，高峰时段车厢里挤满了乘客。大笔投资流向半导体制造、生物技术研究和互联网安全公司。积压房产已近清空。

和武汉一样，中国经济较2015年底有了大幅好转。当时，中国经济因股市崩盘而陷入困境，资本外流、债务累积的速度惊人。然而4月17日公布的数字显示，2018年前三个月经济较去年同期增长6.8%，名义增速超过10%。中国总负债占GDP的比例已经稳定下来，表明金融危机的风险已经消退（见图表）。

中国经济形势的改善可归因于三个因素。首先，政府已经开始解决几个根深蒂固的问题。在经历了长期的钢铁和煤炭生产过剩后，关闭闲置产能的行动控制了产出，推高了价格。为了减少过剩的房地产库存，地方政府从开发商手中购买了数百万套未售出房屋供贫困户居住。

金融监管机构将矛头对准了银行可疑的表外贷款，以及房地产开发商等负债沉重的借贷方。瑞银（UBS）的王涛认为，这些努力提振了投资者的信心。过去两年里，在香港上市的中国公司的股票价值上涨了三分之一。政府也在幕后出手拯救陷入困境的企业。其中一家这样的企业就在武汉。这家当地大型钢铁公司陷入亏损，2016年与实力超出它一大截的上海的宝钢

合并，合并后的公司实现了盈利。

第二个因素是中国经济正在走向成熟。随着中国愈加富裕，增长势必放缓，但结构性变化也让增长更加稳定。劳动年龄人口在2011年达到顶峰后下降，在一定程度上使得收入增速超过了整体经济，而这反过来又让经济实现再平衡。对投资的过度依赖逐步转向依靠消费。服务业的重要性也超过了重工业，已占到GDP的一半以上，而20年前这一比重为三分之一。

与此同时，中国正在从过去十年里投资的一些大型项目上收获回报，比如在人口密集地区修建高铁的项目。武汉政府部门的经济学家秦尊文说，尽管武汉地方债务激增，但几乎都与基建项目相关。政府已建成七条地铁线路、数座横跨长江的大桥，还有高架快速路，都已投入使用。“确实，债务比过去要高得多，”他说，“但超出需求了吗？没有。”

最后一个因素是运气。美国和欧洲经济增长强劲，让中国企业借到了东风。经历了2016年的下滑后，出口已经反弹。全球大宗商品价格的上涨让中国的工业收入增加，提振了采矿和金属冶炼企业。这帮助它们偿还了债务，也让更广泛经济中的去杠杆化变得不那么令人生畏。在更严格的资本管制下，热钱的外流受到限制。2017年初以来的美元疲软增加了人民币的吸引力，这也让中国受益。

然而，未来几个季度的发展可能就不那么平稳了。眼前最大的担忧就是特朗普。美国政府已宣布将对约500亿美元的中国出口产品征收关税，而且可能很快将增加至1500亿美元。对美国的出口只占中国GDP的一小部分，但全球两大经济体之间的贸易战可能会对市场情绪和供应链造成严重破坏。

控制债务水平的消极一面也可能会进一步显现。去年，监管机构专注于治理金融体系，例如限制借钱买债券。今年监管重点转移到了政府融资，这将对经济产生更直接的影响。中国也曾试图约束大手大脚的地方官员，但他们总能钻到空子。最近一个流行的伎俩是将债务隐藏在公私合营项目中。这一次政策似乎更加严格。财政状况脆弱的城市已经停止建设地铁。

收紧流动性也可能会影响投资。信贷增长降至2015年以来的最低水平。

过去十年里，经济增速一旦掉出中国领导人的舒适区，他们就会加大投资。但大权在握的习近平常说增长的质量比数量更重要。武汉的官员似乎正在领悟这个道理。在最近的会议上，他们强调了促进创新、治理环境和遏制债务的重要性。不过还是得看经济增长放缓时他们是否仍将保持这个论调。 ■



European oil majors

From Mars to Venus

Royal Dutch Shell and Total flirt with the idea of becoming utilities

IN AMERICA Big Oil remembers BP's attempt to go "Beyond Petroleum" in the 2000s as a toe-curling embarrassment. In Europe it is seen as being ahead of its time. Once again the oil industry is experimenting with cross-dressing. Statoil, a Norwegian oil firm, is abandoning a name given to it almost 50 years ago to become the wispier Equinor. The firm formerly known as Dong, for Danish Oil and Natural Gas, is now Ørsted, a big wind firm named after the founder of electromagnetism.

Royal Dutch Shell and Total, Europe's biggest private producers, are (mercifully) not changing their names. But they are toying with a strategy that could be far more adventurous—moving their core businesses from hydrocarbons to electrons.

Amid pressure to limit climate change, and the growth of renewable energy and electric vehicles (EVs), they expect low-carbon electricity to become a much bigger part of the world's energy mix within the next few decades. They have already invested heavily in building global natural-gas businesses for cleaner power generation. Now they plan to take on utilities in deregulated markets to provide electricity and gas direct to homes and businesses.

In February Shell completed the acquisition of First Utility, a midsized British gas and electricity supplier that already operates under the Shell brand in Germany. The Anglo-Dutch firm plans to make a similar move in Australia. Late last year Total launched the supply of gas and green power to households in France, through its Total Spring brand. Both have invested

in renewable energy and are installing EV charging points in their networks of petrol stations. “We don’t see how we can be an energy major if we don’t become a significant player in electricity,” says Maarten Wetselaar, head of gas and new energies at Shell. A Total executive says: “Why should we limit ourselves to selling gas to a utility when we can sell to end-customers?”

At first glance the shift could be considered a shrinking of horizons. These firms are global beasts with vast balance-sheets. Customer-facing utilities are minnows by comparison. Centrica, the biggest of Britain’s Big Six, is worth £7.6bn (\$10.8bn), compared with Shell’s market value of £190bn. They often operate in only one or two markets, each a regulatory minefield. Bill-paying customers tend to loathe them far more than they do the purveyors of petrol and pain aux raisins.

Power-generating utilities have also performed poorly in recent years compared with their oil and gas counterparts. They piled on debts before the 2007-08 financial crisis and were then hit by the rise of wind and solar, which drove down wholesale electricity prices. Peter Atherton, of Cornwall Insight, a consultancy, says that whereas supermajors aim for returns on capital on big oil and gas developments of 15%, renewables provide returns of 7-9%. In Britain, the energy retailers aim for profit margins of 4-5%.

Yet Jake Leslie Melville of BCG, a consultancy, says the oil companies are right to “test the waters” in electricity. For instance, Shell’s acquisition of First Utility, reportedly for \$200m, may be deemed expensive considering the latter’s 850,000 household customers. But as a way of exploring whether Shell’s prowess in natural-gas supply and energy trading can be extended to providing services to millions of customers, some of whom will increasingly generate their own electricity, it may be a small price to pay—especially for a company that invests at least \$25bn a year.

Moreover, small beginnings may mask big ambitions. Mr Wetselaar says his

aim is to generate electricity returns of 8-12%, which he thinks is feasible because Shell, with its energy-trading experience, can profit from the heightened volatility of power markets in the era of renewables and EVs, as well as from more flexible demand from consumers. To become material to Shell, the electricity business would need to grow to \$50bn-100bn, on a par with the size of its current gas business, he says. Scott Flavell of Sia Partners, a consultancy, mulls whether, having acquired BG, an upstream producer once owned by British Gas, Shell might covet Centrica, owner of the downstream part of British Gas.

There are reasons for caution. Julian Critchlow of Bain, a consultancy, compares the risks facing the oil industry with those of Eastman Kodak when its business was ruined by digital photography and photo-sharing. It is clear that increased electrification is bound eventually to cause upheaval. “The challenge, as with Kodak, is whether you can spot where the returns will be.” Another risk is that technology firms may move into the domestic electricity market, making use of smart meters and digital devices, which would provide more alternatives to traditional energy suppliers. Yet if other oil and gas producers are not following in Shell and Total’s tentative footsteps, they probably should be. It is time to plug in. ■



欧洲石油巨头

从火星到金星

荷兰皇家壳牌和道达尔想要成为公用事业公司

在美国石油巨头们的记忆中，英国石油公司（BP）在本世纪初那“不仅贡献石油”（Beyond Petroleum）的尝试是一次彻头彻尾的尴尬经历。欧洲人则认为这家公司超前了。现在，石油行业又一次尝试变装跨界。挪威国家石油公司把自己用了差不多半个世纪的名字Statoil换成了更纤柔的Equinor。丹麦石油和天然气公司（Dong，全称Danish Oil and Natural Gas）现在变身大型风能公司Ørsted，以电磁学创始人奥斯特的名字命名。

幸好，欧洲最大的私有石油公司荷兰皇家壳牌（Royal Dutch Shell）和道达尔（Total）还没有更名。但它们正在琢磨采用的策略冒险得多：它们要把核心业务从碳氢化合物转向电子。

面对限制气候变化的压力以及可再生能源和电动汽车的发展，这两家公司预计，未来几十年低碳电力在世界能源结构中占据的比例将大幅提高。它们已经投入巨资设立全球天然气业务，以实现更清洁的发电。现在它们计划在放宽监管的市场上成为公用事业公司，直接为家庭和企业提供电力和天然气。

壳牌在2月完成了对第一电力（First Utility）的收购。第一电力是一家中等规模的英国天然气和电力供应商，已经以“壳牌”的品牌在德国运营。英荷合资的壳牌还计划在澳大利亚开展类似的行动。去年年底，道达尔开始在法国通过其Total Spring品牌向家庭供应天然气和清洁电力。两家公司都已投资可再生能源，并在各自的加油站网点安装电动汽车充电桩。壳牌公司天然气和新能源部门的负责人魏思乐（Maarten Wetselaar）说：“如果不成为供电的重要参与者，我们又怎么能算能源巨头呢？”道达尔的一位高管说：“既然我们能把天然气卖给终端用户，为什么要限制自己只卖给

公用事业公司？”

乍一看，这种转变把格局缩小了。这些公司是拥有庞大资产负债表的全球巨兽。相比之下，面向用户的公用事业公司只是小鱼小虾。英国六大公用事业公司中规模最大的Centrica价值76亿英镑（108亿美元），而壳牌市值为1900亿英镑。它们通常只在一两个国家的市场上运作，每个市场都有监管雷区。向它们支付账单的用户对它们的厌恶往往比对石油和葡萄面包供应商强烈得多。

而且，与石油和天然气供应商相比，电力公司近年业绩不佳。它们在2007年至2008年的金融危机之前就堆积了大量债务，之后又因风能和太阳能的崛起导致批发电价下降而备受冲击。咨询公司Cornwall Insight的彼得·阿瑟顿（Peter Atherton）表示，石油巨头的目标是在大型油气开发项目上获得15%的资本回报率，而可再生能源的回报率只有7%至9%。在英国，能源零售商的利润率目标是4%到5%。

但波士顿咨询公司（BCG）的杰克·莱斯利·梅尔维尔（Jake Leslie Melville）认为，石油公司“试水”电力行业是对的。例如，据报道壳牌收购第一电力花费了两亿美元，考虑到后者仅有85万家庭用户，有人可能觉得买贵了。但作为一种探索方式，看看壳牌在天然气供应和能源交易方面的超凡实力能否扩展到为数以百万计的用户提供服务——其中一些用户还会越来越多地自行发电，这可能只是笔小投入，尤其是对一家每年至少投资250亿美元的公司来说。

此外，小开端中可能掩藏着大野心。魏思乐表示自己的目标是在发电上获得8%到12%的回报，他认为这切实可行，因为在可再生能源和电动汽车的时代，拥有能源交易经验的壳牌将能从电力市场的剧烈波动中获利，也能从消费者更灵活的需求中获利。他表示，电力业务若要真正成为壳牌的重要部门，需要增长到500亿至1000亿美元，与目前的天然气业务规模相当。咨询公司Sia Partners的斯科特·弗拉维尔（Scott Flavell）思忖，壳牌既然已经收购了曾属于英国天然气公司（British Gas）的上游生产商BG集团，那么它是否还觊觎负责英国天然气公司下游业务的Centrica。

有理由谨慎行事。咨询公司贝恩（Bain）的朱利安·克里奇洛（Julian Critchlow）将石油行业面临的风险与柯达的境遇相提并论——柯达的生意被数码摄影和照片共享毁灭了。很明显，电气化的扩展最终会引发剧变。“和柯达一样，挑战在于你能否找到回报所在。”另一个风险是科技公司可能会利用智能电表和数字设备进入国内电力市场，这将为传统能源供应商提供更多选择。不过，如果其他油气生产商还没有追随壳牌和道达尔探索的脚步，它们可能也该启动了。是时候插上电源了。■



Pipelines in Canada

Three-ringed circus

A stalled attempt to unlock Albertan oil

ALMOST all Canada's oil and gas is landlocked, so getting it to market requires pipelines—lots of them. But building them requires skills more suited to circus artists than engineers. They must walk the financial high wire, jump through ever-changing regulatory hoops and juggle conflicting demands from environmental groups and numerous governments. The list of failures is long. It includes Northern Gateway, meant to bring Alberta crude to a port in northwestern British Columbia; Energy East, which would have linked Alberta to the Atlantic coast; Pacific Northwest, to bring gas to the west coast; and the legendary Mackenzie Valley gas pipeline, first proposed in 1974 and dropped in 2017 by its last, exhausted promoter.

Another flop is likely following the announcement last month by Kinder Morgan, one of North America's biggest pipeline firms, that it would freeze spending on the Trans Mountain Expansion, a C\$7.4bn (\$5.9bn) plan to triple the capacity of an existing pipeline carrying fuel from Alberta to a port near Vancouver (see map). Steve Kean, head of Kinder Morgan, complained on April 8th that the newish government in British Columbia (BC) continued to put obstacles in the way of the project, even though it had won approvals from the previous provincial government and the federal government. Unless the governments in Vancouver and Ottawa sort out who has jurisdiction, and provide clarity by May 31st, the company will abandon the plan.

The chaos could be far-reaching. The failure of the Trans Mountain Expansion could provoke a constitutional crisis. It would exacerbate a tit-for-tat trade war between BC and neighbouring Alberta. It threatens to undo

a carefully constructed national climate-change plan. And it may alienate foreign investors who are already pulling back from Canada.

The tussle over who has jurisdiction between the federal government and the powerful provinces goes back to Canada's creation in 1867 and frequently ends up in court. Justin Trudeau, the prime minister, insists the pipeline is in the national interest. The constitution gives parliament the power to override provincial laws and regulations in certain instances. But governments use this power sparingly. In the 1960s, when Quebec refused to allow neighbouring Newfoundland and Labrador to send electricity through Quebec and onwards to American customers, the federal government simply stood by.

Alberta's New Democratic government badly needs a pipeline to carry the province's oil to the ocean to reduce its dependence on America, which buys 99% of Canada's oil exports. Oil firms believe access to new markets would increase the price of Western Canadian Select, the country's heavy crude, which trades at a discount to America's lighter West Texas Intermediate benchmark because of higher transport and refining costs.

But BC's minority New Democratic government is equally determined to placate the Greens who prop it up by honouring a pledge to block the pipeline. As a result of the tiff, Alberta temporarily suspended the import of BC wines earlier this year and is now threatening to restrict exports of petrol to the province, which the existing Trans Mountain pipeline carries in addition to light and heavy crude.

Alberta's agreement to a national climate-change plan that includes a carbon tax was conditional on getting at least one pipeline built. The Trans Mountain Expansion was its best hope. The future of the partially built Keystone Pipeline System, which links Alberta with America, is still uncertain. Should the Trans Mountain Expansion fail, the national climate

deal may too. Canada is already struggling to meet its targets. Losing Alberta could loosen constraints on greenhouse-gas emissions from the oil sands, which make up almost 10% of the national total.

Perhaps the biggest source of concern is the message to foreign investors. Early last month David McKay, head of RBC, Canada's largest bank, fretted that investment was flowing out of the energy and clean-technology sectors "in real time" because Canada was not competitive. Tax and regulatory changes are making America more attractive in comparison, says Philip Cross, an economist. Kinder Morgan wants Mr Trudeau to sort out the mess. The company is looking for "some kind of pre-emptive action" that stops BC from frustrating and opposing the project, Mr Kean told analysts. In short, he wants a ringmaster. ■



加拿大油气管道

三环马戏团

释放阿尔伯塔省石油储备的努力受挫

加拿大几乎所有的油气储备都在内陆，所以需要很多管道将它们输向市场。但建设这些管道更需要马戏演员而非工程师的本领：要能行走财务的高空钢丝，穿越变化无穷的监管火圈，抛接环保团体和多个政府相互冲突的需求。失败的案例不胜枚举。北方门户管道计划（Northern Gateway）本想将阿尔伯塔省（Alberta）的原油输送到不列颠哥伦比亚省（British Columbia，以下简称BC省）西北部的一个港口；能源东输管道项目（Energy East）想把阿尔伯塔省与大西洋沿岸连接起来；太平洋西北项目（Pacific Northwest）计划向西海岸输送天然气；大名鼎鼎的麦肯齐山谷（Mackenzie Valley）天然气管道项目于1974年首次提出，在2017年被最后一个筋疲力尽的项目推动者放弃。

现在，又一个项目很可能以失败告终。北美最大的输油管线公司之一金德摩根（Kinder Morgan）上月宣布将冻结跨山管道扩能项目（Trans Mountain Expansion）的开支。这个74亿加元（59亿美元）的项目计划将现有的一条从阿尔伯塔到温哥华附近港口的管道的运输能力增加两倍（见地图）。金德摩根的CEO史蒂夫·基恩（Steve Kean）4月8日抱怨称，尽管公司已获得了BC省上一届政府和联邦政府的批准，但该省新一届政府持续对该项目设置障碍。除非温哥华和渥太华的地方政府理清管辖权归属，并在5月31日之前给出明确说明，否则公司将放弃该计划。

这个混乱的局面可能影响深远。跨山管道扩能项目的失败可能会引发宪法危机。它可能加剧BC省和邻省阿尔伯塔之间针锋相对的贸易战，可能破坏一个精心制定的国家气候变化计划，还可能把已经开始从加拿大撤资的外国投资者推得更远。

联邦政府和强大省份之间的管辖权之争可追溯到1867年加拿大建国之初，

经常需要诉诸法院裁决。总理贾斯汀·特鲁多（Justin Trudeau）坚称该管道攸关国家利益。宪法赋予议会在某些情况下凌驾于省级法律法规之上的权力。但政府并不轻易行使这种权力。20世纪60年代，魁北克省不允许邻省纽芬兰（Newfoundland）和拉布拉多（Labrador）经魁北克向美国用户输送电力，联邦政府当时只是袖手旁观。

美国购买了加拿大99%的石油出口，阿尔伯塔省的新民主党政府急需一条输油管道将该省的石油输往港口，以减少对美国的依赖。石油公司认为，进入新市场将提高西加拿大重质原油基准价（Western Canadian Select）的价格。目前，由于运输和炼油的成本更高，这种油的基准价低于美国原油密度较轻的西德克萨斯中质原油基准价（West Texas Intermediate）。

但不列颠哥伦比亚省的少数派新民主党政府同样决意要安抚支持其上台的绿党，履行阻止管道项目的承诺。双方争执的结果是，阿伯塔省今年早些时候暂停进口BC省的葡萄酒，现在又威胁要限制对该省出口汽油。现有的跨山管道除轻质和重质原油外，还输送向BC省出口的汽油。

阿尔伯塔省同意加入加拿大的国家气候变化协议（包含征收碳税）是有条件的，即建成至少一条输油管道。跨山管道扩建项目是它最大的希望。连接阿尔伯塔省和美国的拱心石管道系统（Keystone Pipeline System）已部分建成，但前途未卜。如果跨山管道扩张项目失败，全国气候协议也可能瓦解。加拿大在实现其气候变化目标方面本就困难重重。失去阿尔伯塔省的支持可能会放松对油砂温室气体排放的限制，而油砂的排放占全国总排放量的近10%。

也许最令人担心的问题是向外国投资者传递的信号。上月初，加拿大最大的银行加拿大皇家银行（RBC）的总裁大卫·麦凯（David McKay）不无担忧地表示，由于加拿大竞争力不足，投资正在“实时”退出能源和清洁技术领域。经济学家菲利普·克罗斯（Philip Cross）说，相比之下，税收和监管方面的变化正让美国变得更有吸引力。金德摩根公司希望特鲁多能收拾眼前这个乱局。基恩对分析师说，公司正在寻找“某种先发制人的行动”，阻止BC省挫败和反对跨山管道扩建项目的实施。简单点说，他想要一个

马戏团领班。 ■



Innovation prizes

Turning carbon into gold

\$15m is available to solve a burning problem. Ten teams are left in the race

THE X Prize foundation, based near Los Angeles, exists to encourage particular innovations that might be useful but from which conventional financial backers are likely to shy away. Previous X Prizes have been awarded for feats such as flying a reusable spacecraft to the edge of space, and designing cheap sensors to measure oceanic acidity. Those still on offer would, among other things, reward the mapping of Earth's sea floor, and a way of extracting water from air using renewable energy for less than two cents a litre.

Another prize that is still up for grabs is for carbon capture and storage, a putative approach to stopping the rise of climate-changing greenhouse gases in the atmosphere. To claim a share of the \$15m on offer, winners will have to turn carbon dioxide extracted from power-plant flues into something useful—and do so profitably. On April 9th the ten-strong shortlist of those attempting this feat was announced.

At the moment, demand for carbon dioxide as a raw material is a trifling 80m tonnes a year. That compares with annual emissions of 52bn tonnes from power stations, vehicle exhausts, cement factories and so on. Moreover, the biggest use of the gas is to inject it into the ground to displace, and thus force to the surface, otherwise-inaccessible crude oil, so the net benefit in terms of global warming is close to zero. If new uses could be found—ideally ones that locked its carbon up in solid or liquid form for a long time—the market might be expanded into something big enough to make a dent in emissions.

The ten finalists hope to do this. They were selected from 27 teams (out of 47 original submissions) which managed to demonstrate, in a laboratory, that their ideas were feasible. Each was judged on how much carbon dioxide it extracted, net of any emitted in the production process or during subsequent use; by the value of the resulting product; and by the potential size of its market. Only those processes that needed less than 2,300 square metres of land and consumed less than four cubic metres of fresh water per tonne of carbon dioxide converted were deemed to qualify. As Marcus Extavour, who is in charge of the prize, explains, this stricture was intended to bar ideas like growing new forests—which are not exactly a novelty.

Four of the finalists plan to produce sturdy building materials such as cinder blocks made from the slag left over from steel production, cured with carbon dioxide. Another four will fashion the gas into plastics or carbon-fibre composites. The remaining two have invented ways to turn the stuff into carbon monoxide or methanol, which are industrial raw materials.

Each team in the final now gets \$500,000 to spend on proving that its lab-worthy ideas will work at a scale which might make them useful. Half of the shortlist will compete for a pot of \$7.5m at a coal-fired power station in Wyoming. The rest, seeking a similar prize, will set up shop at a gas-fired station in Alberta, Canada.

Some cynics have noted that a successful means of carbon capture and storage would be of great value to the prize's sponsors—NRG, an American energy company, and Canada's Oil Sands Innovation Alliance—since it would make it easier for them to keep their existing methods of business going. No doubt that is true. But in the fight against global warming many weapons will have to be deployed. If another can be added in this way, that is surely all to the good. ■



创新奖金

点碳成金

解决一个紧迫问题可瓜分1500万美元奖金。十支队伍入围争夺

X大奖基金会（X Prize foundation）的总部设在洛杉矶附近，其设立是为了鼓励一些可能有用但不大会获得传统投资者支持的创新。已经有一些成就夺得了X大奖，比如驾驶一艘可重复使用的宇宙飞船抵达太空边缘、设计出低成本传感器来测量海洋的酸度。仍待争夺的奖项包括地球海床测绘，以及以每升不到两美分的成本用可再生能源从空气中提取水，等等。

另一个争夺中的奖项是碳的捕获和储存，这是一种公认的能阻止大气中引起气候变化的温室气体增加的方法。想要在1500万美元的奖金中分得一杯羹，就要把发电厂烟道里提取而来的二氧化碳变成有用的东西，而且要实现盈利。4月9日，尝试这一壮举的十强入围名单公布。

目前，用作原料的二氧化碳年需求量仅为微不足道的8000万吨。相比之下，发电站、汽车尾气和水泥厂等的二氧化碳年排放量高达520亿吨。此外，二氧化碳最大的用途就是注入地下，把原本难以开采的原油挤出到地表。从全球变暖的经济益处来说，这种操作的净效益接近于零。如果能找到新的用途——理想的情况是能以固体或液态的形式长期封存碳——那么对二氧化碳的需求就可能扩大到足以减少排放的程度。

十支决赛队伍都希望做到这一点。它们是从27支队伍中挑选出来的（最初有47支队伍提交方案），都已在实验室里证明了自己想法的可行性。评判的标准是二氧化碳的提取量（扣除了生产过程和后续使用中的排放量）、最终产品的价值，以及潜在市场的规模。只有那些占地少于2,300平方米并且转化每吨二氧化碳消耗的淡水少于4立方米的工艺才能通过审核。评奖负责人马修斯·埃斯塔沃（Marcus Extavour）解释说，这种限制是为了排除植树造林等缺乏新意的想法。

有四支决赛队伍计划生产坚固的建筑材料，比如用炼钢残留炉渣制成并以

二氧化碳强化的炉渣砖。另外四队会把二氧化碳制成塑料或碳纤维复合材料。剩余两队发明了把二氧化碳变为一氧化碳或甲醇等工业原料的方法。

每支决赛队伍现在都拿到了50万美元，用于证明自己在实验室里有价值的想法在实用的规模上同样可行。一半的队伍将在怀俄明州的一家火力发电厂争夺一笔750万美元的奖金，另一半将在加拿大阿尔伯塔省的一家燃气发电厂开工，争夺另一笔类似数额的奖金。

一些愤世嫉俗者指出，对于提供奖金的美国能源企业NRG以及加拿大的油砂创新联盟（Oil Sands Innovation Alliance）而言，一种成功的碳捕获和存储方法将极具价值，因为这将使它们更容易维持现有的业务模式。这一点毫无疑问。但是，抗击全球变暖的斗争将需要运用多种武器，如果能以这种方式添加一种，必定是件大好事。 ■



Renault-Nissan-Mitsubishi

Sharing components

An alliance that has become the world's biggest carmaker faces the tricky task of drawing closer together

RENAULT unveiled the EZ-GO, a concept for a robotaxi, at the Geneva motor show in March. Nissan, in conjunction with DeNA, a Japanese software firm, recently began trials of driverless taxis in Japan. The two companies are pursuing their own paths towards the future of mobility. Yet both are bound together in a close alliance, which celebrates its 20th anniversary next year. In 2016 they were joined by Mitsubishi. Last year the trio sold 10.6m cars between them, one in every nine worldwide.

It is a unique carmaking liaison, neither a full merger nor as loose as the many tie-ups forged to spread the cost of developing pricey pieces of technology. Each firm remains autonomous but shares a growing number of links in the supply chain with the other two. It all looks hugely successful. In 2017 Renault-Nissan-Mitsubishi overtook Volkswagen (VW) as the world's biggest car company (if lorries are included, the German firm is narrowly ahead).

Yet enthusiasm for the alliance among petrolheads and analysts is muted. Despite making some sporty models—Renault even runs a Formula 1 team—the group lacks a brand such as VW's Porsche to set car-buyers' pulses racing. Those who pore over its financial performance use words like “decent” and “reasonable”. The mass market is competitive and margins are low. Investors cringe at a complex structure. Renault owns a controlling 43.4% of Nissan; Nissan has a non-voting 15% stake in Renault. Mitsubishi is controlled by Nissan through a 34% stake. Carlos Ghosn (pictured) is chairman of all three firms. Last year he stepped down as boss of Nissan but

still runs Renault, plus the alliance itself, with its own board and executives.

Hence the calls for a simpler structure, which could cut costs and shore up profits. The current one gives Renault, itself 15% owned by the French state, the upper hand. Yet Nissan, rescued from near-bankruptcy by Mr Ghosn in 1999, now makes more cars and money. When rumours surfaced recently that France may sell its stake to Nissan as a prelude to a full merger, Renault's shares soared by 9%, revealing what investors think of the structure—and the government's involvement. (The alliance has denied the reports.)

French intentions are hard to fathom. Mr Ghosn and Emmanuel Macron, France's president, have a history. As finance minister in 2015, Mr Macron briefly increased France's stake in Renault to 20%, apparently to block Mr Ghosn from pushing through a change to company bylaws that would have inoculated it against a new law granting double voting rights to long-term shareholders. He also reportedly wanted a merger that would keep France as the main shareholder, the better to preserve French interests and jobs.

Mr Macron now insists he wants to get the French state out of business. But he still sees Renault as a symbol of French manufacturing might. He may be reluctant to allow closer integration along the lines Mr Ghosn, who opposes state involvement, has in mind. But the appointment in February of Thierry Bolloré, a Frenchman (and likely successor to Mr Ghosn), to a new role of chief operating officer of Renault may persuade Mr Macron that a merger would safeguard Renault's position at home.

Whatever happens, the logic of the tie-up, which fills gaps in partners' businesses and cuts costs, is clear. Renault's strength in Europe complements Nissan's in China and America. Nissan brings a premium brand, Infiniti. Mitsubishi offers expertise in plug-in hybrids. By 2016 the

alliance claimed annual savings of €5bn (\$6.2bn), despite making just 2m cars on two common “platforms”, the basic underpinnings of a vehicle. In September a new five-year plan promised deeper integration. By 2022, 9m vehicles will be built using four platforms. Savings are promised to double. In order to “turbocharge” performance and growth, at the start of March Mr Ghosn announced more convergence of purchasing, engineering and manufacturing. On March 14th new managers were named.

Tying members together more tightly would advance Mr Ghosn’s wish to make the alliance “irreversible”. Yet that brings problems of its own. It has survived where full mergers have failed because the firms did not have to work too closely together. One former executive recounts how Renault and Nissan engineers could not agree on anything. “There is tension in the system” admits Trevor Mann, a former Nissan executive who is now Mitsubishi’s chief operating officer, “but positive tension.”

Managing internal friction may distract Mr Ghosn from keeping the alliance growing. So far it has, despite challenges facing the mass market. Scale is vital to be able to invest in electric and autonomous vehicles, Mr Ghosn believes. He aims to sell 14m cars a year by 2022. Max Warburton of Bernstein, an equity-research firm, likens the group to a “hustler” for its skills in sniffing out opportunities. With German carmakers dominating the most profitable bits of the European market, Renault pushed Dacia, its successful low-cost brand. Early investments in electric cars will ensure the alliance is the first to turn a profit from them, according to UBS. A big bet on emerging markets looks inspired.

But Mr Ghosn’s acumen has a drawback: it has made him seem indispensable. Succession planning has been overlooked. Impatient contenders such as Carlos Tavares, now boss of PSA, have quit. It will be hard to re-engineer an unusual structure and replace an unusual boss while keeping the hustle going. ■



雷诺-日产-三菱

共享组件

一个已成为全球最大汽车制造商的联盟面临一个棘手问题——如何进一步拉近彼此的距离

雷诺在3月的日内瓦车展上发布了一款机器人出租车（robotaxi）概念车EZ-GO。日产与日本软件公司DeNA合作，最近开始在日本测试无人驾驶出租车。这两家公司正沿着各自的道路探索出行的未来。不过它们又相互捆绑——它们缔结的联盟明年将迎来20周年。2016年，三菱加入了这一联盟。去年，这三家公司在全球共售出1060万辆汽车，占全球汽车销量的九分之一。

这是一种独特的汽车制造联盟，既非完全合并，也不像许多为分摊昂贵技术的开发成本而建立的合作那样松散。每家公司都仍保持自主性，但在供应链中与另两家公司共享的环节越来越多。这一切看起来都极为成功。2017年，雷诺-日产-三菱超越大众成为世界最大的汽车公司（如果算上卡车，大众勉强领先）。

但车迷和分析人士对这一联盟意兴阑珊。尽管该集团也推出了一些运动车型，雷诺甚至还运营着一支F1车队，但仍缺乏像大众旗下的保时捷这样让购车者血脉偾张的品牌。仔细研读过其财务报告的人会用“还行”、“过得去”这类形容词。大众汽车市场竞争激烈，利润率低。投资者害怕复杂的架构。雷诺拥有日产43.4%的控股权；日产拥有雷诺15%的无投票权股份；日产持有三菱34%的控股权。卡洛斯·戈恩（Carlos Ghosn，见图）同时担任这三家公司的董事长。去年，他辞任日产CEO，但仍管理雷诺和联盟（联盟也有自己的董事会和高管）。

因此，联盟需要一个更简单的架构，有机会削减成本，增加利润。在目前的结构下，由法国政府持股15%的雷诺处于支配地位。不过，1999年被戈恩从破产边缘挽救回来的日产现在产量更高、赚钱更多。最近有传闻称，作为全面合并的前奏，法国可能会将所持股份出售给日产。雷诺的股价继

而飙升9%，由此可见投资者对目前的架构以及政府介入其中的看法。
(该联盟否认了这些报道。)

法国政府的想法难以捉摸。戈恩和法国总统马克龙有过节。在2015年，时任财政部长的马克龙曾短暂地将法国政府在雷诺的持股增加到20%，看起来是为阻止戈恩推动修改公司章程——这种改动能让雷诺绕过一项新法规而无须赋予长期股东双重投票权。据报道，马克龙还希望合并能让法国政府成为大股东，更好地维护法国的利益和就业。

但马克龙现在坚称他不想让法国政府参与进来。不过他仍视雷诺为法国制造业实力的象征。他可能不大愿意按照反对政府介入的戈恩心中所想来实现更紧密的整合，但法国人蒂埃里·博洛雷（Thierry Bolloré，可能接替戈恩）在2月出任雷诺首席运营官一职可能会说服马克龙相信，合并会保护雷诺在国内的地位。

无论发生什么，合并的逻辑是明确的，即要填补各家合作伙伴的业务空白，降低成本。雷诺在欧洲的实力与日产在中国和美国的地位互为补充。日产有高端品牌英菲尼迪。三菱可提供插电式混合动力汽车的专业技术。截至2016年，该联盟宣布每年节省了50亿欧元（62亿美元），尽管只在两大通用“平台”（打造一辆车的基本结构）上生产了200万辆汽车。去年9月，一项新的五年计划承诺深化整合，到2022年将在四个平台上生产900万辆汽车，节省的额度有望翻倍。为了提高业绩和增长速度，3月初戈恩宣布在采购、工程和制造方面进行更多融合。3月14日，联盟任命了新的管理人员。

将成员紧密联系在一起会推动戈恩的愿望：让结盟“不可逆转”。然而这本身也带来了问题。其他完全合并的公司失败了，而这一联盟却幸存下来，原因正是其中的各家公司不用太过紧密地合作。一位前高管描述了雷诺和日产的工程师如何格格不入。前日产高管、现任三菱首席运营官的特雷弗·曼（Trevor Mann）承认：“系统中有紧张关系，但这种紧张关系是积极的。”

管理内部摩擦可能会让戈恩分神，不能全身心保持联盟持续发展。到目前为止联盟发展尚好，尽管在大众市场面临着挑战。戈恩认为，规模对于投资电动汽车和自动驾驶汽车的潜力至关重要。他的目标是到2022年每年销售1400万辆汽车。股市调研公司盛博的麦克斯·沃伯顿（Max Warburton）将该集团比作一个“骗钱高手”，因为它能嗅出各种机会。虽有德国汽车制造商主导着欧洲市场中最有利可图的部分，但雷诺成功推动了它的低成本品牌达契亚。瑞银认为，早期对电动汽车的投资会确保该联盟是第一批受益者。对新兴市场的大举押注看来表现出色。

但戈恩的敏锐也带来了一个问题：他似乎变得不可或缺。继任计划一直被忽视。像卡洛斯·塔瓦雷斯（Carlos Tavares，现任标致雪铁龙集团老板）这样已等不下去的竞争者已经退出。要改造一个不同寻常的结构并更换一个不寻常的老板，同时还能保持目前的一派繁荣，颇有难度。 ■



Trade and innovation

China chill

Reports of the death of American innovation are exaggerated

POPULAR concern about free trade with China has focused on the loss of manufacturing jobs in America and Europe. Policymakers have an additional worry: that China's rise is hurting innovation in the West. This fear is among the small set of issues that unites American Democrats and Republicans. In 2016 Barack Obama's commerce secretary said that China's state-driven economy would weaken the world's innovation ecosystem. Donald Trump's advisers allege that China makes it harder for foreign firms to invest in innovation by squeezing their returns. Mr Trump's trade team raised this complaint, among others, with Chinese officials during talks in Beijing on May 3rd and 4th. There is one problem. Data suggest that competition with China has coincided with more innovation in America, not less.

The relationship between competition and innovation is complex, even before considering trade with China. Economists agree that the right competitive landscape fosters innovation. But they disagree about what exactly that landscape looks like. More competition might prod companies to try harder to develop new products in the hope of gaining market share. Alternatively, if competition is cut-throat, profits might evaporate to the point that companies have little incentive to take risks.

The fear is that China generates the wrong kind of competition and stunts the good kind. Businesspeople elsewhere worry that when the Chinese government decides to fund this or that industry, investment soars and margins collapse. Overcapacity in steel was caused in part by Chinese investment in steel processing; semiconductor firms think their industry

might be next. At the same time, argues Robert Lighthizer, the US Trade Representative, foreign companies that beat their Chinese competitors are not adequately rewarded because China presses them to transfer their intellectual property.

The two main academic papers on this question looked at the years around China's accession to the World Trade Organisation in 2001. Far from settling the matter, they were contradictory. Economists studying European companies found that competition from Chinese imports both caused firms to improve their technology and led to a shift in jobs to the most advanced firms. They concluded that 15% of the upgrading of technology in Europe between 2000 and 2007 could be attributed to the increase in imports from China. But economists examining the impact on America argued that, on the contrary, Chinese competition had led companies to spend less on research as profits fell. They calculated that imports from China explained 40% of a slowdown in American patenting between 1999 and 2007, compared with the preceding decade.

The IMF has now weighed in with more recent figures. Its conclusion is rather more cheerful, at least for those who think a trade war with China is a rotten idea. In a report published in April the fund showed that, following an extended period of decline, high-quality patents granted to American companies had risen sharply between 2010 and 2014. It also pointed to a big increase in American spending on research and development during the same years—even as America's trade deficit with China rocketed (see chart). The growth in patents was more sluggish in Europe and Japan. But both patents and research spending soared in South Korea, the country most directly exposed to manufacturing competition from China.

A separate IMF working paper late last year unpicked some of what is happening in America. Competition from Chinese imports has caused

research spending to be reallocated within certain industries, away from also-rans and towards the most productive and profitable firms. At the same time, many researchers left manufacturing industries and moved into service sectors such as data-processing and finance. Both results are consistent with an American economy that is playing to its strengths. The IMF's analysts concluded that Chinese imports were not a threat to innovation in America, after all, and that policymakers could take a deep breath. No loud inhaling sounds have yet been reported from the White House. ■



贸易与创新

中国寒流

美国创新已死的说法言过其实

对于和中国开展自由贸易，普遍的担忧一直都聚焦在欧美制造业岗位的流失上。政策制定者则还有另一层担忧：中国的崛起有损西方的创新活动。这种恐惧是美国民主共和两党少有的共识。2016年，奥巴马政府的商务部长曾表示，中国的政府主导型经济将削弱全球的创新生态系统。特朗普的政府顾问则称，中国挤压外国企业的经营回报，加大了它们投资创新的难度。5月3日至4日，特朗普的贸易团队在北京与中国官员就多方面事宜会谈时提出了这方面的诉求。但这里存在一个问题。数据表明，在与中国展开竞争的同时，美国的创新活动其实有增无减。

撇开与中国的贸易往来不谈，竞争与创新的关系本就错综复杂。经济学家一致认为，恰当的竞争格局能促进创新。但怎样的竞争格局才算恰当？他们意见不一。更多的竞争可能促使公司为争取市场份额而更努力地开发新产品。但另一种情况是，假如竞争过于激烈，利润可能蒸发，最终导致企业丧失冒险创新的动力。

人们担忧的是，中国带来的竞争是第二种，从而阻遏了第一种。中国以外地区的商业人士担心，一旦中国政府拍板扶持某个行业，投资就会飙升，利润就会枯竭。钢铁产能过剩在某种程度上就是由中国在钢铁加工行业的投资造成的；半导体企业认为自己的行业可能会是下一个受害者。与此同时，美国贸易代表罗伯特·莱特希泽（Robert Lighthizer）认为，在竞争中打败中国对手的外国企业并没得到充分的回报，因为中国施压要求它们转让知识产权。

探讨这一问题的两篇主要的学术论文调研了中国在2001年加入世贸组织前后几年的情况。它们非但没有解决难题，反而得出了相互矛盾的结论。研究欧洲企业的经济学家发现，中国进口产品带来的竞争促使企业改进技

术，也令工作岗位流向最先进的企业。他们的结论是，在2000年至2007年间，欧洲的技术进步有15%可归因于中国进口产品的增加。然而，研究美国所受影响的经济学家则认为情况相反，随着利润下降，来自中国的竞争导致企业的研发支出减少。他们计算得出，与之前十年相比，美国在1999年至2007年间取得的专利数量呈下降趋势，其中40%可归咎于中国的进口。

国际货币基金组织（以下简称IMF）如今也拿出了更新的数据加入这场论战。其结论要积极正面得多，至少对那些不支持与中国打贸易战的人而言是如此。IMF于4月份发表的一份报告称，在经历长时间的下滑后，美国公司获得的高质量专利在2010年至2014年间急剧上升。它还指出，同一时期美国的研发支出也大幅上升，尽管美国对华贸易逆差一路飙升（见图表）。欧洲和日本的专利增长较为缓慢。而在受中国制造业竞争影响最为直接的韩国，专利和研发支出都增长迅猛。

去年年底，IMF的另一份工作报告揭示了美国目前正在发生的一些变化。来自中国进口产品的竞争导致研发支出在某些行业内重新分配，从竞争失利的公司转向生产率和盈利能力最高的企业。同时，许多研究人员离开制造业，投身数据处理和金融等服务部门。这两个结果都证明了美国经济正在发挥其优势。IMF的分析师总结道，说到底，中国进口产品对美国的创新并不构成威胁，政策制定者大可松一口气。不过，目前为止白宫还没有传出明显松口气的声音。 ■



Economic and financial indicators

Economic outlook

The Economist's latest poll of forecasters, May



经济与金融指标

经济前景

《经济学人》5月对各家预测机构的最新调查



Schumpeter

Attack of the drones

Zap! American officials can now destroy foreign firms like gremlins in a computer game

WARFARE has been transformed by drones. Using pilotless aircraft armed with precision weapons America can kill its enemies—in, say, the Hindu Kush or Syria—with a click of a mouse. There is a similar shift in economic diplomacy, where Uncle Sam has perfected new weapons that exploit its power over the world's financial plumbing and over the brainiest parts of the tech industry. In April these weapons were used in anger on big, important firms for the first time. The targets were Rusal, a Russian metals firm, and ZTE, a Chinese electronics company. The results have been devastating—and alarming.

In 1919 Woodrow Wilson called international sanctions a “silent, deadly remedy” and over the next 70 years America deployed them about 70 times, reckons Gary Hufbauer of the Peterson Institute. America achieved its geopolitical objectives only a third of the time, he says. But there was little doubt that it could meet its narrower goal of inflicting pain by halting trade with other countries and by freezing foreigners’ assets in America.

But by the 1990s globalisation had weakened America’s clout. Foreign firms had more countries to trade with. Multinationals saw fines from the authorities as a tolerable cost of doing business. The nadir was the Iraq oil-for-food programme in the 1990s, administered by the UN. Over 2,000 firms were suspected of making illegal payments to Saddam Hussein’s regime.

Everything changed after September 11th 2001. American officials realised they could use data and financial flows as a weapon, according to Juan Zarate, a former official, in his memoir “Treasury’s War”. The Patriot Act

in 2001 allowed the Treasury to label foreign banks as threats to financial integrity and to ban them from the system for clearing dollar payments. In 2001-03 America won the right to peer into SWIFT, a formerly confidential global bank messaging system. Suddenly America could track its enemies. And it could make them radioactive to most counterparties, because any bank that touched them, even indirectly and with multiple degrees of separation, could be banned from clearing in dollars—which, if you run a cross-border bank, is fatal.

Between 2002 and 2008 the Treasury experimented with small fry. It brought to heel Victor Bout, an arms dealer; BDA, a bank in Macau that traded with North Korea; and Nauru, a Pacific island with a sideline in exotic finance. Since 2008 Western banks have been fined for breaking rules in the past, but not banned from dollar clearing. More recently Iran and Syria have faced new sanctions but they have few links with the global economy.

Last month, the stakes were raised. At the end of 2017 Rusal was one of the world's largest aluminium producers, with an enterprise value of \$18bn, controlled by Oleg Deripaska, an oligarch close to Vladimir Putin. Kapow! In April it was sanctioned as part of a package of measures against Russia. Rusal's links to America are slight. It makes 14% of its sales there, does not typically use American banks and is listed in Hong Kong and Moscow (a related company, EN+, is listed in London).

The consequences have still been devastating. Many investors must sell their securities. Rusal may be unable to refinance its dollar debts. Global trading houses that buy its product have curtailed activities, as has Maersk, a shipping line. The London Metal Exchange has limited trading with Rusal. Credit-ratings agencies have withdrawn ratings. European clearing houses will not settle its securities. Its shares have dropped by 56% and its 2023 bonds trade at 45 cents on the dollar. Mr Deripaska is scrambling to sell down his indirect interest in Rusal to try and save it.

What about ZTE? At the end of last year it was the world's fourth-biggest telecoms-equipment firm, with an enterprise value of \$17bn, boasting a Chinese state firm as its anchor shareholder. It only makes around 15% of its sales in America. Bang! On April 16th the Commerce Department banned American firms from supplying it with components for seven years. ZTE had admitted trading with Iran and North Korea and then, in 2016 and 2017, it lied about the remedies it had put in place. ZTE's shares have been suspended. The fallout will be severe. UBS, a bank, reckons that 80% of ZTE's products rely on components from America, mainly cutting-edge semiconductors. Western banks and firms will be worried about coming into contact with it.

Companies that break the law or act in concert with autocratic governments do not deserve sympathy. But there are three, unsettling conclusions to draw from America's first use of smart weapons against big foreign firms. First, any large company can be reached. No fewer than 2,000 big companies outside America issue dollar bonds, for example. Total dollar debt owed by firms outside America is over \$5trn. Cross-border supply chains mean most firms rely on American tech components in some way.

Second, these powers could be misused, either for overtly political ends or because they are badly calibrated. The aluminium market is in turmoil—so much so that the Treasury, surprised by its own potency, may do a U-turn over Rusal. After ZTE, investors worry that Huawei, a Chinese rival, could be next. Its international sales are two-thirds as big as General Electric's. Or take Chinese banks, which have built up huge dollar debts and deposits as they globalised. Last year the Treasury considered sanctioning CCB and Agricultural Bank, according to Bloomberg. In total they have \$344bn of dollar liabilities; sanctions could start a run.

The third conclusion is that other countries will develop ways to escape America's reach. ZTE and Rusal offer a step-by-step guide to what you need

to survive without American permission: semiconductors, a global currency and clearing system, credit-ratings agencies, commodity exchanges, a pool of domestic investors and shipping firms. These are all things that China is working on. America's use of its new weapons simultaneously demonstrates its power and will hasten its relative decline. ■



熊彼特

无人机来袭

砰！美国官员现在可以像干掉游戏中的小妖怪那样摧毁外国企业

战争的形态已被无人机改变。利用配备了精确武器的无人机，美国只需点点鼠标就能消灭在兴都库什或叙利亚等地的敌人。在经济外交领域也发生了类似的转变，山姆大叔已经完善了自己的新武器，利用他对全球金融基础设施和高精尖科技企业的影响力打击敌人。上月，美国在怒火中首次动用这些武器对付重要的大企业，打击的目标是俄罗斯金属企业俄铝（Rusal）和中国电子公司中兴。结果极具破坏性，也令人担忧。

威尔逊总统在1919年称国际制裁是“无声但致命的纠正手段”。彼得森国际经济研究所（Peterson Institute）的加利·霍夫鲍尔（Gary Hufbauer）估计，在那之后的70年里美国共实施了约70次制裁。他说，其中只有三分之一实现了美国的地缘政治目标。但毫无疑问，美国还是可以通过停止与他国的贸易并冻结外国人在美资产来实现其较为狭隘的目标：给对手点苦头尝尝。

但到了上世纪90年代，全球化削弱了美国的影响力。外国企业可以和更多的国家展开贸易。跨国公司把政府罚款看作一项可以承受的经营成本。最严重的情形出现在90年代。当时联合国推行了伊拉克“石油换食品”计划，期间有2000多家公司涉嫌向萨达姆政权非法支付回扣。

2001年9月11日之后情形大变。前美国官员胡安·萨拉特（Juan Zarate）在其回忆录《财政部的战争》（Treasury's War）中写到，美国官员意识到他们可以利用数据和资金流作为武器。2001年颁布的《爱国者法案》（The Patriot Act）允许财政部给外国银行贴上威胁金融诚信的标签，并禁止其进入美元清算系统。2001至2003年间，美国获得了监视SWIFT系统的权利。这一全球银行通信系统原本是保密的，突然之间，美国可以追踪敌人了。不仅如此，与其敌人有往来的大部分交易对手都可能

受到“辐射”，因为任何与它们有过接触的银行——即使是间接的、经过层层分隔的接触——也都有可能被禁止开展美元清算业务。这对于一家经营跨境业务的银行是致命的打击。

从2002年到2008年，财政部试着先拿小角色开刀。军火商维克托布特（Victor Bout）、与朝鲜交易的澳门汇业银行，以及兼做离岸金融的太平洋岛国瑙鲁纷纷遭惩戒。2008年以来，一些西方银行因过去的违规行为被罚款，但并未被禁止美元清算。最近伊朗和叙利亚又面临新的制裁，但它们与全球经济联系甚少。

上个月，美国加大了火力。俄铝在2017年底是世界最大的铝生产商之一，企业价值达180亿美元，由与普京过从甚密的寡头欧柏嘉（Oleg Deripaska）控股。嘭！美国在4月启动一揽子措施打击俄罗斯，俄铝也受到了制裁。俄铝与美国的关联不多。对美销售仅占其总销售额的14%，通常也不用到美国银行，且在香港和莫斯科两地上市（其关联公司EN+在伦敦上市）。

尽管如此，制裁仍然产生了强大的破坏力。许多投资者必须抛售股票。俄铝可能无法为其美元债务再获融资。购买俄铝产品的全球贸易公司也减少了与该公司的业务往来，航运公司马士基也一样。伦敦金属交易所（London Metal Exchange）限制了与俄铝的交易。信用评级机构撤销了对俄铝的评级，欧洲各个清算所也不会交收其证券。俄铝的股价下跌了56%，2023年到期的债券交易价格仅为45美分。欧柏嘉正抓紧减持他在公司的间接持股，以图拯救俄铝。

中兴的情况又如何呢？去年年底时，它是全球第四大电信设备公司，企业价值为170亿美元，一家中国国有企业是其大股东。它在美国的销售额仅占其总销售额的15%左右。梆！美国商务部于4月16日禁止美国公司在未来七年向中兴供应组件。中兴先是承认向伊朗和朝鲜出口商品，到了2016年和2017年又就自己对此采取的补救措施撒谎。中兴的股票已经停牌。制裁的后果会非常严重。据瑞银估计，中兴80%的产品都依赖来自美国的组件，主要是尖端半导体。西方银行和企业都会对与中兴接触心怀顾虑。

违反法律或与专制政府合作的企业不值得同情。但是，从美国首次使用智能武器打击大型外国企业的行动中可以得出三个令人不安的结论。首先，任何大公司都有可能被打击。例如，有不少于2000家的非美国大公司发行美元债券。非美国企业的美元债务总额超过5万亿美元。由于跨国供应链的存在，大多数公司都以某种方式依赖美国的高科技组件。

其次，这样的打击能力可能会遭到滥用，或是出于明显的政治目的，或是因为运用不当。铝市场目前一片动荡，连美国财政部都没料到自己的破坏力竟如此之强，因而可能会大幅调整对俄铝的制裁措施。投资者担心美国接下来可能会对中兴的中国竞争对手华为下手。华为的国际销售额为通用电气的三分之二。在全球化过程中积累了巨额美元债务和存款的中国的银行也可能受到攻击。据彭博报道，去年美国财政部曾考虑制裁建行和农行。这两家银行共有3440亿的美元债务，制裁可能会引发挤兑。

第三个结论是，其他国家将会发展出避开美国打击的手段。中兴和俄铝的案例提供了一个详细指南，列出了在不受美国认可的情况下维持生存所需：半导体、全球货币和清算系统、信用评级机构、大宗商品交易所、大批国内投资者和航运公司。中国正在这些方面下功夫。美国动用新武器的做法彰显了它的强大，同时也将加速它的相对衰落。■



Shareholder activism

Voting with your pocket

The proxy season kicks off on Wall Street

JING ZHAO'S main occupation is translating Latin classics into Chinese. He runs a small think-tank, the US-Japan-China Comparative Policy Research Institute. He lives off rents from property bought cheaply after the financial crisis. But this quiet, intellectual California resident has a surprising sideline: submitting proposals to be voted on by the shareholders of companies in which he owns small stakes. That makes him part of a movement that is forcing management at some of the world's biggest firms to consider not just profitability but broad shifts in social attitudes.

The annual meetings of America's listed companies, usually held between February and June, have come to constitute "proxy season"—so-called because shareholders need not cast their votes in person. This year proposals from Mr Zhao will be on the ballot at four giant firms. He wants Apple to create a human-rights committee, citing its decision last year to bow to Chinese censorship by removing hundreds of "virtual private network" apps from its Chinese app store. For Twitter, he proposes a new committee to oversee issues such as human rights and corporate social responsibility. A third proposal would lessen Elon Musk's dominance over Tesla by giving the board more power. And finally, he wants changes to remuneration policies at Wells Fargo, a big bank that faces fines of up to \$1bn for mis-selling financial products.

Each firm has reacted negatively to Mr Zhao's proposals. Apple and Twitter appealed, unsuccessfully, to the Securities and Exchanges Commission (SEC) to have them struck down. So far only the proposal regarding Apple has been voted on, with just 5% in favour. But Mr Zhao, and others trying

to use proxy votes to mould corporate America, are playing a long game. The vote has drawn attention to Apple's concessions in China. And 5% is enough, under the SEC's rules, that Apple cannot block the proposal from next year's ballot.

Shareholder proposals used to relate mostly to corporate governance—for example, splitting the roles of chairman and chief executive. But in recent years that has changed. Even as the total number of proposals has fallen, the number relating to social and policy issues has crept up. Last year, according to the Manhattan Institute, a think-tank, more than half of those at America's 250 biggest firms related to such matters. An analysis by Institutional Shareholder Services (ISS), a proxy-advisory firm—which advises fund managers on how to vote on proposals—found that of the 459 shareholder proposals submitted by early April this year, many fell under just a few headings: transparency about political spending, climate change, racial and gender diversity, and pay.

But that does not capture the proposals' range and creativity. Campaigners on a dizzying array of issues regard proxy voting as an exciting new weapon. For example, this year the Sisters of St Francis of Philadelphia, an American order of nuns, got a proposal onto the ballot at AmerisourceBergen, one of America's largest pharmaceutical distributors. Demanding greater transparency about the sale of opioids, it gained 41% of the vote. That is startling, given that supplying pharmaceuticals is the firm's core purpose. The message to management is unlikely to go unnoticed. Two other distributors, Depomed and McKesson, face similar votes.

The Interfaith Centre on Corporate Responsibility, a group of unions, pension funds, religious groups and self-described "socially responsible" asset managers, published a guide to the 266 proposals its members put forward this year. One wants Amazon to look at how to cut food waste. Another wants Bristol-Myers to consider how to incorporate public

concerns over expensive drugs into executive pay. A third wants Goldman Sachs and Citigroup to say how they will avoid violating the rights of indigenous people whose lands might be crossed by oil pipelines.

Typically, proxy proposals are framed as being beneficial for a firm's bottom line, no matter what the issue. That can stretch credulity. But it also provides essential cover for fund managers who may look kindly on a proposal but are voting on behalf of the shares they manage, since they are generally bound to support only proposals that would enhance a firm's value.

In public, executives tend to welcome proxy activism. In private they moan about the time and money it soaks up. Seemingly innocuous requests for studies on an issue touch a raw nerve; each word could form the basis for future litigation.

It is all a far cry from the early days of proxy voting, in the 19th century, when the rise of public companies with dispersed owners made it hard to get a quorum. Shareholders were permitted to nominate a proxy to vote on their behalf. For a long time, their representation was mostly for show. In 1937 a jaded correspondent for *The Economist* noted that shareholders were merely provided with "special facilities for voting in favour of the chairman's policy before they have heard his speech".

The issue was included in the SEC's original mandate, in 1934. But the agency has struggled ever since to decide who should be able to put forward a proposal, and what sort of demands it may entail. It took years for shareholders to gain the right to approve a firm's choice of auditor, but such a vote is now mandatory—and particularly relevant this year. The collapse of two big firms, Carillion and Steinhoff, is provoking shareholders at some other firms with the same auditors, KPMG and Deloitte, to demand that they switch. ISS has recommended that GE's shareholders vote in favour of dropping KPMG.

The current rules set a low bar for submitting a proposal. A shareholder must have owned at least \$2,000 of a company's stock for a year, and write a letter setting out the topic of the vote in less than 500 words. But getting it accepted is harder. Proposals are supposed to address issues that affect at least 5% of a company's business, and neither conflict with its ordinary activities nor reflect a personal grievance. Management can appeal to the SEC to block a vote. According to the Sustainable Investments Institute, an advisory firm for social, environmental and policy issues, during the past eight years appeals heard by the SEC have been granted 40-60% of the time.

The SEC can be unpredictable and its results and utterances Delphic, says Heidi Walsh, the institute's director. Last year it ruled that Exxon had to allow a vote on proposals requiring extensive studies of the risks climate change posed to its business. Over the firm's objections, the proposals were approved. But this year the SEC allowed EOG, an oil and gas firm, to block a proposal requiring it to set targets to reduce greenhouse-gas emissions.

If either side disagrees with the SEC's decision, it can go to court. In 1969 opponents of the Vietnam war, who had sought and failed to call a shareholder vote to force Dow Chemical to stop making napalm, appealed. That led to the SEC ending its ban on proposals relating to political and moral issues. After a proposal in the 1980s to stop the force-feeding of geese was blocked, litigation established that a proposal can sometimes merit a vote, even if it concerns less than 5% of a firm's business. In 2015 litigation by Walmart reversed an SEC decision to allow a proposal seeking to restrict the retailer's gun sales.

The changing nature of shareholding has created some unlikely social-justice warriors. Shares used to be held in tiny lots by individuals. They are now largely consolidated into big public and private pools. That has turned sovereign-wealth funds, pension funds and the like, which vote in proportion to the shares they manage, into the equivalent of voting blocs.

Private funds often used to neglect to cast their votes, perhaps for fear of antagonising corporate clients. That changed in 2003, when the SEC started requiring them to do so. Some officials running public pension funds seem to revel in their new-found power. Scott Stringer, New York City's chief financial officer, made his stance on proxy proposals relating to diversity and climate change a big part of his election campaign.

In this new framework for corporate governance, the role of *éminence grise* is filled by proxy-advisory firms like ISS. It and Glass Lewis are the two best-known. They help institutional investors to sort through the array of proposals put forward by other shareholders and by the firm itself, and give recommendations to guide votes. But one voice is still scarcely heard: that of individual owners whose shares are held in funds and pension schemes. As social issues rise up the corporate agenda, it is a lingering injustice that they are ignored. ■



股东维权主义

论“资”投票

华尔街进入代理季

赵京的主业是把拉丁语经典著作翻译成中文。他是小型智库中日美比较政策研究所（US-Japan-China Comparative Policy Research Institute）的所长。他目前的生活来源是出租在金融危机后低价购入的房产。但这位沉静知性的加州居民有一份令人意想不到的兼职：作为多家公司的小股东，他发起提案供其他股东投票表决。这让他参与到一项运动当中，迫使世界上一些巨头企业的管理层考虑社会态度的广泛转变，而不是只顾盈利。

美国上市公司的年度会议通常在2月至6月间举行，由于股东不必亲自参加投票，这段时间已经成为了“代理季”。今年，四家大公司的股东将对赵京的提案投票。他提议苹果公司设立人权委员会，指出该公司去年屈从中国的审查制度，从在中国的应用商店中下架了数百个VPN应用。对于推特，他提议成立一个新委员会来监督人权和企业社会责任等问题。他的第三个提案要求给予特斯拉的董事会更大的权力，以减轻马斯克大权独揽的状况。最后，他希望富国银行改变其薪酬政策。这家大型银行因违规销售金融产品正面临高达十亿美元的罚款。

这几家公司都对赵京的提案反应消极。苹果和推特向美国证券交易委员会（SEC，以下简称美国证交会）申请阻止提案进入投票程序，但未能成功。目前为止，只有苹果公司的提案完成了表决，赞成票仅占5%。但赵京和其他希望利用代理投票权来改变美国商界的维权分子打的是一场持久战。此次表决已令人们注意到苹果公司对中国的让步。而且，根据美国证交会的规定，只要赞成票达到5%，苹果公司就无法阻止股东们明年对该提案再次投票。

过去，股东提案大多事关公司治理，如分离董事长和首席执行官的权责。但最近几年情况有变。提案总数下降之时，与社会和政策问题相关的提案

却逐渐增加。据智库曼哈顿研究所（Manhattan Institute）的数据，去年，美国最大的250家公司的股东提案中超过半数与社会和政策问题有关。代理咨询公司美国机构股东服务公司（Institutional Shareholder Services，简称ISS）为基金经理提供如何就股东提案投票的建议。它的一位分析师发现，今年截至4月初提交的459份股东提案中，许多都可归入以下几个方面：政治开支透明度、气候变化、种族及性别多样性、薪酬。

不过，这样的归类掩盖了提案涉及的范围之广和创意之多。社会活动人士关注的议题五花八门，他们把代理投票视为令人振奋的新武器。例如今年，美国费城圣弗朗西斯修女团（Sisters of St Francis of Philadelphia）对美国最大的医药分销商之一美源伯根公司（AmerisourceBergen）的一项提案要求提高阿片类药物销售的透明度，获41%的股东投票赞成。鉴于供应药品是该公司的核心业务，这样的表决结果令人震惊。它向管理层传递的信息很难被忽视。另外两家药物批发公司Depomed及麦克森（McKesson）也面对类似的提案投票。

跨信仰企业责任中心（Interfaith Center on Corporate Responsibility）由工会、养老基金、宗教团体，以及自称“有社会责任感”的资产管理机构组成。该中心公布了一份指南，介绍其成员今年提出的266项股东提案。其中一份提案要求亚马逊公司研究如何减少食物浪费。另一份提案希望百时美施贵宝公司（Bristol-Myers Squibb）在制订高管薪酬时考虑公众对药价高企的忧虑。还有一份提案要求高盛和花旗集团说明，假如原住民的土地上要修建输油管道，它们将如何避免侵犯原住民的权利。

通常情况下，代理提案无论是关于什么问题，都会以有利于公司盈利为名。这难免有点生拉硬扯。不过，这也为基金经理们提供了必要的掩护。这些人表面上可能支持某个提案，实则还是根据自己所管理股份的利益投票，毕竟一般情况下他们还是得支持有助提高公司价值的提案。

在公开场合，高管们往往表示欢迎代理维权行动。但私底下，他们抱怨要为此消耗时间和金钱。看起来维权股东只是在请求对某些问题加以研究，并无恶意，但却可能触及某些人的神经，每个字眼都可能成为未来诉讼的

源头。

现在的代理投票与早年的情形相去甚远。19世纪，上市公司兴起，但股东分散各地，投票难以达到法定人数，因此股东获准指定一名代理人代为投票。很长一段时间里，这种代理投票大多只是走走形式。1937年，本刊一位厌烦这种路数的记者指出，股东们不过是得到了“专门的便利来投票赞成董事长的政策，连听他的演讲都省了”。

美国证交会在1934年成立的使命之一就是解决这个问题，但它一直没能确定该由谁给出提案，以及提案中该有什么要求。经过多年争取后，股东们才在企业选用审计公司方面获得了投票权，而现在这项表决已成为强制性要求，而且在今年尤其重要。英国建筑巨头Carillion和南非零售巨头斯坦霍夫集团（Steinhoff）破产后，其他聘请毕马威和德勤作审计的公司的股东纷纷要求改换审计公司。ISS建议通用电气的股东投票赞成换掉毕马威。

按目前的规则，股东提案的门槛并不高——须持有公司至少2000美元的股票长达一年，并以最多500字陈述要投票的议题。但提案要获得接受，难度就大了。提案涉及的问题应至少影响公司5%的业务，另外既不能与公司日常业务相冲突，也不能表达个人的不满。管理层可以向美国证交会申诉阻止投票。社会、环境及政策问题咨询机构可持续投资研究所（Sustainable Investments Institute）的数据显示，过去八年，证交会处理的申诉有四到六成获批准。

该研究所所长海迪·沃尔什（Heidi Walsh）表示，证交会的立场有时难以预测，其裁定结果和措辞也令人费解。去年，证交会裁定埃克森美孚必须投票表决一项要求其全面研究气候变化对业务造成风险的提案。尽管该公司反对，提案还是获得了通过。但今年，证交会又允许油气公司依欧格资源（EOG）阻止了一项要求其制定减少温室气体排放目标的提案。

如一方不服证交会的决定，可向法庭申诉。1969年，美国的越战反战派曾试图通过股东投票迫使陶氏化学公司停止制造凝固汽油弹，但遭到阻止。

他们提出申诉，最终导致证交会不再禁止政治与道德方面的提案。上世纪80年代，一项要求停止以填饲法养鹅的提案被阻止，后来的法庭申诉裁定，即使提案涉及公司业务不到5%，有时也值得表决。2015年，证交会裁定同意就一项限制零售商售卖枪支的提案投票，但沃尔玛提出申诉，最后逆转了证交会的决定。

股权性质的变化造就了一批让人意想不到的社会正义斗士。以往，股票常常由个人少量持有，现在则大多集中到大型的公共和私人基金池中。这样一来，按所管理的股份比例享有相应投票权的主权财富基金、养老基金等就成了投票集团。私人基金过去经常忽视投票，也许是因为害怕得罪企业客户。但自从2003年证交会开始要求私人基金股东参与投票后，情况发生了变化。一些管理公共养老基金的官员似乎很乐于使用这一新权力。纽约市审计长斯科特·斯特林格（Scott Stringer）就亮明自己对多元化及气候变化相关提案的立场，作为自己竞选活动的一大内容。

在这种新的企业治理框架中，“秘密代理人”的角色由ISS之类的代理投票咨询公司担当。ISS和格拉斯·刘易斯公司（Glass Lewis）是其中最知名的两家。它们帮助机构投资者梳理由其他股东及公司自身提出的各种提案，然后给予投票建议。但仍有一些人的声音几乎被忽略：通过基金和养老金持有企业股份的个人股东。随着社会问题在公司议程上变得愈发重要，忽视这些人的立场是一种长久的不公。■



Buttonwood

Catching the bitcoin bug

A new study offers cold comfort for crypto-investors

SINCE the heady days of late 2017 and January of this year, crypto-currencies have gone into retreat. Bitcoin, the best-known example, is now worth just a third of its value at its peak (see chart).

But there remain plenty of true believers in digital currencies. They point out that prices are still well above where they were in 2016. And interest from institutional investors is still strong enough for analysts to want to make sense of the crypto-phenomenon.

The latest bank to take a shot is Barclays, which devotes a lot more of its “Equity Gilt Study 2018” to the impact of technological change on finance and the economy than it does to either equities or gilts. Its report describes crypto-technology as “a solution still seeking a problem”.

It identifies four challenges in particular. The first is trust. In most countries, consumers and businesses have faith in the currencies issued by the government. The second is sovereignty: the potential for tax avoidance and loss of financial control means that neither governments nor central banks will be keen to see private crypto-currencies take off.

A third challenge is privacy. Although they can be used pseudonymously, crypto-currencies are less reliably anonymous than cash since the blockchain that lies behind them records all transactions. If a pseudonym is cracked, the user's purchase history is revealed. A fourth relates to the ability to undo a transaction in cases of error or fraud—blockchain transactions are hard to reverse.

On top of all these problems is the fact that existing alternatives seem to work perfectly well. It is easy to make payments and transfer money in an instant.

So what is the appeal of digital newcomers? Private crypto-currencies can be attractive in societies where trust is low, or where governments are unwilling or unable to provide reliable means of exchange—in wartime or during periods of sovereign default, for example. Barclays also suggests that in countries where opportunities to invest are limited, “crypto-currencies may be one of the few ways to diversify savings out of domestic assets.”

None of these conditions applies in rich countries. But they hold in some emerging markets. There could also be demand in the developed world from criminals (although they now strongly favour cash). By making generous assumptions about the size of these low-trust and criminal markets, Barclays comes up with a maximum total value for all crypto-currencies of \$66obn-78obn. That is roughly where they were priced at the beginning of 2018.

Maximum value is not the same as fair value. Surveys indicate that most people who buy bitcoin are doing so as an investment. Just 8% of Americans who hold bitcoin do so for purchases or payments. That suggests the main motive for buying crypto-currencies is speculation, which also explains their spectacular recent rise and fall, as with so many bubbles before them, from tulips to dotcom stocks.

Speculative bubbles are hard to model—how to find a rational way to assess irrationality? But Barclays uses the ingenious parallel of an infectious disease. A bubble starts with a small number of asset owners (the “infected”). New buyers are drawn in (or catch the bug) because they witness price increases and fear they will miss out. A large share of the population is immune and will never succumb.

Buyers use a combination of the current price and an extrapolation of the recent increase in price to estimate their expected target value. The faster the price rises, the wilder investors' hopes and the more the infection spreads. Eventually the market runs out of potential participants and the price rise slows. Once it starts to fall, holders lose hope of big gains and start to sell. The epidemic dies out.

The Barclays model fits the history of the bitcoin price pretty well. And it suggests that the long-term outlook for the value of crypto-currencies is bleak. After all, plenty of people will have bought in the past few months, when enthusiasm was at its height. Some will have taken extra risk to buy the currency, via spread betting or other types of gambling. Instead of the riches they expected, they will be nursing losses. Some will be keen to sell their holdings. But new buyers will be harder to tempt now that crypto-currencies no longer look like a one-way bet.

All of this is good news. Perhaps the blockchain will turn out to be useful for other purposes—for example, recording property transactions. But it has been hard to think about such potential innovations when all the attention was focused on an ever-rising price. The crypto-fever has finally broken. ■



梧桐

感染比特币病毒

一项新的研究没有给加密货币的投资者带来任何安慰

经过了2017年末和今年1月那段令人眩晕的日子之后，加密货币一路走跌。最知名的加密货币比特币目前的价值只有最高位时的三分之一（见图表）。

但数字货币仍然有很多忠实信徒。他们指出，目前的价格仍远高于2016年的水平。机构投资者仍然兴趣十足，让分析师想要弄明白这种加密货币现象。

最近做出尝试的是巴克莱银行（Barclays）。在其《2018年股票债券投资研究报告》（Equity Gilt Study 2018）中，它将技术变革对金融和经济的影响作为论述重点，比对股票或债券都着墨更多。这份报告将加密技术描述为“一个还在找问题的解决方案”。

报告特别指出了加密货币面临的四项挑战。首先是信任。在大多数国家，消费者和企业都信任政府发行的货币。其次是控制权：私人加密货币可能导致无需纳税和金融控制的丧失，这意味着政府和央行都不大愿意看到它们取得成功。

第三个挑战是隐私。虽然加密货币可以匿名使用，但其隐匿性不如现金，因为支持加密货币的区块链会记录所有交易。一旦匿名被破解，用户的购买历史就无从隐藏。第四个挑战是在发生错误或欺诈的情况下撤消交易的能力——区块链交易难以逆转。

除了所有这些问题之外，现有的替代方案看起来运作得非常好，人们可以轻松地即时付款及转账。

那么数字货币这一后起之秀有什么吸引人之处呢？在信任度较低的社会，

或者在政府不愿或无法提供可靠交易手段的情况下（例如在战时或主权违约期间），私人加密货币可能颇具吸引力。巴克莱银行还表示，在投资机会有限的国家，“加密货币可能是少数几种让储蓄不会集中在国内资产上的方式之一”。

这些情况在富裕国家都不适用，但在一些新兴市场还是存在的。发达国家的犯罪分子也可能对加密货币有需求（虽然他们现在强烈偏好现金）。通过对这些低信任度和犯罪市场的规模作出宽松的假设，巴克莱银行得出的结论是所有加密货币的最大总值为6600亿至7800亿美元。这也大致与加密货币在2018年初的定价水平相当。

但最大价值与公允价值不同。调查显示，大多数人购买比特币是为了投资，只有8%持有比特币的美国人用比特币买东西或付款。也就是说购买加密货币的主要动机是投机，这也解释了加密货币价格近期大幅涨跌的情况，和之前从郁金香到互联网公司股票泡沫等诸多现象如出一辙。

投机泡沫很难模型化——非理性行为要怎么用理性的方法来评估呢？但巴克莱巧妙地运用了传染病来作类比。泡沫始于少数资产所有者（“受感染者”）。新买家被吸引过来（受到感染），因为他们见证了价格上涨，担心错失良机。很大一部分人口是免疫的，永远不会受影响。

买家结合当前价格和对近期价格上涨的推断来估算预期目标价值。价格上涨越快，投资者的愿望就越膨胀，感染蔓延越广。最终市场再没有潜在参与者，价格上涨放缓。价格一旦开始下跌，持有者就会失去获得巨大收益的希望而开始抛售。疫情平息。

巴克莱的模型与比特币价格的历史非常吻合。而它也显示了加密货币价值的长期前景黯淡。毕竟，在过去的几个月市场情绪高涨时，很多人都买入了加密货币。有些人还通过点差交易或其他类型的赌博方式冒更大风险买入。他们最后非但不会如预期般发财，还会蒙受损失。有些人会急于出售手中持有的加密货币，但既然行情看起来不再一路上涨，也就更难诱惑新买家入手了。

这都是好消息。也许区块链会在其他方面大显身手，例如记录产权交易。而此前所有注意力都集中在不断上涨的价格上时，很难去构想这样的潜在创新。加密货币热终于退烧了。 ■



Financial regulation

Taming crypto

Crypto-assets need corralling. Here is a guide to how much oversight is required

THE wild ride seems to have calmed. Late last year speculators sent the price of crypto-currencies soaring. The value of bitcoin, the best-known, has fallen by half since then. But the momentum behind all things crypto remains powerful. Bitcoin is still worth seven times what it was just a year ago. In the first quarter of this year, according to CoinDesk, a news service, \$6.3bn was raised through initial coin offerings (ICOs), a form of funding in which firms issue digital tokens, more than in all of 2017. Last month the Student Loan Report, a website, found that one in five American students it asked had used part of their loan to join the crypto rush.

No wonder regulators want to exert greater control over the crypto-sphere. The chance to raise money via ICOs has attracted as many con men as it has genuine entrepreneurs. The head of Europol, Europe's policing agency, has estimated that 3-4% of the region's criminal proceeds are now laundered through crypto-assets. Plenty in the industry think regulation would help legitimise crypto. Yet crypto-enthusiasts are also right to fear that overzealous regulation, like China's ban on crypto-exchanges and ICOs, could throttle a promising technology. To achieve the right balance, regulators must find sensible answers to three questions: what are crypto-assets? How should day-to-day risks be managed? And what threat do they pose to financial stability?

Today there is no consensus on what a crypto-asset is. Even within countries, authorities disagree on how to classify them. Are they a commodity, a currency, a security or their own, peculiar asset class? In America the Securities and Exchange Commission has hinted that it will

treat most tokens issued through ICOs as securities. That would mean onerous disclosure requirements. But a blanket approach does not capture the shape-shifting nature of many digital assets. Better to go the way of the Swiss regulator, FINMA, which in February said it would base treatment on their actual function—ie, whether they are used for payments; as a utility token that gives its holder access to a specific service; or as an investment. This also means a token's classification can change over time.

Such decisions point towards how to deal with day-to-day crypto-risks, from money-laundering to consumer protection. Criminals were among the earliest adopters of digital currencies. Regulation could help smoke them out by extending existing anti-money-laundering rules into the crypto-sphere (see Finance section). The obvious targets are the exchanges where ordinary money is swapped for crypto and vice versa. Regulators should demand that these exchanges apply similar standards to those of banks. These include requiring identification from all customers and keeping a record of unusual transactions. Several countries, including Australia and South Korea, already do this; earlier last month the EU passed a directive stipulating the same thing. There is a need for a harmonised approach, in order to prevent illicit flows of money to crypto-havens.

As for how much protection consumers should enjoy when they invest in crypto--assets, some advocate restricting the market to accredited investors, on the ground that they may be better at judging risks than ordinary punters and are certainly more cushioned against any losses. But the bar to imposing bans on how people can risk their own money ought to be high. The authorities in many countries issue explicit warnings about the risks associated with crypto-speculation; several are clamping down on the advertising of ICOs. That, allied with existing rules to punish out-and-out fraud, is sufficient.

The third question is easily answered at the moment. Crypto-assets do not

yet pose a risk to global financial stability; cumulatively, they are worth less than 3% of the combined balance-sheets of the central banks in America, Britain, Germany and Japan. But the wild swings of bitcoin are a warning that things can quickly change. Regulators must keep a weather eye on the factors that could heighten systemic risk, such as the amount of borrowing done by crypto-investors.

Regulating crypto-assets is no easy task. Too much red tape may hamper innovation. Some think, for example, that ICOs could give rise to a new form of “crypto co-operative” in which digital tokens provide founders, employees and users with a shared interest in its success. At the same time, a market in which scammers and criminals roam freely deters honest actors from taking part. The fact that all of this is new technological terrain adds to the pressure on regulators to show unusual flexibility. For as long as crypto has its Wild West image, regulators will need to keep their frontier mentality. ■



金融监管

驯币记

需要把加密资产赶进畜栏。要看得多紧？这里有一份指南

狂野之旅看似已经平息。去年年末投机者将加密货币的价格一路推高，自那以后最出名的加密货币比特币的价值已经跌去一半。但是，各种加密货币背后的势头依然强劲。比特币的价格仍然是一年前的七倍。新闻网站 CoinDesk 的数据显示，今年第一季度首次代币发行（ICO，企业通过发行数字代币融资的一种方式）筹得 63 亿美元，超过了 2017 年全年的总额。上个月，学生贷款报告（Student Loan Report）网站发现，在接受其调研的美国学生中，有五分之一将他们申请到的部分贷款投入到了加密货币的投资热潮中。

难怪监管机构想要加强对加密货币领域的控制。通过 ICO 融资的机会既吸引了很多真正的企业家，也招来了不少骗子。欧洲刑警组织（Europol）的负责人估计，现在欧洲 3% 到 4% 的犯罪所得都是通过加密资产洗白的。很多业内人士认为，监管将有助于加密货币合法化。然而，加密货币的拥趸也有理由担心，如果像中国禁止加密货币交易和 ICO 那样实施过度监管，一项很有前景的技术可能就会被扼杀。为了恰当地平衡监管与发展，监管机构必须找到三个问题的合理答案：加密资产是什么？应如何管理日常风险？加密资产对金融稳定有什么威胁？

目前，人们对于加密资产是什么尚未达成共识。即使在各国内部，不同的权威机构对于如何归类加密资产也有分歧。它们是商品、货币、证券，还是自成一类资产？在美国，证券交易委员会（Securities and Exchange Commission）暗示它将把通过 ICO 发行的大部分代币视为证券。这意味着繁重的信息披露要求。但是一刀切的方法没能抓住许多数字资产形态多变这一特性。瑞士金融市场监督管理局（FINMA）的办法更好，它在 2 月份表示将根据数字资产的实际功能对其分类，即看它是用于支付，还是一种让持有者可以使用特定服务的实用性代币，还是一种投资手段。这也意味

着一种数字代币所属的类别会随时间而改变。

如何分类的决策决定了从洗钱到消费者保护等日常加密资产风险的应对方式。罪犯是最早使用数字货币的群体之一。监管可以通过将现有的反洗钱法规扩展到加密领域来追查他们。显而易见的监管目标是兑换一般货币和加密资产的交易所。监管机构应该要求这些交易所采用与银行类似的标准。这包括要求识别所有客户的身份并记录异常的交易。包括澳大利亚和韩国在内的几个国家已经采取了这种做法；欧盟在上月早些时候也通过了同样的指令。各国有必要协调行动，防止非法资金流入“加密天堂”。

至于消费者在投资加密资产时应该享有多少保护，一些人主张仅限合格投资者进入市场，理由是他们可能比普通投资者更擅长判断风险，而且肯定更能承受损失。但是，若要禁止人们用自己的钱来冒险，应该把做出这类规定的门槛设得很高才行。许多国家的监管部门都对加密资产投机的风险发布了明确警告，有些还开始限制ICO的广告。这些措施，再加上现有的惩治彻头彻尾欺诈行为的规定，已经足够了。

关于第三个问题，眼下的答案很清楚。加密资产尚未对全球金融稳定构成风险，它们的总价值不到美国、英国、德国和日本央行合并资产负债表的3%。但是，比特币价格的大幅波动警告人们，局面可能迅速改变。监管机构必须密切关注可能增加系统性风险的因素，例如加密货币投资者的借贷额。

监管加密资产并非易事。过于繁冗的规定可能会阻碍创新。例如，一些人认为ICO可能会催生出一种新型“加密合作社”——数字代币让企业的创始人、员工和用户共担企业的命运。而与此同时，一个骗子和罪犯横行的市场会让诚实的参与者却步。所有这些都属于新的技术领域，这就更需要监管机构拿出非同寻常的灵活度。只要加密资产领域还是一副狂野西部的景象，监管机构就需要保持不断探索的心态。 ■



Merger reviews

Command and control

China's antitrust regulators are becoming more activist

GLOBAL deals may be growing at a rapid clip, but they seldom offer instant gratification. Qualcomm, an American chipmaker, first bid for NXP Semiconductors, a Dutch company, in October 2016. The union has since been blessed by eight regulators worldwide, but one hurdle remains: China. With no decision yet from its regulator, the companies, which were expecting to have closed the \$44bn deal late last month, now hope to conclude it by July. The purchase of the chip unit of Toshiba, a troubled Japanese company, by a consortium led by Bain Capital, an American private-equity firm, is similarly awaiting sign-off from China.

Some suspect the delays stem from the threat of a trade war with America. Holding back regulatory approval, particularly on sensitive high-tech deals, could be part of the arsenal in any trade conflict. Organisational change may also be to blame. Fay Zhou, who works in Beijing for Linklaters, a law firm, points out that a recent reshuffle, which took merger reviews away from the commerce ministry and put them under the same roof as other competition authorities, may have contributed to lags. Either way, the delays bring home the importance of the Chinese authorities to international deals.

They are now one of the three big regulators to reckon with, together with the Americans and Europeans, says Mark Furse of Glasgow University. Research by Allen & Overy, a law firm, shows that Chinese regulators sought remedies on seven deals in 2017 (see chart). Though fewer than American and European interventions, that is a record for China.

As with much else, China's approach to mergers is distinctive. Like in other

jurisdictions, foreign businesses must seek approval for a merger if their sales or assets in the country cross a certain threshold. But in addition to protecting consumers, the Chinese authorities are required by law to promote “the healthy development of the socialist market economy”. That industrial-policy objective means that regulators can intervene even when competition is not strictly a concern, notes Charles Pommiès of Allen & Overy (although plenty of cases are judged purely on competition grounds).

Deals tend to attract scrutiny if they involve industries where China wants to catch up with the West, such as high-tech sectors, or where it has interests to protect, such as commodities. Although the European Commission was relatively relaxed about Microsoft’s takeover of Nokia in 2013, for example, the Chinese authorities fretted that its firms would lose access to intellectual property as a result. They also intervened in a merger between two mining firms, Glencore and Xstrata, even though their combined market share was less than 20% in each of their product markets in China. Mr Furse points out that, in contrast, it typically takes market shares of over 40% to raise concerns in Europe; thresholds are even higher in America.

Chinese authorities also seek distinctive conditions before clearing a deal. Some divestments have been known to directly benefit the state. The Glencore and Xstrata merger, for example, was approved on the condition that a mine in Peru was sold off; soon afterwards it was snapped up by a consortium of Chinese state-owned firms, led by the China Minmetals Corporation. And “behavioural” remedies can require a combined company to keep prices unchanged after the merger, or to stay out of certain markets. Such conditions can be intrusive, requiring the companies to report regularly to the authorities. Western regulators tend to avoid them, as they are a nuisance to monitor.

A stricter, but rarer, condition is the “hold-separate” remedy, which has

been applied to a handful of hardware deals, including the merger last year of two Taiwanese chipmakers, Advanced Semiconductor Engineering and Siliconware Precision Industries. The two firms cannot integrate their operations for a certain period of time, which kicks the benefits of merging even further down the road. As ever more deals come into the purview of Chinese regulators, dealmakers will have to remind themselves that patience is a virtue. ■



合并审查

命令与控制

中国的反垄断监管机构正变得越来越激进

全球交易也许正迅速增长，但它们很少能即刻得愿以偿。美国芯片制造商高通于2016年10月首次出价收购荷兰公司恩智浦半导体（NXP），自那以后已得到全球八个监管机构的批准，但仍面临一个障碍——中国。两家公司原本预计于上月底完成这一价值440亿美元的交易，但由于中国监管机构尚未做出决定，只好寄希望于7月前完成。由美国私募股权公司贝恩资本（Bain Capital）牵头的财团出手收购陷入困境的日本公司东芝的芯片部门，同样也在等待中国放行。

有人怀疑这类延迟是受到中美之间可能爆发贸易战的影响。在任何贸易冲突中，一方都有可能使出阻止监管部门批准这一武器，当涉及敏感的高科技交易时尤其如此。监管部门的组织架构变动可能也是一个原因。年利达律师事务所（Linklaters）北京代表处的周越指出，最近一次机构重组将并购审查的职能从商务部剥离出来，与其他竞争监管职能整合到了一起，这可能导致了审批延迟。不管是何种原因，这种延迟都让人深刻认识到中国监管机构对于国际交易有多么重要。

格拉斯哥大学的马克·福斯（Mark Furse）说，中国的监管机构如今和美国、欧洲的同类机构并列三大监管者。安理国际律师事务所（Allen & Overy）的研究表明，中国监管机构在2017年就七宗交易寻求补救措施（见图表）。尽管比美国和欧洲做出这类干预的数量要少，但对中国本身而言已经创下记录。

中国在很多事情上都与众不同，对待合并的方式也是如此。与其他司法辖区一样，如果外国企业在中国的销售或资产达到一定的数额，那么其合并就必须申请批准。但是，除了保护消费者，中国的法律还要求其政府部门促进“社会主义市场经济的健康发展”。安理国际律师事务所的查尔斯·帕米

(Charles Pommiès) 指出，这一产业政策目标意味着即使严格说来并无竞争方面的担忧，监管机构也能出手干预（尽管许多案例是完全以竞争问题来评判的）。

如果交易涉及到那些中国希望赶上西方的行业，比如高科技，或是它需要保护自身利益的行业，比如大宗商品，那么往往会展受到严密的审查。例如在2013年，尽管欧盟委员会对微软收购诺基亚的态度相对宽松，但中国当局却担心中国公司会因此而无法使用知识产权。中国还干预了两家矿业公司嘉能可（Glencore）和斯特拉塔（Xstrata）的合并，尽管它们的每种产品在中国的合并市场份额都不到20%。福斯指出，相比之下，市场份额一般超过40%才会引起欧洲的担忧，美国的门槛甚至更高。

中国当局还会在批准交易前提出独特的条件。已知一些企业被迫出售资产给中国政府带来了直接的好处。例如，批准嘉能可和斯特拉塔合并的条件是出售秘鲁的一座矿山，不久之后，由中国五矿集团牵头的国有企业财团收购了该矿山。而“行为”补救措施可能要求合并后的公司保持价格不变，或者避开某些市场。这类条件要求公司定期向监管当局报告，可能会对它们造成干扰。西方监管机构往往会避免提出此类条件，因为监控起来很麻烦。

更严格但也更少被提出的条件是“保持独立”措施，曾在几宗硬件交易中运用过，包括去年两家台湾芯片制造商日月光半导体和矽品精密工业的合并。这两家公司在一定的时间内不能整合业务，这就让合并的好处还要往后拖更久才能显现。随着越来越多的交易进入中国监管机构的受理范围，交易各方将不得不提醒自己，耐心是一种美德。 ■



Compensating blood donors

Blood money

Many countries ban payment for blood plasma. This is mistaken

THIS year marks the 200th anniversary of the first successful human-to-human blood transfusion, conducted by James Blundell, an English obstetrician working just across the Thames from *The Economist's* offices. Today blood is big business—with global exports worth more, in 2016, than global exports of aeroplanes. But that trade is distorted by the refusal of most governments to allow payment to people who give plasma, blood's yellowish liquid component.

The blood trade today consists mostly not of blood for transfusion, demand for which is falling as medical techniques improve, but of plasma (see International section). Most of this comes from plasma-collection centres, where it is extracted from whole blood and the platelets and blood-cells are transfused back into the donor. Plasma is used to make drugs such as factor VIII, which helps haemophiliacs' blood to clot, and vaccines for rabies, tetanus and Rhesus disease. Almost 50m litres of it were used in 2015, enough to fill 20 Olympic swimming pools. America, the OPEC of plasma, produces 15 of those swimming-pool equivalents. Forget steel and cars: plasma makes up 1.6% of America's total goods exports.

The secret of this success is simple: America lets companies pay people for their plasma. So do the few other countries that are good at collecting the stuff, including Germany and Hungary. Others don't. Big importers such as Australia, France and Belgium have banned payment. In Canada, where the issue is a live debate, the lone company trying to collect paid plasma has recently been banned in two provinces and risks the same in a third.

The aversion to paid plasma rests on three reasonable-sounding but largely groundless propositions. The first is that it is unsafe. Payment might encourage donors to conceal dangerous behaviour—such as intravenous drug use. In the 1980s and 1990s, tainted blood products infected half the world's haemophiliacs with HIV, along with tens of thousands of plasma donors in China. But modern plasma products do not carry such risks. They are heat-treated and bathed in chemicals to sanitise them (an impossibility for blood for transfusion). Since the adoption of these techniques there has not been a single case of transmission of HIV or hepatitis via plasma products. Doctors agree that plasma products from paid donors are just as safe as those from unpaid ones.

A second argument is that, if people are paid for their plasma, fewer will volunteer to donate whole blood for transfusions. (Paying for whole blood would be unwise, since it cannot be sterilised as plasma can.) But there is no evidence that paying for plasma diminishes the supply of donated blood. That is why, in Canada, more than 30 economists and philosophers wrote an open letter arguing against bans on paid plasma. Americans voluntarily donate as much blood per person as do Canadians.

A third argument is that paying for plasma preys on the poor. It is possible that those selling plasma need the money and therefore might give too often. In America plasma donors can give twice a week; those in Europe can give just once a week. There is no evidence of harm to their health in either case, but more long-term study would be prudent.

Those against allowing payment suggest using voluntary donors instead. Yet every country that does not pay ends up importing plasma. And the fact that America is by far the dominant supplier carries risks of its own. The dependence on a single source leaves the rest of the world vulnerable to an interruption of supply. To protect their people, therefore, other governments need to diversify their supplies of plasma. Paying for it would

make a big difference. ■



有偿献血

血钱

很多国家禁止有偿捐献血浆，实为错误决策

二百年前，英国产科医生詹姆斯·布伦德尔（James Blundell）首次成功实施了人对人输血，他的诊所就在泰晤士河畔，与《经济学人》办公室隔河相望。如今，血液已经成了大买卖——2016年血液的全球出口额比飞机还高。但是，这项贸易因为大多数政府禁止向血浆（血液中的淡黄色液体成分）捐献者支付报酬而被扭曲。

随着医疗技术的进步，输血用血的需求正在下降，现在血液贸易的主体并非输血用血，而是血浆，其中的大部分来自血浆采集中心。采集中心从全血中提取血浆，将血小板和血细胞输回供体。血浆可用于制造药物，比如有助血友病患者血液凝结的第八因子，以及狂犬病、破伤风和新生儿Rh溶血病的疫苗。2015年，全球血浆用量接近五千万升，足够填满20个奥运会标准游泳池。美国可谓血浆供应上的“欧佩克”：这20个游泳池的血浆用量中，美国出产的占15个。别提钢铁和汽车了：血浆占了美国商品出口总额的1.6%。

成功的秘诀很简单：美国允许公司向血浆捐献者支付报酬。德国和匈牙利等少数几个血浆收集大国也是如此。其他国家没这么做。澳大利亚、法国、比利时等血浆进口大国已禁止有偿采集血浆。在加拿大，人们对该问题仍激辩不休，唯一从事有偿采集血浆的一家公司最近已被两个省禁止采血，在另一个省可能也将遭遇禁令。

人们对有偿血浆反感有三个理由，都看似合理实则毫无根据。首先是认为它不安全。捐献者可能为追逐报酬而隐瞒危险行为，如静脉注射吸毒。上世纪八九十年代，受污染的血液制品导致全球半数血友病患者感染艾滋病，受感染的还有中国数以万计的血浆捐献者。但现代的血浆制品不存在此类风险。这些制品经过热处理及化学品浸泡消毒（输血用血不能这样处

理）。自从采用这些技术后，再没有通过血浆产品传播艾滋病或肝炎的病例。医生们一致认为来自有偿献血的血浆产品与来自无偿献血的一样安全。

第二个理由是，假如捐献血浆可以获得报酬，愿意捐献全血用于输血的志愿者就会减少。（全血不能像血浆那样做消毒处理，所以对捐献全血支付报酬是不明智的。）但没有证据表明有偿采集血浆会导致全血捐献减少。正是出于这个原因，在加拿大，超过30位经济学家和哲学家写了一封公开信，反对有偿采集血浆禁令。美国人均自愿献血量与加拿大相当。

第三个理由是有偿采集血浆是在压榨穷人。出卖血浆的人可能因为需要这笔钱而过于频繁地“捐献”。在美国，人们可每周捐血浆两次；在欧洲，每周只能捐一次。这两种情况下都没有证据显示捐献者的健康受损。但为谨慎起见，这一点还需要更长期的研究。

反对有偿采集血浆的人士建议以无偿自愿捐献的血浆作替代。然而，每个禁止有偿采集血浆的国家最终都得从别国进口血浆。而且，美国在血浆供应市场占据绝对主导地位本身就存在风险。世界其他地区如此依赖单一血浆来源，万一供应中断，它们将陷于困境。因此，为保护国民，其他国家需要让血浆供应多样化。允许有偿采集，情况将大有不同。■



Economic and financial indicators

Oil

Brent crude this week hit a three-and-a-half-year high of \$78 a barrel

Brent crude this week hit a three-and-a-half-year high of \$78 a barrel. It is now worth almost three times as much as it was at its nadir in 2016. The price of oil has been creeping up since last summer, boosted in part by strong global consumption, which expanded by 1.6% in 2017. A deeper-than-expected cut in output by OPEC and other oil-producing countries has also buoyed prices. So too has the collapse of the oil industry in Venezuela. More recently prices have rallied in response to President Donald Trump's withdrawal from the nuclear deal with Iran. It is estimated that this decision could remove 1m barrels of Iranian crude a day from global markets. ■



经济与金融指标

石油

本周，布伦特原油创下三年半以来的最高价位，达到每桶78美元

本周，布伦特原油创下三年半以来的最高价位，达到每桶78美元，是2016年最低点的近三倍。自去年夏天起，油价持续悄然上升，一定程度是由于全球石油消费强劲：2017年，全球石油消费增长1.6%。欧佩克及其他石油生产国减产的水平超出预期，再加上委内瑞拉石油产业崩溃，也推动油价维持在高位。近期美国退出伊核协议，油价应声反弹。估计这一决定会使伊朗的原油供应减少每天100万桶。■



Technology companies

DeFANGed?

America's tech giants are growing, but so is investors' caution

FOR a few years now Facebook, Amazon, Netflix and Google have behaved like sled dogs pulling the stockmarket forward with boundless energy. The ride has been mostly smooth and enriching. To many in Silicon Valley the fortunes of the FANGS—as the pack is known—seemed so entwined that they were treated like a distinct asset class. It was one in which everyone should have coveted a stake (see chart 1). The four firms have accounted for 20% of the rise in S&P 500 stocks since 2016. Yet the FANGs' fates may no longer be indivisible.

On April 23rd Alphabet, Google's parent company, reported its strongest sales growth in nearly four years, but its share price dropped by 4.5% the next day because of rising costs from investments in new businesses such as cloud computing and hardware. On April 25th Facebook posted a large increase in sales and profits, as well as a 39% rise in costs compared with last year. Investors have been most focused on the ramifications of a privacy scandal in March, when it emerged that users' data had been shared without their consent; the fallout so far seems to have been limited enough that the social network's share price rose by more than 7% after hours. Markets are still besotted with Amazon and Netflix. Netflix is the best-performing public company in 2018. But after years of being brushed aside by investors, the differences between the four firms are now commanding greater attention.

The companies still have important things in common: dominance, scale and growth. Each is top dog in its neck of the internet: Facebook in social media, Amazon in e-commerce, Netflix in premium video-streaming,

Google in search. All benefit from network effects, turbocharged by clever algorithms. The more users they have, the better their products, the more new customers are lured. This has helped them confound doubters and grow briskly despite their massive size.

Potential markets remain enormous. Facebook and Google are already goliaths, but can expect to expand as more ad spending migrates online. All told, Amazon is now present in consumer markets worth \$4.8trn, nearly double the equivalent figure in 2015, according to Brian Nowak of Morgan Stanley, a bank. It looks well-placed to benefit from the accelerating shift away from bricks-and-mortar retailers in America. Optimists believe that Netflix can double today's 120m subscribers by 2022. It may have room to raise prices without alienating consumers.

Yet these broad similarities mask deep differences. For a start, the firms make money in distinct ways. Netflix and Amazon, which recently announced it has 100m "Prime" members who pay an annual fee for free shipping and online video, sell subscriptions. On top of that, Amazon sells just about everything else consumers desire, while its cloud-computing business guarantees stable, recurring revenue. Facebook and Google sell users' attention to digital advertisers.

Fearful of a political backlash provoked by the Facebook scandal, companies that do not depend on advertising are trying to distance themselves from the online ad duopoly. Netflix is more of a "media firm" than "pure tech", Reed Hastings, Netflix's boss, recently told analysts, adding that his company was "substantially inoculated" because it does not sell ads and protects users' privacy. Tim Cook, the boss of Apple, sometimes considered a fifth FAANG, has publicly derided Facebook's handling of users' data.

The companies view profitability rather differently, too. Facebook and Google built enormous businesses first and are re-investing the profits to

develop new ones. Netflix and Amazon continue to prioritise scale and are splurging to achieve it, observes Michael Nathanson of Moffett Nathanson, a research firm. This helps explain the companies' disparate valuations (see chart 2). Facebook and Alphabet trade at a conservative 20 times earnings; the figure for Amazon and Netflix is closer to 90, more than five times the average for members of the S&P 500.

The FANGs do face common challenges, albeit to varying degrees. One is regulation. It is too soon to say how much Europe's sweeping General Data Protection Regulation, which is coming into effect in May, will hit Google's and Facebook's bottom-lines—but investors are anxious that hit it will. Another privacy scandal could prompt American regulators to enact onerous rules that hamper digital giants. Talk of antitrust enforcement grows louder every time Facebook notches up another 100m users or Amazon enters a new market (see Schumpeter). Netflix looks safe for now, but that may change if it ever gets as big as investors think it will. Mere threats of regulation—including in a presidential tweet—can dent a firm's share price, as Amazon has learned (Donald Trump is no fan of the *Washington Post*, a newspaper that is owned by Amazon's boss, Jeff Bezos).

A second challenge concerns margins. Facebook and Google are enormously lucrative businesses, with margins of 50% and 29% respectively in 2017. But rising costs may squeeze them. Amazon and Netflix rely on investors' unshaken belief that they are headed for world domination. Netflix may burn through \$3bn-4bn in 2018 alone in its pursuit of that goal. Mr Nathanson expects the company to generate cash only in 2021. Earlier this month his firm wrote that it "still can't justify" Netflix's stock price "under any scenario". Short-sellers now own around 4.5% of Netflix stock, more than four times as much as Amazon, Facebook or Alphabet.

The final problem is competition. One of the few certainties in the

technology sector is that the giants will clash with one another. Having come to dominate a large part of their own markets, they are now striking out in search of new opportunities. Inevitably and increasingly, they will encroach on each other's territory.

Netflix looks the most vulnerable. Disney plans to launch its own subscription-based video service and withhold its blockbusters from Netflix. Amazon already offers a streaming-video service to Prime customers but if it were to announce a serious investment in this market and offer a standalone service, it could temporarily halve Netflix's share price, reckons Mark Mahaney of RBS Capital, an investment bank. Amazon is also building a digital advertising business of its own, which could grow from perhaps \$4bn today to \$22bn over the next five years. For the time being this is likelier to hurt offline media than Facebook or Google, thinks Brent Thill of Jefferies, an investment bank. One day that could change. Intra-FANG rivalry will be bad for returns, but it may also deflect accusations that the companies have grown too dominant. Lower margins could be the price the tech giants must pay to keep regulators off their backs. ■



科技公司

“獠牙帮”瓦解？

美国科技巨头还在扩张，但投资者也愈发谨慎

多年来，Facebook、亚马逊、Netflix和谷歌像精力无限的雪橇犬一般拉动股市，一路大体上顺风顺水，推动价格上涨。在众多硅谷人士的眼中，“獠牙帮”（FANG，这四家公司名称的首字母组合）的命运紧密交缠，以至于它们已被看做一类独特资产。这是一个人人都会想要分一杯羹的资产类别（见图表1）。自2016年以来，四家公司贡献了标普500指数20%的涨幅。然而，“獠牙帮”各成员的命运也许要就此分道扬镳了。

上月23日，谷歌母公司Alphabet公布了近四年最强劲的销售增长，但由于云计算和硬件等新业务的投资成本上升，第二天其股价下跌了4.5%。上月25日，Facebook公布销售及利润取得大幅增长，但成本也同比上升39%。投资者尤其关注该公司3月份爆出隐私丑闻的后果，当时Facebook被揭露未经用户同意即分享他们的数据，目前来看事件影响并不大：公告数小时后，该社交网站的股价上涨超过7%。市场仍然为亚马逊和Netflix神魂颠倒，后者是2018年表现最佳的上市公司。多年来，这四家公司间的差异并不为投资者在意，但现在这些差异正在引起更多的重视。

这些公司仍拥有一些重要的共同点：霸主地位、庞大規模、快速增长。在社交媒体、电子商务、付费视频流媒体、搜索这几大互联网版块上，Facebook、亚马逊、Netflix和谷歌分别独占鳌头。四者均得益于由智能算法强化的网络效应。拥有的用户越多，它们就越能完善产品，进而吸引更多的新客户。这帮助它们战胜怀疑言论，并在业已庞大的规模之上保持迅猛增长。

潜在市场依然巨大。Facebook和谷歌虽已成为行业巨头，但随着更多的广告支出转移到网上，这两家公司有望继续扩张。据摩根士丹利的布莱恩·诺瓦克（Brian Nowak）称，亚马逊涉足的各类消费市场规模达4.8万亿美元

元，比2015年翻了一番。随着美国零售业加速从实体店向网店转移，亚马逊看来势头大好。乐观估计认为，到2022年，Netflix的订户数将在目前1.2亿的基础上翻一番，该公司也许有提高服务价格而不流失用户的空间。

然而，这些宽泛的相同点掩盖了深层的差异。首先，这些公司的盈利模式各不相同。Netflix和亚马逊销售订阅内容，后者最近宣布其Prime会员数量达到1亿，这些会员支付一笔年费即可享受免运费和免费观看在线视频的服务。此外，亚马逊还几乎销售消费者所需的一切，同时其云计算业务能保证稳定的经常性收入。Facebook和谷歌则是向数字广告主出售用户的注意力。

害怕卷入Facebook丑闻引发的政治漩涡，不依赖广告收入的公司正力图与Facebook和谷歌这对在线广告双寡头划清界线。Netflix的老板里德·哈斯廷斯（Reed Hastings）最近向分析师表示，Netflix并非一家“纯技术公司”，而更像是“媒体公司”，还称自家公司不销售广告并且保护用户隐私，因而“有很强的免疫力”。苹果公司有时被视为“大獠牙帮”（FAANG）的第五位成员，它的老板库克公开讥讽过Facebook处理用户数据的方式。

这些公司对盈利的态度也大不相同。莫菲特·内桑森研究公司（Moffett Nathanson）的迈克尔·内桑森（Michael Nathanson）认为，Facebook和谷歌先是打造了庞大的业务，目前正把所得利润重新投资以开发新业务，Netflix和亚马逊则继续把规模放在首位，正大笔投资扩大规模。这有助解释这些公司的不同估值（见图表2）。Facebook和Alphabet的市盈率约为20倍，数字保守；亚马逊和Netflix的市盈率接近90倍，是标普500上市公司平均水平的五倍多。

“獠牙帮”确实面临着相同的挑战，尽管严峻程度不一。首先是监管问题。欧盟将在5月全面实施《一般数据保护条例》（General Data Protection Regulation），现在要估计这对谷歌及Facebook的盈利有何影响还为时过早，但投资者担心该条例会造成重创。如果再发生一宗隐私丑闻，美国监管机构可能就会制定繁琐的规定来限制数字巨头。每当Facebook再增一亿

用户或亚马逊打入又一个新市场，实施反垄断措施的呼声就愈加响亮。Netflix似乎暂时无碍，但只要增长至投资者预期的规模，情况就可能生变。单单是威胁实施监管的言论（包括总统推文中的威胁）便足以挫伤一家公司的股价，亚马逊已经领教过这一点（特朗普不喜欢《华盛顿邮报》，而亚马逊老板杰夫·贝佐斯正是这份报纸的所有者）。

第二个难题事关利润。Facebook和谷歌的业务利润极其丰厚，2017年两者的利润率分别达到50%和29%。但日益上涨的成本可能会压低利润。亚马逊和Netflix则依赖投资者的坚定信念——公司正走在称霸世界的路上。为此目标，Netflix单在2018年就可能烧掉三四十亿美元。内桑森估计Netflix的负现金流要到2021年才能转正。4月初，其研究公司的报告称，它仍然“在任何情况下”都“无法认可”Netflix的股价。Netflix股票约有4.5%由卖空者持有，是亚马逊、Facebook或Alphabet的四倍还多。

最后一个问题是竞争。科技业少有的几个定数之一就是巨头之间会起冲突。在控制所在领域的大部分市场后，这些公司正在寻求开拓新机会。入侵彼此地盘的情况将不可避免，而且会越来越多。

Netflix的前景看似最为危险。迪士尼计划推出自己的订阅视频服务，把自己出品的大片从Netflix平台下线。亚马逊目前已为Prime用户提供流媒体视频服务，但假如它宣布对该市场做出重大投资并提供独立服务，Netflix的股价可能会暂时下跌一半，投行苏格兰皇家银行资本市场（RBS Capital）的分析师马克·马赫尼（Mark Mahaney）估计。亚马逊还在打造自己的数字广告业务，在未来五年规模可能从目前的约40亿美元增至220亿美元。美国投行杰富瑞（Jefferies）的分析师布伦特·泰尔（Brent Thill）认为，就目前而言，这对传统媒体的伤害更甚于对Facebook或谷歌的冲击，但未来可能就不一样了。“獠牙帮”的内部竞争将损害回报，但也可能转移对这些企业垄断市场的指责。科技巨头要摆脱监管机构的威胁，损失一些利润也许是必然的代价。■



Artificial intelligence

The Kamprad test

IKEA furniture and the limits of AI

COMPUTERS have already proved better than people at playing chess and diagnosing diseases. But now a group of artificial-intelligence researchers in Singapore have managed to teach industrial robots to assemble an IKEA chair—for the first time uniting the worlds of Allen keys and Alan Turing. Now that machines have mastered one of the most baffling ways of spending a Saturday afternoon, can it be long before AIs rise up and enslave human beings in the silicon mines?

The research also holds a serious message. It highlights a deep truth about the limitations of automation. Machines excel at the sorts of abstract, cognitive tasks that, to people, signify intelligence—complex board games, say, or differential calculus. But they struggle with physical jobs, such as navigating a cluttered room, which are so simple that they hardly seem to count as intelligence at all. The IKEAbots are a case in point. It took a pair of them, pre-programmed by humans, more than 20 minutes to assemble a chair that a person could knock together in a fraction of the time (see Science section).

AI researchers call that observation Moravec's paradox, and have known about it for decades. It does not seem to be the sort of problem that could be cured with a bit more research. Instead, it seems to be a fundamental truth: physical dexterity is computationally harder than playing Go. That humans do not grasp this is a side-effect of evolution. Natural selection has had billions of years to attack the problem of manipulating the physical world, to the point where it feels effortless. Chess, by contrast, is less than 2,000 years old. People find it hard because their brains are not wired for it.

That is something to bear in mind when thinking about the much-hyped effects of AI and automation, especially as AI moves out of the abstract world of data and information and into the real world of things you can drop on your foot. On April 13th Elon Musk, the boss of Tesla, an electric-car firm, said that the production problems which have dogged his company's high-tech factory were partly the result of an overreliance on robots and automation. "Humans are underrated," he tweeted. Lots of jobs have physical aspects that robots struggle with. Machines may soon be able to drive delivery vans, for instance. But, at least for now, they could well fail to carry a parcel to a flat at the top of a flight of slippery stairs, especially if the garden was patrolled by a dangerous dog.

Today's AI systems are limited in other ways, too. They are pattern-recognition engines, trained on thousands of examples in the hope that the rules they infer will continue to apply in the wider world. But they apply those rules blindly, without a human-like understanding of what they are doing or an ability to improvise a solution on the spot. Makers of self-driving cars, for instance, worry constantly about how their machines will perform in "edge cases"—complicated and unusual situations that cannot be foreseen during training.

Calibrating excitement about AI is tricky. Researchers complain that great progress is quickly forgotten: as soon as a computer can do something, it ceases to count as "AI". But those same researchers also tend to be more cautious about the future than many pundits. There is no reason, in principle, why a computer could not one day do everything a human can and more. But that will be the work of decades at least. Furniture-assembly helps explain why. ■



人工智能

宜家测试

宜家家具与AI的局限

在下棋和诊断疾病上，计算机已经证明了自己强过人类。而现在，新加坡的一群人工智能（AI）研究人员又成功教会工业机器人组装出了一把宜家的椅子。这是艾伦扳手（也叫内六角扳手）和艾伦·图灵的世界头一回联结起来。既然机器已经掌握了消磨周六下午最奇怪的方式之一，那么离AI崛起并奴役人类在硅矿里劳作还会远吗？

这项研究也传达了一个重要信息。它凸显出一个关于自动化局限性的深层真相。机器擅长抽象的认知型任务，这类任务对人类而言是智力的体现，比如复杂的棋类游戏或微积分学。但它们却很难做好那些非常简单、根本用不到什么智力的体力活，比如穿过一个杂乱的房间。宜家机器人就是个很好的例子。经人们预先编程的两个宜家机器人用了20多分钟才装好一把椅子，而一个人用几分钟就拼好了。

AI研究人员把这称作莫拉维克悖论（Moravec's paradox），他们在几十年前就发现了这个现象。这似乎不是那种多做点研究就能解决的问题。相反，它好像是一个基本事实：身体的灵活度比下围棋更难通过计算实现。人们没能透彻地理解这一点这一点，这本身是进化的副作用。自然选择用了几十亿年来解决操纵现实世界的问题，直到达到轻松自如的程度。相比之下，国际象棋只有不到两千年的历史。人们觉得下棋很难，是因为他们的大脑不是为下棋而存在的。

当我们思考AI和自动化的影响这一被大肆宣传的议题时，要把这一点铭记于心，尤其是当AI走出抽象的数据和信息世界、进入实实在在的现实世界时。上月13日，电动汽车公司特斯拉的老板马斯克说，困扰其公司高科技工厂的产能问题在一定程度上是因为过度依赖机器人和自动化。“人类被低估了。”他在推特上写道。很多工作都涉及机器人难以克服的身体活动

的问题。例如，机器可能不久就能驾驶送货车了。但至少在目前，它们很可能无法走过一段滑溜溜的楼梯，把包裹送到楼上的一间公寓，尤其是当花园有只恶狗巡逻时。

如今的AI系统在其他方面也有局限。它们是模式识别型引擎，经过成千上万的例子训练，希望它们推导出的规则能继续适用于更广阔的世界。但它们只是盲目地应用这些规则，并不像人类那样理解自己所做的事情，也不能在现场即兴发挥解决问题。例如，无人驾驶汽车的制造商一直担心它们的机器在复杂且不常见的“边界情况”下会如何表现，这些情况在训练中无法预见。

要校正对AI的兴奋之情是件棘手的事。研究人员抱怨说，伟大的进步很快就会被遗忘：只要一台电脑能做点什么，这就不再算作AI了。但与许多高谈阔论的专家相比，这些研究人员对未来的态度往往也更谨慎。原则上，人类能做的所有事计算机没有理由做不到——而且还能做到更多。但那至少是几十年后的事了。组装家具可以解释其中的原因。■



The world economy

Levelling off

A global economic deceleration should not cause too many jitters—yet

IN 2017 the global economy broke out of a rut. It grew by 3.8%, the fastest pace since 2011. Surging animal spirits accompanied a rebound in business investment across the rich world. Global trade growth rose to 4.9%, also the fastest rate since 2011. Emerging-market currencies appreciated against the dollar, keeping inflation low and debts affordable. Financial markets wobbled in February, but only after reaching all-time highs. In April the IMF said that the global economic upswing had become “broader and stronger”.

Since then that healthy glow has begun to fade. First, economic surveys in Europe took a turn for the worse (presaging growth in GDP of only 1.6%, annualised, in the first quarter). Then the rest of the world seemed to catch the same cold (see chart 1). In the first quarter America’s growth slowed to 2.3%, annualised, from close to 3% in the preceding six months. At the same time, Japan’s economy shrank by 0.6%, ending a growth spurt sustained since the start of 2016. Investors have begun to wonder if the period of global exuberance is over. Even policymakers in China, which has seemed relatively immune to the slowdown, have taken note of weakening domestic demand. In mid-April they loosened monetary policy slightly by allowing banks to hold fewer reserves.

Meanwhile, the slow upward march of American bond yields—the result of expectations of higher inflation and interest rates—has turned the screw on emerging-market currencies, which have fallen by 5.4% since the start of April (see chart 2). A run on the peso has forced Argentina to ask for an IMF bail-out and raise interest rates to 40%. The Turkish lira has also taken a beating, in part because the president, Recep Tayyip Erdogan, says that low

interest rates reduce inflation (see Buttonwood). On May 15th he promised to take more control of monetary policy after the upcoming election.

Make no mistake: world growth has slowed, but it remains strong. Surveys of activity in China, America and Europe are, when combined, higher than they have been 83% of the time over the past decade, according to UBS, a bank. Poor weather may have depressed European growth in early 2018. America's economy often seems to slow early in the year, only to rebound, a phenomenon dubbed "residual seasonality". Strong retail sales and high consumer confidence suggest that if a downturn is coming, Americans have missed the memo.

In a way, however, that is part of the problem. Demand is piling up where it is least needed. American core inflation, which excludes volatile food and energy prices, is now 1.9%, according to the Federal Reserve's preferred measure. That is only just below the central bank's target. And the economy has yet to feel the full impact of the tax cuts and spending rises President Donald Trump recently signed into law.

Outside America, however, inflation is falling short almost everywhere. In the euro zone it is only 1.2%, no higher than at the end of 2016. The Bank of Japan recently abandoned its pledge to raise inflation to 2% by fiscal year 2019—a target it had already postponed six times. Inflation in most emerging markets has been subdued, too. Even in Brexit Britain, where a big fall in the pound pushed inflation well above the 2% target in 2017, it has tumbled more quickly than expected.

In theory, the world economy would be better off if this demand were spread around. Unfortunately, the mechanism that could achieve that is a dangerous one: a stronger dollar. In theory a rising greenback should allow Americans to buy more imports, stimulating foreign economies. In practice

a rising dollar can play havoc with emerging markets that have dollar debts. And because so much trade is invoiced in dollars, a stronger American currency reduces trade between other countries, too. Four of the past five Fed tightening cycles have eventually triggered a crisis in emerging markets.

Yet there are reasons to be more confident this time. Among the ten largest emerging markets, only Turkey and Argentina ran current-account deficits greater than 2% of GDP in 2017. Most have dollar debts that are comfortable compared with the size of their economies.

Another threat talked up by bears is the oil price, which has risen to close to \$80 a barrel. They think this will push inflation up further, forcing higher interest rates. But the Fed usually ignores temporary inflation driven by energy prices. And predicting the impact of oil prices on the world economy has become trickier than it was before the shale revolution. Pricier oil now tends to boost American investment. In any case, it is driven at least partly by demand, reflecting healthy growth.

The biggest risk to the world economy remains the possibility of a trade war. Mr Trump is negotiating with China and others with the aim of closing America's trade deficit. That is difficult to square with a rising dollar sucking in imports. The danger is that slightly slower global growth, combined with ongoing stimulus in America, lays bare this problem and further provokes Mr Trump's protectionism. That could set off a downturn that would really be worth worrying about. ■



世界经济

趋平

无需对全球经济减速过度紧张——至少目前是如此

去年，全球经济一改颓势，增长了3.8%，是2011年以来的最快增速。投资者冒险情绪高涨，富裕国家的商业投资反弹。全球贸易增速升至4.9%，同样是自2011年以来的最快增速。新兴市场货币兑美元升值，令通胀水平保持在低位，偿债负担也保持在合理水平。今年2月金融市场略有震荡，但也是在攀登上历史高位后的回落。4月，国际货币基金组织表示，全球经济增长已变得“更广泛、更强劲”。

但自那时起，这股健康发展的劲头开始消退。先是欧洲的经济调查数据转向下行（预计第一季度GDP的年化增长率仅为1.6%）。而后世界其他地区似乎也受到了感染（见图表1）。美国第一季度GDP年化增长率从之前六个月的近3%放缓至2.3%。与此同时，日本经济萎缩0.6%，自2016年初以来的持续增长宣告终结。投资者开始怀疑全球的经济繁荣期是否已经结束。即便在看起来相对不受经济放缓影响的中国，政策制定者也注意到国内需求正在减弱。4月中旬，中国稍微放宽了货币政策，允许银行降低准备金。

同时，出于对通胀和加息的预期，美国债券收益率缓慢上升，这给新兴市场货币带来了压力，这些货币的汇率自4月初以来已下跌5.4%（见图表2）。比索汇率大跌，迫使阿根廷请求国际货币基金组织纾困并将利率提高至40%。土耳其里拉也受挫，一定程度上是因为总统埃尔多安认为低利率可降低通胀。本月15日，他承诺在即将进行的大选后进一步收紧货币政策。

别误会：世界经济增速确有放缓，但仍然强劲。瑞银集团的调查显示，中国、美国和欧洲的经济活动总和比过去十年里83%的时间都更为活跃。

2018年初的恶劣气候也许压制了欧洲经济增长。美国经济每到年初似乎都会减速，但后来总是会反弹，此现象被称为“剩余季节性”。零售销售强劲，消费者信心高企，显示美国人并没觉察任何经济将下滑的迹象。

然而，在某种程度上，这正是问题的一方面。需求积聚在最不需要的地方。根据美联储的首选衡量标准，美国的核心通胀率（排除波动较大的食品及能源价格）目前为1.9%，仅略低于美联储的目标水平。另外，特朗普最近签署实施的减税和加大开支措施的全面影响尚未反映于美国经济。

然而，美国以外的几乎所有地区的通胀都达不到预期。欧元区通胀仅为1.2%，相比2016年底时的水平没有提高。日本央行最近放弃了原本要在2019财年将通胀提高到2%的承诺，此前该目标已被推迟过六次。大多数新兴市场的通胀也受到抑制。在正实施脱欧的英国，即便此前英镑大幅下跌将通胀推高至远超过2017年2%的目标，近期通胀也已经以超出预期的速度回落。

理论上，假如这股需求的势头扩张，世界经济会好转。不幸的是，可能实现这一目标的是一个危险的机制：美元走强。理论上，美元走高，美国人就能购买更多的进口产品，从而刺激外国经济体。但实际上，美元上涨可能严重打击持有美元债务的新兴市场。而且由于大量贸易以美元结算，美元强势也会导致其他国家之间的贸易减少。在美联储过去五次的紧缩周期里面，有四次最终引发了新兴市场危机。

不过，这次有理由更为乐观。2017年，十大新兴市场中只有土耳其和阿根廷的经常账户赤字超过GDP的2%。其他大多数新兴国家的美元债务与自身经济规模相适应。

悲观派大谈的另一个威胁是油价，最近已上升至近每桶80美元。他们认为这会进一步推高通胀，推动加息。但美联储通常会忽略能源价格导致的暂时性通胀。而且相比页岩革命发生之前，现在更难预测油价对世界经济的影响。高油价如今更有利地推动美国的投资。无论如何，油价上涨至少在某种程度上是由需求驱动的，反映了一种健康增长。

世界经济面临的最大风险仍然是贸易战的爆发。为消除美国的贸易赤字，特朗普正与中国及其他国家谈判。但这和美元升值刺激进口的趋势相左。危险之处在于，全球经济增长略微放缓，加上美国持续推出刺激措施，令上述问题暴露，促使特朗普进一步采取保护主义行动。到时，可能会触发真正值得担忧的衰退。 ■



Aerospace

Engine trouble

A spanner in the works for the world's biggest makers of jet engines

IT USED to be the world's two biggest makers of airliners that would invariably deliver new designs late and over budget. A decade ago the cost of Airbus's A380 superjumbo soared by about €5.5bn (\$6.6bn) after engineers got its 330 miles of cables in a jumble. Boeing's rival 787 Dreamliner exceeded its forecast costs by a whopping \$20bn, give or take; its parts, once assembled, did not fit together properly. But just as both planemakers are mending their ways—Airbus's A350 and A320neo and Boeing's 737 MAX arrived in a much more timely and economical manner—manufacturers of the engines which power the aircraft are beginning to stall.

On March 15th Boeing revealed that the new engines, the largest ever made, for its new 777X wide-body airliner had completed their first test flight. But GE, the American engineering giant that built them, is already three months behind with their development, because of hiccups with the engine's compressor.

GE is not the only engine-maker with problems. Pratt & Whitney, a rival owned by UTC, an American conglomerate, has had a catalogue of problems with its new engines for the A320neo. The latest, a fault with knife-edge seals on some of them, forced American and EU safety regulators to limit their use. On March 12th regulators in India, where 40% of the world's A320neos fly, grounded all aircraft with faulty engines. That forced IndiGo, India's largest airline, to cancel 5% of its flights.

Worse still are errors made by Rolls-Royce. Warren East, the embattled British company's chief executive, fessed up in March that replacing faulty

turbine blades in engines on 787s will cost it £580m (\$800m) over the next two years. The defect has forced airlines, including ANA of Japan and British Airways, to cancel flights. Repairs could take four years or more.

Engines are complicated pieces of machinery, so teething troubles are not new, points out Richard Aboulafia of the Teal Group, a research firm. Problems with Pratt engines in 1969 delayed the development of Boeing's 747 jumbo jet. Rolls had to be bailed out in 1972 because of costs associated with design faults in its RB211 engine. But as technology matured over the next 40 years glitches became rarer.

A new generation of engines is stretching designs and materials to their limit. At Rolls's new engine factory in Singapore, lightweight titanium fan blades similar to the faulty ones on 787s are baked into shape in ovens. Some 150 measurements are then taken to ensure that the curves are accurate to the width of a human hair. Be off by more than that and you risk a catastrophic failure.

Strict safety rules mean defects have so far been spotted before they have caused an accident. And demand from airlines for the new generation of engines remains robust, thanks to their high fuel efficiency (over 85% of the fuel savings for the Boeing 737 MAX comes from the engines).

However, shifting more motors is not how engine-makers turn a profit. Engines are like razors, explains Adam Pilarski, an economist at Avitas, a consultancy. They are sold at a loss—of £1.6m for each one Rolls churns out, for example. The money is recouped by lucrative service contracts and data analytics, which used to command margins of up to 35%.

No longer. Slight errors in forecasts, such as underestimating repair costs or overpromising how long engines will last, can push a programme into the red, says Sandy Morris of Jefferies, a bank. That could easily happen on

Rolls's 787 engine if, for instance, the replacement blades do not last as long as expected. Moving production to cheaper countries like China or Russia could cut production costs but puts intellectual property at risk.

Airbus and Boeing pose another threat. The planemakers want to grab a share of servicing and analytics contracts to leaven their own margins. They are finding other ways of gouging the engine-makers, too, for instance by forcing them to pay billions of dollars to help develop new planes in exchange for the exclusive right to supply engines for them. For engine-makers, the sky has more limits. ■



航空

引擎故障

世界上最大的几家喷气式航空发动机制造商陷入麻烦

过去，总是不能按时交付新设计还超预算的是那两家最大的飞机制造商。十年前，因工程师在总长330英里的电线设计上出现失误，空客A380超大型飞机的成本激增约55亿欧元（66亿美元）。波音与之竞争的机型787梦想飞机的零部件在组装后无法匹配，导致成本超出预期200亿美元左右。如今，空客的A350和A320neo以及波音737 MAX的交付比以前及时了很多，成本也控制得更好，但正当这两家飞机制造商改过自新之时，为飞机提供动力的发动机的制造商又开始拖后腿了。

波音在3月15日透露，该公司的新型777X宽体客机采用的新型发动机已完成首次试飞。这是史上最大的飞机发动机。但是，由于发动机的压缩机存在问题，其制造商美国工程巨头通用电气（GE）的进度实际已经延误了三个月。

GE不是唯一出问题的发动机制造商。GE的竞争对手、隶属美国企业集团联合技术公司（UTC）的普惠公司（Pratt & Whitney）为A320neo提供的新发动机也遇到了一连串的问题。最新的一个是一些发动机的刀口密封发生故障，迫使美国和欧盟的安全监管机构限制其使用。全球40%的A320neo是在印度飞行，该国的监管机构于3月12日停飞了所有引擎存在隐患的飞机。印度最大的航空公司靛蓝航空（IndiGo）不得不因此取消了5%的航班。

罗尔斯·罗伊斯公司（Rolls-Royce）的失误更严重。这家英国公司最近陷入困境，首席执行官华伦·伊斯特（Warren East）3月坦承，未来两年里，公司将花费5.8亿英镑（8亿美元）为波音787的发动机更换有缺陷的涡轮叶片。这一缺陷已迫使全日空航空公司（ANA）和英国航空公司（British Airways）等公司取消了部分航班。维修工作可能需要四年甚至更久。

研究公司蒂尔集团（Teal Group）的理查德·阿波拉弗亚（Richard Aboulafia）指出，发动机是复杂的机械设备，因此初期故障并不是什么新问题。1969年，普惠发动机的问题延误了波音747大型客机的开发。罗尔斯·罗伊斯曾因RB211发动机的设计缺陷而花去巨额资金，在1972年靠政府出手相救才得以生存。但之后的40年里，随着相关技术日臻成熟，问题也越来越少。

新一代发动机将对设计和材料的要求推到了极限。在罗尔斯·罗伊斯位于新加坡的新发动机工厂，与波音787发动机上发生故障的叶片类似的轻量钛叶片在烤炉中烧制成型，随后会进行约150次测量，确保叶片曲线的精度误差小于一根头发丝的直径。误差超出这一范围，就可能导致灾难性的故障。

由于制定了严格的安全规则，到目前为止缺陷在导致事故发生之前就被发现了。而航空公司对新一代发动机的需求依然强劲，这要归功于这些发动机的高燃油效率（波音737 MAX节省的燃油用量中有超过85%是源于发动机效率提升）。

然而，发动机制造商并不是靠销售更多的新发动机来获利的。咨询公司Avitas的经济学家亚当·皮拉斯基（Adam Pilarski）解释说，发动机和剃须刀一样，是亏本销售的。例如，罗尔斯·罗伊斯每销售一台发动机就亏损160万英镑。这个损失是通过利润丰厚的检修服务合同和数据分析来补偿的，过去依赖这些部分曾令利润率达到35%。

如今售后的钱不好赚了。杰弗瑞投资银行（Jefferies）的桑迪·莫里斯（Sandy Morris）说，预测若出现微小的差错，比如低估了维修成本或者过长保证发动机寿命，都可能让项目陷入亏损。例如，如果罗尔斯·罗伊斯的787发动机的替换叶片寿命达不到预期，很容易就会发生这种情形。将生产转移到中国或俄罗斯等人力成本更低的国家可能会降低生产成本，但会使知识产权面临风险。

空客和波音构成了另一项威胁。这两家飞机制造商希望能在检修服务和分

析合同方面分一杯羹，以提升自身盈利。它们也在找别的法子敲发动机制造商一笔，比如迫使它们支付数十亿美元支持新飞机的研发以换取发动机的独家供应权。对于发动机制造商来说，天空越来越狭窄了。■



Schumpeter

The subscription addiction

Who needs customers? Subscribers are the new, new thing

ONE of the most fashionable ideas in business is that companies should earn their crust from subscribers, who are “locked in” for a period of time, rather than from customers who can easily switch to another provider at any time. Subscription models are seen by many investors and executives as the holy grail, because they promise a recurring stream of revenue. But the approach suffers from three underappreciated problems. Acquiring subscribers can be eye-wateringly expensive. Their urge to run away is often only temporarily suppressed. And consumers may have more than one relationship at a time.

The best-known subscription model is probably Amazon Prime. It has about 80m members in America alone and for \$99 a year offers films and music, speedy delivery of goods and even discounts on goods such as baby food. There are many other examples. Netflix offers a wall of TV for a monthly fee. And more are coming. Venture-capital firms are pouring money into subscription-based home-delivery firms that bring to your doorstep meals, pills or even fresh underpants. Zuora, a software firm, talks of the rise of the “subscription economy”.

Several star firms floating their shares this year have subscription models. Dropbox, a cloud-storage firm, listed on NASDAQ on March 23rd and is worth \$13bn. It boasts 500m registered users and wants to convert them into “paying users”, of whom there are already 11m, who get a superior service. Spotify, a music-streaming firm that listed on April 3rd, has 159m users but derives its \$27bn valuation from 71m “premium subscribers” who pay to listen without adverts. On average each generates 13 times more sales and 27

times more gross profit than users who pay no fee.

The attractions of subscription businesses are obvious. Firms can predict the future better and build deeper relationships with customers who have less incentive to shop around. Some venerable firms discovered long ago how to transform one-off purchases into recurring sales. Gillette gets customers to “join” (by buying a subsidised razor) and then charges them “monthly fees” (buying replacement blades). Rolls-Royce, General Electric and Pratt & Whitney rarely sell passenger-jet engines in one-off transactions, but instead offer “power by the hour” through complex service contracts that tie them to airlines for decades.

Subscription models are becoming more popular, in part because technology has made it easier to rent rather than own assets. Instead of buying software, for example, users can get access to it as a cloud-based service. Data mining means that the insights gained from a sustained relationship are more valuable than before, for customers and firms—Netflix purports to know what viewers want to binge-watch. And after a scandal involving Cambridge Analytica’s dubious acquisition of data from 87m Facebook users, there could be a shift from digital businesses built around advertising to subscription models that protect privacy.

The subscription approach also makes investors and creditors more comfortable with intangible businesses, which have no factories that can be relied on to generate goods and sales year after year. Instead, a subscriber base can be thought of as an enduring “asset” in which firms can invest. Businesses that rely instead on a frantic series of one-off transactions—Uber, for example—may be more volatile and vulnerable because barriers to entry are lower.

The subscription boom will doubtless continue. So much so that antitrust regulators may eventually become nervous if too many consumers are

unable to switch from their providers, either because they are contractually bound in or because the cost of doing so is prohibitively high (for example, if they lose their historical data). Yet before assuming that world domination beckons, it is worth noting the flaws of the subscription approach.

First, firms have to pay upfront to attract new subscribers, either by keeping prices artificially low or by spending heavily on marketing. Consider half a dozen subscription-based firms: Amazon Prime (defined here as Amazon excluding AWS, its hosting business), Blue Apron, Dropbox, Hulu, Netflix and Spotify. Next, compare their meagre combined free cashflow last year to the amount they would need to earn a 10% return on capital. The total shortfall is \$14bn, or \$4bn excluding Amazon Prime. This is a proxy for the subsidy being paid to attract and retain subscribers. Eventually these firms may have to raise prices in order to boost profits, or sell a broader range of services, stepping on the toes of other subscription businesses. All these companies use statistical models to try to ensure that the “lifetime value” of a customer exceeds the cost of acquiring them, but it is still a guessing game.

The second problem is that subscribers are annoyingly disloyal. At the end of a contract period some turn to a different provider. Netflix is thought to lose less than 1% of its customers per month to “churn”; this is in line with established subscription-based firms such as mobile-phone operators. For Spotify, a music-streaming service, the figure is a more worrying 5%; for some meal-delivery firms, it is a lethal 10%. Churn could rise further for all these firms as competition intensifies or if they raise prices.

The final shortcoming is the lack of exclusivity. Consumers love two-timing companies—corporate loyalty clubs have 4bn members in America alone, as people sign up with lots of different airlines and hotels. Saturation could occur in the digital subscription world, too. America’s 118m households now

have over 200m subscriptions to streaming media, e-commerce and other web-based services. The high valuations of the listed firms they subscribe to imply that this will grow to well over 350m by 2027. From newspapers' digital offerings to car-navigation services and startups selling web-based home-security services, America is at the forefront of a giant boom in subscription businesses. A first sign of trouble could be that there are not enough Americans to satisfy them all. ■



熊彼特

订阅成瘾

谁还需要客户啊？“订户”才是新新事物

商界最时兴的点子之一是企业应该从订户而非普通客户身上赚钱：前者会在一段时间内被“锁定”，而后者随时都能轻而易举地转投其他供应商的怀抱。很多投资者和高管都将订阅模式视作圣杯，因为它可能会带来源源不断的收入。但这种模式受到三个人们认识不足的问题的拖累：开发订户的成本非常高昂；企业通常只能暂时遏制住订户“出走”的念头；消费者可能会同时脚踏几条船。

最知名的订阅模式可能要数亚马逊Prime。单在美国就有8000万亚马逊Prime会员，他们每年支付99美元获取电影、音乐、快速送货服务，甚至还可享受某些商品的折扣价，如婴儿食品。还有许多别的例子。Netflix按月收费，向订户提供琳琅满目的电视节目。还会有更多后来者。风投公司正向基于订阅的宅配公司大把投钱，这些公司给你送餐、送药，甚至还会把干净的内裤送到你府上。软件公司祖睿（Zuora）称“订阅经济”正在崛起。

今年上市的几家明星公司也采用订阅模式。提供云端存储服务的Dropbox于3月23日在纳斯达克上市，市值达130亿美元。它拥有五亿注册用户，希望能将他们转化为“付费用户”，而现有的付费用户数已达1100万，Dropbox向他们提供更优质的服务。4月3日上市的音乐流媒体公司Spotify有1.59亿用户，不过成就其270亿美元市值的还是7100万选择了付费免广告的“高级订户”。平均来看，一名高级订户带来的销售额和毛利分别是免费用户的13倍和27倍。

订阅业务的吸引力显而易见。企业能够更好地预测未来，消费者货比三家的意愿也没那么强，企业也就能和他们建立更深入的关系。一些备受尊崇的企业很早就发现将一次性买卖转化成回头生意的方法。吉列吸引消费者

“入会”（通过购买受到补贴而低价的剃须刀），之后再每月向他们“收费”（购买替换刀片）。罗尔斯·罗伊斯、通用电气和普惠的喷气式客机发动机销售很少是一次性交易，它们利用复杂的合约提供“按小时包修”服务，和航空公司建立起长达数十年的联系。

订阅模式越来越流行，一定程度上是因为科技已令租借资产变得更容易，而不必再自己拥有资产。例如，用户无需购买某个软件，而是可以把它当作一种云服务来使用。有了数据挖掘，对消费者和企业来说，从持久关系中获取的洞见比从前更有价值了——Netflix就声称自己知道观众想“刷”什么节目。另外，之前剑桥分析（Cambridge Analytica）以不当手段获取了8700万Facebook用户的数据，这宗丑闻暴发后，围绕广告建立起来的数字业务可能会向保护隐私的订阅模式转变。

订阅模式也会让投资者和债权人对无形业务感到更踏实，这类业务没有工厂来年复一年地生产商品并贡献销售。他们可以把订户群视作一种企业可对其进行投资的耐久型“资产”。而那些依赖海量一次性交易的企业——例如优步——可能会更不稳定、更易受到挑战，因为准入门槛较低。

订阅业务蓬勃发展的势头无疑还将继续，甚至最终可能会让反垄断监管机构紧张起来——假如到时候有太多消费者或是因为合约束缚、或是因为转换别家的代价过高（例如失去自己的历史数据）而无法改用其他服务提供商的话。不过先别忙着畅想订阅服务未来如何主导全球，还是注意下这个模式有哪些缺陷吧。

首先，企业必须要为吸引新订户做前期投入，或是通过人为压低价格，或是在营销上砸重金。先来看六家基于订阅模式的公司：亚马逊Prime（这里指的是排除了托管业务AWS在内的亚马逊）、蓝围裙（Blue Apron）、Dropbox、Hulu、Netflix和Spotify。我们计算了这几家公司去年惨淡的自由现金流总额，以及要获得10%的资本回报率所需的自由现金流额度。总共缺口为140亿美元，如果把亚马逊Prime排除在外为40亿美元。这个指标可用来衡量为了吸引及留住订户要拿出多少补贴。为了增加利润，这些公司最终可能不得不提高价格，或扩大所售服务的种类，而这又会踩到别

家订阅业务的地盘而招来不悦。这几家公司都采用了统计模型，试图保证客户的“生命周期价值”超过开发他们所付出的成本，但这能不能实现就说不准了。

第二个问题是订户的忠诚度低，让人恼火。合约到期后，一些订户会转用其他服务商。据信Netflix每月的客户流失率将近1%，与传统的订阅服务提供商例如移动电话运营商的数字齐平。音乐流媒体服务Spotify的数字是5%，更令人担忧一些；一些送餐公司高达10%的流失率就很要命了。随着竞争加剧或者这几家公司决定涨价，它们的客户流失率还会进一步上升。

订阅模式的最后一个缺陷是缺乏专属性。消费者很喜欢脚踏两条船，单在美国，企业忠诚客户俱乐部就有40亿名会员，因为人们会在很多家不同的航空公司和酒店注册。数字订阅的世界里也可能会出现饱和。美国1.18亿户家庭订阅的服务超过两亿份，涵盖流媒体、电子商务和其他基于网络的服务。服务这些家庭的上市公司市值很高，从这点来看，到2027年美国家庭订阅的服务数量将大大超过3.5亿份。从数字版报刊到汽车导航服务，再到提供基于网络的家庭安全服务的创业公司，订阅业务正经历巨大的繁荣发展，而美国在此历程中占据潮头。要说有什么麻烦的苗头，那可能就是没有足够的美国人来满足所有的企业。 ■



Prizewinning economics

School rules

Parag Pathak, a market-design specialist, has won the John Bates Clark medal

BOSTON parents were fed up. To get their children into public schools they had to submit a list of their preferences. Spots were allocated first to those who put a school top. Only then would schools consider pupils who put them second or third. Sounds fair? Hold on. The best schools are popular. Picking them risks rejection. Good schools are sought after, too. If put second they may also fill up, leaving only places at worse schools. Should parents aim for the best and risk mediocrity, or settle for the good?

On April 20th the American Economic Association (AEA) awarded the John Bates Clark medal, given annually to a leading economist under 40, to Parag Pathak of the Massachusetts Institute of Technology. He researches market design—eg, creating mechanisms to allocate resources without money, such as school places in Boston. Solutions he devised there have been applied widely, from New York to New Orleans. The AEA says that by improving pupil allocation Mr Pathak had “influenced the lives of over 1m public school students”.

In Boston, as a graduate student at Harvard, Mr Pathak worked with his mentor Alvin Roth (since awarded a Nobel prize) on a new system. It asks pupils and schools to list each other from first to last. A computer program offers places to pupils that schools put top. Pupils take the best offer and reject the rest. Schools work down the list making fresh offers as rejections occur, with each pupil keeping a single, most preferred, offer. Parents no longer need strategies.

Mr Pathak has since pondered related questions, such as whether parents

can truly judge schools' quality. In Boston, he found that charter schools (public schools exempt from some regulation) improved the performance of disadvantaged pupils. Children randomly allocated places there tended to flourish; those elsewhere languished. Parents spotted high achievement, and applications rolled in. But in New York, where parents pay handsomely to live near elite schools, he showed that whether pupils just squeak in or just miss out, they do equally well and attend similar colleges. The best schools get the best pupils, but may not make them better.

When he was growing up in New York state, Mr Pathak "used to dream about attending a selective public school in New York City". It seems that he needn't have worried. ■



获奖经济学 择校新规则

市场设计专家帕拉格·帕沙克获约翰·贝茨·克拉克奖

波士顿的父母们过去备受折磨。为了让自己的孩子入读公立学校，他们必须提交一张择校的优先顺序列表。学校会把名额优先给那些把它排在首位的学生，之后才会考虑那些把它排在第二位或第三位的学生。这听起来很公平？稍等一下。最好的学校极受欢迎，选择它们可能被拒。较好的学校也很受追捧，如果把它们放在第二位，它们可能也很快满员，结果就只剩较差的学校可去了。父母应该冒着落入平庸学校的风险去追求最好的学校，还是应该退而求其次直接选择较好的学校？

美国经济学会（American Economic Association）每年向一位40岁以下的杰出经济学家授予约翰·贝茨·克拉克奖（John Bates Clark medal）。4月20日，麻省理工学院的帕拉格·帕沙克（Parag Pathak）获得此荣誉。他的研究领域是市场设计，即建立免费分配资源的机制，比如波士顿学校名额的分配。从纽约到新奥尔良，他为波士顿设计的解决方案已被广泛应用。美国经济学会表示，通过改善学校分配名额的机制，帕沙克“影响了100多万公立学校学生的生活”。

在波士顿，当时还是哈佛研究生的帕沙克和导师埃尔文·罗斯（Alvin Roth，后来获得了诺贝尔奖）合作建立了一个新系统。该系统请学生和学校都按优先顺序列出对彼此的选择。计算机程序随后会给每个学生一个将其列为优先选择的学校的列表。学生从中选择自己最满意的学校，拒绝其余学校。一旦有学生拒绝，学校就会把空出来的名额按顺序提供给下一个学生。每个学生都只能保留一个自己最满意的选择。这样，父母们再也不需要择校“策略”了。

之后，帕沙克一直在思考一些相关问题，比如家长能否真正评判学校的质量。在波士顿，他发现特许学校（被豁免而无需遵守某些监管规定的公立

学校)能提升弱势学生的成绩。被随机分配到那里的儿童大多成长良好,相比之下被分配到其他学校的儿童成长乏力。一旦父母发现一所学校成绩斐然,申请量就大增。但在家长为居住在名校附近而花费不菲的纽约,他发现无论学生是刚好挤进还是错过名校,他们的成长都会一样好,并能入读类似的大学。最好的学校招收了最棒的学生,但未必会让他们变得更强。

帕沙克在纽约州长大,幼时“曾梦想能就读纽约市的一所公立名校”。看起来,他当时并不需要担心。■



Economic and financial indicators

Government debt

Global gross public debt is set to stand at 82% of GDP in 2018, according to the International Monetary Fund

Global gross public debt has risen in recent years and is set to stand at 82% of GDP in 2018, according to the International Monetary Fund. Japan's level of gross government debt is the highest in the world: it is likely to be 236% of GDP this year. Although Saudi Arabia has a smaller amount of public debt relative to output, it has rocketed in recent years, partly because of an oil-price slump. The average amount of government debt owed by low-income economies is set to be 46% of GDP this year, a 14-percentage-point increase since 2013. That still trails rich economies, where public debt has been about 105% of GDP on average since 2012, a level not seen since the second world war. ■



经济与金融指标

政府债务

国际货币基金组织的数字显示，2018年全球公共债务总额占GDP的比例可能会达到82%

国际货币基金组织的数字显示，近年来全球公共债务总额上升，2018年占GDP的比例可能会达到82%。日本的公共债务总额为全球最高，今年很可能占到GDP的236%。尽管沙特阿拉伯公共债务的数额相对于产出而言要小些，但近些年债务水平猛增，部分原因是油价暴跌。今年，低收入经济体的政府债务平均数额可能会占GDP的46%，较2013年增长14个百分点。不过这仍不及富裕经济体的水平。自2012年以来，富裕经济体公共债务占GDP的平均比例大约为105%，是二战以来的最高水平。■



China's economy

Disappearing trick

The demise of China's current-account surplus will change the global economy

NOT long ago China was a leading culprit in global economic imbalances. Whether blame was ascribed to its undervalued yuan or its frugal people, the problem seemed clear. China was selling a lot abroad and buying too little back. One data-point summed this up: its current-account surplus reached 10% of GDP in 2007, well above the level that is generally seen as reasonable. Far less attention has been paid to its steady decline since then. In the first quarter of 2018 China ran a current-account deficit, its first since joining the World Trade Organisation in 2001. Just as its massive surpluses of yore had big consequences for the global economy, so does this swing in the opposite direction.

China still exports many more goods than it imports, to the tune of nearly \$500bn annually. But its share of global exports appears to have peaked. At the same time its trade deficit in services is getting bigger, largely thanks to all its tourists venturing abroad (see chart).

At bottom, a current-account balance is the difference between a country's investment and savings. When China had a big surplus, its savings, at 50% of GDP, far outstripped even its colossal investment. Data on savings are patchy in China. But it is known that investment has declined as a share of GDP. The implication is that the rate of savings has almost certainly declined more sharply, reflecting a big increase in consumption. Its economy is, in other words, better balanced than just a short while ago.

China's current-account deficit in the first quarter was exaggerated, since exports tend to be subdued at the start of the year. It is likely to return to

a surplus in the coming months. But Ding Shuang of Standard Chartered, an emerging-markets bank, forecasts that the surplus will be just 1% of GDP this year and 0.5% next year. The trade ruckus with America could reinforce the downward trend. To placate President Donald Trump, China will try to import more from America and pay more for foreign intellectual property (IP), Mr Ding says.

One probable outcome is that the exchange rate will become more volatile. In recent years capital outflows have pressed down on the yuan, but the current-account surplus has countered that effect. In the future China will have a thinner cushion. Depending on quarterly trade swings, the yuan will be as likely to fall as to rise.

If China's current-account deficits become more frequent, it will have to run down its foreign assets or borrow more from abroad to pay for its consumption. Should its external liabilities—that is, money it owes the rest of the world—increase rapidly, that might signal greater financial vulnerability. But as long as the increase is moderate, it could actually help China by boosting the yuan's global profile.

To fund its deficit, China might choose to sell more bonds to foreign investors. And in paying more for goods and services than it earns, it could supply its currency abroad. By itself this would not be enough to make the yuan go global. Investors would need more faith in China's institutions. But technically, the conditions would be ripe for the yuan's emergence as a more credible rival to the dollar. America might find itself pining for the days when the Chinese currency was undervalued. ■



中国经济

消失魔术

中国经常账户盈余消失将改变全球经济

不久以前中国是全球经济失衡的罪魁祸首。无论人们是将问题归咎于人民币被低估还是其国民节俭成性，问题本身似乎一目了然：中国出口多，进口太少。一个数据点概括地反映了这一点：2007年，中国的经常帐户盈余占到GDP的10%，远高于一般认为的合理水平。但是，实际上自此以后这一盈余不断减少，而这种变化却远不为人所注意。2018年第一季度，中国的经常账户出现了赤字，是2001年中国加入世贸组织以来的头一回。正如之前其巨额盈余对全球经济产生了重大的影响，此次逆转也一样。

中国的商品出口仍远超进口，每年顺差近5000亿美元。但它在全球出口中所占的比例似乎已经见顶。与此同时，其服务业贸易逆差扩大，主要是受中国游客的出国游热潮带动（见图表）。

经常账户余额实际上就是一国投资和储蓄之间的差额。在中国拥有高额盈余时，其储蓄额占GDP的50%，远超过本已很庞大的投资。眼下关于中国储蓄的数据不多，但已知投资占GDP的比重有所下降。因此几乎可以肯定储蓄率下降更甚，反映出消费大幅增加。换言之，中国经济比不久以前更趋于平衡。

今年第一季度的中国经常账户赤字实际是被夸大了，毕竟年初出口一般较为疲软，未来几个月很可能恢复盈余。但主营新兴市场的渣打银行的丁爽预测，今年中国的经常帐户盈余将仅占GDP的1%，明年将占0.5%。与美国的贸易摩擦可能会加剧下行趋势。丁爽表示，为安抚特朗普，中国会尝试加大从美国进口和对外国知识产权的支出。

一个可能的结果是汇率波动加大。近年来，资本外流令人民币汇率受压，但经常帐户盈余抵消了这一影响。然而未来，中国的这一缓冲会减弱。人

民币既可能升值也可能贬值，这要看贸易的季度波动情况。

假如经常账户赤字更频繁地出现，中国将不得不减持外国资产或加大对外举债以支付本国消费。假如外部负债（即欠其他国家的钱）迅速增加，那中国的金融体系可能变得更脆弱。但如果负债温和上升，实际上可以提升人民币的全球影响力，因而对中国有利。

为弥补赤字，中国可能会选择向外国投资者出售更多债券。而让商品和服务进口大于出口也可使人民币走向全球。但单靠这一点还不足以让人民币国际化。投资者还需要加强对中国制度的信心。但从理论上讲，人民币崛起成为美元有力对手的时机可以说已经成熟。美国可能发现自己会怀念人民币被低估的旧时光。 ■



China Three Gorges and EDP

Opening the floodgates

A Chinese bid for a big Portuguese utility may run into opposition

SHOULD Europeans worry that China Three Gorges (CTG), a state-owned firm, wants to buy EDP, a utility that is Portugal's biggest company? It is three years since one local banker, Fernando Ulrich, called Portugal "a Chinese aircraft-carrier in Europe"—back then, Chinese buyers were already snapping up stakes in "strategic" local companies as quickly as the government could privatised them. CTG's offer of €9.1bn (\$10.8bn) for EDP, which was made on May 11th, will further unsettle those suspicious of China's desire to snap up European assets.

The country is unusually welcoming to investors from the east. Its national airline, TAP Air Portugal, and Redes Energéticas Nacionais, the monopoly power transmitter, both have Chinese investors. CTG is already EDP's largest owner, with a stake of 23%, after a €2.7bn investment in 2012. Now the Chinese want outright control.

To get that, CTG will probably have to raise its offer; EDP's board rejected the price offered by the Chinese on May 15th. Crucially, however, CTG won Chinese approval in advance, necessary these days given official restrictions on capital flowing abroad. Portugal's government is also relaxed, calling the Chinese "good investors". It helps that EDP's headquarters would remain in Lisbon.

Officials elsewhere may yet object. EDP has electricity or gas operations in 14 countries, including America, where it bought Horizon, a Texan wind-farm company, in 2007. Joint ventures with CTG elsewhere are sizeable. In Brazil the firms together run hydropower stations, and constitute one of the

largest private energy producers. EDP makes and distributes electricity in Spain; it operates wind farms in France, Italy and Poland.

Chinese firms have been investing heavily in energy in Europe (see chart). But governments are getting twitchier about this. France and Germany have started to push for stricter screening of foreign investment, especially in sectors involving sensitive technology. Proposed deals have caused trouble in the past: two years ago another Chinese energy firm, State Grid, failed in a bid for 14% of Eandis, a public distributor of gas and electricity in Flanders, Belgium, after an intelligence service warned of threats of theft and corporate espionage from China. A counter-bid for EDP from a European buyer is possible. But that would be tricky to engineer, given the existing links between the Chinese investor and its Portuguese partner.

CTG also faces hurdles across the Atlantic. In view of EDP's American operations, the Chinese firm needs approval from America's powerful Committee on Foreign Investment in the United States. Hoping to pre-empt objections that Chinese ownership of power generation in America threatens national security, CTG has hinted it would consider selling some assets (though it also indicated it would drop its EDP bid rather than give up too much).

Exactly what the Chinese firm hopes to gain with its takeover offer remains to be seen. Getting more access to European technology is one possible benefit. Being able to sell Chinese technology, such as the ultra-high voltage networks in which China specialises, to European buyers might eventually be another goal.

Probably more important for Chinese companies, however, is learning how Europe's liberalised energy markets work. John Seaman, who studies Chinese investors in Europe's energy sector for IFRI, a think-tank in Paris,

points out that China is reforming its own energy markets, letting its firms compete more in an effort to reduce costs. “In Portugal China is looking for know-how, to drive its own energy transition [and] to learn how to integrate renewables,” he says. That interpretation of events sounds benign. But it may not drown out talk of aircraft-carriers. ■



三峡集团和葡萄牙电力公司

开闸泄洪

一家中国企业出价收购葡萄牙大型电力公司，但可能遭遇阻力

中国国企中国长江三峡集团公司（以下简称三峡集团）想要收购葡萄牙最大的企业葡萄牙电力公司（EDP），欧洲人应该为此担忧吗？三年前，一位当地银行家费尔南多·乌尔里奇（Fernando Ulrich）将葡萄牙称为“中国在欧洲的航空母舰”，当时中国买家紧跟葡萄牙政府实施私有化的步伐，已经开始抢购当地“战略性”企业的股份。本月11日，三峡集团报价91亿欧元（108亿美元）收购葡萄牙电力，那些对中国抢购欧洲资产的意图怀有戒心的人将会更加不安。

葡萄牙对来自东方的投资者异常欢迎。葡萄牙国家航空公司葡萄牙航空（TAP Air Portugal）和垄断输电企业葡萄牙国家电网公司（Redes Energéticas Nacionais）都有中国投资者。2012年三峡集团向葡萄牙电力投资27亿欧元，拥有23%的股份，已经是该公司最大的股东。现在中国人想要全面控制这家公司。

要实现这个目标，三峡集团可能得提高报价，因为葡萄牙电力的董事会在15日拒绝了中方报价。然而，至关重要的是，三峡集团已事先获得了中国政府的批准——由于中国限制资本外流，如今这是海外投资的必要前提。葡萄牙政府的态度也颇宽松，称中国企业是“很好的投资者”。收购成功后将葡萄牙电力的总部将留在里斯本，这一点也有所帮助。

不过其他国家的官员可能会提出反对。葡萄牙电力在包括美国在内的14个国家拥有电力或天然气业务，2007年还收购了德克萨斯州的地平线风能公司（Horizon）。在其他地区，葡萄牙电力还与三峡集团联手组建了规模可观的合资企业。在巴西，两家公司共同经营水电站，是该国最大的私营能源企业之一。葡萄牙电力在西班牙也有发电和和输配电业务，还在法国、意大利和波兰经营风力发电站。

中国企业大力投资欧洲能源产业已有时日（见图表），但现在欧洲各国政府对此愈发不安。法国和德国已开始对外国投资实行更严格的审查，特别是在涉及敏感技术的领域。投资提案在过去遇到过麻烦：两年前，另一家中国能源公司国家电网想要购买比利时法兰德斯（Flanders）地区的公共天然气和电力配送公司伊安第斯（Eandis）14%的股份。但该国情报部门警告说，此交易存在中国窃取技术和进行商业间谍活动的风险，国家电网因而遭拒。欧洲买家也可能对葡萄牙电力提出竞购，但考虑到中国投资者与其葡萄牙合作伙伴之间已存在的联系，操作会很困难。

三峡集团在大西洋彼岸也面临阻碍。鉴于葡萄牙电力在美国的业务，三峡集团需要得到强大的美国外国投资委员会（Committee on Foreign Investment）的批准。为了提前应对认为中国在美国拥有发电资产会威胁国家安全的反对意见，三峡集团暗示将考虑出售一些资产（不过它也表示不会为了收购葡萄牙电力而放弃太多）。

三峡集团究竟希望通过收购实现什么目的还有待观察。获得更多欧洲技术可能是一个好处，将中国擅长的超高压输电网络等技术出售给欧洲买家可能最终会是另一个目标。

然而对中国企业而言，更重要的可能是了解欧洲自由化能源市场的运作方式。巴黎智库法国国际关系研究所（IFRI）的约翰·希曼（John Seaman）研究欧洲能源行业里的中国投资者。他指出，中国正在改革自己的能源市场，增加竞争以降低成本。他说：“在葡萄牙，中国正在寻求相关经验来推动自身的能源转型，学习如何整合可再生能源。”这样的解释听起来没什么威胁，但可能无法盖过“航空母舰”的论调。 ■



Iran's stricken economy

A system in shock

With fear and opportunism, Iran braces for economic war with America

TEHRAN'S grand bazaar, a weathervane of politics, is on strike again. Shutdowns there foreshadowed Iran's 1979 revolution. In 2012 they pushed the government into talks that eventually resulted in a deal, signed in 2015, that restricted Iran's nuclear efforts in exchange for sanctions relief. And Donald Trump's pull-out from that deal on May 8th drew an instant reaction from traders, who sense something ominous. "Tehran feels like it did before...1979," says Pejman Abdolmohammadi, an Iranian lecturer at the London School of Economics.

Iran's business world was already glum. America's continued curbs on dollar transactions had muted the effect of the lifting of global sanctions in January 2016. But now, merchants say, America is moving from containing the regime to trying to change it. Mr Trump has told firms worldwide that they have three to six months to cut ties with Iran or face sanctions, too. Oil exports, which rose as a result of the deal, are already falling. Maersk, the world's largest shipping line, no longer takes orders for Iranian oil. South Korea has cut oil imports from Iran by 40%.

President Hassan Rouhani, who struck the nuclear deal, is struggling. His officials have shut currency exchanges, chased money-changers off the streets and fixed the exchange rate. But most of the foreign reserves needed to calm the market are abroad, and America is making it hard to repatriate them. On May 15th America's Treasury called the governor of Iran's central bank a financer of terrorism. The Paris-based Financial Action Task Force reports soon on whether Iran's banks heed anti-terror and money-laundering rules. This "could knock Iran off the financial system", says a

diplomat.

Middle-class Iranians are sullenly cancelling foreign trips. But they always disliked the regime; worse for the clerics is the loss of their base. In December the urban poor in the provinces took to the streets, denouncing theocracy. Despite efforts to quell it, industrial action rages on. Merchants in other bazaars have also gone on strike, as have some teachers. Officials have blocked Telegram, a popular social-media app. Young Iranians are furious.

The regime is resilient, some say. Its economy is the world's 27th largest. It pumps 3.8m barrels a day of oil, and it is good at smuggling. Muhammad Javad Zarif, the foreign minister, has taken to Beijing and Brussels his ideas for dodging American curbs. They include creating a bank trading only in euros, and depositing Iran's oil takings in Europe's central banks. But getting Europeans to forfeit American markets will be hard.

Meanwhile, hardliners have Mr Rouhani in their sights. They say his deal gave up a lot for little reward. With their grip on the judiciary, the security forces and some state concerns, they are squeezing him. They have chased an adviser of his back to London and arrested many dual nationals. Some see in sanctions a chance to resume smuggling. If regime change comes, it could consist of a coup mounted by these dark and well-connected characters. ■



伊朗经济受创 受冲击的系统

带着忧惧和投机心理，伊朗迎接与美国的经济战

政治风向标德黑兰大巴扎又罢工了。这里的罢工曾是1979年伊朗伊斯兰革命的先兆。2012年的罢工则推动政府谈判，最终达成一项于2015年签署的协议，限制伊朗核项目以换取解除制裁。本月8日，特朗普退出该协议，感觉到不祥的贸易商立即作出反应。伦敦政治经济学院的一位伊朗裔讲师佩吉曼·阿布多穆罕默迪（Pejman Abdolmohammadi）说：“德黑兰给人的感觉就像……1979年之前一样。”

伊朗商界早就愁眉不展。美国持续限制美元交易，削弱了2016年1月解除全球制裁的效果。但现在，商人们说，美国正从遏制伊朗政权转向试图颠覆它。特朗普已经告诉世界各国的企业，它们有三到六个月的时间断绝与伊朗的关系，否则也会面临制裁。曾因协议而攀升的石油出口已经开始下降。全球最大的航运公司马士基已不再接受运输伊朗石油的订单。韩国已将伊朗进口石油量削减了40%。

达成伊核协议的伊朗总统鲁哈尼举步维艰。他的官员已经禁止了外汇交易，驱逐街头兑换交易，并固定了汇率。但稳定市场所需的外汇储备大部分都在国外，而美国正采取措施让这些储备难以汇回伊朗。5月15日，美国财政部称伊朗央行行长资助了恐怖主义活动。很快，总部设在巴黎的反洗钱金融行动特别工作组（Financial Action Task Force）会就伊朗的银行是否遵守了反恐和洗钱规则给出报告。一位外交官说，这“可能会把伊朗赶出全球金融体系”。

伊朗的中产阶级正愤愤地取消外国旅行。但他们一贯不喜欢这个政权。对神职人员来说，更糟糕的是他们的信徒在流失。去年12月，各省的城市贫民走上街头，谴责神权政治。尽管官方力图镇压，但劳工示威抗议仍如火如荼。其他巴扎的商人也在罢工，一些教师也参与进来。官方已经封锁了

流行社交媒体应用Telegram。伊朗的年轻人非常愤怒。

有人说，这个政权的复原力很强。它是世界第27大经济体。它每天开采380万桶石油，而且擅长走私。外交部长穆罕默德·贾瓦德·扎里夫

(Muhammad Javad Zarif) 已向北京和布鲁塞尔提出了规避美国限制的想法，其中包括建立一家仅以欧元交易的银行，以及把伊朗的石油收入存入欧洲各国央行。但要欧洲人放弃美国市场会很困难。

同时，强硬派也在盯着鲁哈尼。他们认为他的协议做了很多让步，但只换回很少的回报。他们通过对司法部门、安全部队和一些国企来向他施压。他们已经把鲁哈尼的一名顾问赶回了伦敦，还逮捕了许多双重国籍的人。一些人认为制裁是恢复走私的机会。如果真的发生政权更迭，那可能会是这些黑暗而人脉深远的势力发起政变造成的。 ■



China's stockmarket

IT, phone home

After forcing its tech firms to list abroad, China tries to bring them back

FOR a country that is hugely proud of its high-flying tech firms, China has a funny way of showing it. None of its internet giants—not Alibaba, nor Tencent, nor Baidu—is listed on the domestic stockmarket. Rules that were supposed to help investors have had the perverse effect of forcing firms to go public abroad, mostly in America. The result is that most people in China cannot buy stocks in the country's biggest, most innovative companies. But change is finally at hand. In the coming weeks China is expected to start letting these firms list some of their shares at home. If handled well—a big if—it would be a boon for the young stockmarket.

China's tech darlings initially went abroad because it was their only real option. Chinese regulations forbid dual-class shares, a structure favoured by tech entrepreneurs because it means they can raise capital while retaining control. Companies must also have three years of profits before going public. This is a stumbling block for tech companies, which often burn through cash as they scale up.

But as tech has grown ever more important to China's economy, its absence from the stockmarket has become glaring. The fact that foreigners have easier access to China's most dynamic companies is a long-standing gripe for local investors.

So the government looked for ways to bring them home. It has not been a simple matter: their foreign corporate structures and dual-class shares violate local market rules. Officials finally settled on depositary receipts as the answer. The firms will keep their primary listings abroad but entrust

banks with a small portion of their shares; the banks will then offer certificates in China backed by these shares.

The threshold for issuing Chinese Depository Receipts (CDRs) will be high. Listed companies must have market capitalisations of more than 200bn yuan (\$31bn). Companies going public abroad can offer CDRs at the same time if their market cap is expected to be higher than 20bn yuan. The first approvals could come as soon as June. Four companies are mentioned most often as candidates: Xiaomi, a smartphone maker that filed for a flotation in Hong Kong on May 3rd; Alibaba and JD.com, two e-commerce rivals; and Baidu, known for its search engine.

Companies could reap several benefits, says James Wang, the head of Goldman Sachs's equity business in China. CDRs will be good for marketing, because their legions of Chinese users will now be able to own part of them. They will make it easier to include shares in pay packages, which previously had been complicated by capital controls. And they will give companies one more avenue for raising cash, all the more useful since it will be yuan (bringing dollars in from overseas takes time).

Yet there is no doubt that the overriding motive will be political. Keeping regulators happy is a requirement for any company in China. Left to their own devices the tech firms would be in no rush to sell shares in China; foreign listings have served them well. But when the government asks them to do something, they cannot say no.

What might the downsides be? One risk is that, as local investors clamour to buy them, CDRs will trade at a huge premium to their foreign counterparts. Because of capital controls, there is no channel for arbitraging between onshore and offshore markets. If premiums are too high, companies might look exploitative. Sean Darby of Jefferies, an investment bank, says they will need to issue enough CDRs to satisfy pent-up demand. But regulators will

want to cap CDRs for fear that cash will be drained from the rest of the market.

Another worry is that companies will have to comply with onerous extra rules after issuing CDRs. One example concerns follow-on offerings. Listed firms in developed markets can go from announcing extra share sales to completing them in a day; in China, the process can take two months since they must obtain shareholder and regulatory approval. Analysts had thought that China would ease rules such as these for CDR issuers, but it appears set to keep them in place. The upshot is that the tech firms that list in China will, for their troubles, face cumbersome new regulations. Welcome home. ■



中国股市

IT，打电话回家

在迫使自己的科技公司在海外上市之后，中国正努力让它们回归

对于本国高唱凯歌的科技公司，中国深感自豪，但它表达这种自豪感的方式却很奇特。其互联网巨头没有一家是在国内股票市场上市的，阿里巴巴、腾讯、百度无一例外。本应帮助投资者的规则却产生了不合理的影响，迫使企业到海外上市，主要在美国。结果，大多数中国人无法购买本国最大、最具创新力公司的股票。但情况终于要改变了。预计接下来的几周，中国将让这些公司在国内上市部分股份。假如处理得当——这一点存在巨大的未知数——对中国年轻的股票市场而言将是一个福音。

中国的科技宠儿最初在海外上市，因为那是它们唯一的选择。中国法规禁止双重股权结构，但科技企业家偏爱这种结构，因为这样可以使他们在融资时保持控制权。公司在上市前须连续三年盈利。这对科技公司而言是块绊脚石，毕竟在扩大规模时这些公司往往要大笔烧钱。

但随着科技企业对中国经济变得愈加重要，它们在中国股市的缺席也变得格外刺眼。外国人能更方便地投资中国最具活力的公司，国内投资者对于这件事抱怨已久。

所以中国政府设法要把这些公司领回家。这并非易事：它们的外国公司架构及双重股权结构有违本地市场法规。官员们最终选定存托凭证为解决方案。这些公司将保留在海外上市的大部分股份，而把小部分股份委托银行管理，然后由受托银行在中国发行这些股份的存托凭证。

发行中国存托凭证（以下简称CDR）的门槛会很高。已上市公司的市值必须超过2000亿元人民币（310亿美元）。准备在国外上市的中国公司如果估值高于200亿元人民币，则可以在上市的同时发行CDR。首批CDR可能在6月就获准发行。最常被提及的四家候选公司是：5月3日在香港提交上市申请的智能手机制造商小米、互为竞争者的两大电子商务巨头阿里巴巴

和京东、搜索巨头百度。

高盛的股票业务中国区主管王亚军表示，企业能因此多重获益。CDR将有利于企业营销，因为它们庞大的中国用户群将可以拥有公司股份。CDR将使员工股权激励更易实施，而此前受限于资本管制政策，操作一直很复杂。CDR还将为企业提供又一条融资渠道，因为融到的是人民币，作用就更大了（把美元从海外汇回中国需要时间）。

然而毫无疑问，此举主要还是出于政治考虑。中国任何一家公司都得让监管机构满意。如果让它们自己决定，这些科技公司是不会急于在中国出售股票的，因为在海外上市已经很好地满足了它们的需求。但当政府提出要求时，它们无法拒绝。

可能有什么弊端？一个风险是，由于本地投资者争相购入，相比在国外发行的股票，CDR将以高溢价交易。由于资本管制，在岸与离岸市场之间没有套利渠道。假如溢价过高，发行公司会有“宰客”之嫌。投行杰富瑞集团的肖恩·达比（Sean Darby）表示，这些公司需要发行足够的CDR来满足市场压抑已久的需求。但监管机构担心这会从市场其他部分吸走资金，所以会想要限制CDR的发行量。

另一个担忧是公司在发行CDR后将不得不遵守繁琐的额外规定。比如增发新股。发达市场的上市公司从宣布增发新股到完成发行可在一天内完成。而在中国，这个过程可能需要长达两个月，因为必须获得股东的同意和监管机构的批准。分析师们曾以为中国会为发行CDR的公司放宽这类规定，但目前看来它们会继续实行。其结果是，在中国上市的科技公司免不了要面对繁琐的新规。欢迎回家。 ■



Post offices in the rich world

Going postal

Amazon is not the only threat to universal mail services

IT MAY be hard to imagine a world without cheap postal services, but 200 years ago sending mail was a luxury. Posting a letter from London to Edinburgh cost an average daily wage. In 1840, after a proposal by Rowland Hill, an inventor, Britain launched the Penny Post, the world's first universal mail service. The state-run post office was given a mail monopoly in return for delivering letters to any address in the country at the same rate. Cheaper postage proved wildly popular and the flows of information it enabled boosted economic growth. But the scheme's finances proved controversial. The low cost of the service hit profits and the government introduced income tax to fill the fiscal hole.

That did not stop the idea of a “universal service obligation” for post spreading across the entire rich world over the next century. At the industry's peak, post offices worldwide delivered nearly 350bn items of mail in 2007. But over the past decade this model has come under threat from falling letter volumes and from gig-economy firms and e-commerce giants expanding into parcel delivery.

As a result, the postal service in America has again become controversial. On April 12th President Donald Trump set up a task force to examine the finances of the state-owned United States Postal Service (USPS). In March and April he has attacked Amazon, an e-commerce giant, on Twitter for costing USPS “massive amounts of money” for delivering its items. Analysts think that claim is dodgy. Mr Trump has a well-known dislike of Amazon and its boss, Jeff Bezos, who also owns the *Washington Post*, no fan of the president. But it is true that USPS is in serious financial trouble. Since 2008

revenues have fallen by 35% in real terms and it last made a profit in 2006.

Post offices elsewhere in the rich world suffer the same underlying problems, yet are more financially successful. Letter volumes have fallen at a rate of between 3% and 5% a year across the developed world over the past decade, says Brody Buhler of Accenture, a consultancy. Up to 80% of letter volumes could be lost before a floor is reached, says Rob Wolleswinkel of BCG, another consultancy.

Most of the decline has been due to bank statements and utility bills going online and personal letters and greeting cards going out of fashion. Junk mail has also begun to crumble due to the rise of digital advertising on smartphones. Online government services are likely to reduce demand for first-class letters even further. Denmark scrapped that service in 2016.

Parcels could come to the rescue. In 2014-16 global package volumes surged by 48%, reckons Pitney Bowes, a tech firm. But unlike with letters, most post offices do not have a monopoly in parcels, so margins are thinner. The machines needed to sort bulky parcels require heavy investment that strains cash-strapped post offices.

Their struggles are also due to delivery startups. Investors are pouring money into gig-economy couriers that use cheaper, self-employed drivers. BCG reckons that investment in such firms grew from \$200m to nearly \$4bn in 2014-16. Post offices, weighed down by strident unions, high labour costs and costly networks of sorting centres, struggle to compete.

But it is not yet clear that gig couriers will survive in the long term, says David Jinks of ParcelHero, a parcel broker. In March two American startups, UberRUSH, a service owned by Uber, a ride-hailing app, and Shyp, shut themselves down due to a lack of demand. Bad publicity about working conditions is forcing others, such as DPD of Britain, to introduce holiday

and sick pay. Tighter labour markets may make it harder to find enough cheap drivers to compete with the postal services.

E-commerce giants may prove a greater threat. The biggest risk is not that post offices bid for their business too cheaply, as Mr Trump suggests. It is that they lose their custom completely. Amazon has already hit Britain's Royal Mail hard by starting its own door-to-door deliveries. In California it has launched a grocery-delivery service as a way of gaining greater scale to deliver its own e-commerce parcels itself. The biggest threat of all may come from Amazon's Chinese rival, Alibaba, which is injecting \$15bn into its own delivery arm, Cainiao, and aims to expand beyond China. By doing their own deliveries in cities, where profits are juicier, these firms could leave less money on the table for post offices to cross-subsidise rural services, where costs are higher.

The answer to these challenges is not to shield postal services from competition. Four out of the world's five fastest-growing legacy firms—Singapore Post, Poste Italiane, bpost of Belgium and Austrian Post—are privately owned and face rivals. Royal Mail, which was privatised earlier this decade, is using gig-economy staff to deliver parcels and is investing in startups to improve its services, says Daniel Roeska of Bernstein, a research firm. Although Deutsche Post DHL of Germany will be 30% more labour-efficient in a decade's time, Frank Appel, its chief executive, insists that the growth of e-commerce will keep his existing workforce fully employed.

Amazon dreams of using drones to disrupt delivery to the doorstep. But that will take years to win regulatory approval. And in spite of new rivals and continued universal service obligations, the sheer scale of post offices still give them a big comparative advantage. Royal Mail has dozens of competitors, yet still has nearly all of the door-to-door letter business. The

same is true for other EU countries with competition. Postal firms can survive and thrive if they are prepared to change how they operate. Rowland Hill, a radical reformer in his own era, would approve of that. ■



发达国家的邮局

喋血邮局

亚马逊并非普遍邮政服务的唯一威胁

一个没有平价邮政服务的世界或许很难想象，但在200年前，寄邮件还是一种奢侈。从伦敦寄一封信到爱丁堡的花费相当于当时普通人一天的收入。1840年，在发明家罗兰·希尔（Rowland Hill）的提议下，英国推出了“一便士邮政”（Penny Post），这是世界上第一个普及邮件服务。国营邮局以统一资费向国内任意地址寄件，并以此获得了邮政的垄断经营权。结果，平价邮政服务大受欢迎，所带来的信息流动更是促进了经济增长。但这套方案在财务方面却备受争议。邮政服务靠低资费难以盈利，政府决定开征所得税来弥补财政亏空。

这并未阻挡之后的一个世纪里履行邮政“普遍服务义务”的理念在富裕国家中传扬开来。在邮政行业还处于巅峰期的2007年，全球邮局递送了近3500亿个邮件。但在过去十年里，该模式受到重重威胁，除了信函邮寄量大减，零工经济公司和电子商务巨头也开始向包裹递送领域扩张。

结果，美国邮政服务再次成为争议焦点。4月12日，特朗普成立工作小组，审查国有的美国邮政局（以下简称USPS）的财务状况。三四月间，他在Twitter上怒斥电商巨头亚马逊，说USPS为给亚马逊递送货物亏了“很多钱”。分析人士认为这种指责很可疑。众所周知，特朗普向来不喜欢亚马逊及其老板贝佐斯——贝佐斯拥有的《华盛顿邮报》对这位总统很不买账。但USPS确实面临严重的财务困境。自2008年起，它的实际收入下降了35%，最近一次盈利已远在2006年。

其他富裕国家的邮政系统也面临同样的深层问题，只是财务状况要好些。咨询公司埃森哲（Accenture）的布罗迪·布勒（Brody Buhler）表示，过去十年，发达国家的信函量每年下降3%到5%。波士顿咨询公司的劳勃·沃利斯文科（Rob Wolleswinkel）认为，在触底之前，多达80%的信函量可

能会消失。

下滑的主要原因是银行账单和水电燃气账单已逐渐转为电子账单，私人信函和贺卡也不再流行。由于智能手机数字广告的兴起，邮寄垃圾广告也开始走向消亡。政府推出的各种在线服务很可能会进一步降低对一类邮件的需求。丹麦已于2016年取消了次日收信。

包裹寄递服务或许可以救场。据科技公司必能宝（Pitney Bowes）估计，2014年至2016年间，全球包裹寄送量激增48%。但是，不同于信函，大多数邮局在包裹投递上没有垄断地位，所以利润较薄。分拣大件包裹的机器需要大量投资，资金短缺的邮局对此力不从心。

快递创业公司也是令邮局陷入困境的原因。投资者正大笔押注于采用更廉价的自雇司机的零工快递公司。据波士顿咨询估计，从2014年到2016年，对这类公司的投资从两亿美元增至近40亿美元。邮局受强势工会、高人力成本和成本高昂的分拣中心网络所累，难以与之竞争。

但英国快递代理公司ParcelHero的大卫·金克斯（David Jinks）表示，零工快递公司能否长久生存仍是未知数。3月，网约车公司优步旗下的UberRUSH和Shyp这两家美国创业公司因需求不足分别关停和倒闭。关于员工工作条件的负面报道则迫使英国DPD等其他快递创业公司为员工增加带薪年假和病假等福利。由于劳动力市场趋紧，这些公司可能更难找到足够多的廉价司机与邮政服务竞争。

电商巨头也许会是更大的威胁。最大的风险倒不是如特朗普所说的邮局以过低的价格竞标电商巨头的快递业务，而是邮局完全丧失这些业务。亚马逊已自立门户提供送货上门服务，对英国皇家邮政造成重创。在加州，亚马逊推出了杂货递送服务，借此扩大递送自有电商包裹的规模。而最大的威胁也许来自亚马逊的中国竞争对手阿里巴巴。该公司向旗下快递业务“菜鸟”注资150亿美元，并计划向海外拓展。通过在利润更丰厚的城市地区自营快递业务，这些公司可能会分流邮局的收入，让它们难以交叉补贴成本更高的农村服务。

要应对这些挑战，答案不是保护邮政服务免于竞争。全球增长最快的五大传统邮政企业中有四家（新加坡邮政、意大利邮政、比利时邮政和奥地利邮政）是私营公司，且不乏竞争对手。研究公司盛博的分析师丹尼尔·罗尔斯卡(Daniel Roeska) 称，于2013年私有化的英国皇家邮政目前以零工模式聘用员工递送包裹，同时也在投资创业公司来改善自身服务。虽然德国邮政DHL在未来十年内会将劳动效率提高30%，但其首席执行官弗兰克·阿佩尔（Frank Appel）坚称，电子商务的发展将令现有员工得到充分就业。

亚马逊梦想用无人机打破快递员送货上门的常规做法。但这估计还要等好几年才能获得监管部门的批准。而尽管邮政系统面临新对手，而且还要继续承担提供普遍邮件服务的义务，但它仍可凭借邮政网络的庞大規模取得重大相对优势。皇家邮政虽竞争者众，但仍几乎垄断了所有门到门送信业务。欧盟其他国家的竞争态势也是如此。邮政企业只要愿意改变经营方式，依然能够生存并繁荣发展。作为他那个时代的激进改革者，罗兰·希尔也会赞同这一点。 ■



Free exchange

The worth of nations

Economists sometimes fail to measure what matters most. The fourth in our series on the profession's shortcomings

A CYNIC, says one of Oscar Wilde's characters, is a man who knows the price of everything and the value of nothing. But, as philosophers have long known, assigning values to things or situations is fraught. Like the cynic, economists often assume that prices are all anyone needs to know. This biases many of their conclusions, and limits their relevance to some of the most serious issues facing humanity.

The problem of value has lurked in the background ever since the dismal science's origins. Around the time Adam Smith published his "Wealth of Nations", Jeremy Bentham laid out the basis of a utilitarian approach, in which "it is the greatest happiness of the greatest number that is the measure of right and wrong". In the late 19th century Alfred Marshall declared the correct focus of economics to be the "attainment and...use of material requisites of well-being". Or, as his student, Arthur Pigou, put it, "that part of social welfare that can be brought directly or indirectly into relation with the measuring rod of money".

Equating money with value is in many cases a necessary expedient. People make transactions with money, of one form or another, rather than "utility" or happiness. But even if economists often have no choice but to judge outcomes in terms of who ends up with how many dollars, they can pay more attention to the way focusing on "material well-being", as determined by the "measuring rod of money", influences and constrains their work.

The measuring rod itself often causes trouble. Not every dollar is of equal value, for instance. You might think that if two economists were forced to

bid on an apple, the winner would desire the apple more and the auction would thereby have found the best, welfare-maximising use for the apple. But the evidence suggests that money has diminishing marginal value: the more you have, the less you value an extra dollar. The winner might therefore end up with the apple not because it will bring him more joy, but because his greater wealth means that his bid is less of a sacrifice. Economists are aware of this problem. It features, for example, in debates about the link between income and happiness across countries. But the profession is surprisingly casual about its potential implications: for example, that as inequality rises, the price mechanism may do a worse job of allocating resources.

Equating dollar costs with value misleads in other ways. That economic statistics such as GDP are flawed is not news. In a speech in 1968 Robert Kennedy complained that measures of output include spending on cigarette advertisements, napalm and the like, while omitting the quality of children's health and education. Despite efforts to improve such statistics, these problems remain. A dollar spent on financial services or a pricey medical test counts towards GDP whether or not it contributes to human welfare. Social costs such as pollution are omitted. Economists try to take account of such costs in other contexts, for example when assessing the harms caused by climate change. Yet even then they often focus on how environmental change will affect measurable production and neglect outcomes that cannot easily be set against the measuring rod.

Economists also generally ignore the value of non-market activity, like unpaid work. By one estimate, including unpaid work in American GDP in 2010 would have raised its value by 26% (and drawn a very different picture of the contributions of different demographic groups). As Diane Coyle of Cambridge University has argued, the decision to exclude unpaid work may reflect the value judgments of the (mostly male) officials who first ran statistical agencies. But it seems likely that economists today still treat

things which cannot easily be measured as if they matter less.

Economists are at their least useful when a measuring stick should not be used at all. They have been known to calculate, for example, the financial gains from achieving gender equality. But gender equality has an intrinsic value, regardless of its impact on GDP. Similarly, species loss and forced mass migration impose psychic costs that resist dollar valuation but are nonetheless important aspects of the threat from climate change.

Such quandaries might suggest that ethical issues should be left to other social scientists. But that division of labour would be untenable. Indeed, economists often work on the basis that tangible costs and benefits outweigh subjective values. Alvin Roth, for example, suggests that moral qualms about “repugnant transactions” (such as trading in human organs) should be swept aside in order to realise the welfare gains that a market in organs would generate. Perhaps so, but to draw that conclusion while dismissing such concerns, rather than treating them as principles which might also contribute to human well-being, is inappropriate. Further, the very act of pulling out the measuring rod alters our sense of value. Though the size of the effect is disputed, psychological research suggests that nudging people to think in terms of money when they make a choice encourages a “businesslike mindset” that is less trusting and generous. Expanding the reach of markets is not just a way to satisfy preferences more efficiently. Rather, it favours market-oriented values over others.

Some economists advocate the creation and use of broader measures of well-being. Several organisations, including the European Commission and the World Bank, now publish data series presenting a more comprehensive picture of social health. But the costs of the standard approach are growing. Price is a poor measure of the value of digital goods and services, which are often paid for by giving access to data. Technological progress promises to create ever more situations in which ethical considerations conflict with

narrowly material ones. The question of how to increase well-being in such a world deserves greater attention. ■



自由交流

“国值论”

经济学家有时无法衡量那些最重要的事物的价值——经济学的不足系列之四

王尔德笔下的一个人物说过这么一句话：愤世嫉俗者知道万物的价格，对价值却一无所知。但是，正如哲学家们早就知道的那样，确定事物或事态的价值是件伤脑筋的事情。和愤世嫉俗者一样，经济学家常认为大家只需知道价格就行了。这导致他们的很多结论有失偏颇，也限制了他们在人类面对一些最重要的问题时所能发挥的作用。

自经济学这门“沉闷的科学”起源以来，价值的难题就一直潜藏其中。在亚当·斯密发表《国富论》的前后，杰里米·边沁（Jeremy Bentham）奠定了功利主义理论的基础，该理论主张“以绝大多数人的最大幸福作为判断是非的标准”。19世纪末，阿尔弗雷德·马歇尔（Alfred Marshall）宣称，经济学应该关注的是“对保障安乐的物质必需品的获取和使用”。或者，用他的学生亚瑟·庇古（Arthur Pigou）的话来说，是“能够直接或间接地用货币尺度来衡量的那部分社会福利”。

很多情况下，将货币等同于价值是迫不得已的权宜之计。人们用不同形式的货币，而不是根据“效用”或幸福感进行交易。但就算经济学家常常别无选择而只能通过谁最终得到多少钱来判断结果，他们还是可以对一个问题多些关注——只盯着由“货币尺度”判定的“物质福利”如何影响并束缚了他们的工作。

货币尺度本身常引发麻烦。比如，并非每一美元都有相同的价值。你可能会认为，如果非要让两位经济学家竞拍一个苹果，胜者一定会是更想得到苹果的那个，因此竞拍就为这个苹果找到了能令福利最大化的最佳用途。但证据表明，金钱的边际价值是递减的：你拥有的金钱越多，就越不把增加的一美元当回事。因此，胜者最终得到苹果可能并不是因为苹果会给他带来更多快乐，而是因为他拥有的更多财富让他这次出价的牺牲更小。经

济学家清楚这一点。比如在世界各国对于收入和幸福感之间关系的争论上，这方面的因素已经占据重要地位。但是，对于这一因素的潜在影响——比如价格机制对资源配置的作用会随着不平等的加剧而变糟——经济学界满不在乎的程度令人吃惊。

将价值和金钱成本划等号还会在其他方面产生误导。像GDP这样的经济统计数据存在缺陷并不是什么新鲜事。1968年，罗伯特·肯尼迪（Robert Kennedy）在一次演讲中抱怨道，衡量产出时会计入香烟广告、凝固汽油弹等方面的花费，却忽略了儿童健康和教育的质量。尽管在改进这些统计数据方面做了努力，这类问题依然存在。花在各种金融服务及昂贵体检上的钱无论是否增进了人类福祉都被计入GDP，而诸如污染之类的社会成本却未计入考虑。经济学家力图在其他情境下考虑这些成本，比如在评估气候变化带来的损害时。然而，即便如此，他们仍是常常关注环境变化会如何影响可衡量的产出，而忽视那些无法轻易用金钱尺度衡量的结果。

经济学家还普遍忽视无偿工作等非市场化活动的价值。曾有一项估算得出，如果把无偿工作计算在内，2010年美国GDP将上升26%（并且会大大改写不同人群对GDP贡献的比例）。正如剑桥大学的戴安娜·科伊尔

（Diane Coyle）所言，不把无偿工作计入GDP可能反映了最早执掌统计机构的那些官员（主要是男性）的价值判断。但今天的经济学家似乎仍然将那些不易衡量的事物看得无关紧要。

如果完全不使用量尺，经济学家也就百无一用了。例如，人们知道经济学家计算出了实现男女平等的经济效益。但不管是否影响GDP，男女平等本身就具有固有价值。同样，物种灭绝和被迫大迁徙会带来心理成本，这种成本无法用金钱估量，但却是气候变化带来的威胁的重要方面。

如此窘境或许表明伦理问题应该留给其他的社会科学家。但这种分工是站不住脚的。诚然，经济学家的工作常以“有形的成本和收益比主观价值更重要”为出发点。例如，阿尔文·罗斯（Alvin Roth）认为，应该把对于“令人反感的交易”（如买卖人体器官）的道德不安放到一边，以实现一个器官交易市场所能带来的福利收益。或许确实应当如此，但如果在得出这一

结论时摒弃了这类道德顾虑，而不是视之为可能同样与人类福祉相关联的准则，是不恰当的。此外，掏出金钱量尺这一行为改变了我们的价值观。尽管对影响的大小尚有争议，但心理学研究表明，敦促人们在做选择时从金钱的角度考虑问题会助长一种不信任他人和不够慷慨宽厚的“务实思维模式”。扩大市场的范围不仅仅更有效地满足了人们的偏好，它也将市场导向的价值观凌驾于其他价值观之上。

一些经济学家主张创建并使用更宽泛的幸福衡量标准。包括欧盟委员会和世界银行在内的几个组织如今公布了一系列数据，展示了一幅更全面的社会健康图景。但是，使用这种标准方法的成本在增加。人们常通过提供数据来偿付数字化商品和服务，还用价格来衡量它们的价值就够了。科技进步必然会带来更多伦理考量与狭隘的物质价值发生冲突的情形。如何在这样一个世界里提升人的福祉，这个问题值得更多关注。■



Free exchange

Diminished expectations

The business cycle is misunderstood. The second in our series on the shortcomings of economics

THE aftermath of the 2007-08 financial crisis ought to have been a moment of triumph for economics. Lessons learned from the 1930s prevented the collapse of global finance and trade, and resulted in a downturn far shorter and less severe than the Depression. But even as the policy remedies were helpful, the crisis exposed the economic profession's continued ignorance of the business cycle. That is bad news not just for the discipline, but for everyone.

The aim of those studying the macroeconomy has always been to understand the economy's wobbles, and to work out when governments should intervene. That is not easy. Downturns come often enough to be a serious irritant, but not often enough to give economists sufficient data for rigorous statistical analysis. It is hard to distinguish between short-run swings and structural economic changes resulting from demography or technology. Most classical economists were sceptical of the idea that the macroeconomy needed much oversight at all.

By the early 20th century some thinkers were groping their way towards a better understanding of money in the economy, and how its mismanagement could cause problems. The Depression forced non-interventionists to concede ground. John Maynard Keynes blamed recessions on a shortfall of demand linked to changes in saving and investment behaviour. Governments used both monetary and fiscal policy with gusto in the years after the second world war to maintain full employment.

Yet the Keynesians' heavy-handed approach never sat well with classically minded economists. In 1963 Milton Friedman and Anna Schwartz published their "Monetary History of the United States", which resurrected the pre-Depression "monetarist" view that monetary stability can mend all macroeconomic ills. Other economists, including Edmund Phelps and Robert Lucas, recognised that people learn to anticipate policy changes and adjust their behaviour in response. They predicted that sustained stimulus would eventually cause inflation to accelerate and were vindicated by runaway price growth in the 1970s.

In the years that followed, Keynesians regrouped, borrowed ideas from their critics and built "New Keynesian" models (on which much modern forecasting is based). The synthesis of Keynesian and neoclassical ideas informed a new approach to managing the business cycle. The job was outsourced to central bankers, who promised to keep a lid on inflation. Adopted around the world, this approach seemed to work. Downturns became less frequent and less severe; inflation was low and stable; expansions became longer.

But all was not well. Many neoclassical economists rejected the "New Keynesian consensus" and worked along separate lines. Some followed their models back to the classical idea that fluctuations were natural and required no intervention. That occasionally led to absurd conclusions, for instance that falling inflation in the early 1980s had almost nothing to do with monetary policy. Although central banks largely ignored this work, its leading theorists retained influence within the profession—winning Nobel prizes, for example—and with conservative politicians.

The New Keynesians had their own troubles. To satisfy critics they built more mathematical models, which aimed to show how decisions by rational, forward-looking people could, in aggregate, cause downturns. The project was quixotic. People are often irrational. Their behaviour in groups

is not as predicted by models that treat the economy as a mass of identical individuals. These models were complex enough to be fitted to almost any story. They could replicate features of the economy, but that did not amount to understanding why those features occurred.

The gap between many neoclassical economists and the New Keynesians running central banks remained unbridgeable. As Paul Romer has pointed out in some scathing recent papers, the rival camps were unable to settle their arguments by appealing to facts, or even to debate politely. You might suppose that the existence of wildly different business-cycle theories would make macroeconomists more humble, but no. Improbably, both groups argued that, in the words of Professor Lucas, the “central problem of depression-prevention has been solved”.

Where consensus did prevail, it proved to be misguided. Economists of all ideological stripes cheered on the financial deregulation of the 1980s and 1990s. The work of thinkers like Hyman Minsky and Charles Kindleberger, whose writings on financial excess were rediscovered after the financial crisis, gathered dust. In a speech in 2005 to central bankers, Raghuram Rajan, an academic who later ran India’s central bank, warned of the risks building within the financial system. He got a chilly reception.

There has been progress since the crisis. New research questions the old orthodoxy on matters from the appropriate role of fiscal policy and the risks associated with large-scale financial flows to the relationship between unemployment and inflation. But the profession remains in a dangerous and unsustainable position. The macroeconomic approach favoured by economists within central banks, regulatory agencies and finance ministries has erred repeatedly in its prognostications over the past decade, predicting that labour markets would heal quickly, for example, while underestimating the risks of targeting a low rate of inflation. A compelling new paradigm seems a distant prospect. Nor is it clear economists are

capable of sorting out their disagreements. Macroeconomics must get to grips with its epistemological woes if it hopes to maintain its influence and limit the damage done by the next crisis. Because economists have learned one thing: there is always another crisis. ■



自由交流

降低的期望

被误解的经济周期——经济学的不足系列之二

经历了2007到2008年的金融危机，经济学界本该享受到劫后余生带来的片刻欢愉。从上世纪30年代汲取的教训让全球金融和贸易免于灭顶之灾，危机导致的经济衰退也远不及大萧条时期那么持久和严重。但即便补救政策产生了效果，此次危机还是暴露出一点：经济学界对经济周期依然无知。对于这门学科而言这是一个坏消息，对于所有人来说也一样。

宏观经济学家的目标一直是了解经济波动，并确定政府干预的时机。这并非易事。经济衰退出现的频率足以让人大伤脑筋，但还不足以让经济学家提供充分的数据来做缜密的统计分析。很难分清哪些是短期波动，哪些是由人口或技术导致的结构性经济变化。大多数古典经济学家对宏观经济需要大量调控的观点抱持怀疑态度。

到了20世纪初，一些经济学家开始尝试更深入地了解货币在经济中的作用，以及货币管理不善会导致怎样的后果。大萧条的发生让不干预派不得不让位。凯恩斯将经济衰退归咎于与储蓄和投资行为变化有关的需求不足。二战后的数年里，各国政府都满腔热情地同时使用货币和财政政策来维持充分就业。

然而，凯恩斯主义的强力干预做派从未得到古典派经济学家的认同。1963年米尔顿·弗里德曼（Milton Friedman）和安娜·施瓦茨（Anna Schwartz）合作出版了《美国货币史》（Monetary History of the United States）。该书复兴了大萧条前的“货币主义”观点，认为稳定的货币可以修复所有宏观经济的弊病。包括埃德蒙·菲尔普斯（Edmund Phelps）和罗伯特·卢卡斯（Robert Lucas）在内的其他经济学家认识到，人们会学着预测政策变化并相应调整自己的行为。他们预测持续的刺激最终将导致通胀加速。70年代物价疯涨，就验证了这一点。

接下来的几年里，凯恩斯主义者重新组合、借鉴批评者的思想，建立了“新凯恩斯主义”模型（许多现代预测都是基于这个模型）。凯恩斯主义和新古典主义思想结合，提供了一种管理经济周期的新方法，即把这项工作交由承诺抑制通胀的各国央行承担。这种方法被世界各国采用，似乎行之有效。经济衰退不再那么频繁，也没那么严重了，通货膨胀率走低并且稳定，扩张期变得更长。

但不是从此万事大吉。很多新古典经济学家摒弃了“新凯恩斯主义共识”，各自为政。其中一些人顺着他们的模型又回到了古典主义观点，认为经济波动是自然现象，无需干预。这间或会导致一些荒谬的结论，诸如认为上世纪80年代初的通胀下降与货币政策几乎毫无关系。尽管各个央行对此基本上未予理会，他们当中最重要的理论家仍对保守的政客和经济学界保有影响力（比如获得诺贝尔奖）。

新凯恩斯主义者也有自己的麻烦。为了让批评者信服，他们建立了更多的数学模型，力图显示，当理性而有远见的人们的决策集合在一起时会如何导致经济衰退。但这项论证不切实际。人们常常是非理性的。他们在群体中的行为并不像那些模型将经济视为大量完全相同的个体相加而预测出来的那样。这些模型非常复杂，足以适用于几乎每种情况。它们可以复制出经济的特征，但这并不等同于了解了这些特征生成的原因。

许多新古典经济学家和掌管央行的新凯恩斯主义者之间的鸿沟仍旧无法逾越。保罗·罗默（Paul Romer）在最近发表的一些尖锐的论文中指出，对阵双方无法诉诸事实来解决争端，甚至在辩论时失礼。你可能会以为，迥然不同的经济周期理论的存在会让宏观经济学家们更加谦逊，然而事实并非如此。不可思议的是，双方都认为“预防经济萧条的核心问题业已解决”（卢卡斯语）。

而在双方真正达成共识之处，已被证明是错误的。不管持哪种思想的经济学家都为上世纪八九十年代金融管制的放松而欢欣鼓舞。海曼·明斯基（Hyman Minsky）和查尔斯·金德尔伯格（Charles Kindleberger）等思想家的研究遭到冷落，他们关于金融过度的论述在金融危机后才被重新认

识。后来成为印度央行行长的学者拉格拉迈·拉詹（Raghuram Rajan）在2005年对各国央行行长的一次演讲中警告道，金融体系内部存在风险。但人们对此反应冷淡。

自金融危机以来，经济学已经有了进步。从财政政策应扮演的恰当角色、与大规模资金流动相关的风险，到失业和通货膨胀之间的关系等等，新研究都对老派正统观念提出了质疑。但经济学仍然岌岌可危、后继乏力。过去十年里，为各国央行、监管机构和财政部中的经济学家所青睐的宏观经济学方法在预测中屡屡失误，比如预言劳动力市场将很快恢复，却低估了设定过低通胀目标的风险。一个令人信服的新范式似乎还遥遥无期。同样不清楚的是，经济学家能否解决他们之间的分歧。如果宏观经济学想要保持影响力，并减少下一次危机带来的损害，那么就必须着手解决其认识论上的难题。因为经济学家已经认识到了一件事——下一场危机总会来临。





Free exchange

A little knowledge

Many microeconomics results are shaky. The third in our series on the profession's shortcomings

MICROECONOMISTS are wrong about specific things, Yoram Bauman, an economist and comedian, likes to say, whereas macroeconomists are wrong in general. Macroeconomists have borne the brunt of public criticism over the past decade, a period marked by financial crisis, soaring unemployment and bitter arguments between the profession's brightest stars. Yet the vast majority of practising dismal scientists are microeconomists, studying the behaviour of people and firms in individual markets. Their work is influential and touches on all aspects of social policy. But it is no less fraught than the study of the world economy, and should be treated with corresponding caution.

For decades non-economists have attacked the assumptions underlying economic theory: that people are perfectly informed maximisers of their own self-interest, for instance. Although economists are aware that markets fail and humans are not always rational, many of their investigations still rely on neoclassical assumptions as “good enough” descriptions of the world. But this “101ism”, as Noah Smith, an economist and journalist, calls it, is less prevalent than it was in the 1950s and 1960s, when researchers like Gary Becker reckoned everything from crime to marriage could be described in terms of rational self-interest. Since the 1970s, as Roger Backhouse and Béatrice Cherrier describe in “The Age of the Applied Economist”*, a new collection of essays, the field has taken a decidedly empirical turn.

Most influential economic work today involves at least some data from the real world. Many economists made their names by finding unique datasets

containing “natural experiments”, in which a change in policy or conditions affects only parts of a population. This allows researchers to tease out the effect of the change. In a famous example, published in 2001, John Donohue and Steven Levitt used variations in abortion laws across states to conclude that legalising abortion had been responsible for as much as half of the decline in crime in America in the 1990s. Other economists used randomised controlled trials (RCTs) to generate experimental data on the effects of social and development policies. In RCTs randomly chosen subjects are given a “treatment”, such as a microloan or a school voucher, while those in a control group are not. The behaviour of the two groups is then compared.

These developments have led to better, more substantial research. Yet they have also exposed economics to the problems bedevilling most social sciences, and some hard sciences, too. Researchers can tweak their statistical tests or mine available data until they stumble on an interesting result. Or they read significance into a random alignment. Economics, like other social sciences, is suffering a replication crisis. A recent examination in the *Economic Journal*, of almost 7,000 empirical economics studies, found that in half of the areas of research, nearly 90% of those studies were underpowered, ie, that they used samples too small to judge whether a particular effect was really there. Of the studies that avoided this pitfall, 80% were found to have exaggerated the reported results. Another study, published in *Science*, which attempted to replicate 18 economics experiments, failed for seven of them.

Even when a study is perfectly designed and executed, the result is open to interpretation. Environmental factors such as changing institutions or social norms inevitably play some role, but researchers cannot fully account for them. The results of an experiment conducted in one country might not be relevant in another, or in the same country at a later date. Research may suffer from more than one of these problems. Critics of the paper by

Messrs Donohue and Levitt reckon, for instance, that the authors' computer code contained an error, that they used a measure of crime that flattered their results, and that they neglected the possibility that differences in the change in crime across states were caused by differences in factors other than abortion laws. (The pair conceded an error, but responded that taking better account of confounding factors did not weaken their conclusion.)

Small wonder that economists struggle to answer seemingly straightforward questions, such as how minimum-wage laws affect employment. In 2017 two teams of researchers released assessments of a change in Seattle's minimum-wage laws within days of each other. Each came to wildly different conclusions (continuing an established pattern of such research).

New techniques could help. Machine learning, in which computer programs comb through vast datasets in search of patterns, is becoming more popular in all areas of economics. A future beckons in which retailers know virtually everything about every transaction, from the competing products buyers considered before their purchases to their heart rates at the moment of payment. That could mean better predictions and policy recommendations without a smidgen of economic analysis. But pitfalls are already apparent. The algorithms used are opaque. And getting access to the richest data will require researchers to work with, or for, giant tech firms which have their own interests.

Economics enjoys greater influence over policy than other social sciences. Striking new findings are publicised by researchers and their institutions, promoted by like-minded interest groups and politicians, and amplified by social media. Conflicting results and corrections are often ignored. Being alert to the shortcomings of published research need not lead to nihilism. But it is wise to be sceptical about any single result, a principle this columnist resolves to follow more closely from now on.

*A list of cited studies is at economist.com/micro2018 ■



自由交流

一知半解

微观经济学的很多研究结果都站不住脚。经济学的不足系列之三

经济学家、脱口秀演员尤伦·鲍曼（Yoram Bauman）总爱说，微观经济学家错在具体的事情上，宏观经济学家是整个都错了。过去十年里，全球经济经历了金融危机和失业率飙升，也见证了各路明星经济学家之间激烈的唇枪舌战。宏观经济学家首当其冲，遭到公众最猛烈的批评。不过，从事这门“沉闷的科学”的绝大多数都是微观经济学家，他们致力于研究单个市场中个人和企业的经济行为。他们的研究颇具影响力，且触及社会政策的方方面面。但是，和研究世界经济相比，微观经济学的麻烦并不会更少些，应当同样审慎对待。

数十年来，奠定了经济学理论的种种假设不断遭受外界的攻击，比如认为人们充分掌握信息以追求自身利益的最大化。尽管经济学家知道市场会失灵，人们也并非总是理性，但他们的很多研究仍然依赖新古典经济学的各种假设作为对世界的“足够好”的描述。但今时今日，这套方法——经济学家兼记者诺亚·史密斯（Noah Smith）称之为“经济学导论主义”（101ism）——已不像上世纪五六十年代那样盛行了。那时，加里·贝克尔（Gary Becker）这样的研究人员认为，从犯罪到婚姻，一切事情都可以用人们理性的自利动机来解释。然而正如罗杰·巴克豪斯（Roger Backhouse）和贝亚特丽斯·谢里耶（Béatrice Cherrier）在新编写的论文集《应用经济学家的时代》*（The Age of the Applied Economist）中所述，自70年代起，经济学研究已明确转向了实证主义。

如今最具影响力的经济学著作多少都会涉及一些来自现实世界的数据。很多经济学家因为发现了包含“自然实验”的独特数据集而声名鹊起。在自然实验中，政策或形势的变化只会影响到人群的一部分。这就使得研究人员可以分辨出变化产生的影响。约翰·多诺霍（John Donohue）和史蒂芬·列维特（Steven Levitt）于2001年发表的一项著名的研究就是一个例子。他

们考察了各州在堕胎法律上的差异，得出结论称，上世纪90年代美国犯罪率的下降有50%是由于堕胎合法化促成的。其他一些经济学家采用随机对照试验（RCT）来生成关于社会及发展政策影响的实验数据。在这类试验中，随机选择的实验对象会被给予一项“待遇”，比如小额贷款或教育补助金券，而对照组的实验对象则没有。随后研究人员会对比两组实验对象的行为。

这样的发展变化已催生出更优质、更重大的研究。然而经济学也因此遇到了长期困扰大多数社会科学乃至某些“硬科学”的问题。研究人员可能会对统计测试加以微调，或挖掘已有数据，直到撞见一个有趣的结果。或者，他们会从随机匹配中强行看出显著性来。和其他社会科学一样，经济学也存在可复制性危机。近期，一项发表在《经济学杂志》（*Economic Journal*）上的调查考察了将近7000个实证经济学研究，发现在半数研究领域，有接近90%的研究都存在统计效力过低的问题，即样本量太小，无法判断某个特定影响是否确实存在。而在那些不存在这一问题的研究中，有80%都夸大了研究成果。另一项发表在《科学》上的研究尝试复制18个经济学实验，其中有7个无法复制。

就算一项研究的设计和执行都无可挑剔，得出的结果也可以有不同的解释。类似制度变化或社会规范演变这样的环境因素必然会影响到一些作用，但研究者并不能充分解释这类因素的影响。在一个国家开展一项实验得出的结果换到另一个国家可能就不成立了，即使仍在同一个国家，过一段时期可能也不再站得住脚。一项研究可能同时存在上述问题中的几种。例如，多诺霍和列维特的论文的批评者认为：两位作者的计算机代码中存在一个错误；他们采用的衡量犯罪的标准美化了研究结果；他们忽视了这样一种可能性，那就是各州犯罪率的变化之所以存在差异，是因为它们在堕胎法以外的因素上存在差异。（两位研究者承认研究确实存在一个错误，但回应说，把干扰因素更仔细地考虑进去后，并不会削弱结论的合理性。）

难怪经济学家连看似简单的问题都难以作答，比如最低工资法如何影响就业率。2017年，两组研究人员发布了对西雅图调整最低工资法的评估，前

后只相隔几天，但结论迥乎不同（这类研究历来都有这样的问题）。

新技术也许能帮上忙。在经济学的所有领域里，运用计算机程序在庞大数据库集中搜寻规律的机器学习技术正愈发流行。在将来，零售商几乎可以了解每笔交易的方方面面，比如顾客在购买之前考虑过哪些同类产品，他们在付款时的心率水平等等。这也许意味着一点经济学分析都不用做，就能做出更好的预测、给出更好的政策建议。但是其中的陷阱也已经显而易见。运用的算法不够透明。而且，研究者如果要使用最丰富的数据资源，就得与科技巨头公司合作，或者为它们工作，而这些公司有自身的利益考量。

经济学对政策的影响力比其他社会科学更大。一旦有了惊人的新发现，研究人员及其所属机构会广而告之，志趣相投的利益集团和政客会大力宣传，社交媒体则会扩大这些新发现的影响力。然而与新发现相矛盾的研究结果以及对研究做出的纠正却往往被忽略。对已发表研究的缺陷保持警觉未必就会导致虚无主义。但是，对任何单个研究结果都抱持怀疑是明智的。本专栏作者决心今后要更严格地践行这个准则。

*欲查看所引用研究的列表，请访问economist.com/micro2018 ■



Free exchange

Root and branch

Economists understand little about the causes of growth. The first of a series on the profession's shortcomings

OVER the past decade economists have been intensely scrutinised for their intellectual failings in the run-up to the 2007-08 financial crisis. Yet had the recession that followed been more severe—wiping a quarter off the GDP of every advanced economy, say—those countries would still have ended up four times as rich per person, in purchasing-power terms, as developing countries are now, and more than ten times as rich as sub-Saharan ones. Robert Lucas, a Nobel prizewinning economist, once wrote that after you have started to think about the gap between poor and rich countries it is hard to think about anything else. Economists understand even less about economic growth than about business cycles. But the profession has done too little to address this failure or to understand its implications.

Economists have precious few hard facts about growth. They know that sustained growth in GDP per person only started in the 18th century. They know that countries can become rich only by growing steadily over long periods. They know that in some fundamental way growth is about using new technologies to become more productive and to uncover new ideas. Beyond that, almost everything is contested.

There are three broad lines of thinking. The first dates from 1956, when Robert Solow and Trevor Swan independently developed models based on the idea that growth is a consequence of capital accumulation. Their models explained how poor countries could catch up with rich ones, but not why rich countries had grown in the first place. Mr Lucas and other economists, including Paul Romer, sought to fix that by adding descriptions of how

knowledge is developed and disseminated. As simple stories about how growth might work, such models function well.

Yet they share two flaws. First, they are often too vague to be of much practical use. As Paul Krugman, another Nobel prizewinner, once wrote, they “involved making assumptions about how unmeasurable things affected other unmeasurable things”. And they leave out most of what matters. Some economies do indeed leap from poverty to riches by mastering state-of-the-art technologies. But most do not, suggesting that formidable obstacles prevent many poor countries from growing in the way that models of knowledge accumulation and diffusion suggest they could. Growth theory is silent about what those obstacles might be.

A second strand of empirical research followed. Economists pored over cross-country economic data in search of factors that might explain differences in growth. Some focused on individual countries and used techniques known as “growth accounting” to quantify the relative contributions of capital and labour. Often, however, much of the growth could be attributed only to an unexplained residual, sometimes interpreted as representing progress in technology but better understood, in the words of Moses Abramovitz, another economist, as “a measure of our ignorance”.

Other empirical researchers compared countries, seeking links between economic and political characteristics and rates of growth. Yet, as Mr Solow has remarked, this project has not inspired much confidence. The trouble is the sheer number of variables that might matter, alone or in combination. A study might find that some factor—the rate at which businesses are created, say—is materially linked to growth. But in reality something else correlated with business creation, not included in the study, might be the crucial influence. The world is too complicated to be dissected and examined this way.

A third group of researchers look to history for lessons, examining the Industrial Revolution, the diverging fortunes of former European colonies and so on. They are held back by a paucity of data and have not managed to converge on a shared understanding of the nature of growth. Yet their approach is in some ways the most promising, because it means grappling with the ways in which culture and politics constrain economics. Debates about the origins of the Industrial Revolution revolve around the relative importance of secure property rights, the extent to which cultures tolerate personal ambition and so on. Those about why one European colony ended up rich and another poor focus on why different places ended up with different sorts of institutions, and to what effect.

At bottom, such issues must be the most important ones. An economist might explain China's rapid growth in the 1980s by saying that it began to deploy more capital per worker and to adopt foreign technologies. Yet it was very clearly the result of a political decision to loosen state control over economic activity. It would similarly be accurate to say that China's future growth will depend on how well it develops and deploys new technologies. But that depends on decisions about economic governance taken by its leaders, which will in turn be influenced by social and geopolitical forces that economists scarcely understand and generally ignore. Economists might imagine that if they were put in charge of a poor country, they could get it to grow. But a formula for growth that takes no account of social and political complexities is no formula at all.

A clearer understanding of how growth happens, and why growth-boosting institutions sometimes wither or fail to take root, could raise the living standards of billions of people. The economics of growth should therefore be central to the discipline, even though the questions it poses are objectively hard, and the answers rest more in history and politics than in elegant mathematics. Until they can give better answers in this area, economists should speak with greater humility about how this structural

reform or that tax change might affect long-term growth. They have not earned the right to confidence. ■



自由交流

根本与枝节

经济学家对经济增长的原因知之甚少——经济学的不足系列之一

过去十年里，经济学家因为在2007至2008年金融危机的酝酿阶段失职而受到严格的拷问。然而，即使随后发生的经济衰退再严重些——比方说各个发达经济体的GDP缩水四分之一，这些国家的人均购买力仍会是发展中国家现有水平的四倍、撒哈拉以南非洲国家的十倍以上。诺贝尔经济学奖得主罗伯特·卢卡斯（Robert Lucas）曾写道，一旦你开始思考穷国和富国之间的差距，就很难再思考其他任何问题了。经济学家对经济增长的了解甚至比对经济周期还要少。但他们在解决这种缺陷或是了解其影响上几乎无所作为。

经济学家有关经济增长的定论寥寥无几。他们知道的无非就是：人均GDP直到18世纪才开始持续增长；只有通过长期的稳定发展，国家才能富有；从某些根本方面来说，所谓增长就是利用新技术来提高生产力、发现新思想。除此之外，其他的一切几乎都存有争议。

关于经济增长，经济学大体有三种思路。第一种可追溯到1956年，其时罗伯特·索洛（Robert Solow）和特雷弗·斯旺（Trevor Swan）基于“增长是资本积累的结果”这一思想，各自提出了模型。他们的模型展示了穷国如何能赶上富国，却没能解释富国为何先富起来。为解决这一问题，卢卡斯和包括保罗·罗默（Paul Romer）在内的其他经济学家增加了对知识的形成及传播的描述。作为对经济增长如何发生的简单解释，这些模型很管用。

然而这些模型有两个共同缺陷。首先，它们往往过于笼统，因而不太实用。正如另一位诺贝尔奖得主保罗·克鲁格曼（Paul Krugman）曾经写到的那样，它们是“对一些无法计量的事物如何影响另一些无法计量的事物做出种种假设”。其二，这些模型忽略了大部分重要因素。一些经济体确实通过掌握最先进的技术从穷国一跃而成富国。但它们只是少数，这表明

由于某些巨大障碍的存在，很多穷国无法按知识积累和扩散模型所指示的路径实现经济增长。至于这些障碍可能是什么，增长理论并未提及。

第二种思路是随后出现的实证研究。经济学家仔细研究全国各地的经济数据，寻找可能解释增长差异的因素。一些经济学家把注意力集中在单个国家，使用被称为“增长核算”的方法来量化资本和劳动力的相关贡献。然而，很多时候，大部分增长只能归因于一种无法解释的剩余，有时候被解释为技术进步的体现，但还是另一位经济学家摩西·阿布拉莫维茨（Moses Abramovitz）的说法更贴切，即“对我们无知的度量”。

其他实证研究者则在国家间进行比较，寻找经济和政治特征与增长率之间的联系。然而，正如索洛所言，这样的研究难以让人信服。问题就出在可能起作用的变量太多，无论它们是单独还是联合发挥影响。一项研究可能会发现某一个因素与经济增长密切相关，比如企业创办的速度。但在现实中，产生关键影响的也许是其他与创业相关的因素，但它却没有被纳入研究范围。世界太复杂，不能用这种方式剖析和审视。

第三种思路希望从历史中获得教训。研究者考察了工业革命以及前欧洲殖民地各不相同的命运等等。但他们受制于数据匮乏，最终并未能对增长的本质达成共识。然而从某种程度上说，这种方法最被看好，因为它想要弄清文化和政治以何种方式制约经济。比如，有关工业革命起源的争论围绕着有保障的财产权的相对重要性、文化对个人抱负的包容程度等议题展开。而至于为什么有的欧洲殖民地最终走向富有，有的却陷于贫困，辩论则集中在为何不同的地方最终产生了不同的体制及其影响上。

实际上，这类问题肯定是最重要的。经济学家可能将中国上世纪80年代的快速增长解释为中国开始增加人均资本配置以及采用外国技术。然而，这一增长无疑是国家放松对经济活动的控制这一政治决策的结果。同样地，说中国未来的增长取决于它对新技术的开发和利用也是正确的，但这取决于中国领导人对经济治理方式的决策，这些决策反过来又受社会和地缘政治的影响，而经济学家对这些因素几乎不了解，基本上忽略它们。经济学家可能会想象，如果自己被派去治理一个穷国，将能帮助它实现经济增

长。但是，一个不考虑社会和政治复杂性的增长方案根本不能算是方案。

经济增长是如何发生的？为什么促进经济增长的体制有时会逐渐衰落或者未能扎根？如果能对这些问题得出更清晰的认识，可能会提高数十亿人的生活水平。因此，经济增长理论应该成为经济学这门学科的核心，尽管这方面的问题确实很难，而且答案更多来自历史和政治，而非简练的数学计算。在就这方面给出更好的答案之前，经济学家在谈论这项结构改革或者那项税改可能如何影响长期增长时还是应该多一些谦逊，毕竟他们还没有自信的资本。 ■



Free exchange

Barriers to entry

The last in our series on the shortcomings of economics looks at the discipline's lack of diversity

SCIENCE is supposed to be the ultimate meritocracy. People might sneer at a thinker's background or training, but there can be no arguing with a powerful new idea which explains the world better than its rivals do. In reality, academia is cluttered with odd cultures and practices which serve as barriers to entry—and, at times, as cover for discrimination. In economics, men receive tenure at a rate 12 percentage points higher than women do, after controlling for family circumstances and publication records. Women who clear that hurdle are about half as likely as men to be named full professor within seven years. Just 4% of doctoral degrees in economics were awarded to African-Americans in 2011 (compared with about 8% across all academic fields). Something is broken within the market for economists, and the profession has moved only belatedly and partially to address it. A lack of inclusivity is not simply a problem in itself but a contributor to other troubles within the field.

Though women in economics have long been aware of the discipline's biases, a growing body of research is making the problem harder for men to ignore. When decisions are made about tenure, men are not penalised for having co-authored lots of papers, whereas women who co-author with men are, according to work by Heather Sarsons, of Harvard University. That suggests women's contributions to such papers are discounted; in other fields, like sociology, this is not the case. Research by Erin Hengel of the University of Liverpool has shown that papers by women are better-written, on average, than those by men, but spend longer in peer review, suggesting that women are held to a higher standard. That makes female researchers

less productive.

The climate within economics can be hostile as well. Economics Job Market Rumors, an anonymous website frequented by graduate students and used to discuss job openings and candidates, has long been notorious for threads that include derogatory or sexually inappropriate remarks. A recent newsletter of the American Economic Association (AEA) opens with an essay by Jennifer Bennett Shinall, of Vanderbilt University. On a flight home from the AEA's annual meeting, another attendee attempted to kiss her and suggested her career would be fine so long as she "made smart decisions". Ms Shinall says she considered keeping the incident to herself, because she did not yet have tenure and might need letters of reference from her attacker's colleagues. Such concerns surely stop other episodes of this sort from ever coming to light.

The profession's failings in this regard almost certainly influence the quality and focus of economic research. Putting women off careers in academic economics, and undermining the productivity of those who persist, means excluding good minds and good ideas. It also means excluding different viewpoints. Although individual women have all sorts of ideologies, surveys suggest that the views of men and women on some issues diverge, on average, in significant ways. Male economists are more likely to prefer market solutions to government interventions. Women are more likely to favour redistribution and environmental-protection rules. Were economics to include a broader array of views, its findings might well change, too.

Indeed, these biases may also inform views about bias. Women are far more likely than their male colleagues to say that gender gaps are rooted in inequities in the market. A survey of a random sample of members of the AEA, by Ann Mari May and Mary McGarvey of the University of Nebraska and Robert Whaples of Wake Forest University, found that hardly any men

believed professional opportunities for economics faculty are tilted against women. Remarkably, about a third believe there is bias in favour of women. Many male economists seem to reckon the meritocracy is functioning perfectly well, with no problems to fix; men presumably dominate because of superior ability.

The lack of diversity within economics is not just a matter of women. Limited diversity of race and background at the top of the field can distort policy in worrying ways. For example, Narayana Kocherlakota, an economist and former president of the Federal Reserve Bank of Minneapolis, argued in 2014 that an absence of diversity at the Fed reduces the breadth of perspectives considered and undermines its effectiveness as a central bank. (Mr Kocherlakota was the first non-white person to be president of a regional Fed bank.)

Economists are taking some steps to address these problems. The AEA recently adopted a code of conduct obliging economists to carry on civil and respectful dialogue, and is working to set up its own forum for discussion of job openings and candidates. But there is far more to be done. Hiring committees should re-examine their recruitment and promotion practices. Economic journals could take a page out of sociology's book and list authors according to their contributions to papers, rather than alphabetically. Removing the barriers faced by underrepresented groups would not transform the profession overnight, but would inject a bracing gust of competition into the field's imperfect meritocracy.

To generate lasting improvement, in its diversity and in other problem areas, economics could also do with a change in mindset. The profession has a strong sense of who an economist is and what one does; it is, as Axel Leijonhufvud once noted in an amusing paper, like a strange and insular tribe. This group identity is bolstered by the field's status and influence, which might be threatened by changes to its composition, ideas and

methodologies. But as economists point out so persuasively in other contexts, to improve requires change. Economics, like the economy, cannot thrive without a little creative destruction. ■



自由交流

准入壁垒

缺乏多样性——经济学的不足系列之末篇

科学界按说应该是最唯才是用的地方。人们可能会嘲笑某位思想者的教育或学术训练背景，却一定会欢迎一个出类拔萃、能更好地解释这个世界的强大新思想。然而事实上，学术界充斥着各种古怪的文化和习惯，它们成了准入壁垒，还不时为歧视开脱。在经济学界，在家庭环境和发表论文情况相当的条件下，男性获得终身教职的比率比女性高出12个百分点。而跨越了这一障碍的女性在七年内被任命为正教授的可能性大约是男性的一半。2011年，经济学专业只有4%的博士学位颁给了非裔美国人（而在所有学科里这一比例平均约为8%）。经济学界的内部“市场”出了些故障，而它一直没能及时、全面地解决这一问题。缺乏包容性不单本身是个问题，还引发了该领域的其他问题。

女性经济学家早就意识到这个学术圈子存在偏见，而越来越多的研究也开始让男性逐渐正视这个问题。哈佛大学的希瑟·萨森斯（Heather Sarsons）的研究表明，评定终身教职的时候，男性不会因为与他人合著大量论文而受到不利影响，而与多名男性合著论文的女性则不然。这表明女性对这些论文的贡献被低估了，而在社会学等其他学术领域却没有这种情况。利物浦大学的艾琳·亨格尔（Erin Hengel）的研究显示，女性的论文质量平均来说优于男性，但却耗费更长的同行评审时间，这表明人们对女性的要求更高。而这也使得女性不如男性多产。

经济学界内部的风气可能也很不友善。研究生们经常在经济学就业市场传闻（Economics Job Market Rumors）网站上匿名讨论就业机会和求职者等话题，其中包含的贬损或涉及性的不当言论让这里一直声名不佳。美国经济学会（AEA）最近一期简报的头条是范德堡大学的珍妮弗·班尼特·诗尼尔（Jennifer Bennett Shinall）的文章。她说在一次AEA年会结束后的回程航班上，另一位与会者试图亲吻她，并暗示只要她“做出聪明的决定”，职

业生涯就会一帆风顺。诗尼尔说，自己曾经考虑对此事秘而不宣，因为当时她还未获得终身教职，可能需要这名骚扰者的同事写推荐信。这样的担心无疑让其他类似事件永无曝光之日。

经济学界在这方面的缺陷几乎必然会影响该学科的研究质量和研究方向。让女性对学术研究望而却步，又压制那些坚持下来的女性的产出，这无异于将优秀的头脑和创意拒之门外。这也意味着排斥不同的观点。虽就个体而言，女性的想法五花八门，但调查显示，总体来说，男女在某些议题上的观点相去甚远。男性经济学家更可能偏好市场解决方案而不是政府干预，女性经济学家则更可能倾向再分配和环保法规。倘若经济学能包容更为广泛的观点，它的研究成果很可能也会随之改变。

事实上，这些偏见还可能影响人们对偏见本身的看法。比起她们的男性同事，女性将男女差别待遇归根于市场不平等的几率要高得多。内布拉斯加大学（University of Nebraska）的安·玛丽·梅（Ann Mari May）、玛丽·麦加维（Mary McGarvey）以及维克森林大学（Wake Forest University）的罗伯特·霍普里斯（Robert Whaples）对AEA成员的随机抽样调查发现，几乎没有男性认为女性在申请经济学教职时会受到歧视。值得一提的是，约有三分之一的男性认为女性反倒会更受青睐。许多男性经济学家似乎都认为目前的人才体制完美无缺，如果说学界真是由男性主宰，那也是因为他们有能力更强。

经济学内部缺乏多样性不仅仅只关乎女性问题。在该领域的上层，缺乏种族和背景多样性可能会以令人不安的方式扭曲政策。2014年，经济学家、美国明尼阿波利斯联邦储备银行前主席纳拉亚纳·柯薛拉柯塔（Narayana Kocherlakota）曾指出，美联储内部缺乏多样性局限了它看待问题的角度，进而削弱了其作为央行的效力。（柯薛拉柯塔是首位非白人地区联储主席。）

经济学家正采取一些措施来解决这些问题。AEA最近通过了一项行为准则，要求经济学家之间开展文明礼貌的对话；同时也在建立自己的论坛以供讨论就业机会和求职者等内容。路漫漫其修远兮。招聘委员会应该重新

审查他们的聘用和晋升程序。经济学期刊可以效仿社会学的做法，根据对论文的贡献大小而不是字母顺序罗列作者名字。消除弱势群体面临的壁垒不会在一夜之间改变这个行当，却会给它不完善的人才体制注入一股令人振奋的竞争之风。

要在多元化和其他问题上有持久的改善，经济学界可能还需要改变思维方式。经济学家这个圈子对于自身身份和职责有一种强烈的意识，就像阿克塞尔·莱永胡武德（Axel Leijonhufvud）在一篇妙趣横生的论文中所说的那样，它就像一个怪异而自我封闭的部落。这种群体认同因为这个圈子的地位和影响力而得以强化，而圈子的构成、思想及方法论上的变化可能会威胁这种地位。但是，正如经济学家在其他场合非常令人信服地指出的那样：不破不立。经济学界，就像经济一样，不来点创造性的破坏就不能繁荣发展。 ■



Entrepreneurship in France

Seeking the big time

A site-search startup swiftly scales

IT WAS not the sort of do-it-yourself activity that Castorama, a French home-improvement chain, usually promoted. The search engine on the firm's website started offering customers puerile responses to their inquiries. Its auto-complete text function suggested such intriguing products as a “bollock hammer” or “cock sander”. It also returned offensive anti-Semitic phrases. The firm blamed manipulation by unnamed actors and had to briefly scrap its search function.

That incident, two years ago, was a reminder that much online search occurs within websites. Internet giants such as Google excel at bringing users to sites but once there customers often rely on websites' own search functions to find products or services. Some firms build their own engines; others use open-source software, such as Elasticsearch, to supply them. The results can sometimes be painfully slow and undiscerning.

As e-commerce grows, so does demand for search systems that are fast, accurate and resilient to typos or tampering. A firm that saw an opportunity in this is Algolia, a French startup founded in 2012. It has a search application that hunts the client's website and swiftly offers consumers relevant results.

Algolia is growing unusually fast for a European startup. It has some 200 engineers and other staff, up from 60 in 2016, most of them based in penthouse floors at its new headquarters behind Paris-Saint-Lazare station (its legal headquarters and a marketing office are still in San Francisco). The firm says it has over 4,500 clients, more than double the tally of two years

ago, mostly in America. Its platform is processing 41bn search requests a month, as of March, again more than double the equivalent figure two years ago.

One client, Twitch, a live-streaming video platform owned by Amazon, sees nearly 1bn visits to its site each month, leading to lots of searches. Other customers include Stripe, a cloud-based payments firm; Medium, a publisher; Crunchbase, a database for techies; and various Fortune 500 and CAC 40 firms.

Its figures sound impressive, but there is no ad spending attached to its searches since users are already on company websites. Algolia's model is to charge clients for its bespoke service, rather than selling ads and scooping up data about users. Its revenues reached \$1m in 2014, two years after founding, rose to \$10m in 2016 and doubled to \$20m last year.

Julien Lemoine, Algolia's co-founder, sees opportunity among midsized European firms, which are belatedly aware that they must expand their digital offerings. He has plans for operations in Germany and Japan, after opening in Australia this year. Engineers are focused on "natural-language processing" to improve search in tricky tongues like Arabic and Japanese.

A perennial complaint about young tech firms in France is that—despite their gifted engineers and smart ideas—few know how to scale up fast enough to interest big investors. Cedric Sellin, a Paris-based business angel, reckons that locals are too scared of venturing abroad early. "Too many startups try to nail it here, before they think of going elsewhere," he says. Algolia, in contrast, uses English in all its offices and sought clients in America from the start. The founders' experience at Y Combinator, a revered school for startups in California, helped them become unusually comfortable, for a French outfit, about taking risks.

Raising serious amounts of capital early also helped. France may have plenty of seed funds for the smallest startups, but ambitious firms usually have to relocate across the Atlantic in search of big investments. But Algolia drew in \$74m from investors led by Accel, a venture-capital firm in London, that were attracted by the firm's global ambitions. Turning *l'Hexagone* into a "startup nation" means looking beyond France's borders. ■



创业在法国

大显身手

一家站内搜索创业公司飞速扩张

这不是法国家装连锁店Castorama通常会向顾客推荐的那类DIY操作。该公司网站的搜索引擎开始对顾客的搜索给出恶作剧般的回答。其文本自动补全功能推荐了“蛋蛋锤子”或“丁丁打磨机”等神奇的产品，此外还出现了无礼的反犹太字眼。这家公司声称网站遭身份不明者操控，并不得不暂时关闭了搜索功能。

这宗发生于两年前的事件提醒人们，很多的在线搜索都发生在网站内部。谷歌等互联网巨头擅长将用户引向各个网站，但用户一旦到达网站，通常就只能依赖网站本身的搜索功能来寻找产品和服务了。有些公司会打造自己的搜索引擎，另一些会利用Elasticsearch等开源软件来提供搜索。有时搜索速度会非常慢，结果也欠精准。

随着电子商务的发展，对快速、精确、能够识别打字错误和防篡改的搜索系统的需求也在增长。成立于2012年的法国创业公司Algolia发现了这一商机。该公司的搜索应用会在客户的网站中搜寻，即刻为消费者奉上有用的结果。

以一家欧洲的创业公司来说，Algolia的成长可谓异常迅速。2016年它有60名员工，如今连工程师在内约有200名，多数人都在新总部顶层的高级套间里办公。新总部就在巴黎圣拉扎尔车站（Paris-Saint-Lazare station）的后方（其法定总部和一个营销办公室仍设在旧金山）。该公司称自己有超过4500个客户，是两年前的两倍多，这些客户大多数都在美国。截至3月，其平台每月处理410亿次搜索请求，同样是两年前的两倍以上。

亚马逊旗下的流媒体视频直播平台Twitch便是Algolia的客户，该平台的月访问量接近10亿次，自然也产生了大量搜索活动。Algolia的其他客户还包括云支付公司Stripe、出版商Medium、供“技术控”们使用的数据库

Crunchbase，以及各路财富500强公司和法国CAC40公司。

这些数字很亮眼，但Algolia的搜索服务并不涉及吸引广告投放，因为用户已经在各家公司的网站上了。它的经营模式是为客户提供定制服务并收取费用，而不是出售广告和搜罗用户数据。成立两年后，公司在2014年的收入达到100万美元，到2016年增至1000万美元，去年又翻一番，达到2000万美元。

Algolia的联合创始人朱利安·勒莫瓦尼（Julien Lemoine）认为欧洲的中型企业中蕴藏着机会。这些企业终于开始意识到它们必须拓展自己的数字服务。他计划，等今年在澳大利亚的业务开展起来后，还要向德国和日本进军。工程师们正集中精力攻克“自然语言处理”这一课题，力求提升阿拉伯语和日语这类复杂语言搜索的表现。

关于年轻的法国科技公司，一个屡屡听闻的抱怨就是，尽管它们拥有才华横溢的工程师和高明的创意，但几乎无一知道如何足够快地扩大规模以吸引投资大户。巴黎的天使投资人塞德里克·塞林（Cedric Sellin）认为，当地人太害怕早早向海外进军了。他说，“有太多创业公司都是先努力在本地取得成功，然后才考虑向其他地方扩张。”相比之下，Algolia自创立之初就在所有办公室使用英语，并在美国寻找客户。两位创始人在备受尊崇的创业公司摇篮——加州的Y combinator——的经历也让他们能以法国公司中少见的放松态度去冒险。

公司在早期就募得的大笔资金也起到了作用。法国或许有很多面向最小型创业公司的种子基金，但那些目标宏伟的公司通常得跨过大西洋去寻觅大额投资。但是，Algolia从以伦敦风投公司Accel为领投方的一批投资人那里获得了7400万美元。Algolia向全球扩张的雄心赢得了Accel的青睐。要让“六边形之国”变身“创业国度”，其国民须放眼国界以外。■



Rethinking death

The only end of age

Barbara Ehrenreich wants readers to ditch the “illusion of control” over their bodies

A FEW years ago Barbara Ehrenreich stopped going for check-ups. The decision to forgo cancer screenings and physical exams has set her apart from her friends, whose calendars are full of doctors' appointments and whose cupboards are crammed with supplements and medicines. But as the American writer, who is 76, explains in “Natural Causes”, once she realised she was “old enough to die”, there was no good reason to live a “medicalised life”. Her remaining time is “too precious to spend in windowless waiting rooms”.

Ms Ehrenreich is no anti-science hippy. She will go to the doctor in an emergency. The author of over 20 books of social commentary, including “Nickel and Dimed”, an acclaimed account of poverty in America, she has a PhD in cellular immunology.

What angers her is the “illusion of control” sold by the “medical-industrial complex”. She skewers the fads that promise eternal youthfulness, such as celebrity-endorsed “radio-frequency skin-tightening”, and bossy books on “successful ageing”. But she argues that mainstream procedures such as cancer-screening are oversold as well. One study published in 2012 by the *New England Journal of Medicine* estimated that from 1976 to 2008 over 1m American women received a diagnosis—plus painful treatment—for tumours that would not have led to clinical symptoms.

Yet “Natural Causes” is more than a rant about snake-oil salesmen. It is an eclectic, if scattershot, musing on attitudes to life and death. These have changed hugely since the pre-modern era, as other writers have noted. In

a seminal book about Western attitudes to mortality published in 1974, Philippe Ariès, a French historian, argued that before the 18th century death was rarely resisted. Life expectancy at birth hovered at around 30. Since Christianity taught that time on Earth was preparation for the afterlife, and that God decided death's moment, you might as well do good works in the meantime.

Thanks to the wonders of science and economic growth, life expectancy in rich countries is now more than 80. Death is generally less capricious and sudden. Concomitantly humans are far less likely to see themselves as helpless against the grim reaper. Doctors have ousted priests as the anointed experts in mortality. Spin classes have replaced the sacraments.

For Ms Ehrenreich, the notion that humans can master their bodies is flawed and dangerous. Disease will strike everyone eventually. As Philip Roth wrote in his novel “*Everyman*”, “Old age is a massacre.” Equating health with virtue, she adds, means that the rich, who may spend \$100 per hour on fitness regimes, look down on obese people as incapable of self-control, when they may instead lack education.

In one of the book’s more interesting digressions, Ms Ehrenreich argues that the idea of self-mastery is misguided since it stems from a misreading of biology. Articulating her “dystopian view of the body”, she rejects the concept of it as a well-oiled machine. Instead it is a battleground. She emphasises new research in immunology that suggests different cells are often in conflict with each other rather than working in concert. Macrophages, often seen as biochemical binmen which circulate gobbling pathogens, can help cancer cells spread—“cheerleaders on the side of death”, she calls them.

It is just one logical step from Ms Ehrenreich’s dystopian view to believing that control over our health is illusory. She urges readers to spend less time

self-medication. “Many people will find this perspective disappointing, even defeatist,” she concedes.

She does go too far. For all the false positives, screening programmes still save lives. Other tenets of preventative medicine, such as vaccines, sanitation and anti-smoking initiatives, save many more. And for most of the world, including America, a lack of health care is a bigger problem than a surplus of it. It may be easy for a well-heeled American to feel over-medicalised; less so a single mother without insurance.

Nevertheless there is a profound message buried in this survey. It is that real choice in health care must involve the freedom to refuse it. ■



反思死亡

暮年的唯一归宿

芭芭拉·艾伦瑞克希望读者抛弃对自己身体的“虚幻的掌控感”

从几年前起，芭芭拉·艾伦瑞克（Barbara Ehrenreich）不再去做体检了。决定放弃癌症筛查和体检的她和她的朋友们形成了鲜明的对比：他们的日历上密密麻麻地记着与医生的预约信息，橱柜里塞满了膳食补充剂和药品。但是，这位76岁的美国作家在《自然原因》一书中解释道，当她意识到自己已经“活得足够久，可以等死了”，就没什么理由再去过一种“医疗化的人生”了。余下的时光“太宝贵”，她可不想“花在没有窗户的候诊室里”。

艾伦瑞克并不是个反科学的嬉皮士。她还是会去看急诊。这位作者出版了20余本社会评论，其中包括备受推崇、记述美国贫困状况的《我在底层的生活》（*Nickel and Dimed*）。她拥有细胞免疫学博士学位。

让她愤慨的是“医疗-产业复合体”售卖的“虚幻的掌控感”。她对承诺让人青春永驻的各种时兴事物大加嘲讽，例如有名人为之代言的“射频紧肤”，对那些专断地鼓吹“成功老化”的书籍也没说什么好话。但她认为类似癌症筛查的各种主流诊疗手段也被吹捧过头了。2012年发表在《新英格兰医学杂志》（*New England Journal of Medicine*）上的一项研究估计，1976年至2008年间，超过100万名美国妇女因原本不会发展出临床症状的肿瘤接受诊断并接受了痛苦的治疗。

不过《自然原因》并不仅仅是对江湖骗子的声讨。本书兼容并蓄——尽管也失之松散——思索了人们对生存和死亡的态度。正如其他作家曾指出的那样，自前现代以来，人们的生死观已发生巨大的变化。法国历史学家菲利普·阿里耶斯（Philippe Ariès）在1974年出版了一本影响深远的著作，探讨了西方社会对人终有一死这种命运的态度。他指出，18世纪以前人们很少会与死亡抗争。那时人们在出生时的预期寿命在30岁徘徊。既然基督教

教导人们活在尘世是为来生做准备，生命何时和如何终结也由上帝决定，那么人们最好在有生之年行善。

科技和经济发展创造了奇迹，在富裕国家，人们的预期寿命现在已超过80岁。总体来看，死亡已不再那么无常而突然。相应地，人们在面对死神时也远不像从前那样可能觉得无助。医生已经取代牧师成为人们心目中由上帝钦点的死亡专家。动感单车训练也取代了圣礼。

在艾伦瑞克看来，“人们可以掌控自己的身体”这种想法既错误又危险。病魔终究会找上所有人。正如菲利普·罗斯（Philip Roth）在小说《凡夫俗子》（Everyman）中写道的那样，“老年是一场大屠杀。”她还说，人们在健康和美德之间划上等号，结果就是那些可能会花每小时100美元健身的富人瞧不起肥胖人士，认为他们缺乏自控力，但后者真正缺的也许是教育。

书中有些枝节话读来更有趣。比如，艾伦瑞克指出，主宰身体的想法之所以是错误的，是因为它源自对生物学的误读。在阐释自己“有关人体的反乌托邦式观点”时，她驳斥了人体是一部运转顺畅的机器这一观念，而认为它是一个战场。她强调，免疫肿瘤学领域的研究显示，不同的细胞往往彼此冲突，而非协同工作。人们常以为巨噬细胞是“生化清道夫”，在组织内游走时会吞噬病原体，然而它们却可能帮助癌细胞扩散。她称它们是“为死亡助威的啦啦队员”。

从她的反乌托邦式观点出发，艾伦瑞克劝人们相信他们对自己身体的掌控感是一种错觉，这是她迈出的合乎逻辑的一步。她呼吁人们少花些时间自我治疗。她承认，“很多人会觉得这种观点令人沮丧，甚至是失败主义论调。”

她的确太激进了。尽管医疗筛查存在误报，但仍挽救了生命。疫苗、公共卫生和反吸烟措施等预防医学的其他种种举措拯救的生命还要更多。对于包括美国在内的世界大部分地区来说，更大的问题在于医疗保健不足，而不是过剩。一名富裕的美国人可能容易觉得自己被过度治疗，但一位没有

保险的单身妈妈就不大会是这样。

然而艾伦瑞克的探究中蕴藏着一个深刻的道理。让人们在面对医疗服务时有拒绝的自由，才算真正赋予了他们选择权。 ■



Undertakers

Death, disrupted

Great news for the dead: the funeral industry is being shaken up

FEW choose how they die, but they can choose what happens next. Most leave this to loved ones who, in their distress, usually outsource the decision to an undertaker. The transaction is often a let-down, with hardly any choices beyond “Burn or bury?” and “Cheque or card?”

The average American funeral with a burial costs nearly \$9,000. In some countries, the exorbitant cost of staging a “proper” funeral can lead families to financial ruin. Nearly everywhere, the bereaved have put up with rip-off last rites because of the lack of better options. At last, technology and competition are starting to disrupt this most conservative of industries (see International section). This is good news for anyone who plans to die one day.

The funeral trade has the most basic of business advantages: inexhaustible demand. Every minute more than 100 people die somewhere. Not all pay for a funeral. Tibetans still practise sky burial, leaving bodies on mountaintops; the Caviteño in the Philippines bury their dead in hollowed-out tree trunks. But in the rich world, dying is big business—an industry, for example, worth \$16bn in 2017 in America.

Undertakers have long been able to get away with poor service. Their customers are typically distressed, under time-pressure and completely inexperienced (people in rich countries buy more cars than they do funerals). As a result, few shop around, let alone haggle. With consumers docile, providers can keep quality low and prices high—much like tourist-trap restaurants, another one-off purchase made in haste with little

information. Some sellers have made matters worse with techniques ranging from opaque pricing to emotional blackmail. The asymmetry in knowledge between undertaker and grief-stricken client allows ludicrous markups on things like coffins. It also makes it easier to sell services that people do not realise are mostly unnecessary, such as embalming.

But now undertakers' market power is being challenged on at least three fronts. One is changing customer demand. Driven in part by the decline of religion, and broader shifts in attitudes to death and dying, fewer bereaved are ready to cede their dead unthinkingly to an off-the-shelf burial. They prefer shrouds and woodland burials to coffins and graveyards; celebrations of life to sombre rituals in funeral homes; and video tributes to a life just lost to displays of the embalmed dead.

Second, more and more, they choose cremation, which is cheaper than burial, and allows a "direct" form in which the disposal of the body is handled without fuss, and kept separate from the commemoration of the life lost. And third, the internet is disrupting death as it has life. Comparison sites shed light on funeral providers' services. And though not many bereaved relations yet "bring their own coffin", a quick browse online gives people a far better idea of what it should cost. Startups are offering more radical disruption: rocket-launches for ashes; QR codes on graves linked to online tributes; new ways of disposing of bodies besides burying or burning.

Nobody is yet writing undertaking's epitaph. But the industry will have to adapt. The first signs of a shift are already on display in America, where funeral-home revenue is projected to stagnate despite an annual death rate—the industry's lifeblood, after all—that is expected to rise. In Britain a price war between the largest providers may at last cause prices to drop.

The most important effect of all this disruption is not just cheaper funerals and fewer debt-burdened families. It is a more profound shift in returning

to consumers perhaps the most personal of all decisions: control over their farewell. ■



殡葬服务商

颠覆死亡

给逝者的好消息：殡葬业被撼动

几乎没有谁能选择自己的死法，不过他们可以选择如何处理自己的身后事。大多数人都把这个选择留给至亲之人，而悲痛的亲朋往往又会委托给殡葬服务商来决定。结果往往令人失望。选择大抵只有“火葬还是土葬？”，“支票还是刷卡？”

在美国，土葬葬礼的平均费用接近9000美元。在某些国家，举行一场“像样”的葬礼花销极高，有可能令死者家庭倾家荡产。几乎在所有地方，亲友们只得咬着牙花大价钱举行临终圣礼，因为也没有更好的选择了。如今，科技和竞争终于开始颠覆这个最保守的行业。这对任何一个打算某天驾鹤西归的人来说都是个好消息。

殡葬业具有一个最基本的商业优势：源源不断的需求。全世界每分钟都有一百多人死去。不是所有人都会为葬礼花钱。藏民仍使用天葬，将遗体置于山顶；菲律宾的甲米地人（Caviteño）将死者安葬在掏空的树干中。但在富裕国家，死亡却是桩大买卖。比如，2017年美国的殡葬业价值160亿美元。

殡葬服务商一直都未因劣质服务而受罚。它们的客户往往情绪悲痛，时间紧而又全无经验（富裕国家的人买车比买丧葬服务多），结果就是几乎没有人会货比三家，更不用说讨价还价了。消费者这么和顺，供应商也就维持低质高价。这很像那些专宰游客的餐馆——游客同样只掌握少量信息，点菜吃饭的时间也有限，而餐馆也不追求回头生意。一些服务商的行径也让情况变得更糟：除了不明码标价，他们还会使出情感勒索等种种手段。由于服务商与它们悲痛欲绝的客户之间存在信息不对称，前者在销售棺材等物品时就可以漫天要价，向后者推销遗体防腐处理之类的服务也更容易，而消费者并不知道这类服务基本上并无必要。

不过，殡葬服务商的市场支配力如今正受到至少三个方面的挑战。首先是顾客需求的变化。某种程度上由于宗教的衰落，加上人们对死亡和临终态度的广泛变化，越来越多的死者亲友不愿不假思索地选择现成的葬礼形式与死者告别。他们更乐意为死者穿上寿衣，安葬在林地中，而不想让死者在墓地的棺材中长眠；更乐意赞颂生命的美好，而不愿在殡仪馆举行沉痛的仪式；更乐意用视频缅怀逝者，而不是让吊唁者瞻仰死者经防腐处理的遗容。

其次，人们越来越倾向选择火化。火化比土葬花费少，形式“直接”，遗体的处理不用那么大事铺张，还可与纪念死者的活动分开。第三，互联网颠覆了人们的“生”，如今又开始颠覆他们的“死”。人们可以通过比价网站了解殡仪服务商提供的服务。另外，虽然“自备棺木”的死者亲属还不是很多，但他们上网快速浏览一下就可以更清楚地了解棺材的合理售价是多少。创业公司提供的服务对殡葬业的颠覆更为激进，像是用火箭将骨灰发射至太空，扫描坟墓上的二维码在线悼念死者，以及土葬或火化以外的遗体处理方式。

目前还没有人着手为殡葬业写墓志铭，但该行业必须做出调整了。转变的迹象已首先在美国显现：尽管年死亡率这一殡葬业的“命脉”预期会升高，但殡仪馆的收入水平预计却将陷入停滞。在英国，规模最大的几家殡葬服务商打起了价格战，最终可能会令价格下降。

殡葬业经受这样的颠覆，最重要的影响不仅仅是丧礼花费降低、承受债务重压的家庭减少。它还会带来一个更加意义深刻的转变：将一个也许最为私人的决定交还给消费者，由他们来掌控自己向世界告别的方式。 ■



Genomes and privacy

No hiding place

American police have used genealogy to make an arrest in a murder case

ON APRIL 24th police in California announced the arrest of Joseph DeAngelo. Mr DeAngelo stands accused of eight counts of murder. On April 27th some intriguing details emerged of what had prompted the arrest. The starting-point was genetic material recovered from the crime scenes. Though this directly matched no DNA held in a police database, analysis of it led investigators all the way back to the 1800s, to Mr DeAngelo's great-great-great grandparents. The trail they followed allegedly links Mr DeAngelo to crimes committed around Sacramento in the 1970s and 1980s by an unknown man who acquired the nickname of the Golden State Killer, and who murdered at least 12 people and raped more than 50.

That a link to distant ancestors could lead to an arrest is testament to the power of modern genomics. Investigators first uploaded Mr DeAngelo's genetic profile to a website called GEDmatch. This allows anyone to use his or her own genetic profile to search for family connections. GEDmatch's database turned out to hold profiles, returned as weak matches, which looked as if they had come from distant cousins of the Golden State Killer. GEDmatch encourages uploaders to include their real name with their genomes, and the investigators were able to trace back through the matches' parents and grandparents to find their most recent common ancestor. Then, having moved backward in time, they moved forward again, looking for as many as possible of this ancestor's descendants. Using newspaper clippings, census records and genealogy websites, they discovered some 25 family trees stretching down from the common ancestor. On its own, the tree on which Mr DeAngelo appears has 1,000 members.

After that, old-fashioned sleuthing took over. From these thousands of descendants, the detectives found two who had had connections with Sacramento at the time the Golden State Killings were taking place. One was eliminated from the investigation by further DNA tests of a family member. The other, Mr DeAngelo, was arrested after police had tested the DNA on an item he had discarded.

If a serial killer really has been caught using these methods, everyone will rightly applaud. But the power of forensic genomics that this case displays poses concerns for those going about their lawful business, too. It bears on the question of genetic privacy—namely, how much right people have to keep their genes to themselves—by showing that no man or woman is a genetic island. Information about one individual can reveal information about others—and not just who is related to whom.

With decreasing degrees of certainty, according to the degree of consanguinity, it can divulge a relative's susceptibilities to certain diseases, for example, or information about paternity, that the relative in question might or might not want to know, and might or might not want to become public. Who should be allowed to see such information, and who might have a right to see it, are questions that need asking.

They are beginning to be asked. In 2017 the Court of Appeal in England ruled that doctors treating people with Huntington's chorea, an inherited fatal disease of the central nervous system the definitive diagnosis of which is a particular abnormal DNA sequence, have a duty to disclose that diagnosis to the patient's children. The children of a parent who has Huntington's have a 50% chance of inheriting the illness. In this case, a father had declined to disclose his newly diagnosed disease to his pregnant daughter. She was, herself, subsequently diagnosed with Huntington's. She then sued the hospital, on the basis that it was her right to know of her risk. Had she known, she told the court, she would have terminated her pregnancy.

That is an extreme case. But intermediate ones exist. For example, certain variants of a gene called BRCA are associated with breast cancer. None, though, is 100% predictive. If someone discovers that he or she is carrying such a variant, should that bring an obligation to inform relatives, so that they, too, may be tested? Or does that risk spreading panic to no good end?

It may turn out that such worries are transient. As the cost of genetic sequencing falls, the tendency of people to discover their own genetic information, rather than learning about it second-hand, will increase. That, though, may bring about a different problem, of genetic snooping, in which people obtain the sequences of others without their consent, from things like discarded coffee cups. At that point genetic privacy really will be a thing of the past. ■



基因组与隐私

无所遁形

美国警方利用基因族谱分析缉拿杀人案嫌疑犯

加州警方4月24日宣布逮捕约瑟夫·迪安吉多（Joseph DeAngelo），他被指控犯有八项谋杀罪。4月27日，导致嫌犯归案的一些耐人寻味的细节曝光。一切始于从犯罪现场采集到的遗传物质。尽管在警方数据库里找不到与其直接匹配的DNA数据，但调查人员分析这些物质后一直追溯到了迪安吉多在19世纪的先祖。他们跟踪的线索显示，迪安吉多涉嫌与20世纪七八十年代在萨克拉门托附近发生的多宗凶案有关。当时，一名身份不明的男子杀害了至少12人，强奸超过50人，被冠以“金州杀手”的绰号。

通过与先祖的遗传联系缉拿嫌犯，这证明了现代基因组学的强大力量。调查人员先是把迪安吉多的基因档案上传到GEDmatch网站上，该网站能让任何人使用自己的基因档案搜寻亲缘联系。他们发现该数据库中有基因档案与凶案现场的基因呈弱匹配，貌似是金州杀手的远房亲戚。因为GEDmatch鼓励人们实名上传自己的基因组信息，调查人员得以通过这些匹配者的父母和祖父母找到他们最近的共同祖先。经过这番向上追溯后，他们又往下查探，尽可能寻找这位祖先的所有后代。利用剪报、人口普查记录和家谱网站，他们发现了该共同祖先传续下来的约25支家族。单是迪安吉多所在的支系就有一千人。

接着就是传统的侦查工作了。在这成千上万的后裔中，警方探员发现有两人在金州杀人案发生时与萨克拉门托有关联。在对某一家族成员做进一步的DNA检测后，其中一人被排除。剩下一人也就是迪安吉多在警方检测其丢弃物品上的DNA后被捕。

如果通过这些方法真的抓到了一名连环杀手，人们自然会拍手称快。但法医基因组学在此案中显现的威力也引发了合法使用方面的担忧。这涉及到基因隐私的问题，即人们享有多少保密自己基因信息的权利。而这一案例

显示，在基因世界里没有人是孤岛。一个人的信息可以揭示其他人的信息，而且不仅是谁跟谁有亲缘关系那么简单。

举例来说，基因信息可显示一位亲属遗传某些疾病的几率或其亲子关系信息，确定性随血缘关系渐远而降低。而这位亲属不一定想知道这一切或公开这些信息。谁可以获准查看这些信息？谁又有权查看这些信息？这些都是需要提出的问题。

已经有人开始提出这类质疑。2017年，英格兰上诉法院裁定，治疗亨廷顿舞蹈症患者的医生有责任向患者子女披露诊断结果。这是一种中枢神经系统的遗传性致命疾病，通过发现特定异常的DNA序列确诊。若父母一方患有此症，孩子遗传患病的几率为50%。在该案中，一名父亲拒绝向其怀孕的女儿透露自己最近被确诊患病的消息。女儿自己后来被诊断出患有此病，遂将所涉医院告上法庭，理由是她有权知道自己有患病风险。她在庭上声称，假如当时知情，自己本来会终止怀孕。

这是个极端的案例。但也有一些不那么极端的情况。例如，有一种名为BRCA的基因，它的某些变体与乳腺癌相关，但没有哪个变体会100%引发乳腺癌。假如有人发现自己携带这样一个基因变体，是否有义务告知亲属，好让他们也去做检测？还是说，这可能导致恐慌蔓延，于人无益？

最终，这些可能只是一时的担忧。随着基因测序成本的下降，人们会更倾向于主动了解自己的遗传信息，而非间接获得二手信息。但这又带来了另一个问题——基因窥探，即在未经本人同意的情况下获得他人的基因序列信息，例如从别人丢弃的咖啡杯等物品上获取。到那时，遗传隐私就永远地成为了历史。■



Automotive engineering

The art of reflection

How paint jobs can make autonomous cars safer

CUSTOMERS could, Henry Ford once quipped, have a car in any colour they wanted so long as it was black. In the end consumer choice got the better of him; cars now come in all manner of complexions. Black, nevertheless, remains popular. Some 17% of new cars sold around the world are black, second only to white, at 37%. White is favoured in hot countries because, along with silver, it is good at reflecting light—including the infra-red wavelengths that carry most of the sun's heat. Black, grey and other dark colours, in contrast, absorb light, thereby warming cars painted in those hues.

Despite Ford's equivocations, none of this has, until recently, presented carmakers with much of a problem. That is changing because, besides absorbing sunlight, dark shades also tend to absorb much of the signal transmitted from the increasing number of sensors being fitted to vehicles.

Radar sensors are used to operate safety systems such as automatic braking. They transmit radio waves and measure the time it takes for those waves to bounce back, and any changes in their frequency. From this it is possible to determine the range, position and velocity of objects around a vehicle. If some or all of the signal is absorbed instead of being reflected, though, radar sensors can miss things.

The same is true of lidar, which is similar to radar except that it employs infra-red laser light instead of radio waves. At present lidar is big and bulky (the blob-shaped roof racks on self-driving cars are lidar sets) but miniature versions are being developed. Though self-driving cars have suffered

setbacks recently (in March a pedestrian was killed in Arizona by an Uber test vehicle fitted with lidar and a Tesla running on radar-assisted Autopilot crashed and killed its driver in California), both radar and lidar are likely to be used more widely as cars become more automated.

To improve the reliability of sensors it would help if all vehicles were painted in colours that are good at reflecting a wide range of wavelengths. But that is not going to happen, for the same reason Ford had eventually to introduce shades other than black—namely that colour is an essential part of vehicle design and marketing. But PPG, a firm in Pittsburgh that is one of the world's biggest suppliers of paints and coatings, believes it has an answer. Its researchers are tampering with paint at a molecular level so that whatever colour a coat of it appears to be to the human eye, it will still be highly reflective to the signals from a car's sensors.

Painting cars has become a high-tech process. Painted surfaces are now so good that cars barely rust as they once did. Arriving at this perfection involves the extensive cleaning and preparation of the surfaces in question, and the spraying of several layers of different formulations of paint in precise ways, usually by robots. As the layers dry, chemical reactions can change the size and spacing of pigments within them to produce such effects as vibrant colours or deep, rich tints. It is this sophistication that has allowed PPG's paint technologists to make dark colours reflective to the signals from sensors.

The clue as to how to do this came in the form of an aubergine (or eggplant, as it is known in America). The aerospace division of PPG had already solved a different problem—that of keeping aircraft painted in dark colours cool—by basing the way they paint these aircraft on the dark-purple skin of aubergines. Instead of absorbing infra-red radiation, an aubergine's skin permits such wavelengths to pass through. They are then reflected back out again by the vegetable's white interior flesh. That way, an aubergine in a

sunny field remains cool. By dispersing specially engineered pigments in a dark-coloured surface layer over the top of a reflective white underlayer, PPG was able to achieve the same thing for aircraft paint.

And, as David Bem, PPG's chief technology officer, observes, what works for solar heat also works for the sensor radiation bounced back from cars. This permits a similar approach to be taken to the painting of vehicles in dark colours. Dr Bem also reckons that a reverse approach could be used to tone down, in relevant frequencies, road signs that are designed to be super bright to people but thus risk blinding lidars. In such cases, Dr Bem says, it is possible to engineer the pigments and layers of paint in ways that retain the brightness for human eyes but tone down the dazzling effect on artificial ones. ■



汽车工程

反射的艺术

喷漆工艺如何让无人驾驶汽车更安全

亨利·福特曾打趣说，客户想要什么颜色的车都可以，只要是黑色的就行。最终，还是消费者的喜好占了上风：汽车现在有各种颜色。不过，黑色仍然很受欢迎。全球售出的新车约有17%是黑色，仅次于占37%的白色。白色在气候炎热的国家很受欢迎，因为它和银色一样能很好地反射光线，包括传递大部分阳光热量的红外光。而黑色、灰色和其他深色车体会吸收光线，让车内温度升高。

尽管福特如此“搪塞”，不过颜色从没给汽车制造商带来什么问题，直到最近。情况发生变化的原因是如今汽车安装的传感器越来越多，深色车漆除了吸收阳光，往往还会吸收传感器发射的大部分信号。

雷达传感器用于操作自动制动等安全系统。它们会发射无线电波，并测量电波反射回来的时间以及任何频率上的变化，由此就可以确定车辆周围物体的距离、位置和速度。如果部分或全部信号被吸收而没有反射回来，雷达传感器可能就会“漏掉”一些事物。

激光雷达也有同样的问题。激光雷达与雷达很相近，只不过采用的是红外激光而不是无线电波。目前的激光雷达装置大而笨重（无人驾驶汽车车顶支架上的那坨东西就是激光雷达），不过微型版本正在研发中。虽然无人驾驶汽车最近遭受挫折（3月，亚利桑那州一辆装有激光雷达的优步测试车撞死了一名路人；一辆雷达辅助自动驾驶模式下的特斯拉汽车在加州发生车祸，驾驶员丧生），但随着汽车自动化程度的提高，雷达和激光雷达很可能都会更加普及。

要提高传感器的可靠性，可以给所有车辆都涂上能够反射各种波长的颜色。但这不可能实现，因为颜色是汽车设计和市场营销的重要组成部分，

当初福特最终在黑色之外推出了其他颜色也正是因为这个原因。不过PPG公司认为自己找到了解决办法，这家位于匹兹堡的公司是全球最大的油漆和涂料供应商之一。其研究人员在分子水平上对油漆进行了调整，无论在人眼中是什么颜色，都能高度反射来自汽车传感器的信号。

汽车喷漆已成为一道高技术含量的工序。如今，汽车漆面的保护效果非常好，几乎不会像以前那样生锈。要达到这种完美效果，需要对车体表面进行大量的清洁和预处理，再精确地喷涂多层不同配方的油漆——这项任务通常由机器人完成。漆层干燥时发生的化学反应可以改变颜料颗粒的大小和间距，从而产生或鲜艳亮丽、或深沉厚重的色彩效果。正是凭借这种复杂的技术，PPG的油漆技术人员得以确保深色油漆也能反射来自传感器的信号。

这一技术的灵感源于茄子。PPG的航空涂料部门已经解决了另一个不同的问题：让涂上深色漆的飞机不因此而升温。方法是根据茄子的深紫色外皮的特点来给这些飞机上漆。茄子皮会让红外光通过而不会吸收它们，而茄子内部的白色果肉又会将这些红外光反射回外部。这样，即使艳阳高照，地里的茄子也不会发热。通过在位于下层白色反射层上方的深色涂料层中散布经特殊处理的颜料，PPG能让飞机涂料也获得同样的效果。

正如PPG的首席技术官大卫·贝姆（David Bem）所说，能反射阳光热量的技术也适用于让汽车反射传感器信号。因此，可以采用类似的方法给车辆喷涂深色漆。贝姆还认为，还可以采用相反的做法，降低路标对某些频率的光的反射。路标需要在人眼中非常明亮，但这可能会把激光雷达“亮瞎”。贝姆说，在这种情况下，可以对颜料和涂层进行处理，让路标既能保持在人眼中的亮度，又能减少对感应设备的冲击。■



Economic and financial indicators

Trade-weighted exchange rates

The dollar, on a downward trajectory since the end of 2016, has risen recently

A country's trade-weighted exchange rate is an average of its bilateral exchange rates, weighted by the amount of trade with each of its partners. The dollar, on a downward trajectory since the end of 2016, has risen recently. The greenback has been boosted principally by rising bond yields, which reflect a more positive outlook for the American economy. The Japanese yen, conventionally a safe-haven currency, rose in the first quarter of this year partly because of reduced quantitative-easing purchases; the rally has since eased. The pound has made up ground from its lows after the Brexit referendum. But weak inflation data are putting it under renewed pressure. ■



经济与金融指标

贸易加权汇率

自2016年末一直呈下滑趋势的美元近日反弹

一个国家的贸易加权汇率是其双边汇率的平均值，这个值受该国与各贸易伙伴国之间的贸易量比重加权。自2016年末一直呈下滑趋势的美元近来出现反弹。这主要是受美债收益率上升提振，而收益率上升反映出美国经济前景更为乐观。作为传统避险货币的日元在今年第一季度走高，部分原因是日本央行缩减量化宽松规模，购债减码。自那以后，日元的反弹趋势已经放缓。英镑已从脱欧公投后的低点收复失地，但疲弱的通胀数据正令英镑重新受压。 ■



Trade with America

Assessing the pain

America says a threatened trade war with China is on hold. Chinese officials still have plenty to worry about

WANG XINGXING taps the back of his dog which, on command, stands tall, shakes its legs and struts forward. It is not a well-trained pooch so much as a well-built one. Laikago, its name, looks like a miniature version of the robo-dogs that propelled Boston Dynamics, an American robotics company, to fame. Mr Wang, a boyish 28-year-old, started work on his dog as a graduate student. It can walk on uneven surfaces, carry small loads and steady itself when kicked lightly.

Laikago is a far cry from the Boston Dynamics breed, which is sturdier, swifter and smarter. That has not stopped China's patriotic media from asking whether the firm Mr Wang founded, Unitree, could now rival the American one. But Boston Dynamics has been at it for more than two decades. Unitree is just getting going. It plans to open its first factory soon. For now it has a cluttered workshop in the city of Hangzhou, a tech hub west of Shanghai.

Unitree is not alone in China. The government has declared robotics a priority. On the other side of Hangzhou, a university research team has also started making robo-dogs. In northern China there are at least three companies doing the same. So, reportedly, is the army. China's robotic technology, by most measures, lags behind America's. But the country has abundant talent, money and determination. Its robo-dogs are snapping at America's heels.

The pooches also show how a trade conflict with America could hurt China. Mr Wang admits that their most valuable parts—their semiconductors—are

mostly made in America. Were the American government to block exports of these to China, Mr Wang's dogs would not work.

That is an extreme scenario. But it is the kind that China's government and companies feel they have to consider as their country's dispute with its largest trading partner grinds on. In the past few days, their fears have ebbed and flowed. On May 20th America's Treasury secretary, Steven Mnuchin, said his country would refrain for now from its threat to impose punitive tariffs. "We're putting the trade war on hold," he told Fox News after two days of talks in Washington with Liu He, a Chinese deputy prime minister. But Mr Trump is unpredictable. He may be mindful of the outrage that Mr Mnuchin's talk has stirred among China-sceptics in Washington. After first declaring success in the negotiations, Mr Trump later said he was dissatisfied. So Chinese officials are still preparing for the worst. And they know that even if this storm blows over, others lie ahead. Rivalry with America is getting more intense.

After the talks, the two sides issued a statement pledging to reduce America's \$375bn trade deficit with China "substantially". But the agreement was strikingly light on details. The Americans wanted China to cut its trade surplus by \$200bn. China refused, pledging only to buy more. Later it said it would cut import duties on cars to 15%, but that was well above the 2.5% level the Americans had demanded. Mr Trump boasted that China had agreed to buy "massive amounts" of American farm goods. But this will have a modest impact on the bilateral trade balance. It will not satisfy some American negotiators who have fumed about China's industrial policies, calling them mercantilism gone wild.

The next steps will depend to a worrying extent on Mr Trump's whims. He could claim China's offers, however limited, as a victory. Or he may conclude that Xi Jinping, China's leader, has played him for a fool and fire off a petulant tweet, nudging the two countries' relationship back into crisis

and reigniting global fears of a full-blown trade conflict.

It may be that Mr Trump does want to ease tensions with China, but only as a temporary ruse to enlist Mr Xi's support for talks due to be held on June 12th between Mr Trump and Kim Jong Un, North Korea's dictator. Once that event is over (if it actually takes place), Mr Trump could again turn up the heat on China. Trade is one of the few issues on which he is close to consistent. Impervious to economic logic, Mr Trump thinks that America loses when it imports more than it exports. China accounts for about three-fifths of America's trade deficit (see chart 1).

And China is not merely contending with a truculent Mr Trump and his more hawkish economic advisers. A broad swathe of American opinion has turned against it. Businesses see a China that is determined to prop up its own companies, both at home and, increasingly, abroad. America's national-security officials see a China that is converting economic heft into geopolitical clout and military might. Kenneth Jarrett of the American Chamber of Commerce in Shanghai says that Mr Trump's anger about the deficit has at least helped China to wake up to the depth of foreign frustration. A quick deal in which China pledges to buy more American goods will not ease it.

Leading the charge against China on economic matters has been Robert Lighthizer, the United States Trade Representative. In March, after an investigation into China's trade practices, he alleged that China had, time and again, stolen American technology or forced firms to hand it over. He called on China to stop subsidising industries that it deems strategic, from renewable energy to electric vehicles.

From China's standpoint, this is a non-starter. Its plan known as "Made in China 2025" identifies ten high-tech industries and sets out global market-

share goals. For policymakers in Beijing, it is their blueprint for reaching the next level of development—a reasonable desire for a middle-income country, as 19th-century Americans would have agreed. But foreign governments and businesses see it as a declaration of intent to seek global dominance.

The more the rest of the world complains, the more irascible China sounds. Mei Xinyu, a researcher in the commerce ministry, likened America's demands to what are known in China as the country's "unequal treaties" with foreign powers in pre-communist days. The most notorious of these accords was forced on China in 1842 by Britain after a war over British opium sales. It required China to open its doors to foreign trade and cede Hong Kong. State media have been even more colourful than Mr Mei. "Anyone who tries to hinder China's emergence is like a mantis trying to stop a car, or an ant trying to shake a tree, and will pay a bitter price in the end," said the Communist Party's mouthpiece, the People's Daily.

Despite such talk, China worries. There are four main ways in which its economy could be harmed by a trade war with America. The first is by tariffs. Although America has delayed these, they may yet happen. After the talks with Mr Liu, Mr Lighthizer vowed that if China were to fail to change its ways sufficiently, America would use "all of its legal tools", including tariffs, to protect itself. Mr Trump has previously threatened tariffs on \$150bn of imports from China. They would throw sand in the gears of Chinese commerce.

But trade fuels less of China's growth than it used to. Exports to America were the equivalent of nearly 10% of Chinese GDP before the global financial crisis of 2008. Today they are just 4%. China has forged closer ties with many developing countries and cultivated its own domestic market. Moody's, a credit-rating agency, estimates that Mr Trump's initial set of tariffs, valued at \$50bn, would shave only 0.14 percentage points from

China's growth rate—a rounding error for an economy that is expected to grow by about 6.5% this year.

A second vulnerability is to what might be called America's industrial policy in reverse. While China steers investment into favoured sectors, America adopts countermeasures. In recent years the Committee on Foreign Investment in the United States (CFIUS), which checks whether deals threaten national security, has blocked Chinese acquisition of firms in industries from semiconductors to payments. The reviews will only get tougher, says Scott Kennedy of the Centre for Strategic and International Studies, an American think-tank. Previously CFIUS focused on the purchase of controlling stakes. New legislation will expand its oversight to any investment, however small, that might help a "country of special concern" (read: China) catch up with America's technology.

Another bill would specifically restrict Chinese investments in the ten sectors targeted by the Made in China 2025 plan. If America does impose tariffs, they would also mainly focus on these ten industries. Nearly all the proposed duties affect high-tech products such as avionics and medical devices. Low-tech goods that China sells by the shipload would be mostly untouched. He Weiwen, a former diplomat, says that America's goal is not to shrink its trade deficit but to impede China's progress. He has a good point.

China's third vulnerability is to blocks on American exports. A taste of this was given on April 16th when America punished ZTE, a Chinese telecoms firm, for violating sanctions against Iran and North Korea. The penalty was a ban on American sales of parts to the company. ZTE is a large global business. But around 90% of its products use American parts, especially semiconductors. The ban would render ZTE comatose, said its chairman. In the past few days Mr Trump has appeared to have second thoughts on this. On May 13th he pledged to help ZTE "get back into business, fast". On May 22nd he said there was "no deal", but later suggested it may only have to pay

a big fine and change its management. Whatever he is pondering, China has learned a lesson about how tech superiority gives America clout.

Chinese officials frankly admit that their technology is far from the global leading edge. The Made in China 2025 plan can be read as a confession of backwardness. China's dream of becoming a semiconductor powerhouse stirs fear abroad. But it is far from that today. Its domestic production satisfies only a little more than a tenth of its demand for chips (see chart 2). China produces nearly a third of the liquid crystal displays (LCDs) in televisions and car dashboards. But about 50% of the glass substrate used in its LCDs is made by Corning, an American company. Most of the rest comes from Japanese firms. China uses more robots than any other country. But imports account for 72% of the cost of the more complex ones that it makes.

Still more alarming for China is the way that America can weaponise its financial system. By denying banks access to its market, it can freeze them out of international transactions. American politicians muse about punishing big Chinese banks for doing business with North Korea. To reduce its reliance on the dollar, China wants to make the yuan a global currency. But that would require it to open its financial system to foreigners much more widely than it is now willing to do.

China's final area of vulnerability, and potentially its biggest, is to a united international front. Though a conflict with America would be bad, China could eventually work round it. Since the 1990s America has blocked the export of commercial satellites and their parts to China. But China was eventually able to get what it needed from Europe. Its satellite capabilities have almost caught up with America's. (Mr Wang of Unitree says he could redesign his robo-dogs for use with non-American microchips—Laikago would live.)

It would be far worse for China if other countries were also to turn against it. Governments from Australia to Germany have already started objecting to Chinese investments on security grounds, seemingly emboldened by Mr Trump. “We’ve become Chinese takeaway in Europe but we can’t get a look at their companies in China,” says Joerg Wuttke, a former head of the European Chamber of Commerce in China. Twenty-seven European ambassadors to Beijing complained in April that China’s Belt and Road Initiative—its massive overseas investment plan—would harm global trade by subsidising Chinese firms. A multi-country alliance against China would “almost be a doomsday scenario”, says Edward Tse of Gao Feng, an advisory firm. But he believes one is unlikely to emerge. Mr Trump has a tendency to alienate his country’s usual friends.

How could China fight back? Were it just a tit-for-tat tariff battle, America would have the upper hand. America could, in theory, impose duties on its \$500bn-worth of imports from China. China only buys \$130bn of American goods, limiting its scope for retaliation. But it could make the brawl about more than tariffs. It could disrupt the business of American firms in China. The government has form in whipping up consumer boycotts, as South Korean retailers and Japanese carmakers can attest. China is the fastest-growing big market for American companies, from Apple to GM.

If America were to deploy sanctions such as those imposed on ZTE more widely, it would find that China can escalate matters, too. “From zero to 100, anything is possible,” says a senior Chinese government adviser. American firms have invested \$250bn in China, according to Rhodium Group, a consultancy (see chart 3). The potential for asset seizures would keep executives up at night. Supply chains would be torn apart. Apple would no longer be able to use China as its main production base for iPhones. Walmart’s shelves would be bare. America’s chipmakers would lose half their sales. China could further fan the flames by frustrating Mr Trump’s

efforts to bring North Korea to heel, or by flexing muscle against Taiwan or in the South China Sea (where it emerged last week that it had, for the first time, landed long-range bombers on a disputed island).

Given America's entanglement with China, an all-out trade war would be sheer folly. But even if one is avoided, prolonged strategic competition remains likely. Some analysts say this would involve a tech war or an economic cold war. These terms are misleading. China's integration with the global economy cannot be undone; there is no real way to cut it off as America once did to the Soviet Union. But China's ascent could get much bumpier. It is likely to face more restrictions on overseas investments, more pressure to open its market and more scrutiny of its economic policies. China's options for countering such amorphous efforts are not straightforward.

A complicating factor in China's handling of the trade dispute is nationalism. Advisers have highlighted the risk of going too far to placate foreigners. Zhang Ming of the Chinese Academy of Social Sciences recalls the Plaza Accord, a multinational agreement reached in 1985 under American pressure. It resulted in a soaring yen, arguably leading to Japan's economic stagnation in later years. Mr Zhang says that China must resist such pressure. Going by their unwillingness to yield to America's demands for deficit-reduction targets, Chinese leaders seem to agree.

Their response instead has two planks. The first involves reducing dependence on foreign technology. The punishment of ZTE has only reinforced their commitment to this strategy. China must "cast aside illusions and rely on ourselves", President Xi said in a speech shortly after the American sanctions against the company were announced. One outcome has been more money for the semiconductor industry. China has nearly finished raising a 300bn yuan (\$47bn) fund to foster domestic chipmakers, its biggest ever.

Officials are aware that excessive government meddling in industry can be counterproductive. China has previously tried but failed to create chipmaking champions. So the state's fund managers are now operating more like venture capitalists. They are spreading cash around and monitoring returns. Much the same is happening in the other industries specified in the Made in China 2025 plan, from biotechnology to aerospace.

A go-it-alone approach to innovation rarely works. China has been most successful in industries such as high-speed rail, in which it has obtained foreign technology and combined it with domestic know-how. Hence the second plank of China's strategy: winning foreign friends, even if not the Americans. China still needs foreign technology, so is doing what it can to stop antagonism from coalescing.

Diplomatically, it is taking a softer tack. One recent example was its support for a three-way leaders' summit with Japan and South Korea. This was held on May 9th after years of tetchy relations. Chinese negotiators also want to give Mr Trump at least something he can claim as a victory. During the talks in Washington they promised that China would buy more farm goods and oil from America.

China has started throwing juicier morsels at foreign firms, too. It has unveiled a faster timeline for opening its banking industry to foreign investors. It has pledged to scrap limits on foreign ownership of carmakers. It has also been arguing that deals generated by its Made in China 2025 scheme will involve foreign businesses.

These steps alone will not disarm critics. Even with full control of their Chinese operations, foreign companies will encounter regulatory hurdles, written and unwritten. Foreign governments will continue to bristle as well-funded Chinese companies buy up technology. The rivalry that has brought

China and America to the brink of a trade war will not abate.

But so long as China can keep enough foreign businesses and governments on side for enough of the time, it will be able to carve out space for its economic rise. Faced with obstructive foreigners, China might well find that the target date of Made in China 2025 is overly ambitious. Yet that will not induce it to give up. Made in China 2035? If that, in effect, were the outcome, China could live with it. ■



对美贸易

疼痛评估

美国称对华贸易战的威胁暂缓。中国官员仍有诸多担忧

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Oil

The crude curve

Does dear oil help or hurt emerging economies? It's complicated

When they are not fretting about the American dollar or Chinese debt, policymakers in emerging economies keep a close eye on the oil market. The price of Brent crude has risen by nearly 50% in the past year to around \$80 a barrel. It ranks as the 11th-biggest spike in the past 70 years (adjusted for inflation), according to UBS, a bank. So should emerging markets now worry that oil prices will carry on rising above \$100, or that they will tumble below \$50? The answer is yes.

Many emerging economies import oil; others export it. As a rule, higher prices hurt the first group and lower ones hurt the second. But it can be more complicated than that. Indonesia, for example, is a net importer of oil, but a net exporter of “energy”, more broadly defined, including coal and palm oil. Since coal, palm and oil prices tend to rise roughly in tandem, Indonesia would benefit overall from \$100 oil, according to UBS. Mexico, like America, is also a net importer of crude. But in both countries a higher oil price will help investment and employment in the oil industry by more than it hurts household spending.

The impact of a price change also depends on the price level. A jump from cheap to dear oil works differently than a jump from dear to even dearer. In America, many rigs that are not profitable at \$40 become viable at \$60 or more. Conversely, most rigs that would be lucrative at \$120 are already viable at \$100. So an increase in price from \$40 to \$60 might inspire a lot of additional investment and employment, whereas an increase from \$100 to \$120 might induce less. Meanwhile, the damage to household wallets increases relentlessly.

As a consequence, the relationship between oil and growth is not straight but curvy. Prices below \$50 and above \$75 seem to hurt global prospects, according to calculations by Arend Kapteyn of UBS. In between, they appear to help.

Thus if the oil price remains within its recent range, the global economy should suffer few ill effects. But that is a big if. It is perilous to predict whether the oil price will lurch up or down, safer to predict that it will do one of the two. ■



石油

原油曲线

昂贵的石油会帮助还是伤害新兴经济体？情形复杂

当新兴经济体的政策制定者不担心美元或中国债务时，他们会密切关注石油市场。过去一年布伦特原油价格上涨了近50%，达到每桶80美元左右。根据瑞银（UBS）的数据，这是过去70年中的第11大涨幅（经通胀调整后）。那么新兴市场是否应该担心油价会继续攀升至每桶100美元以上或是跌破50美元？答案是肯定的。

许多新兴经济体都进口石油，还有一些会出口石油。通常情况下，高油价会伤害前一类经济体，低油价则会伤害后一类。但情况可能比这更复杂。例如，印尼是石油净进口国，但按照更宽泛的定义，将煤炭和棕榈油包括进来，印尼又是“能源”净出口国。根据瑞银的数据，由于煤炭、棕榈油和石油价格往往大致会一前一后地上涨，印尼总体上将从每桶100美元的油价中受益。墨西哥和美国一样，也是原油净进口国。但是在这两个国家，高油价对于石油业获得投资和增加岗位的助力将大于对家庭支出的损害。

价格变化的影响也取决于价格水平。油价从便宜到贵和从贵到更贵的影响是不同的。在美国，许多钻井平台在油价每桶40美元时无利可图，但如果油价达到60美元或者更高，它们就能维持下去。相反，大部分在油价120美元时利润丰厚的钻井平台在油价为100美元时就已能维持。因此，油价从40美元涨至60美元也许能激发投资和就业大量增加，而从100美元涨至120美元带来的这种增加可能较少。同时，油价上涨对家庭钱袋子的损害不断增加。

因此，石油与经济增长之间的关系不是直线而是曲线式的。据瑞银的阿伦·卡普廷（Arend Kapteyn）计算，油价低于50美元或超过75美元似乎都会损害全球经济前景，处于50美元至75美元之间则可能对经济有益。

所以如果油价保持在近期的范围内，全球经济应该就几乎不会受到什么负面影响。但这是一个很大的未知数。预测油价是否会上下波动非常冒险，还是预测它非涨即跌更稳妥些。 ■



Privacy and advertising

GDParrrgh...

Who will be the main loser from Europe's new data-privacy law?

“PLEASE don’t leave us.” From the dozens of e-mails in people’s inboxes, begging them to give their consent to be sent further messages, you could deduce that the senders of newsletters and the like are hardest hit by the European Union’s tough new privacy law, the General Data Protection Regulation (GDPR), which goes into effect on May 25th. But the main loser may well be an industry that few have ever heard of but most have dealings with every day: advertising technology, or ad tech. In fact, the GDPR would probably not exist at all were it not for this collection of companies, which have an insatiable hunger for personal data.

Ad tech emerged because advertising is the internet’s default business model. Since targeted ads tend to be more efficient and targeting requires personal data (sites previously visited, searches in online stores and the like), these data became the fuel of a new industry to automate online advertising. It is so complex that even experts often resort to what is known as “LUMAscape”, a collection of maps of the business packed with logos put together by Luma Partners, a bank. It lists hundreds of firms in 18 different subcategories.

One cause for this fragmentation is the generosity of over-optimistic venture capitalists, who have backed even the most unlikely ad-tech ideas. Another is the nature of the beast: many cogs have to mesh to match people and ads in real-time. The fact that personal data are widely shared with lots of companies creates even more business complexity—but also makes the system a favourite target of privacy advocates.

Yet the “ad-tech bubble” has been deflating for some time, says Brian Wieser of Pivotal, a research firm. The industry thought that consumers would welcome “relevant” ads, but as these got more intrusive and creepy, people reacted by installing ad-blockers. Both Facebook and Google, ad-tech ecosystems unto themselves, have grabbed ever more ad dollars, leaving slim pickings for rivals. As a result, the industry was already consolidating.

The GDPR will speed up the process by, in effect, assigning a value to personal data. Under a realistic reading of the GDPR, most ad-tech firms will need consent from individuals to process their data. This will be hard, since most have no direct relationship with consumers. And even if they do, people are unlikely to approve being tracked across the web; only 3% would opt in, according to Johnny Ryan of PageFair, an ad-tech firm critical of the industry.

Reactions to GDPR have varied. Some ad-tech companies have pulled out of Europe. Others think they can get away with claiming “legitimate interest”, which is another legal basis for processing personal data allowed by the GDPR—an optimistic interpretation, and one that is likely to become obsolete with the ePrivacy directive, another privacy law the EU is working on. For its part, the European arm of the Interactive Advertising Bureau, a lobbying group, has released technical standards to ensure that an individual’s consent or the lack thereof is communicated across the advertising supply chain.

Another tack is to try and use the GDPR to improve companies’ position in the market. Google has told all the websites and apps that use its ad-tech tools that they must get people’s consent. It also says that if they use its consent tool, they must limit their use of other ad-tech vendors. That has publishers up in arms. They worry it will make Google an even more dominant force in the online advertising market. Instead, they harbour hopes that the GDPR will end up helping them. The rise of ad tech meant

that advertisers no longer targeted websites and apps, but people. If the law makes individual targeting more difficult, publishers will regain some control of customer relationships, says Jason Kint of Digital Content Next, a publisher group.

Early signs suggest that the ad-tech industry may indeed be turning away from individually targeting people, and not only in Europe. Google, for instance, has said it will offer ads that are less targeted at particular individuals. A group of media companies has launched TrustX, a non-profit ad exchange which does not allow people's data to be shared by lots of other firms. If the GDPR strengthens this trend, consumers will breathe easier online—and not just because their inboxes will be emptier. ■



隐私与广告

GDPR来啦

欧洲出台新数据隐私法，谁将成为大输家？

“请不要离开我们。”人们的收件箱收到数十封这样的电子邮件，请求他们同意继续接收信息。你可能会由此推断，在5月25日欧盟严格保护隐私的新法律《通用数据保护条例》（GDPR）生效后，受打击最重的是这类发送营销内容的企业。然而，主要的输家很可能是一个少有人听说、但大多数人每天都在接触的行业：广告技术。事实上，要不是因为这个对个人数据贪得无厌的行业的存在，GDPR条例可能根本就不会出台。

广告技术的兴起是因为广告是互联网的默认商业模式。由于定向广告往往更奏效，而定向又需要个人数据（曾访问过的网站、在网上商店的搜索历史等），因此这些数据成为一个新行业实现在线广告自动化的“燃料”。广告技术十分复杂，连专家也要经常依靠LUMAscape这份行业地图。该地图由投行Luma Partners绘制，分18个类别罗列了数百家公司的标志。

市场如此分散，一个原因是过度乐观的风险资本家慷慨投资——他们甚至会支持那些最不切实际的广告技术理念。另一个原因是这一行业的特性：要实现人和广告的实时匹配需要众多环节的紧密配合。众多公司广泛共享大量个人数据，增加了业务的复杂性，但同时也让整个系统成为隐私保护倡导者最热衷攻击的目标。

不过，研究公司Pivotal的布莱恩·威泽（Brian Wieser）表示，“广告技术泡沫”一直在缩小。业界以为消费者会欢迎“关联性”广告，但这些广告越来越能干扰人，也越来越鬼鬼祟祟，人们开始安装广告拦截软件。自成广告技术生态系统的Facebook和谷歌攫取了越来越多的广告收入，没给竞争对手留下什么机会。因此，该行业已经在整合。

GDPR条例实际上是为个人数据赋予了价值，将加速这一整合过程。一种对GDPR条例比较现实的解读是，大多数广告技术公司未来将需要征得个

人同意才能使用他们的数据。这会很难，因为这些公司大多与消费者并无直接关系。即使有，人们也不太可能同意自己在网上被跟踪。约翰尼·莱恩（Johnny Ryan）在对该行业持批评态度的广告技术公司PageFair任职，他说只有3%的人会给予这样的许可。

业界对GDPR条例的反应各有不同。一些广告技术公司已退出欧洲市场，另一些认为它们可以借“合法利益”的名义侥幸过关。“合法利益”是GDPR允许使用个人数据的另一个法律基础——一种对条例的乐观解读，并且可能会随着欧盟正在修订的另一部隐私法《电子隐私指令》（ePrivacy directive）的实施而失效。在业内，游说团体美国互动广告局（Interactive Advertising Bureau）的欧洲分部已经发布了技术标准，确保整个广告供应链都能知晓是否获得了某个人的许可。

另一种做法是尝试利用GDPR条例来改善企业的市场地位。谷歌已经告知所有使用其广告技术工具的网站和应用必须获得人们的个人数据使用许可。它还表示，如果它们使用谷歌的许可工具，就必须限制使用其他广告技术供应商。这让出版商们很恼火，担心这会进一步加强谷歌在网络广告市场的主导地位。它们反而暗暗希望GDPR条例最终能帮到它们。广告技术的崛起意味着广告主瞄准的不再是网站和应用，而是人。出版集团未来数字内容公司（Digital Content Next）的詹森·金特（Jason Kint）说，如果法律让精准定向广告变得更难开展，出版商将重新获得一些对客户关系的控制权。

早期迹象表明，广告技术行业可能确实正在放弃定向广告，而且不仅仅是在欧洲。例如谷歌已表示未来将减少提供针对特定个人的广告。一批媒体公司已经推出了非盈利广告交易平台TrustX，该平台不允许个人数据被分享给其他众多公司。如果GDPR条例强化了这一趋势，消费者在网上将能松一口气——不仅仅是因为他们的收件箱不会那么满了。 ■



University rankings

Higher and higher education

League tables lead universities to favour research over teaching and hard sciences over the humanities. Yet they foster global co-operation

In early May Peking University played host to perhaps the grandest global gathering ever of the higher-education business. Senior figures from the world's most famous universities—Harvard and Yale, Oxford and Cambridge among them—enjoyed or endured a two-hour opening ceremony followed by a packed programme of mandatory cultural events interspersed with speeches lauding “Xi Jinping thought”. The party was thrown to celebrate Peking University’s 120th birthday—and, less explicitly, China’s success in a race that started 20 years ago.

In May 1998 Jiang Zemin, China’s president at the time, announced Project 985, named for the year and the month. Its purpose was to create world-class universities. Nian Cai Liu, a professor of polymeric materials science and engineering at Shanghai Jiao Tong University, got swept up in this initiative. “I asked myself many questions, including: what is the definition of and criteria for a world-class university? What are the positions of top Chinese universities?” Once he started benchmarking them against foreign ones, he found that “governments, universities and stakeholders from all around the world” were interested. So, in 2003, he produced the first ranking of 500 leading global institutions. Nobody, least of all the modest Professor Liu, expected the Shanghai rankings to be so popular. “Indeed, it was a real surprise.”

People are suckers for league tables, be they of wealth, beauty, fame—or institutions of higher education. University rankings do not just feed humanity’s competitive urges. They are also an important source of

consumer intelligence about a good on which people spend huge amounts of time and money, and about which precious little other information is available. Hence the existence of national league tables, such as US News & World Report's ranking of American universities. But the creation of global league tables—there are now around 20, with Shanghai, the Times Higher Education (THE) and QS the most important—took the competition to a new level. It set not just universities, but governments, against each other.

When the Shanghai rankings were first published, the “knowledge economy” was emerging into the global consciousness. Governments realised that great universities were no longer just sources of cultural pride and finishing schools for the children of the well-off, but the engines of future prosperity—generators of human capital, of ideas and of innovative companies.

The rankings focused the minds of governments, particularly in countries that did badly. Every government needed a few higher-educational stars; any government that failed to create them had failed its people and lost an important global race. Europe's poor performance was particularly galling for Germany, home of the modern research university. The government responded swiftly, announcing in 2005 an *Exzellenzinitiative* to channel money to institutions that might become world-class universities, and has so far spent over €4.6bn (\$5.5bn) on it.

Propelled by a combination of national pride and economic pragmatism, the idea spread swiftly that this was a global competition in which all self-respecting countries should take part. Thirty-one rich and middle-income countries have announced an excellence initiative of some sort. India, where world rankings were once regarded with post-colonial disdain, is the latest to join the race: in 2016 the finance minister announced that 20 institutions would aim to become world-class universities. The most generously funded initiatives are in France, China, Singapore, South Korea

and Taiwan. The most unrealistic targets are Nigeria's, to get at least two universities in the world's top 200, and Russia's, to get five in the world's top 100, both by 2020.

The competition to rise up the rankings has had several effects. Below the very highest rankings, still dominated by America and western Europe—America has three of the THE's top five slots and Britain two this year—the balance of power is shifting (see chart). The rise of China is the most obvious manifestation. It has 45 universities in the Shanghai top 500 and is now the only country other than Britain or America to have two universities in the THE's top 30. Japan is doing poorly: its highest-ranked institution, the University of Tokyo, comes in at 48 in the THE's table. Elsewhere, Latin America and eastern Europe have lagged behind.

The rankings race has also increased the emphasis on research. Highly cited papers provide an easily available measure of success, and, lacking any other reliable metric, that is what the league tables are based on. None of the rankings includes teaching quality, which is hard to measure and compare. Shanghai's is purely about research; THE and QS incorporate other measures, such as “reputation”. But since the league tables themselves are one of its main determinants, reputation is not an obviously independent variable.

The research boom is excellent news for humanity, which will eventually reap the benefits, and for scientific researchers. But the social sciences and humanities are not faring so well. They tend to be at a disadvantage in rankings because there are fewer soft-science or humanities journals, so hard-science papers get more citations. Shanghai makes no allowance for that, and Professor Liu admits that his ranking tends to reinforce the dominance of hard science. Phil Baty, who edits the THE's rankings, says they do take the hard sciences' higher citation rates into account, scoring

papers by the standards of the relevant discipline. But that is only a partial solution: much social-science and humanities output comes in the form of books rather than papers, which the rankings do not count. Moreover, researchers in those subjects tend to write in local languages. The rankings count only work in English.

The hard sciences have benefited from the bounty flowing from the “excellence initiatives”. According to a study of these programmes by Jamil Salmi, author of “The Challenge of Establishing World-Class Universities”, all the programmes except Taiwan’s focused on research rather than teaching, and most of them favoured STEM subjects (science, technology, engineering and mathematics). This is no doubt one of the reasons why the numbers of scientific papers produced globally nearly doubled between 2003 and 2016.

The rankings may be contributing to a deterioration in teaching. The quality of the research academics produce has little bearing on the quality of their teaching. Indeed, academics who are passionate about their research may be less inclined to spend their energies on students, and so there may be an inverse relationship. Since students suffer when teaching quality declines, they might be expected to push back against this. But Ellen Hazelkorn, author of “Rankings and the Reshaping of Higher Education”, argues that students “are buying prestige in the labour market”. This means “they want to go to the highest-status university possible”—and the league tables are the only available measure of status. So students, too, in effect encourage universities to spend their money on research rather than teaching.

The result, says Simon Marginson, Oxford University’s incoming professor of higher education, is “the distribution of teaching further down the academic hierarchy”, which fosters the growth of an “academic precariat”. These PhD students and non-tenured academics do the teaching that the star professors, hired for their research abilities, shun as a chore. The British

government is trying to press universities to improve teaching, by creating a “teaching-excellence framework”; but the rating is made up of a student-satisfaction survey, dropout rates and alumni earnings—interesting, but not really a measure of teaching quality. Nevertheless, says Professor Marginson, “everybody recognises this as a problem, and everybody is watching what Britain is doing.”

A third concern is that competition for rankings encourages stratification within university systems, which in turn exacerbates social inequality. “Excellence initiatives” funnel money to top universities, whose students, even if admission is highly competitive, tend to be the children of the well-off. “Those at the top get more government resources and those at the bottom get least,” points out Ms Hazelkorn. That’s true even in Britain, which, despite not having an excellence initiative, favours top universities through the allocation of research money. According to a study of over 120 universities by Alison Wolf of King’s College London and Andrew Jenkins of University College London, the Russell Group, a self-selected elite of 24 universities, get nearly half of the funding for the entire sector, and increased their share from 44.7% in 2001-02 to 49.1% in 2013-14.

The rankings race draws other complaints. Some universities have hired “rankings managers”, which critics argue is not a good use of resources. Saudi Arabian universities have been accused of giving highly cited academics lucrative part-time contracts and requiring them to use their Saudi affiliation when publishing.

Notwithstanding its downsides, the rankings race has encouraged a benign trend with far-reaching implications: internationalisation. The top level of academia, particularly in the sciences, is perhaps the world’s most international community, as Professor Marginson’s work shows. Whereas around 4% of first-degree students in the OECD study abroad, a quarter of PhD students do. Research is getting more global: 22% of science and

engineering papers were internationally co-authored in 2016, up from 16% in 2003. The rankings, which give marks for international co-authorship, encourage this trend. That is one reason why Japan, whose universities are as insular as its culture, lags. As research grows—in 2000-14 the annual number of PhDs awarded rose by half in America, doubled in Britain and quintupled in China—so does the size and importance of this multinational network.

Researchers work together across borders on borderless problems—from climate change to artificial intelligence. They gather at conferences, spend time in each other's universities and spread knowledge and scholarship across the world. Forced to publish in English, they share at least one language. They befriend each other, marry each other and support each other, politically as well as intellectually. Last year, for instance, when Cambridge University Press blocked online access to hundreds of articles on sensitive subjects, including the Tiananmen Square massacre, at the request of the Chinese government, it faced international protests, and an American academic launched a petition which was signed by over 1,500 academics around the world. CUP backed down.

The rankings race is thus marked by a happy irony. Driven in part by nationalistic urges, it has fostered the growth of a community that knows no borders. Critics are right that governments and universities obsess too much about rankings. Yet the world benefits from the growth of this productive, international body of scholars.

Essay: *The Economist* is holding an essay contest for people aged between 16 and 25, based on the five themes of our Open Future initiative: Borders, Ideas, Markets, Society and Progress. Essays should be no longer than 1,500 words and the deadline is July 15th 2018. The best essays will be published on *The Economist's* Open Future website and winners are invited to attend one of the three Open Future Festivals on September 15th, in Hong Kong,

London or New York. Details can be found at: Economist.com/openfuture/
essay-contest



大学排名

高等教育，高无止境

大学排名令学校重视科研甚于教学，重视硬科学甚于人文学科。不过它们也促进了全球协作

五月初，北京大学主办了可能是高等教育产业有史以来最盛大的一次聚会。哈佛、耶鲁、牛津和剑桥等世界最知名学府的重要人士出席。他们或是饶有兴趣或是如坐针毡地看了长达两个小时的开幕式，随后又别无选择地参加了安排得满满当当的文化活动，其中穿插着赞扬“习近平思想”的演讲。举办这次盛会是为了庆祝北京大学建校120周年，也是为了——虽未明言——庆祝中国在一场开始于20年前的竞赛中取得了成功。

1998年5月，时任中国国家主席的江泽民提出了“985工程”。这项计划的名称来自提出时的年份和月份，目标则是建设世界一流大学。上海交通大学高分子材料科学与工程教授刘念才积极投身于这项计划。“我问了自己许多问题，包括：世界一流大学的定义和标准是什么？中国的顶尖大学在世界大学体系中的位置如何？”当他开始以外国大学为基准衡量国内大学时，他发现“世界各地的政府、大学和利益相关者”对此都有兴趣。因此，他在2003年编制出了首个世界大学500强排名。谁也没料到这份排名会如此受欢迎，谦逊的刘教授更是没有想到。“这实在太让人惊讶了。”

人们对排行榜非常着迷，不管是关于财富、美貌、名气的，还是关于高等教育机构的。大学排名并不仅仅满足了人类的竞争欲望，还是消费者情报的重要来源：人们在高等教育这件商品上投入了大量时间和金钱，但可获取的相关信息却少之又少。为此，一些国家性的排名应运而生，例如《美国新闻与世界报道》（US News & World Report）针对美国大学的排名。但全球排行榜的诞生把竞争推向了新高度——如今彼此竞争的不只是各个高校，还有各国政府。这种排名如今有约20个，其中以上海交大的排名、泰晤士高等教育世界大学排名（以下简称THE）和QS世界大学排名最为重要。

上海交大的排名刚发布时，“知识经济”正开始成为一种全球化的认知。政府意识到优秀的大学不再仅仅是文化自豪感的源泉，或富裕阶层子女进入上流社会之前的进修学校，而是推动一个国家在未来走向繁荣的引擎——是人力资本、创意以及创新型企业的摇篮。

各国政府对这些排名很上心，名次欠佳的国家尤其如此。每个政府都需要几所明星大学，没能建立起这样的大学的政府不仅有负于人民，也在一场重要的全球比拼中败下阵来。对于现代研究型大学的发源地德国来说，欧洲高校在排名中的糟糕表现尤其令人难堪。该国政府迅速作出反应，在2005年宣布启动“卓越计划”，向有望成为世界一流大学的高校拨款。截至目前，德国政府已向该项目投入了超过46亿欧元（55亿美元）。

在民族尊严的激励下，也是出于经济上的务实考虑，各国迅速接受了这样一种理念：高校排名是一场全球性的竞争，所有有自尊的国家都应参与其中。已有31个富裕国家和中等收入国家推出了与“卓越计划”类似的战略。印度一度对全球排名抱以一种后殖民主义色彩的蔑视，它最晚加入战局。2016年，印度财政部长宣布该国的20所高校将力争成为世界一流大学。法国、中国、新加坡、韩国和台湾对本土项目的资金投入最大。尼日利亚和俄罗斯的目标最不切实际：前者立志到2020年将至少两所高校送入全球前200名，后者力争在同一年让五所俄罗斯高校进入世界前100名。

全球高校在排名上的竞争产生了几方面的影响。虽然前几名的宝座仍由美国和西欧霸占——在今年的THE排名中三所美国大学和两所英国大学占据了前五，但往下的座次正在重新洗牌（见图表）。中国的崛起便是明证。上海交大世界大学学术500强中有45所是中国高校；在THE排名中，中国目前是除英国和美国外唯一有两所高校挤进前30名的国家。日本表现不佳：该国最顶尖的高校东京大学在THE排名中位列第48。在其他地区，拉美和东欧的高校被甩在了后面。

争夺名次的竞赛也使高校愈发重视科研。高引用率论文提供了一种易于获得的成功衡量尺度，因此，在缺乏其他可靠衡量标准的情况下，各种高校

排名都以论文引用率作为评定名次的基础。这些排名均未将教学质量这一难以衡量和比较的因素纳入考量。上海交大的排名完全看科研实力；THE和QS倒也考量了其他指标，例如“声誉”。但是，这些排行榜本身就是决定一所学校声望的主要因素之一，因此声誉并不是一个明显的自变量。

科研领域一派繁荣，这对科研工作者是个极好的消息，对全人类也是如此，因为他们终将从科研成果中获益。但社会科学和人文学科的境遇就不太妙了。它们在排名中往往处于劣势，原因是软科学或人文学科的期刊数量较少，因此硬科学领域的论文会有更高的引用率。上海交大的排名没有考虑到这一点，刘念才也承认这个排名有强化硬科学主导地位的倾向。THE排名的主编菲尔·巴提（Phil Baty）说，他们确实考虑到了硬科学论文引用率更高这一点，进而在给论文打分时遵从了相关学科的标准。但这只能解决部分问题：很多人文社科研究成果都以著作而非论文的形式出现，而各个排名并不将著作计入考量。而且，人文社科研究人员通常都是以本地语言写作，而排名只统计以英语写就的成果。

来自各种“卓越计划”的大量资金让硬科学受益。《建立世界一流大学的挑战》（The Challenge of Establishing World-Class Universities）的作者贾米尔·萨尔米（Jamil Salmi）研究了这些项目，发现除台湾以外，所有项目都专注于科研而非教育，而且大多数项目都更重视STEM科目（即科学、技术、工程和数学专业）。2003年到2016年期间，全球科学论文的数量几乎翻番，这种倾斜无疑是原因之一。

这些排名也许导致了教学质量的滑坡。教师们科研成果的质量对他们教学质量的影响微乎其微。事实上，对科研充满热情的教师可能不大愿意在学生身上花费精力，因此科研和教学之间也许还是反比关系。教学质量下降，倒霉的还是学生，因此可以料想他们或许会做出反抗。但《排名与高等教育的重塑》（Rankings and the Reshaping of Higher Education）的作者爱伦·哈泽科恩（Ellen Hazelkorn）指出，学生“都忙着在就业市场中购买能给自己贴金的东西”。也就是说，“他们都想尽可能进入声望最高的大学”，而大学排名是唯一可供参考的声望标准。因此，学生实际上也鼓励了大学把资金投入到科研而非教学上。

新近被任命为牛津大学高等教育学教授的西蒙·马金森（Simon Marginson）说，上述情形产生的结果就是“教学在学术金字塔上被推到了更低的位置”，而这又催生出更多的“学术界无保障无产者”。这些博士生和未获得终身教职的教师承担了明星教授有意躲避的教学工作——在这些因科研实力而受聘的教授眼里，教学实在是琐碎无趣的活计。英国推出了“教学卓越框架”，试图敦促各大学提升教学质量。但该框架是根据学生满意度调查、辍学率和校友收入水平对学校作出评定。有意思。但这其实并不是个衡量教学质量的标准。尽管如此，马金森说，“人人都承认这是个问题，但人人都在盯着英国的做法。”

第三个问题是争夺排名的竞争造成了大学体系的分级，进而加剧了社会不公。各种“卓越计划”令资金都汇集到了顶尖大学，而即便这些学校的录取竞争相当激烈，挤进校园的往往都是富裕阶层的子女。哈泽科恩指出，“那些顶尖的高校能得到更多的政府资源，而垫底的学校得到的最少。”即使在英国也不例外：该国尽管没推出什么卓越计划，但在拨发科研经费时还是会倾向顶尖大学。伦敦大学国王学院的艾莉森·沃尔夫（Alison Wolf）和伦敦大学学院的安德鲁·詹金斯（Andrew Jenkins）研究了120多所大学，发现将近一半的高等教育经费都流向了由24所大学自发组成的名校联盟罗素大学集团（Russell Group），且占比从2001-02年度的44.7%上升到2013-14年度的49.1%。

排名竞赛还引来了其他抱怨。有些大学聘请了“排名经理”，批评人士认为这并不是在好好利用资源。沙特阿拉伯的大学被指责向论文引用率高的教师提供油水丰厚的兼职工同，要求他们在发表论文时把自己列作第二单位。

尽管存在种种消极面，大学排名还是促成了一种影响深远的良性趋势：国际化。如马金森的研究所示，学术界的最上层，尤其在科学领域，也许是全世界最国际化的社群。经合组织国家约有4%的本科生是国际学生，而在博士生中这一比例达到四分之一。科研的全球协作程度也日益提升：2016年，科学与工程领域内的国际合著论文占比达到22%，2003年的数字是16%。在编制大学排名时，国际合著是个打分项，因此排名助推了这一

国际化潮流。这是日本之所以排名落后的原因之一：日本的大学就像这个国家的文化一样封闭保守。2000年到2014年间，每年授予的博士学位数量在美国增长了一半，在英国翻了一番，在中国增长了四倍。随着科研越做越大，这个跨国网络的规模和重要性也在增长。

研究人员在从气候变化到人工智能的种种无国界问题上展开跨国合作。他们在学术会议上相聚，到彼此的院校访问学习，将知识和学问散播到全世界。由于必须用英语发表论文，他们就有了至少一种可交流的语言。他们有的成了朋友，有的成了伴侣。他们相互支持——在智力上，也在政治议题上。例如，去年剑桥大学出版社在中国政府的要求下，从网上撤下了数百篇涉及敏感议题的文章，包括有关天安门事件的内容。此举引发国际抗议，一位美国学者发起请愿行动，争取到了全世界1500多名学者的签名。剑桥大学出版社屈服了。

因此，这场排名竞赛就带有了一种令人愉快的反讽。它本来在一定程度上是受民族主义情绪驱使而来，却促进了一个无国界社群的壮大。批评者认为政府和高校对排名太过沉迷，他们是对的。但这个世界却因为这个既能干、又国际化的学者群体的壮大而获益。





Workers and merchants

A long way from home

Growing numbers of Chinese see opportunities in the developing world

ON THE EDGE of Walvis Bay, a port town in Namibia sandwiched between the Atlantic Ocean and endless sand dunes, the offices-cum-residential-quarters of the China Harbour Engineering Company (CHEC) look like a barracks. Electrified barbed wire tops the surrounding wall. A Chinese manager explains that “we have military-style management.”

The grim complex, with its rows of single-storey tin-roof accommodation blocks, is home to several hundred Chinese workers. They are building a new container terminal in Walvis Bay and an oil-storage facility just outside the town. They are taken to and from the construction sites in company buses and must apply for permission to leave their barracks. “They have very little interaction with local society,” says the manager.

Across Africa, state-owned companies like CHEC are opening up new frontiers in China’s global economic expansion. They often recruit local workers. CHEC’s boss, Feng Yuanfei, says about half the staff at Walvis Bay are Namibians. Many locals are also employed at the Husab uranium mine, a vast opencast operation surrounded by desert and scrub about 70km (45 miles) north-east of Walvis Bay, which at around \$5bn is one of China’s biggest investments in Africa. According to UNCTAD, a UN agency, the amount of Chinese investment in the continent nearly tripled between 2010 and 2015, to \$35bn. McKinsey reckons there are thousands of Chinese businesses in Africa employing millions of locals.

But it is the rise in the number of Chinese people in Africa that is striking. Many are temporary residents employed by state-owned companies, like

those working on the harbour in Walvis Bay. In recent years their number has ranged from 181,000 in 2011 to 264,000 in 2015. Far more numerous are the Chinese who have set off for Africa to set up their own businesses as shopkeepers, restaurateurs and traders.

In his book, “China’s Second Continent”, Howard French calls this influx “one of the most important and unpredictable factors in China’s relationship with Africa”. Numbers are hard to pin down, but writing in 2014 Mr French estimated that 1m had arrived in just a decade. The whole of Namibia has a population of only about 2.5m, scattered across an area more than twice the size of Germany. Mr French thought it might have the highest concentration of Chinese people in any African country. In his book he quoted common estimates of 40,000, but the number is now likely to be lower than that.

Chinese businesspeople across Namibia complain of an economic chill, and some are thinking of leaving. The country’s economy fell into recession last year. Unemployment is sky-high. Namibia’s own currency has suffered from global investors’ jitters about South Africa’s, to which it is pegged. This has made it more expensive for Chinese traders to import products from China for sale in Namibia.

But many Chinese doggedly carry on. Even remote towns have “China shops”, as locals call them: small stores filled with cheap, basic household goods made in China and run by Chinese. Locals may not have much cash to spare, but the prices are low and the shops are popular. The traders often employ locals to deal with customers, but on a recent weekday in Karibib (population about 5,000), 190km north-west of the capital, Windhoek, the Chinese owners of the town’s two China shops were on duty. Both were young men from the southern Chinese province of Fujian. Both were despondent. One of them used to do business on the Angolan border and says many of his colleagues there have left for other countries. “I hear

Zimbabwe is good now,” he says wistfully. But he does not talk about returning to China. Many Chinese traders say their country may be thriving, but the competition there is vicious. Africa still holds promise.

Some Namibians wish the Chinese would go home, wondering how they ever established such a strong foothold in trades that should be dominated by locals. Local media ask why so many Chinese workers have been brought in to work on big construction projects, and why Chinese companies win so many contracts to build things—including government buildings. They also point to the harm the incomers cause to wildlife. China has been trying harder recently to help stop the slaughter of elephants in Namibia and elsewhere in Africa. Last year it banned the sale of ivory. But although the sale of rhino horn has long been illegal in China, the poaching of rhinos for sale to Chinese gangs continues.

Beneath the surface, racial tensions simmer. “So tired of these foreigners coming to Namibia and ruining our beautiful country,” was one of the politer comments by locals on Facebook in response to a report in 2016 in *Namib Times*, a newspaper based in Walvis Bay, about the arrest of three Chinese people for alleged possession of live pangolins, an endangered species. Last July the paper reported on a protest by local workers who had failed to get jobs at CHEC’s projects in the area. This started a stream of xenophobic tirades on Facebook. “This is no longer Namibia, it’s China,” said one.

Conversely, Chinese people in Namibia often speak disparagingly of “blacks” (*feizhounren*, the Chinese for African, is online slang for a loser). The manager of a Chinese-owned factory in Walvis Bay is exasperated by endless protests and strikes by his local workforce. “They are so lazy. You give them more money and they still don’t work harder,” he says. “Where in China it takes three hours to do a job, here it takes 30.”

The mutual antipathy is not confined to Namibia. As Mr French observes, grumblings about the Chinese presence in Africa are rife among ordinary people, even as their governments encourage and support it. Phil ya Nangoloh, the head of NamRights, a human-rights group in Windhoek, accuses China of “looking for *Lebensraum*” and practising “neo-colonialism” in Africa. He notes rumours that the new harbour at Walvis Bay could one day become a base for China’s navy. The Chinese, he says, are “operating literally above the law”.

Similar mutterings about Chinese immigrants can be heard in Europe. By the European Union’s reckoning, in 2011 (when the most recent census was conducted) around 820,000 people born in China were living in the EU. That, notes the European Commission’s website, was 40% more than the number of EU residents born in America. ■



工人和商人

远离故乡

越来越多的中国人看到发展中国家的机遇

纳米比亚的港口城镇沃尔维斯湾（Walvis Bay）一面朝向大西洋，另一面是无尽的沙丘。坐落于城镇边缘的中国港湾工程有限责任公司的办公兼住宿区看上去像一个兵营。围墙上是带刺的电网。一名中国管理人员解释说：“我们这里是军事化管理。”

沉闷的大院里有一排排铁皮屋顶的平房，这里是几百名中国工人的宿舍。他们正在建造沃尔维斯湾的一个新集装箱码头和城边的一座储油设施。他们乘坐公司大巴往返于工地，不经允许不得擅自离开营地。“他们和当地社会的接触极少。”那位管理人员介绍说。

在中国的全球经济扩张中，像中国港湾这样的国企正在整个非洲开疆拓土。他们经常雇用当地员工。中国港湾纳米比亚公司的经理冯云飞表示，沃尔维斯湾项目大约一半的员工都是纳米比亚人。还有许多当地人受雇于哈萨博（Husab）铀矿。这座大型露天铀矿位于沃尔维斯湾东北向约70公里处，四周被沙漠和灌木环绕，是中国在非洲最大的投资之一（约50亿美元）。根据联合国贸发会议（UNCTAD）的数据，2010年到2015年间，中国在非洲大陆的投资额增加了近两倍，达到350亿美元。麦肯锡估计，目前在非洲的中国企业有好几千家，本地雇员达数百万人。

然而让人吃惊的是不断涌入非洲的中国人的数量。其中很多是受雇于中国国企的暂住人口，比如沃尔维斯港码头项目的员工。近年来，他们的数量已从2011年的18.1万增加到2015年的26.4万。而数量还要多得多的是前往非洲自主创业的中国人，比如商店老板、餐馆老板和贸易商等。

霍华德·弗伦奇（Howard French）在其著作《中国的第二大陆》（China's Second Continent）中，把这一人口涌入称为“中国与非洲关系中最重要、也最难预测的因素之一”。具体数字很难确定，但2014年成书时，弗伦奇

估计，短短10年间有100万中国人到达非洲。而整个纳米比亚只有250万人口，分布在比德国大一倍多的国土上。弗伦奇认为，纳米比亚是所有非洲国家中中国人最集中的地方。当时他书中引用的是普遍估计的4万人，但现在看来实际数字可能要低一些。

整个纳米比亚的中国商人都抱怨经济低迷，一些人正打算离开。纳米比亚经济在去年陷入衰退。失业率极高。由于全球投资者对南非货币感到担忧，与其挂钩的纳米比亚货币受到波及。中国贸易商从中国购买商品到纳米比亚销售的成本也就更高了。

但还是有很多中国人在苦撑。就连偏远的城镇也有当地人所说的“中国商店”。这些中国人经营的小店里摆满了中国制造的廉价生活必需品。当地人可能没多少闲钱，但店里的商品价格低廉，因而广受欢迎。贸易商经常雇用当地人与顾客打交道。但最近的一个工作日，在首都温特和克（Windhoek）西北190公里的卡里比布（Karibib，大约5000人口），镇上两家中国商店却是由年轻的店主自己当班。两人都来自福建省。两人都很沮丧。其中一人曾在安哥拉边境做过生意，他说自己在那里的同行有许多都去了别的国家。“我听说津巴布韦现在不错。”他向往地说，语带惆怅。但他并没有说要回中国。许多中国贸易商表示，中国可能确实在蓬勃发展，但竞争也很残酷。非洲仍然是希望之地。

一些纳米比亚人希望中国人回到自己国家去，他们惊讶于中国人究竟是如何能在本该由当地人主宰的贸易中扎下了如此稳固的根基。当地媒体质问，为什么有那么多中国工人进入大型建设项目中工作，为什么中国公司赢得了那么多包括政府建筑在内的建造合同。他们还提到这些外来者对野生动物的伤害。中国最近一直在加大力度帮助制止屠杀纳米比亚和其他地区的大象。去年中国还禁止了象牙交易。但是，尽管中国早已将犀牛角交易定为违法行为，偷猎犀牛卖给中国团伙的情况却从未停止。

种族矛盾在悄然酝酿。2016年，沃尔维斯湾的《纳米布时报》（Namib Times）刊登了一篇讲述三个中国人因涉嫌拥有活体濒危物种穿山甲而被捕的报道。对此当地人在Facebook发表评论，其中语气还算客气的一条写

道：“真是受够了这些跑到纳米比亚来毁坏我们美丽家园的外国人。”去年7月，该报报道了一起抗议事件，抗议的发起者是未能在该地区的中国港湾公司项目中找到工作的当地工人。这在Facebook上引发了一连串排外性质的长篇大论。“这里不再是纳米比亚，这里成了中国。”有人写道。

反过来，在纳米比亚的中国人常常蔑称非洲人为“黑鬼”（在网络上，中国人也用“非洲人”来表达“窝囊废”之意）。沃尔维斯湾一家中资工厂的经理因为当地雇员无休止的抗议和罢工大感恼火。“他们太懒了。就算你多给他们钱，他们干活也不会更卖力，”他说，“在中国3小时能完成的工作，在这里得花30个小时。”

这种互不待见的情况并不局限于纳米比亚。正如弗伦奇所说，尽管当地政府鼓励并支持中国人在非洲安身立业，但民众对此怨声载道。温特和克的人权组织NamRights的领导人菲尔·亚·南戈洛（Phil ya Nangoloh）指责中国“像纳粹一样寻找‘生存空间’”，在非洲实行“新殖民主义”。他指出，有传言说沃尔维斯湾的新港口有朝一日可能会成为中国的海军基地。他说，中国人“做事简直无法无天”。

在欧洲也有类似针对中国移民的抱怨。根据欧盟的估算，2011年（最近一次人口普查的时间），出生地为中国、但在欧盟各国生活的人口约为82万。欧盟委员会的网站指出，这个数字比出生于美国的欧盟居民多出40%。 ■



Markets and society

Sale of the century

An arresting manifesto argues that what liberal democracy needs is a bigger role for the market

ACCORDING to its detractors, and even some of its acolytes, the philosophy of liberalism has run its course. Populist critics of capitalism and democracy have been emboldened by the financial crisis and amplified by social media. Liberals have struggled to respond. Many are insecure about their intellectual—or geographical—blind spots, apparently exposed by Donald Trump’s election victory and the Brexit referendum. They feel like conductors of a train that has veered off the tracks. Amid this disorientation, an important possibility may have been overlooked: that the rich world’s problems do not stem from an overdose of liberal principles, but from their insufficiently bold application.

In “Radical Markets” Glen Weyl, an economist at Microsoft, and Eric Posner, a law professor at the University of Chicago, argue that the ideals of thinkers such as Adam Smith, John Stuart Mill and Henry George can still inspire radical change. Such luminaries were unafraid of challenging the status quo. Following suit, Mr Posner and Mr Weyl want to expand and refine markets, putting them to work for society as a whole.

In truth, the policies they advocate are so radical that they are unlikely ever to be adopted. But they may help jolt liberals out of their hand-wringing, and shape a new line of market-oriented thinking, as Milton Friedman’s “Capitalism and Freedom” did almost six decades ago. That too was an idealistically pro-market book, unconcerned with the feasibility of its proposals. The authors of “Radical Markets” open with a Friedman quote.

Yet they distance themselves from the “market fundamentalism” inspired

by him, Friedrich Hayek and George Stigler. Such thinking is more concerned with protecting property rights than with correcting market failure. By contrast, their primary concern is to mount an onslaught against market power. That does not just mean the overweening clout of the tech titan or the oil baron. It includes the power intrinsic to the very property rights that market fundamentalists often defend. This power, the authors say, prevents markets themselves from being truly free.

Take land. An owner of a valuable plot in, say, the Bay Area of California is inherently a monopolist. Should an entrepreneur need a lot of space to build an office block or houses, the owner of a single parcel can hold her to ransom. Property may not be theft, but it is monopoly.

The authors think this applies to all property, not just land. Their solution is a new wealth tax. Every individual would put a value on each item she owned, down to the last pencil (potentially a laborious exercise), and would be taxed on her total declared wealth. The twist: she must stand ready to sell any item at its declared value, should a buyer emerge. To see off interested purchasers, she would have to set the value high, and thus incur a hefty tax that would compensate society. If she set the price low, to minimise her tax burden, her assets would be bought up.

The tax would enable property to be put to its most profitable use, while raising revenue efficiently, perhaps to fund a universal basic income. Because rich people own the most stuff, it would be drastically redistributive. Most important, people would come to see property as rented from society, rather than as conferring exclusive ownership. Radical collectivism would replace property-owning democracy. The authors are ready with responses (some more convincing than others) to obvious objections, such as the notion that the poor would live in fear of the rich stripping them of their assets. Still, the scheme will baffle anyone who sees property rights as the foundation of law, even of civilisation, and as crucial

to individual flourishing.

Rethinking property rights from scratch might seem sufficiently ambitious for one book. But it is just one of several big ideas. The next is to overhaul electoral systems. Democracy, the authors argue, has never found the right balance between conflicting aims. Minority rights must be protected from tyrannical majorities. But this introduces the same hold-out problem—where small groups can exert undue influence—as bedevils property markets. Policies with diffuse benefits and concentrated costs, such as environmental regulation, are hard to implement in systems that erect too many hurdles to legislation.

Their solution is to import market principles to the ballot box. They would scrap “one person one vote”. In its place, everyone would get an income of credits, to be used to buy votes in elections or referendums. The more influence voters exerted over any single issue, the less they would be able to wield elsewhere. Crucially, the price of a vote in any given election would be the square of the number bought. One vote would cost one credit; two votes would cost four; three votes, nine. Minorities which cared a lot about a particular issue, or feared their rights were under threat, could decide to spend their credits heavily to face down a majority. But it would be expensive. That would make it harder for hobbyhorses to stand in the way of social progress.

The authors say their book is intended to refresh liberalism. But their animating philosophy is really utilitarianism: the idea that doing good means maximising the overall level of happiness. They seem relatively unconcerned with individual rights. At the end of the book, they suggest that the logical extension of their property tax would be to apply it to human capital—ie, to require citizens to declare a wage at which they would work, tax them on the basis of that number, and force them to accept any job offers that materialised. They shy away from this idea not because it resembles the

enslavement of individuals to society, but because it is impractical.

In another chapter they argue that every citizen should be given the chance to sell a visa directly to an immigrant, whom they would house and help find low-wage work. They say the economic gains to all would be worth the inequality and power imbalances this would produce. At the end of their chapter on voting, they calculate that their proposed electoral reforms could boost GDP by 20%—as if that, rather than the fair allocation of power, is what matters in electoral systems.

“Radical Markets” is refreshing and welcome in its willingness to question received wisdom. Yet it will do little to mollify those who say liberal capitalism has neglected human needs beyond the yen for economic advancement—for community, say, or a sense of wider belonging. Such critics will understandably protest that market principles would sully institutions, such as property rights and elections, that confer dignity on individuals.

Readers who suspect that economic progress cures most ills will be more sympathetic. But even they may view Mr Posner and Mr Weyl in the way radicals are often perceived: as somewhat eccentric. Still, liberals must find some antidote to populism and protectionism. A little outlandishness may be necessary. ■



市场与社会

世纪大买卖

一项引人注目的宣言认为，自由民主制需要的是让市场发挥更大的作用

自由主义哲学的批评者、甚至它的一些追随者都认为，自由主义哲学已经走到了尽头。民粹主义对资本主义和民主的批评因为金融危机而底气十足，并通过社交媒体放大了效果。自由主义者难以应对。许多人对自己的智识或地理盲点感到不安——这些盲点似乎因为特朗普胜选和英国脱欧公投而暴露出来。他们觉得自己像一列脱轨火车上的列车员。在这种迷失之中，一个重要的可能性也许被忽略了：富裕世界的问题并非源于自由主义原则被运用过多，而是因为运用得还不够大胆。

在《激进市场》一书中，微软的经济学家格伦·韦尔（Glen Weyl）和芝加哥大学的法学教授埃里克·波斯纳（Eric Posner）认为，亚当·斯密、约翰·穆勒和亨利·乔治等思想家的理念仍然可以激发根本性的变革。这些杰出人物无惧挑战现状。波斯纳和韦尔继承了这样的精神，他们想要扩大和完善市场，让市场为整个社会服务。

事实上，他们倡导的政策非常激进，可能永远都不会被采纳。但是，他们可能会将自由主义者从茫然无措的局面中唤醒，并形成一种新的市场导向的思路，正如近60年前米尔顿·弗里德曼（Milton Friedman）的《资本主义与自由》一书所发挥的作用那样。那也是一本亲市场的理想化著作，并不在乎自己的提议是否可行。《激进市场》的作者就引用了弗里德曼的话作为开篇。

不过，他们与弗里德曼、弗里德里希·哈耶克（Friedrich Hayek）和乔治·斯蒂格勒（George Stigler）所启迪的“市场原教旨主义”相去甚远。市场原教旨主义更关心保护财产权，而不是纠正市场失灵。相反，两位作者的主要关注点是对市场势力发起猛烈攻击。这并不仅仅指科技巨头或石油大亨过大的市场影响力，还包括市场原教旨主义者经常捍卫的财产权所固有的

力量。作者说，这种力量阻碍了市场真正自由地运作。

以土地为例。美国加州湾区一块高价值地块的所有者本质上就是一个垄断者。如果有企业家需要一大片土地来兴建办公楼或房屋，那么其中一小块地的所有者就可以漫天要价。拥有财产可能不是盗窃，但却是垄断。

两位作者认为这一点适用于所有财产，而不仅仅是土地。他们的解决方案是一种新型的财产税。每个人都对自己拥有的每件物品标上价值，哪怕是一支铅笔（这项工作可能很费力）。然后政府会根据每个人所申报财富的总额进行征税。意想不到的转折来了：如果有买家出现，财产所有者必须准备好按自己申报的价值出售任何物品。如果所有者想要避免自己的物品被有兴趣的买家买走，就得将物品的价值设高，这就需要为此担负沉重的税负来补偿社会。如果她为了减轻税负把价格定得很低，那么她的资产就会被买走。

这种税制可以让财产发挥最大价值，同时又有效地提高税收，也许可以用来为全民基本收入提供资金。因为富人拥有的东西最多，这种财产税将会大大促进再分配。最重要的是，人们会将把财产看做是从社会租赁而来，而非由谁独占。激进的集体主义将取代财产所有的民主制。对于这显而易见会引发的一些反对意见，比如有人认为穷人会因此陷入被富人买光资产的恐慌，作者都有自己的解答（不过，有些答案比另一些更有说服力）。不论如何，对于任何将财产权视为法律甚至是文明的基石、并认为它对个人发展至关重要的人来说，这样的制度会让他们困惑不已。

从头重新思考财产权的问题对一本书来说已经是足够宏大的命题了，但这还只是本书探讨的几个重大想法之一。另一个是彻底改革选举制度。作者认为，民主制度从未在相互冲突的目标之间找到适当的平衡点。少数人的权利必须得到保护，以避免“多数人的暴政”。但这引发了一个持续存在的问题——小群体可能会发挥过度的影响力。房地产市场就被这个问题困扰。像环境监管这样益处分散而成本集中的政策很难在设置了重重立法障碍的制度中实施。

两位作者提出的解决方案是在投票上引入市场原则。他们会摒弃“一人一票”制，取而代之的方案是，每个人都将获得一种积分收入，用于在选举或公投时购买选票。选民在一个议题上投票越多，他们能在其他议题上施加的影响力也就越小。关键的一点是，在任何选举中，每次投票的代价是所购票数的平方数。一票需要一个积分，两票四个，三票九个。对特定问题非常关心或担心自身权利受到威胁的少数群体可能会决定花大量积分来压倒多数派，不过这样做代价高昂。这会让人们更难因为个人偏好而阻挡社会进步。

两位作者说他们的书旨在重振自由主义。但他们颇具启发性的哲学理念实际上是功利主义，即认为行善是要最大限度地提高总体幸福感。他们似乎不大关心个人权利。他们在本书的末尾提到，他们提出的财产税制度逻辑上可以被延伸应用于人力资本，即要求公民申报他们愿意为之工作的工资水平，并据此对他们征税，迫使他们接受能支付相应工资的任何工作。他们没有深入阐释这个想法，倒不是因为它好像是社会对个人的奴役，而是因为它不切实际。

在另一章中，他们认为每个愿意为移民提供住宿并助其找到低薪工作的公民都应该有机会直接向移民出售签证。他们表示，该做法为所有人带来的经济收益与其带来的不平等和权力失衡相比都是值得的。在投票选举这一章的结尾，作者计算得出，他们提出的选举改革可能将GDP提高20%——就好像这才是选举制度的重点，而不是权力的公平分配。

《激进市场》质疑普遍认知的态度令人乐见且耳目一新。但它无法平息一些人对自由资本主义的批评。这些批评者说，自由资本主义为了集体利益或更广泛的归属感等原因，热衷于追求经济发展而忽略了人的需求。他们自然会抗议说，市场原则会损害那些赋予个人尊严的制度，如财产权和选举制度。

那些估测经济发展能治愈大多数弊病的读者会更加赞同书中的观点。但就连他们也可能对波斯纳和韦尔抱有人们对激进分子常有的看法：有点离经叛道。不论如何，自由主义者还是必须找到应对民粹主义和保护主义的解

药。一点匪夷所思可能是必要的。 ■



Economic and financial indicators

Economic outlook

The Economist's latest poll of forecasters, June



经济与金融指标

经济前景

《经济学人》6月对各家预测机构的最新调查



The Vision Fund

The \$100 billion bet

Succeed or fail, Masayoshi Son is changing the world of technology investing

TWO years ago, if you had asked experts to identify the most influential person in technology, you would have heard some familiar names: Jeff Bezos of Amazon, Alibaba's Jack Ma or Facebook's Mark Zuckerberg. Today there is a new contender: Masayoshi Son. The founder of SoftBank, a Japanese telecoms and internet firm, has put together an enormous investment fund that is busy gobbling up stakes in the world's most exciting young companies. The Vision Fund is disrupting both the industries in which it invests and other suppliers of capital.

The fund is the result of a peculiar alliance forged in 2016 between Mr Son and Muhammad bin Salman. Saudi Arabia's thrusting crown prince handed Mr Son \$45bn as part of his attempt to diversify the kingdom's economy. That great dollop of capital attracted more investors—from Abu Dhabi, Apple and others. Add in SoftBank's own \$28bn of equity, and Mr Son has a war chest of \$100bn. That far exceeds the \$64bn that all venture capital (VC) funds raised globally in 2016; it is four times the size of the biggest private-equity fund ever raised. One VC grandee calls Vision Fund “the most powerful investor in our world”.

Power does not necessarily mean success. Sceptics about the Vision Fund have lots of ammunition. After a long bull market, the valuations of tech firms are stretched. Mr Son personally makes most of the investing decisions. He has notched up some triumphs in his career, including an early bet on Alibaba. But his dotcom-era investments mean he is also the person to have lost more money than anyone else in history. His pursuit of the “singularity”, the point at which computer intelligence exceeds the

human kind, might make him a visionary—or just an eccentric. The money is being shovelled out almost as fast as it was taken in. The fund has already spent \$30bn, nearly as much as the \$33bn raised by the entire American VC industry in 2017. And because about half of its capital is in the form of debt, it is under pressure to make interest payments. This combination of gargantuanism, grandiosity and guaranteed payouts may end up in financial disaster. Indeed, the Vision Fund could mark the giddy top of the tech boom.

But even if the fund ends up flopping, it will have several lasting effects on technology investing. The first is that the deployment of so much cash now will help shape the industries of the future. Mr Son is pumping money into “frontier technologies” from robotics to the internet of things. He already owns stakes in ride-hailing firms such as Uber; in WeWork, a co-working company; and in Flipkart, an Indian e-commerce firm that was sold to Walmart last month (see Business section) . In five years’ time the fund plans to have invested in 70-100 technology unicorns, privately held startups valued at \$1bn or more. Its money, often handed to entrepreneurs in multiples of the amounts they initially demand and accompanied by the threat that the cash will go to the competition if they balk, gives startups the wherewithal to outgun worse-funded rivals. Mr Son’s bets do not have to pay off for him to affect the race.

Mr Son’s second impact will be on the venture-capital industry. To compete with the Vision Fund’s pot of moolah, and with the forays of other unconventional investors, incumbents are having to bulk up. Sequoia Capital, one of Silicon Valley’s most famous names, is raising its biggest-ever fund in response. Mr Son is also bringing capital to places where it is still in fairly short supply—to India, to South-East Asia and to several European countries. When the Vision Fund invested close to \$500m in Improbable, a British virtual-reality firm, it broke a funding record, and its €460m (\$565m) in Auto1, a German online car dealer, was one of the

country's biggest such investments in several years. Rather than wait for founders to make the trip to California, investors are under greater pressure to seek out entrepreneurs.

The Vision Fund's unprecedented span, across countries and industries, leads to its third impact. Mr Son says he wants to create a "virtual Silicon Valley in SoftBank", meaning a platform on which unicorns can offer each other contacts and advice, buy goods and services from each other, and even join forces. The concept of portfolio companies collaborating is familiar from private equity, but the fund's sheer breadth marks it out. Mr Son is, for example, trying to orchestrate his various ride-hailing investments so that they do not burn through so much cash by competing with each other. He encouraged Uber to sell its South-East Asian business to Grab earlier this year and is urging it to make a deal in India with Ola.

The Vision Fund model is disruptive, then. But is it good for innovation and consumers? Mr Son's project certainly has its attractions. It is shaking up the cosy world of Silicon Valley venture capital. And it may nurture competition against the tech giants. The fund offers founders of startups an alternative to cashing out to the likes of Google, Facebook and Amazon; its massive chequebook also gives those entrepreneurs a better shot at competing with the titans. The fund may perform a similar function in China, where nearly half of all unicorns are by now backed by one of the country's four tech giants, Baidu, Alibaba, Tencent or JD.com.

Yet its disadvantages extend beyond the risk of losses. Its sheer size risks raising the cost of running a startup for everyone. Young firms that receive its cash often spend it on sales and marketing, which puts pressure on every other company in the industry to spend as lavishly in order to acquire customers. Companies that receive hundreds of millions of dollars of capital in one go are elevated far above their competitors. That hands a single individual kingmaking powers, while keeping young firms out of the

clarifying glare of the public markets for even longer. Attempts to carve up markets among portfolio firms may in time raise a different set of competition concerns.

A proper verdict on the Vision Fund will not be possible for years. But the fate of many startups and the choices consumers enjoy in the future will be guided by the bets Mr Son is making today. Fortune's biggest wheel is spinning. ■



愿景基金

千亿美元之赌

无论成功或失败，孙正义正在改变技术投资界

两年前，如果你问专家谁是科技界最有影响力的人，你会听到一些熟悉的名字：亚马逊的杰夫·贝佐斯、阿里巴巴的马云或Facebook的马克·扎克伯格。如今又多了一个竞争者：孙正义。作为日本电信和互联网公司软银的创始人，他设立了一个庞大的投资基金，正在狼吞虎咽全球最激动人心的一批年轻公司的股份。愿景基金正在颠覆其投资的行业以及其他资本供给方。

该基金是孙正义与穆罕默德·本·萨勒曼（Muhammad bin Salman）于2016年建立的一个特殊联盟的结晶。这位沙特阿拉伯王储塞给孙正义450亿美元，试图让国家经济多元化。这一大笔资金吸引来了更多的投资者——来自阿布扎比、苹果公司以及其他。再加上软银自有的280亿美元股本，孙正义的投资专款达到了1000亿美元。这远远超过2016年全球所有风险投资（VC）基金募集的640亿美元，也是有史以来最大的私募股权基金规模的四倍。一位VC大佬把愿景基金称为“世界上最强大的投资者”。

强大并不一定等于成功。愿景基金的怀疑者弹药充足。经过长时间的牛市后，科技公司的估值已然过高。孙正义亲自做出大部分投资决策。他在职业生涯中取得了一些胜利，包括早期押注阿里巴巴。但他在网络泡沫时代的投资意味着他损失的金额在历史上无出其右。他对计算机智能超越人类的“奇点”时刻的追求可能会彰显他的远见卓识——但也可能沦为一个“怪人”。他花钱的速度几乎赶上钱进账的速度。基金已经花掉了300亿美元，和2017年整个美国VC行业筹集到的330亿美元相差无几。而且由于其中大约一半资本是债务形式，因此在支付利息方面面临压力。这种庞大規模、好大喜功和保障派息的结合可能会导致财务灾难。事实上，愿景基金可能标志着技术热潮令人眩晕的顶峰。

但即使基金最终失败，它也会对技术投资产生几方面的持续的影响。首先，现在部署如此多的现金将有助于塑造未来的行业。孙正义正将资金投入到从机器人到物联网的“前沿技术”中。他所持的股份包括优步这类叫车公司、联合办公公司WeWork，以及上月卖给沃尔玛的印度电子商务公司Flipkart。该基金计划五年内投资70到100家技术独角兽，也就是估值在10亿美元以上的私营创业公司。他拿出的资金通常是创业者最初要求的好几倍，连带威胁他们，如果不拿就转手给他们的竞争对手。这些钱为创业公司提供了必需的资金来碾压资金匮乏的竞争对手。孙正义的投注并不一定要回本才能影响比赛。

孙正义带来的另一个影响将是对风险投资行业的冲击。为了能与愿景基金的钱罐子以及其他非常规投资者的偷袭竞争，该行业内的既有企业不得不大规模扩张。硅谷最著名的风投企业之一红杉资本就在为此展开自己有史以来规模最大的筹资。孙正义还把资本带到那些资金仍然相当短缺的地方，如印度、东南亚和几个欧洲国家。愿景基金对英国虚拟现实公司Improbable投资的近5亿美元打破了融资记录，对德国在线汽车经销商Auto1投资的4.6亿欧元（5.65亿美元）是该国近些年最大的此类投资之一。投资者如今面临更大的压力来寻找创业者，而不能光等着企业创始人来加州要钱了。

愿景基金前所未有地横跨多个国家和多个行业，这造成了它的第三个影响。孙正义说，他想要创建一个“软银中的虚拟硅谷”平台，独角兽们可以在其中互相提供人脉和建议，购买彼此的商品和服务，甚至联合起来。投资组合中的公司相互合作的概念对私募股权来说十分熟悉，但愿景基金单从广度来说就已卓尔不群。例如，孙正义正在试图协调他对叫车企业的多项投资，以免它们在相互竞争中消耗掉如此多的现金。今年早些时候他鼓励优步将其东南亚业务出售给了Grab，现在又在敦促它与Ola在印度达成交易。

这样说来，愿景基金的模式可谓是颠覆性的了。但这对创新和消费者有好处吗？孙正义的项目当然有其吸引力。它正在震撼硅谷风险投资的惬意世界。它可能会培育出针对科技巨头的竞争。愿景基金让创业公司的创始人

除了向谷歌、Facebook和亚马逊等公司套现之外又多了一种选择；其深厚的支票簿也让那些创业者更有机会与巨头一较高下。该基金在中国也可能起到类似的作用——这里近一半的独角兽目前都受到四大科技巨头之一（百度、阿里巴巴、腾讯或京东）的支持。

然而它的缺点不仅仅在于可能亏损。其庞大的规模可能会提高每个人创业的成本。收到现金的年轻公司往往将其用于销售和营销，这让同行业的每一家公司都面临比拼烧钱来抢夺客源的压力。一次性获得数亿美元资本的公司被抬得比其竞争对手高得多。这让孙正义一个人有了“拥立国王”的大权，同时也进一步延长了年轻公司避开公开市场审视的时间。试图在投资组合公司之间瓜分市场，久而久之可能会引发另一套对竞争的担忧。

要给愿景基金一个恰当的定论还需要很多年。但孙正义今天所下的赌注将会影响许多创业公司的命运以及消费者未来的选择权。世界上最大的财富转盘正转个不停。 ■



Ride hailing

Steering group

A bold scheme to rule ride-hailing and take a grip on the future of transport

OF ALL his ambitious plans, Masayoshi Son's most audacious is to create an informal business group among the world's leading ride-hailing firms. SoftBank has put \$20bn into these businesses, starting in 2014 with an investment in India's Ola. It soon added a stake in Grab, which operates across South-East Asia. Its first investment in China's Didi came in 2015; it later added an investment in Brazil's 99 (which is controlled by Didi). Its 15% stake in Uber was acquired in January. How sound a bet this web of investments is remains uncertain, given low barriers to entry and the fact that none of the firms is profitable. But now that around 90% of rides hailed in the world—45m a day—use one of the firms in which SoftBank has stakes, success for the industry will almost inevitably mean success for Mr Son.

In the near term, the focus is on encouraging the ride-hailing firms to compete less feverishly and push up fares. Mr Misra has called on Uber to concentrate on its core markets of North and South America, Europe and Australia in order to narrow its losses before an IPO expected in 2019. In March SoftBank pulled off a coup when Uber agreed to sell its business in South-East Asia to Grab in return for a 27.5% stake. Uber will stop operating in Singapore, the Philippines, Malaysia and Vietnam, leaving the field clear, in theory, for Grab to raise prices.

SoftBank is now urging consolidation in India, where Uber is battling Ola. Mr Son and Mr Misra are encouraging meetings between the firms' bosses and stress the benefits of a deal. But having backed out of Russia, China and South-East Asia, Uber is determined not to cede in India. It will test the relationship between Uber and its new, biggest shareholder. "Masa can be

forceful but it is advice only," says Dara Khosrowshahi, Uber's boss.

In the longer term Mr Son sees ride-hailing as a way to profit from a wider upheaval in transport, as the firms develop autonomous cars and roll out electric vehicles. He may invest in charging stations, as well as leasing and financing vehicles. Mr Son's family of firms could help. Nauto, for example, collects data about drivers' behaviour that will be useful for self-driving cars. As Mr Khosrowshahi notes, it is another example of Mr Son putting the pieces together and seeing the end state in an industry. And then backing the idea with lots of money. ■



网约车

掌舵者

一个大胆的计划要在网约车行业一统天下以掌握交通的未来

在孙正义所有雄心勃勃的计划中，最大胆的一个是在全球最大的一批网约车公司中创建一个非正式的商业集团。软银已在这些公司上砸下200亿美元。它在2014年首先投资于印度的Ola，不久后入股在东南亚各国运营的Grab。2015年它首次投资于中国的滴滴，后来又加入了对巴西的99（现由滴滴控股）的投资。今年1月它收购了优步15%的股份。鉴于网约车行业门槛低，而且这些公司目前无一盈利，孙正义织就的这一投资网络是个多明智的赌注还很难说。但既然现在全世界约九成的网上叫车——每天共4500万次——用的都是软银持股的公司，行业的成功几乎必定会造就孙正义的辉煌。

短期内，孙正义的重点是促使这些公司减少彼此间的竞争并提高价格。拉吉夫·米斯拉（Rajeev Misra）呼吁优步全力发展南北美、欧洲和澳大利亚的核心市场，以便在预期于2019年IPO之前缩小亏损。3月，软银完成了一桩“不可能的任务”：优步同意将自己在东南亚的业务卖给Grab，换取Grab 27.5%的股权。优步将停止在新加坡、菲律宾、马来西亚和越南运营。理论上说，这让Grab在该区域一家独大，从而可以抬高车费。

目前软银正敦促该行业在印度实现整合，优步在这里与Ola激战正酣。孙正义和米斯拉鼓励两家公司的老板碰面，并强调达成交易的好处。但是，已经撤出了俄罗斯、中国和东南亚的优步决意不在印度让步。这将考验优步与自己新的最大股东之间的关系。“孙正义有时很强势，但这件事只是个建议。”优步老板达拉·霍斯劳沙希（Dara Khosrowshahi）说。

长期而言，孙正义将网约车视为从更广泛的交通业巨变中获利的一个途径——他投资的这些公司将研发无人驾驶汽车并推出电动车。他可能会投资充电站以及汽车租赁和融资。他的企业网络会有帮助。例如，Nauto公司

收集有关司机行为的数据，这对开发无人驾驶汽车会很有用。正如霍斯劳沙希所说，这是孙正义将零散的部分拼凑到一起，由此看到行业最终形态的又一个例子。然后，他会用很多钱来支撑自己的构想。■



Buttonwood

Where will the next crisis occur?

Corporate debt could be the culprit

INTEREST rates are heading higher and that is likely to put financial markets under strain. Investors and regulators would both dearly love to know where the next crisis will come from. What is the most likely culprit?

Financial crises tend to involve one or more of these three ingredients: excessive borrowing, concentrated bets and a mismatch between assets and liabilities. The crisis of 2008 was so serious because it involved all three—big bets on structured products linked to the housing market, and bank-balance sheets that were both overstretched and dependent on short-term funding. The Asian crisis of the late 1990s was the result of companies borrowing too much in dollars when their revenues were in local currency. The dotcom bubble had less serious consequences than either of these because the concentrated bets were in equities; debt did not play a significant part.

It may seem surprising to assert that the genesis of the next crisis is probably lurking in corporate debt. Profits have been growing strongly. Companies in the S&P 500 index are on target for a 25% annual gain once all the results for the first quarter are published. Some companies, like Apple, are rolling in cash.

But plenty are not. In recent decades companies have sought to make their balance-sheets more “efficient” by raising debt and taking advantage of the taxdeductibility of interest payments. Businesses with spare cash have tended to use it to buy back shares, either under pressure from activist investors or because doing so will boost the share price (and thus the value

of executives' options).

At the same time, a prolonged period of low rates has made it very tempting to take on more debt. S&P Global, a credit-rating agency, says that as of 2017, 37% of global companies were highly indebted. That is five percentage points higher than the share in 2007, just before the financial crisis hit. By the same token, more private-equity deals are loading up on lots of debt than at any time since the crisis.

One sign that the credit quality of the market has been deteriorating is that, globally, the median bond's rating has dropped steadily since 1980, from A to BBB- (see chart). The market is divided into investment grade (debt with a high credit rating) and speculative, or "junk", bonds below that level. The dividing line is at the border between BBB- and BB+. So the median bond is now one notch above junk.

Even within investment-grade debt, quality has gone down. According to PIMCO, a fund-management group, in America 48% of such bonds are now rated BBB, up from 25% in the 1990s. Issuers are also more heavily indebted than before. In 2000 the net leverage ratio for BBB issuers was 1.7. It is now 2.9.

Investors are not demanding higher yields to compensate for the deteriorating quality of corporate debt; quite the reverse. In a recent speech during a conference at the London Business School, Alex Brazier, the director for financial stability at the Bank of England, compared the yield on corporate bonds with the risk-free rate (the market's forecast for the path of official short-term rates). In Britain investors are demanding virtually no excess return on corporate bonds to reflect the issuer's credit risk. In America the spread is at its lowest in 20 years. Just as low rates have encouraged companies to issue more debt, investors have been tempted to

buy the bonds because of the poor returns available on cash.

Mr Brazier also found that the cost of insuring against a bond issuer failing to repay, as measured by the credit-default-swap market, fell by 40% over the past two years. That makes it seem as if investors are less worried about corporate default. But a model looking at the way that banks assess the probability of default, compiled by Credit Benchmark, a data-analytics company, suggests that the risks have barely changed over that period.

So investors are getting less reward for the same amount of risk. Combine this with the declining liquidity of the bond market (because banks have withdrawn from the market-making business) and you have the recipe for the next crisis. It may not happen this year, or even next. But there are already ominous signs.

Matt King, a strategist at Citigroup, says that foreign purchases of American corporate debt have dried up in recent months, and the return on investment-grade debt so far this year has been -3.5%. He compares the markets with a game of musical chairs. As central banks withdraw monetary stimulus, they are taking seats away. Eventually someone will miss a seat and come down with a bump. ■



梧桐

下一次危机的源头

企业债务可能是罪魁祸首

利率正在走高，可能会让金融市场承压。投资者和监管机构都很想知道下一场危机将因何而起。最可能的罪魁祸首是什么？

金融危机往往涉及三个因素中的一个或多个：过度借贷、集中押注，以及资产与负债的不匹配。2008年的危机之所以非常严重，正是因为涉及到了全部这三个因素：大举押注与房地产市场有关的结构性产品、银行资产负债表过度扩张且依赖短期融资。上世纪90年代末的亚洲金融危机则是由于企业在以本币获得收入的情况下借入了过多的美元债务。互联网泡沫的后果没有这两次危机严重，因为集中押注都是在股票上，债务没有起到太大的作用。

如果说下一场危机的起源可能潜藏在公司债务中，可能会有人感到惊讶。公司利润一直在强劲增长。待到标准普尔500指数的成份股公司第一季度的业绩全部公布时，年度收益有望达到25%。有些公司可以说是财源滚滚，比如苹果。

但很多公司并非如此。近几十年来，企业通过提高债务、用利息抵扣税款来让资产负债表更“高效”。有闲置资金的企业往往用这些钱回购股票，要么是迫于维权投资者的压力，要么是因为这样做会抬高股价（进而提升高管所持期权的价值）。

与此同时，长期的低利率也诱使企业举债更多。信用评级机构标普环球（S&P Global）表示，截至2017年，全球有37%的公司债台高筑。这比2007年金融危机前夕的水平高出五个百分点。同样地，私募股权交易也在累积大量债务，达到金融危机以来的最高点。

揭示市场信贷质量一直在恶化的一个迹象是全球范围里债券评级的中值自

1980年以来稳步下跌，从A降到了BBB-（见图表）。债券市场分为投资级（信用等级高的债券）和低于这一级别的投机级，也称“垃圾”级。分界线在BBB-和BB+之间。所以现在债券评级的中值只比垃圾债券高一级。

即使是投资级债券，质量也已下降。根据基金管理公司太平洋投资管理公司（PIMCO）的数据，目前美国48%的此类债券评级为BBB，上世纪90年代这一比例为25%。发行人的负债也比以往多得多。2000年BBB级债券发行人的净杠杆率为1.7，现在是2.9。

投资者并没有要求更高的收益率来补偿公司债务质量的恶化，情况恰恰相反。最近在伦敦商学院的一次会议上，英国央行的金融稳定主管亚历克斯·布雷热（Alex Brazier）在演讲中对比了企业债券的收益率与无风险利率（市场对官方短期利率走势的预测）。在英国，投资者几乎不要求公司债券以超额收益反映发行人的信用风险。在美国，这一利差达到了20年来的最低点。就像低利率鼓励企业发行了更多债券那样，投资者也因为现金的低回报而更愿意购买债券。

布雷热还发现，根据信用违约掉期市场的数据，债券发行人不能偿还债务的保险成本在过去两年中下降了40%。由此看来，投资者似乎较过去更不担心企业违约了。但是，数据分析公司Credit Benchmark编制的一个模型研究了银行对违约概率的评估，显示这一时期的风险几乎没有变化。

因此，投资者承担的风险没变，获得的回报却减少了。再加上债券市场流动性下降（因为银行已经退出了做市业务），下一场危机的配方已经备齐。今年可能不会爆发，甚至明年也不会。但已经出现了一些不祥的征兆。

花旗集团的策略师马特·金（Matt King）说，近几个月外国人已经开始停止购买美国企业债券，而今年迄今为止投资级债券的回报率为-3.5%。他把市场比作抢椅子游戏。各国央行撤回货币刺激措施，就相当于在撤走椅子。到最后就会有人没位子坐，一屁股摔到地上。■



Football

How to win the World Cup

Though tainted by corruption, the tournament rewards liberalism, internationalism and open markets

“FOOTBALL is a simple game,” explained Gary Lineker, formerly the captain of England’s team. “Twenty-two men chase a ball for 90 minutes and at the end, the Germans always win.” Billions of fans will nonetheless pour their hopes into the World Cup, which begins in Russia on June 14th. Many people will join in even if their countries have not made it to the competition. Bangladeshis follow the World Cup fervently, ignoring killjoy officials who have tried to stop them flying flags. The flags of Argentina and Brazil, that is—Bangladesh’s national team is ranked 197th out of 207 in the world and has never qualified for the World Cup.

The Economist is looking forward to the competition, too. Not because we think the country that hosts our head office has much of a chance of winning it—we are too rational for that. But because, first, improbable athleticism, drama and heroism can elevate the game to the level of art (see Books and Arts). And, second, because we see in the World Cup the fulfilment of some of our most cherished values.

Admittedly, much about the tournament is distasteful. Its governing body, FIFA, has a woeful history of cronyism and corruption. This year’s competition will be a fillip for Vladimir Putin’s kleptocratic regime. (In March, after Russia tried to murder an exile and his daughter in the city of Salisbury, England briefly considered withdrawing from the World Cup, but then decided to express its disapproval by—horrors!—instructing Princes William and Harry to boycott the tournament.)

Yet the competition itself, as opposed to the murky process of deciding

where it is played, showcases progress. Teams really are better than they used to be. It also rewards good government. Autocratic regimes such as China and Russia can ruthlessly drill track-and-field athletes—indeed, the Olympic games sometimes resemble an authoritarian pageant. But dictatorships are rubbish at football, which requires more creativity and flair. The contrast between the former East and West Germany is striking. The East trained massively muscled shot-putters; the West, sublime shot-makers. Only four countries rated “not free” by Freedom House, a charity, have qualified for this year’s World Cup, and none is likely to get far. The last country with an autocratic government to win the tournament was Argentina in 1978. The women’s contest has only ever been won by democracies (America, Germany, Japan and Norway), though China once made it to the final.

International football punishes inward-looking countries and rewards those with more cosmopolitan attitudes. When picking team managers, wise countries pass over their national heroes and appoint managers of any nationality who have proved themselves in western Europe’s tough football leagues. They also call upon their diasporas. African countries can field half-decent teams largely because so many of their players have refined their skills abroad. Rich-country teams also benefit from the talents of immigrants. Fully half of France’s victorious squad in 1998 were of migrant stock.

Football can also teach countries how to spot and hone human capital. The best performers not only have systems for finding gifted children, but also ways of spotting late developers who failed to make the first cut. Their academies turn out intelligent, creative players rather than dribbling automatons. Then, if they are clever, they drop their best footballers into a competitive market. A simple model of countries’ aptitude for football, which weighs things like wealth and interest in the game, suggests that America ought to be doing better (see International section). One possible

reason for the failure of its men's teams is that America's professional soccer league is a cartel. Salaries are capped, and the lower-division teams in which domestic players might develop cannot be promoted.

So liberal internationalists should enjoy the World Cup, despite the Putinophile propaganda that will no doubt disfigure it from time to time. Football, like life, is gloriously unpredictable. For what it is worth, our model suggests that one country is best-placed to dominate the beautiful game; indeed, it has performed slightly worse than it should have done over the years. That country is Germany. ■



足球

世界杯取胜要诀

虽受贪腐丑闻影响，这一赛事仍然褒奖自由主义、国际主义和开放市场

“足球是个简单的游戏，”英格兰队前队长加里·莱因克尔（Gary Lineker）解释说，“22名队员追逐一个皮球90分钟，到最后赢的总是德国人。”不过，数十亿球迷依然对今天在俄罗斯揭幕的世界杯满怀希望。即使自己的国家并未入围，许多人仍会观战。孟加拉人狂热追捧世界杯，即使自己国家的官员大煞风景，企图阻止他们悬挂国旗。那是阿根廷和巴西的国旗——孟加拉国国家队在国际足联排名中位列全部207位中的第197位，从未参加过世界杯。

《经济学人》也对世界杯翘首以盼。倒不是因为我们觉得自己总部所在的国家赢面很大——在这一点上我们太过理智。而是因为，第一，非凡的竞技性、戏剧性和英雄主义可将此项赛事升华为艺术。第二，世界杯体现了我们最珍视的一些价值。

无可否认，围绕这一赛事的很多事情都令人生厌。其管理机构国际足联一直有任人唯亲和贪腐的恶名。今年的世界杯将是对普京窃盗统治的一种提振。（今年3月，俄罗斯企图在英国索尔兹伯里市谋杀一名流亡者及其女儿，之后英格兰曾一度考虑退出本届世界杯，但最后也只是决定让威廉王子和哈里王子拒绝出席这届赛事以示不满，唉！）

然而，不同于确定世界杯主办国的暗箱操作，比赛本身彰显着进步。球队的确比以前更优秀。比赛也是对良好国家体制的一种嘉奖。中国和俄罗斯等威权国家可以残酷无情地训练田径运动员——奥运会有时简直就像是威权国家的盛会。但在足球这项更讲求创造力和天赋的运动上，威权统治无能为力。前东德与西德之间的对比就很鲜明。东德训练出肌肉发达的铅球选手，而西德则培养出伟大的射门高手。慈善机构自由之家（Freedom House）评定为“不自由”的国家只有四个入围了今年的世界杯，而且都不

太可能走得很远。上一次夺得世界杯的威权国家是1978年的阿根廷。至于女足世界杯，尽管中国曾打入决赛，但最后夺冠的都是民主国家（美国、德国、日本和挪威）。

在国际足球竞技中，封闭的国家落败，而态度更开放更国际化的国家胜出。在选择球队主教练时，明智的国家放弃了本国的英雄人物，任命那些已经在西欧高水平联赛中证明过自身价值的人，而不论其国籍。他们还会征召海外侨民。非洲国家之所以能派出还算像样的球队，主要原因就是其中不少球员在国外磨练出了一身好球技。发达国家的球队也得益于移民人才。1998年法国夺得世界杯时，队中一半球员都是移民后裔。

足球也可以教导国家如何发掘和培养人力资本。足球强国不仅有挖掘天才少年的体系，还有办法发现未能在一开始脱颖而出的大器晚成者。他们的足球培训学校培养会动脑筋、有创造力的球员，而非运球机器。之后，明智的话，他们会把最好的球员投放到竞争激烈的市场上。一个评估各国足球潜力的简单模型衡量了财力、对足球的兴趣等因素，显示出美国本应有更好的表现。美国男足失败，一个原因可能是因为美国职业足球联赛是一个垄断联盟。球员工资设有上限，能锻炼本国球员的低级别球队又无法升级。

所以，自由开明的国际主义者应该享受世界杯，尽管亲普京的宣传无疑会不时折损其光彩。足球，和人生一样，因不可预知而壮美。不管价值几何，权且看看我们的模型做出的预测：有一个国家最可能称霸这一美妙的竞赛。事实上，这些年该国的表现一直略低于它本应达到的高度。它就是德国。■



Buttonwood

Thinking outside the police box

Time for this column to regenerate

IN A British television show, “Doctor Who”, the titular character is able to travel anywhere in time and space in his Tardis police box. Given access to that technology, what useful message would this columnist impart to his previous self, nearly 12 years and 550 columns ago?

The first lesson would be to avoid confusing the economy with the financial markets. If you looked at share prices alone, you might assume the intervening period had been calm; the S&P 500 index is around double its level when this column began in September 2006. But though the markets have long since recovered their sangfroid after the crisis of 2008-09, the trend growth rate of developed economies has never regained its strength. That is a bitter irony given that the crisis originated within the financial sector, bringing to mind a teenager who crashes their parents’ car and leaves them with the bill.

In part, the market’s resilience was owing to the remarkable strength of corporate profits, something else that would not have been obvious 12 years ago. Back then American profits were only just reaching a post-war high, relative to GDP. When they plunged in 2009, it looked like a return to normal. But the pre-crisis levels were rapidly regained and, indeed, surpassed. Explanations for the strength of profits include less competition in some industries, in particular technology, and the way globalisation has suppressed wage growth. In turn, this sluggish growth of real wages was a significant factor in the rise of populism, another big development of the past 12 years.

The second lesson would be never to underestimate the power of central banks. Readers would have scoffed if this column had forecast, back in 2006, that short rates would be cut to zero and below; that trillions of dollars of government bonds would trade on negative yields; and that even the ultra-cautious European Central Bank would join its peers in wholesale purchases of government debt. But quantitative easing happened without creating the inflation that many feared. And it perhaps averted another Depression.

Another timely tip back in 2006 would have been to relax about China. Those who worried about a banking crash or “ghost cities” full of vacant skyscrapers have yet to be proved right. China’s economy may be growing a little more slowly, but it has not stalled. More broadly, there have been crises in specific emerging markets over the past decade, but nothing as widespread as the turmoil of the late 1990s.

Perhaps these were obvious monsters, like the Doctor’s foes, the Daleks, who could be confused by the simple expedient of throwing a coat over their heads or (in early series) defeated by their inability to climb stairs. The greater financial dangers may be the equivalent of the Weeping Angels—living statues that creep up on you when you are not looking.

For example, experience has shown that there is no innovation, however seemingly benign, that the finance sector cannot overcomplicate and overextend. Securitisation was a good idea when first adopted, but ended with the mess of subprime loans that were sliced and diced into a dog’s breakfast. Exchange-traded funds (ETFs) are an excellent idea—a low-cost way for investors to own a diversified portfolio. But there are now too many funds and too many unnecessary varieties, such as ones that bet on trends in volatility or invest in ETF providers.

One day, this overexpansion may turn out to be a problem, especially as

some ETFs have a liability mismatch. They offer instant liquidity in assets, like corporate bonds, that are fundamentally illiquid. Market-makers known as authorised participants (APs) are supposed to step in and keep the price of ETFs and asset values aligned. But as Helen Thomas of Blonde Money, an economic consultancy, points out, it is not clear which APs back which fund, nor whether it is easy for them to hedge their risks. What will happen in a sharp market downturn?

Markets have recovered from the crisis of 2008. But some day a combination of high valuations, illiquidity and the withdrawal of monetary stimulus by central banks will cause a problem that takes more than the Doctor's sonic screwdriver to fix. Forecasting exactly when that will happen is the tricky bit and, sadly, Buttonwood's Tardis can only go backwards, not forwards, in time.

Indeed, the moment has come for a change. Eventually, after a few series, Doctor Who has to regenerate and be replaced by someone younger, and with a better script. The same is true of columnists. Thank you all for reading. ■



梧桐

超时空思考

本专栏重生的时候到了

在英剧《神秘博士》（Doctor Who）里，神秘博士有个像警亭一样的塔迪斯（Tardis）时光机，能让他任意穿梭时空。如果本专栏的作者也可以使用这种技术，那么会向差不多12年前、550期之前的自己传递什么有用的信息呢？

第一个教训是避免将经济和金融市场混为一谈。如果只看股票价格，你可能会以为这段时期很平静——和2006年9月本专栏刚推出时相比，如今的标准普尔500指数大约翻了一番。但是，尽管市场经过2008年至2009年的危机后早已恢复了冷静，发达经济体的长期增长率却一直未恢复元气。这真是个辛辣的讽刺，因为危机源自金融业内部。这就好比一个十几岁的少年开父母的车出了事故，还把账单留给父母。

在某种程度上，市场的韧性源自异常强劲的企业利润，而这在12年前同样并不明显。当时，美国企业利润占GDP的比例刚刚达到战后的最高点。当2009年利润暴跌时，看起来就像是回归到常态。但是利润却迅速恢复，甚至还超越了危机前的水平。人们对利润强劲做出了种种解释，像是某些行业尤其是科技行业竞争减少，还有全球化抑制了工资增长。实际工资的这种增长疲软继而又成为民粹主义兴起的一个重要因素，这是过去12年中另一个重大发展。

第二个教训是永远不要低估央行的力量。如果本专栏在2006年做出以下预测——短期利率将降至零及负值；数万亿美元的政府债券将以负收益率交易；即使是极度谨慎的欧洲央行也会像其他国家的同行一样大规模购买政府债券——读者可能会嗤之以鼻。但量化宽松政策的实施并没像许多人担心的那样造成通胀，而且或许还避免了又一场大萧条。

回到2006年，另一个适时的建议是不用对中国那么紧张。一些人曾担心

出现银行业崩盘或者充斥着空置摩天大楼的“鬼城”，他们的担忧尚未应验。中国的经济增长可能是放慢了一些，但并没有停滞。从更大的范围看，过去10年有些新兴市场出现了危机，但并不像上世纪90年代末的动荡那样波及广泛。

上面提到的这些也许是显而易见的恶魔，就像神秘博士的对头戴立克（Dalek）那样，扔件外套把它们的脑袋盖住这样的应急招数就能让它们陷入混乱，或是像早期的剧集里那样，利用它们不会爬台阶的劣势就能打败它们。而更大的金融危险可能更像剧中的哭泣天使（Weeping Angel），当你不注意时，这些活雕像就会悄悄发起攻击。

例如，经验表明，金融部门可以把任何一项看似无害的创新过度复杂化并过度扩展。证券化起初被采用时是个好主意，但最终导致了被各种切分打包、极为混乱的次级贷款。交易所交易基金（ETF）是个非常好的想法，可以让投资者以低成本拥有多样化的投资组合。但现在有太多的基金和太多不必要的种类，比如那些押注于波动趋势或投资ETF供应商的。

某一天，这种过度扩张可能会成为问题，特别是考虑到有些ETF存在资产负债不匹配。它们对公司债券这类根本上缺乏流动性的资产提供即时流动性。被称为授权参与商（AP）的做市商按理说应该介入，并让ETF的价格和资产价值保持一致。但是，正如经济咨询公司Blonde Money的海伦·托马斯（Helen Thomas）所指出的那样，目前还不清楚哪些授权参与商支持了哪些基金，也不清楚它们是否容易对冲自己面临的风险。在市场急剧下滑时会发生什么？

市场已经从2008年的危机中恢复过来。但总有一天，高估值、流动性不足、再加上央行撤回货币刺激政策会引发一个靠神秘博士的超声波螺丝刀也解决不了的问题。要预测问题究竟何时会出现很难，而且可悲的是，梧桐专栏的塔迪斯时光机只能回到过去，无法去到未来。

的确，改变的时刻到了。最终，在经历了几季之后，神秘博士必须要重生，被更年轻的人所取代，并采用更好的剧本。专栏作者也是如此。感谢

大家的阅读。 ■



Buttonwood

Lessons from Las Vegas

For all but the most talented, a rules-based approach works best—in poker and investing

AT THE annual World Series of Poker, which begins this week in Las Vegas, the main event is the no-limit Texas hold 'em tournament. In the course of two weeks of gruelling knock-out play, several thousand players are whittled down to just two, playing “heads-up” for one of the WSOP's coveted bracelets.

In last year's final hand, both players had pushed all their chips in, with five shared cards yet to be dealt. Scott Blumstein, who held Ace-Deuce, was a big underdog against Daniel Ott, who held Ace-Eight. With one card to come, Mr Blumstein's hand had not improved. His chances had narrowed to 7%. Of the remaining 44 cards, only one of the other three deuces could give him victory.

The cards—and thus the odds of winning or losing—were known to both players, because they had already committed all their chips. Poker is not usually like this. Winning depends not only on your cards but on the unseen cards held by other players, on your ability to deceive them by your betting policy and on their ability in turn to deceive you. Fear and greed induce errors. In short, there is uncertainty. All this is also true of investing. The truly talented are able to read complex situations to their advantage. But there are ways for the less gifted to succeed—in both poker and investing.

They can start by being aware of the ludic fallacy. This is how Nassim Nicholas Taleb, an author, refers to the belief that risk in financial markets can be calculated as if it were a game with known odds. If you throw a pair of fair dice, you cannot know how they will land. But you do know some

things. There are 36 possible pairs of numbers. Some totals are more likely than others. There are six ways to throw a seven, for instance, but only one way to throw either a two or a 12.

It is tempting to think that investing is like this—that the risks are calculable in advance. They are not. Investment returns are highly uncertain and irregular. Extreme events, such as market crashes, are more frequent than you would expect if dice games were your model of the world. After repeated rolls, dice throws fit a pattern that is known beforehand. In markets, almost anything can happen.

That is also true of poker. Each player has to live with uncertainty: about the cards opponents hold; about their betting strategy; about their understanding of your betting strategy; and even their grasp of the game. Emotions come into play. Players fold winning hands because an aggressive bluff makes them fear losing. And players call bets with losing hands out of greed for a big pot. The best players, like the best investors, seem to thrive on uncertainty. They look for betting patterns or for “tells” (expressions or hand movements) that betray the strength or weakness of an opponent’s hand. They make uncertainty work for them. They find spots where a big bluff is hard for an opponent to call.

For the rest of us, says Aaron Brown, a quantitative analyst and author of “The Poker Face of Wall Street”, a sound principle is to settle on a basic strategy and stick to it. In poker that means choosing in advance which starting hands you will play in each table position and deciding how you will bet should those hands improve when the shared cards are dealt.

The policy also works in investment. A simple strategy is to allocate a fixed portion of your wealth to different assets—half in a broad index of stocks, say, and half in bonds—and to “rebalance” every so often so that the weights are kept constant. An advantage is that you will automatically sell assets

that have become dearer and buy assets that have become cheaper. “It turns out that any simple fixed-weight allocation works well,” writes Andrew Ang, of BlackRock, in his book, “Asset Management”.

Though simple in principle, a rules-based approach is difficult to follow in practice. It is hard to stay disciplined when your opponents in poker repeatedly draw the improbable cards they need to beat your strongest hands. A player is said to be “on tilt” when frustration at bad luck leads him to abandon his strategy. Investors are prone to similar sorts of errors when things go against them. “Having a non-stupid strategy and sticking to it will leave you better off than most people,” says Mr Brown.

Bad luck is part of the game. The best you can do is to try to make the right decisions given the inevitable uncertainty. In the final hand of the WSOP main event last year, Mr Ott made the right decision when he called Mr Blumstein’s bet. The odds favoured him. And they continued to until the moment when the dealer turned over the final card—a deuce. ■



梧桐

向拉斯维加斯取经

除了最有才华的人之外，不管是玩扑克还是投资，还是坚守一套策略最有用

五月底在拉斯维加斯开幕的年度世界扑克大赛（WSOP）中，主赛事是无限注德州扑克。经过两周艰苦的淘汰赛，数千名选手最终剩下两人，为 WSOP 那令人垂涎的金手链展开“单挑”。

在去年的最后一手牌中，在还有五张公共牌未发的时候，双方都已将全部筹码推入底池。此时斯科特·布卢姆斯坦（Scott Blumstein）和丹尼尔·奥特（Daniel Ott）的底牌分别为 A2 和 A8，布卢姆斯坦的牌面很不利。在发最后一张河牌之前，布卢姆斯坦的手气一直没有好转，他的赢面已经降低到 7%。在剩下的 44 张牌中，只有其余三张 2 中的一张可以让他获胜。

双方都知道已经发出的牌，也知道胜负的几率，因为他们已经投下了全部的筹码。玩扑克牌通常不是这样的。能否获胜不仅取决于你手上的牌，还取决于其他玩家手上你看不到的牌，以及你利用下注策略蒙骗对手的能力和他们反过来蒙骗你的能力。恐惧和贪婪会导致犯错。总之，这其中存在不确定性。投资也是如此。真正天赋禀异的人能够解读复杂情况为己所用。但是，也有些方法可以让天资平平的人成功，无论是玩扑克还是投资。

他们可以先从了解“戏局谬误”开始。这是作家纳西姆·尼古拉斯·塔勒布（Nassim Nicholas Taleb）提出的一个概念，描述了这样一种谬误：相信可以像面对输赢几率已知的游戏那样计算金融市场上的风险。假如你掷出一对骰子，你无法预知会掷出什么结果。但有些事情你是知道的。两个骰子可以掷出 36 个组合，得到某些总点数的概率要比另一些概率高。举例来说，有六种方法可以掷出七点，但只有一种方法可以掷出两点或 12 点。

人们很容易认为投资也是这样，可以预先计算风险。其实不然。投资回报具有高度不确定性和不规律性。市场崩盘等极端事件要比你拿骰子游戏模

拟世界得出的预期更频繁。不断掷骰子，结果将符合事先已知的模式。而在市场上，几乎任何事情都可能发生。

扑克也是如此。每个玩家都必须接受不确定性：对手的牌不确定；他们的下注策略不确定；他们对你的下注策略的理解不确定；甚至他们对牌局的理解都不确定。情绪会产生影响。玩家在手握好牌时会因为对手咄咄逼人的虚张声势而畏惧弃牌，也会在握着一手烂牌时因为觊觎桌上的大笔筹码而下注。像最好的投资者一样，最优秀的扑克玩家似乎也靠不确定性而成功。他们会寻找对手的下注模式或暴露对手牌面大小的“破绽”（下意识的表情或手部动作）。他们会充分利用不确定性。他们会把握机会做出对手难以看穿的大虚招。

《华尔街扑克脸》（The Poker Face of Wall Street）的作者、定量分析师亚伦·布朗（Aaron Brown）说，对于我们其他人而言，合理的原则是制定一个基本策略并坚持下去。在牌局中，就要事先选择在每个桌位上拿到哪些起手牌时可以玩下去，并决定公共牌发出后如果牌面有改善该如何下注。

该原则也适用于投资。一个简单的策略是把你的财富按固定比例分配给不同的资产，比如一半投资跟踪综合股指，一半投资债券，并不时“重新平衡”一次，以保持权重不变。这样做的一个好处是你会自动出售价格上涨的资产并买入变得更便宜的资产。资产管理公司贝莱德集团

（BlackRock）的安德鲁·昂（Andrew Ang）在其《资产管理》（Asset Management）一书中写道：“事实证明，任何简单的固定权重配置都很奏效。”

尽管从理论上讲很简单，但在实践中要坚守策略很难。在牌局中，当对手总能抽到不可思议的好牌而压过你最好的牌时，你很难淡定遵循原则。如果运气不好让一个玩家因受挫而放弃策略，我们就会说“玩家急眼了”。当局面不利于投资者时，他们也容易犯下类似的错误。布朗说：“制定一项还不坏的策略并坚持下去，会让你的结果比大多数人更好。”

坏运气不可避免。你所能做的最好选择就是鉴于不可避免的不确定性尽量

做出正确的决定。在去年WSOP主赛事的最后一局，奥特在布卢姆斯坦下注后正确地选择了跟注。当时的几率一直有利于奥特。而在发牌员把最后一张牌翻过来时，一切戛然而止——那是一张2。 ■



Economic and financial indicators

Central banks

More than \$9trn of global sovereign bonds were trading at negative rates last summer

Since the 2007-08 financial crisis, big central banks have carried out asset-purchase programmes to stimulate economic growth and reduce borrowing costs. Government-bond yields have fallen as a result. More than \$9trn of global sovereign bonds were trading at negative rates last summer, according to the OECD. The Bank of Japan now holds over 40% of the country's government debt. Monetary policy has diverged between America and Europe. Whereas the Federal Reserve started to reduce the size of its balance-sheet last year, the European Central Bank intends to continue asset purchases until inflation is close to the target of just under 2%. ■



经济与金融指标

中央银行

去年夏天，全球超过9万亿美元的主权债券收益率为负

自2007年至2008年金融危机以来，为刺激经济增长、降低借贷成本，各大央行实施了资产购买计划。政府债券收益率因此下降。根据经合组织的数字，去年夏天，全球超过9万亿美元的主权债券收益率为负。日本央行如今持有超过40%的国债。美国和欧洲的货币政策出现分化。美联储去年开始缩表，而欧洲央行却打算继续购买资产，直到通胀接近比2%略低的目标。 ■



Conservation

A great survivor

Australia's coral barrier reef keeps dying and coming back

THE Great Barrier Reef, which runs for 2,300km along the coast of Queensland, is one of the icons of environmentalism. Conservationists constantly worry that human activity, particularly greenhouse-gas-induced global warming, will harm or even destroy it. Such fears are not foolish, but they do reflect a view of the reef's permanence that is at variance with the truth. For, a mere 10,000 years ago, the coral-covered seabed that now forms the Great Barrier Reef was dry land—a fact lamented in the songs, tales and dances of indigenous people living along the coast, which speak of homelands being drowned by incoming waters.

The reality of the Great Barrier Reef's existence is that it is a movable feast. Reef-forming corals prefer shallow water so, as the world's sea levels have yo-yoed during the Ice Ages, the barrier reef has come and gone. The details of this have just been revealed in a paper published in *Nature Geoscience* by Jody Webster of the University of Sydney and her colleagues. The authors examined cores drilled through the reef in different places. They discovered, as the chart shows, that it has died and then been reborn five times during the past 30,000 years. Two early reefs were destroyed by exposure as sea levels fell. Three more recent ones were overwhelmed by water too deep for them to live in, and also smothered by sediment from the mainland. The current reef is therefore the sixth of the period.

The barrier reef's ability to resurrect itself is encouraging. But whether it could rise from the dead a sixth time is moot. The threat now is different. It is called bleaching and involves the tiny animals, known as polyps, which are the living part of a reef, ejecting their symbiotic algae. These algae

provide much of a polyp's food, but also generate toxins if the temperature gets too high, in which case the polyp throws them out. That causes the coral to lose its colour.

Polyps can tolerate occasional bleaching, but if it goes on too long, then they die. In the short term, therefore, global warming really does look a serious threat to the reef. It would, no doubt, return if and when the sea temperature dropped again. But when that would be, who knows? ■



环境保护

了不起的幸存者

澳大利亚的大堡礁不断上演死而复生

大堡礁位于昆士兰东海岸，绵延2300公里，是环境保护主义的象征之一。环保人士时常担心，人类活动尤其是温室气体引发的全球变暖会危害甚至毁灭大堡礁。这种担忧并不愚蠢，但确实反映出有些人把大堡礁看作某种一成不变的东西，而事实并非如此。因为，仅仅在一万年前，构成了今天的大堡礁的这片珊瑚覆盖的海床还是陆地——当时生活在海岸上的土著人用歌声、传说和舞蹈哀婉地述说了自己的家园如何被涌入的海水淹没。

关于大堡礁的事实是它的存在是一场流动的盛宴。珊瑚礁由珊瑚构成，而珊瑚喜欢浅水区，因此，随着冰河时期全球海平面的高低变化，大堡礁也不断死而复生。近期发表在《自然-地球科学》上的一篇论文对此作出了详细的描述。论文作者、悉尼大学的乔迪·韦伯斯特（Jody Webster）及其同事在大堡礁各处钻取岩心加以分析，发现大堡礁在过去三万年里上演了五次死亡和重生（见图表）。前两代大堡礁因为海平面下降致使珊瑚露出水面而覆灭。距今更近的那三代则因为海水太深无法生存，以及被来自陆地的沉积物掩埋。因此，如今的大堡礁已是第六代。

大堡礁的重生能力令人振奋。但它能不能第六次起死回生就是个未知数了。如今的威胁不同以往。这是一场叫作珊瑚白化的危机，产生的原由是珊瑚礁上有生命的那部分——也就是人们所知的名叫珊瑚虫的微小动物——将共生藻从体内排出。共生藻为珊瑚虫提供了大部分养料，但如果水温过高也会产生毒素。在这种情况下，珊瑚虫就会将共生藻从体内驱逐出去。而珊瑚也会因此失去颜色。

珊瑚虫可以忍受偶尔的白化，但如果持续时间过长，它们就会死亡。因此，从短期来看，全球变暖对大堡礁确实是个严峻的威胁。如果有一天海水温度再次下降，毫无疑问，大堡礁还会再次重返世界。但谁知道水温什

么时候才会降下来呢？ ■



Regional development

Bootstrapping a backwater

The biggest centres of tech industry in China are on the coast. Two stories look at how inland provinces are trying to change that

A ROBOT taller than the Arc de Triomphe towers over a new theme park on the edge of Guiyang, the capital of the southern province of Guizhou. Attendants at Oriental Science Fiction Valley dress in blue-and-silver space suits. They greet visitors with salutes used by the Vulcans in “Star Trek”. The main attraction is an indoor rollercoaster. It simulates an air battle over a futuristic city with the help of virtual-reality headsets that are handed out to every rider. Outside, a troop of black-clad security guards armed with big sticks adds a genuine air of menace.

Such space-age fantasy appears incongruous in Guizhou. The mountainous region is one of China’s poorest provinces (see map). More than 4m of its 35m inhabitants live on less than \$1.90 a day, according to the government. In 2016 less than 45% of them used the internet. Five years ago, however, Guizhou started selling itself as a good place for big companies to store vast reservoirs of data. Now it is experiencing a tech boom. Beneath a hill not far away from the amusements, Tencent, an internet giant, has finished excavating a bomb-proof cavern with five massive entrances. It will house one of the company’s largest server centres. Last year Apple said it would invest \$1bn in the region. On April 25th it broke ground there on its first data centre in China.

China has a history of trying to develop important industries deep inland. In the 1960s Mao began moving much of China’s weapons production and other manufacturing away from coastal areas that were easy to attack. Now the country wants to lead the world in big data, artificial intelligence and

other cutting-edge pursuits. The coast would make sense: that is where the techies mainly congregate. China, however, is encouraging some of this business to move beyond the wealthy boom towns of the seaboard.

Security is only one, minor, reason. In 2015, when the central government declared that Guizhou would be a “National-level Pilot Zone” for big-data development, it had two main motives. The first was to fulfil a promise to stimulate regions that have benefited least from China’s rapid development (last year the country’s leader, Xi Jinping, showed his support for backward Guizhou by attending a Communist Party congress as a delegate of the province). The second was to show that China’s less industrialised regions can modernise without the dirty factories that have left urban areas elsewhere in China choking in smog. The number of tourists visiting Guizhou jumped by 40% last year—many of them attracted by its beautiful landscapes.

Officials say there are more than 8,500 big-data firms in Guizhou, more than eight times as many as in 2013. Much of the action in the province is taking place in and around Guiyang, a verdant city of 3m people surrounded by tree-covered karst. A guide displays a map of the area, pointing to its data centres. As well as those of Tencent and Apple, they include facilities for Foxconn of Taiwan, South Korea’s Hyundai and China’s three state-owned telecoms firms. A new complex being built by Huawei, a telecoms equipment-maker, will resemble a Swiss lakeside town.

Guizhou is a reasonable enough place to house large servers. Land is cheaper than on the coast. Electricity costs less, thanks to local hydropower and the province’s position on the route of big transmission lines that bring power from China’s sparsely populated west. It has a milder climate than southern coastal cities, making it easier to keep servers cool. It is not prone to natural disasters.

Tech executives also have political motives for investing in Guizhou. They want to be seen to support the government's pet projects. Investing in Guizhou has been a chance to curry favour with the party's rising stars, who are sometimes dispatched to the province as a sort of trial by fire. As party chief of Guiyang from 2013 to 2017, Chen Gang was one of the tech cluster's architects. He is now in charge of one of Mr Xi's big schemes—the building of Xiong'an New Area, a whole new city near China's capital. Chen Min'er, Guizhou's boss until last summer when he took over as party chief of Chongqing, is another person whom companies have wanted to butter up. In October he gained an additional title: member of the ruling Politburo.

But will Guizhou's data-hosting industry transform its economy? Warehouses filled with servers require huge upfront investments but few staff. The bigger spoils flow from sprightlier businesses that know how to crunch data. Guizhou also wants to attract those. One of the perks of becoming a big-data pilot zone was being allowed to supply such firms with reams of government-held data to process for profit.

Between May 26th and 29th many company bosses flew in from their coastal headquarters for a "Big Data Expo" held in Guiyang. Billboards filled the city with such pithy slogans as: "Acutely grasp the historical opportunity of informatisation development." But getting firms to stay will be tricky. A few years ago officials enticed Huochebang—a startup that helps find loads for lorry-drivers and which was recently valued at more than \$6bn—to move to Guiyang from Chengdu, a much bigger and trendier city. But many of its best-paid staff continue to work at offices in coastal cities, notes Dan Wang of Gavekal Dragonomics, a research outfit.

The government of Guizhou is an enthusiastic champion of companies that make the province their home, says William Li of Esgyn, a database firm with offices in Guiyang and two other Chinese cities. Yu Yueqing, who owns a business that crunches educational data, agrees. He left Guiyang after

graduating in 2009, but decided to move his eight-year-old company back to the city last year. However, he still struggles to find enough qualified staff. For the foreseeable future, his research team will continue working in Beijing.

It is unclear whether Guizhou's political fortune will change now that the pilot's early proponents—the two Mr Chens—have moved to other provinces with their own tech dreams. When a routine letter of congratulation from Mr Xi was read aloud at Guiyang's recent expo, the province's current boss, Sun Zhigang, described it as "historic" and "a milestone". Such sucking up is common among officials across China. Given the competition, Mr Sun may have good reason to indulge in it. ■



区域发展

内陆奋起

中国最大的科技产业中心都位于沿海地区。两则报道讲述内陆省份如何试图改变这一现状

在贵州省会贵阳的近郊，坐落着一个新建的主题公园——东方科幻谷，一个比凯旋门还高的机器人耸立其中。工作人员身穿点缀着银色的蓝色宇航服，用电影《星际迷航》里的瓦肯举手礼向游客打招呼。公园的主要项目是一座室内过山车。乘客戴上景点分发的VR头显，进入一座未来城市参与一场空战。而在室外，一群身穿黑衣、配备警棍的保安增添了真实的肃杀气氛。

这样一种太空时代的奇幻景象似乎与贵州格格不入。多山的贵州是中国最贫困的省份之一（见地图）。政府数据显示，贵州3500万人口中有400多万人每天生活费不足1.9美元。2016年，这里的互联网普及率不到45%。然而，五年前贵州开始宣传自己是供大企业存储海量数据的乐土。如今它正经历着一场科技热潮。在离科幻谷不远的一处山脚下，互联网巨头腾讯已开凿出一个有五个巨大入口的防空洞。这里将成为腾讯最大的服务器中心之一。去年，苹果表示将在贵州投资10亿美元。4月25日，苹果在中国的第一个数据中心在这里破土动工。

中国在很久以前就试图在内陆腹地发展重要产业。上世纪60年代，毛泽东开始将很多兵工厂和其他制造业搬离易受攻击的沿海地区。如今，中国希望在大数据、人工智能以及其他前沿领域领先全球。沿海地区理应担此重任，因为这里集聚了大部分技术人才。然而，中国正在鼓励其中一些业务向富裕的沿海新兴城市以外的地方扩展。

安全只是个次要原因。2015年，中央政府出于两方面的考虑，宣布将贵州建成发展大数据的“国家级试验区”。首先是兑现承诺，促进那些从国家的高速发展获益最少的地区的发展（去年，国家领导人习近平作为贵州代

代表团代表参加了党代会，以表现对这个落后省份的支持）。其次是要表明中国工业化程度相对较低的地区不需要依靠高污染工厂来实现现代化，这样的工厂已使得中国许多城市被雾霾笼罩。去年，到贵州的游客数量猛增40%，其中很多人是被这里美丽的风景所吸引。

官员们表示，贵州现有大数据公司8500多家，是2013年的八倍多。该省的科技热大多发生在贵阳及其周边。人口300万的贵阳绿意葱茏，周围是林木覆盖的喀斯特地貌。一本旅游指南中的贵阳地图上标示了该地的多个数据中心。除了腾讯和苹果，其中还包括台湾的富士康、韩国的现代以及三家国有电信企业的设施。电信设备制造商华为正在兴建一个建筑群，建成后将仿若瑞士的湖畔小镇。

贵州有很好的理由充当“大机房”。这里的地价比沿海便宜。得益于当地的水力发电，加上地处从人口稀少的西部向东输送电力的干线之上，电力成本也更低。贵州的气候也比南部沿海城市温和，更易于让服务器保持在较低的温度。而且贵州也不易发生自然灾害。

科技企业的高管们投资贵州也有政治目的。他们希望表现出自己支持政府看重的项目。共产党内的后起之秀有时被派往贵州接受锻炼，投资贵州一直是讨好这些人的机会。2013年至2017年时任贵阳市委书记的陈刚是贵州科技集群的缔造者之一。现在他负责习近平的一项重大计划，要在北京附近建设一个全新的城市——雄安新区。陈敏尔是另一个很多公司都想巴结的人物。去年夏天接任重庆市委书记之前，他在贵州担任省委书记。去年10月，他又获得了中央政治局委员的头衔。

但是，贵州的数据托管产业会改变当地经济吗？放满服务器的机房需要巨额前期投资，却不需要多少员工。那些知道如何处理数据的更有活力的企业才会带来更大的好处。贵州也想吸引这类企业。成为大数据试验区享受到的待遇之一就是可以向这些公司提供政府拥有的大量数据，供它们处理并获利。

五月26日到29日，许多公司老总从他们的沿海总部飞抵贵阳参加一个“大

数据博览会”。市里到处可见写着各式简洁标语的广告牌，比如“敏锐把握信息化发展的历史机遇”。但是要让公司留下来不容易。帮助卡车司机寻找货源的创业公司货车帮原本开在远比贵阳更大更时尚的成都，几年前贵阳的官员们把它挖了过来。最近货车帮估值超过60亿美元。但是研究机构龙洲经讯的王丹（Dan Wang，音译）指出，货车帮许多薪酬最高的员工仍然在沿海城市的办公室里工作。

在贵阳和另外两个中国城市设有办公室的数据库公司易鲸捷的李为冲表示，贵州政府热情支持企业扎根贵州。对此，拥有一家教育数据处理公司的余月清表示认同。2009年余月清毕业后离开贵阳，但是去年他决定将成立八年的公司搬回来。然而他仍旧难以招到足够多的合格员工。在可预见的将来，他的研究团队仍将继续留在北京工作。

试验区的两位陈姓早期倡导者已带着他们自己的科技梦想赴任其他省份，很难说贵州的政治命运是否会发生变化。贵阳最近举办的数博会上宣读了习近平的例行贺信，现任省委书记孙志刚形容这是“历史性的”、“里程碑意义的大事”。这样的奉承在中国官员中司空见惯。鉴于竞争之激烈，孙志刚或许有充分的理由沉湎其中。 ■



Overbond

Unbounded

A Canadian startup seeks to shed light on bond issuance

WITH the exception of a few governments big enough to run their own auctions, anyone wishing to issue bonds must seek bankers' help. A hefty fee will buy assistance in calibrating the size, structure and timing of a bond issue, as well as connections to lots of buyers. And once a bank has agreed to underwrite an issue, it bears the risk of failing to get a good price for the bonds. But the process is old-fashioned and inefficient (the head of bond origination at one American bank jokes that "not a lot has changed since 1933"), and the accuracy of the advice is hard to gauge. Overbond, a financial-technology startup in Toronto, wants to change all that.

Investment bankers responsible for bond issuance still operate largely by feel, calling up asset managers to get a sense of demand, rather than by crunching numbers. Rules against insider trading mean they cannot talk directly with their trader colleagues. Data on existing bonds are more abundant. In America, for instance, information on the price, timing, yield and volume of all bond transactions must be reported publicly within 15 minutes. But so far, comparing primary and secondary markets has been difficult. By crunching a wide array of public data, Overbond seeks to provide a link between the two.

Its main offering is a set of machine-learning algorithms powered by neural networks, a type of artificial intelligence, that predict the timing and pricing of new bond issues. The service is already fully in place for the Canadian corporate-bond market, and partly so for the American one. The algorithms crunch through credit ratings and real-time data on secondary trading for a firm and its peers, among other things. Recent predictions for the yield

on new bond issues have been, on average, off by less than 0.02 percentage points.

A subscription buys tailored estimates of demand for new bonds, including the interest rate the market is willing to bear. This helps corporate treasurers gauge market conditions and decide when to issue bonds and in what maturity. Of the 200 or so Canadian corporations that issue debt frequently, 81 are signed up.

Investors can use a basic version of the service without charge, partly because the firm collects data from them that then feed into the algorithms. They can, for instance, get estimates of the timing of the next bond issue to hit the market, using data on the timing of previous issues, issues by similar companies and balance-sheet data. Around half of Canada's institutional bond investors use it in some way.

Canada's corporate-bond market is a relative tiddler, with a total of 604 new bond issues in the past two years. Its investment-banking community is small, too; Overbond reckons that every new bond issue passes through one of just seven individuals. But the firm now hopes to break into America, the world's largest corporate-bond market with around 3,000 new issues annually. There, issuance is much more fragmented. Around 40 banks are active in bond origination, and no firm has more than a 12.5% market share, according to Thomson Reuters, a financial-data firm.

Vuk Magdelinic, Overbond's founder and chief executive, says that starting small in Canada gave the firm the chance to perfect its algorithms. It has refined its timing-prediction algorithm for the American market (see chart for an example on Microsoft). Some actively managed bond funds have already expressed interest. It has opened a New York office and is seeking funding from American investors.

Bankers, perhaps unsurprisingly, proclaim themselves sceptical that something as sophisticated as bond origination could be pried from their grasp by a fintech challenger. Instead, they think they spy an opportunity. Some have expressed interest in using Overbond's timing algorithm to help spot firms in need of financing before they come asking for it. In finance, as elsewhere, machines and humans may be more powerful together than either is alone. ■



Overbond公司

不受限制

加拿大一家创业公司试图简化债券发行

除了少数大国政府能够自己拍卖债券，其他任何人想要发行债券都必须找银行帮忙。付一大笔费用就可以获得以下帮助：校准债券发行的规模、结构和时机，还有与众多买家建立联系。一旦银行同意承销一只债券的发行，它就要承担无法为债券拿到好价钱的风险。但这个过程过时又低效（一家美国银行的债券发行部主管开玩笑说，这一行“自1933年以来就没有多大变化”），而且难以衡量建议的准确性。位于多伦多的金融科技创业公司Overbond想要改变这一切。

负责发行债券的投行人士依然主要凭感觉行事，给资产管理公司打打电话感觉一下需求，而不是依靠数据分析。防止内幕交易的规则让他们无法直接与交易员同事沟通。相比之下，已发行债券的数据更丰富些。例如，在美国，所有债券交易的价格、时机、收益和数量的信息必须在15分钟内公开报告。但到目前为止，要比较一级市场和二级市场仍很困难。

Overbond处理了大量公开数据，试图在这两者之间建立关联。

该公司的主要产品是一套由神经网络（一种人工智能）驱动的机器学习算法，能够预测新债券发行的时间和定价。针对加拿大企业债券市场的服务已经完全就绪，针对美国市场的服务则已部分到位。这些算法为一家公司及其同业分析信用评级和二级市场实时交易数据等信息。平均而言，最近对新发行债券收益率的预测误差不到0.02个百分点。

付费用户将获得对于新债券需求量的定制化预测，包括市场愿意承受的利率。这有助于企业的财务主管评估市场状况，并决定发行债券的时间和期限。在经常发行债券的大约200家加拿大企业中，有81家已经与该公司签约。

投资者可以免费使用这项服务的基础版本，一定程度上是因为该公司要从

他们那里收集数据，然后输入到算法中。例如，他们可以利用以往债券发行的时间、相似企业发行债券及资产负债表数据，来预测下一次债券发行的时机。加拿大有一半左右的债券机构投资者都以某种方式使用这种服务。

加拿大的企业债券市场规模相对较小，过去两年总共发行了604只新债券。它的投资银行群体也很小——Overbond认为每一只新债券都是由7家投行之一发行的。但该公司现在希望进入美国这个世界最大的企业债券市场，这里每年发行约3000只新债券。发行渠道也分散得多。根据金融数据公司汤森路透的数据，约有40家银行从事债券发行，没有一家的市场份额超过12.5%。

Overbond的创始人兼首席执行官武克·马德里尼（Vuk Magdelinic）表示，从较小的加拿大市场做起给公司提供了完善算法的机会。它已经为美国市场改进了预测时机的算法（如图，以微软为例）。一些主动型债券基金已表达了兴趣。Overbond在纽约设立了办事处，并正在争取美国投资者的资金。

或许并不令人意外的是，银行家们表示了怀疑。他们认为债券发行这么复杂，是不会被一家金融科技挑战者从他们手中撬走的。相反，他们认为自己看到了一个机会。一些银行表示，有兴趣使用Overbond的时机算法来提前找到有融资需求的企业。与其他领域一样，在金融领域，机器和人的联手可能比任何一方单打独斗都更为强大。 ■



Toyota and autonomy

Speed limited

The Japanese giant is taking a measured approach to autonomous vehicles

UBER's fleet of autonomous vehicles has been parked up since one of its self-driving cars struck and killed a woman in Tempe, Arizona in March. That death highlighted once again the industry's rush to develop self-driving cars. Waymo, a sister company of Google, plans to launch a robotaxi service in Arizona this year. General Motors says it will launch a fully autonomous taxi service, using cars with no steering wheel or pedals, in an American city in 2019. Volkswagen will make autonomous vehicles available through its new ride-hailing service, Moia, in 2021. Ford says it will be mass-producing fully autonomous cars by then, too.

But not every carmaker is going at the same speed. Toyota, one of only three car companies that sells over 10m vehicles a year, has made no equivalent commitments. The Japanese firm is instead concentrating on using artificial intelligence (AI) and automation to make conventional cars safer and more enjoyable to drive.

The immediate aim is to extend the age at which it is safe for older people to drive themselves, by using technology that can catch their mistakes. Software that processes data from on-board cameras and radar units will watch out for impending crashes and try to stop the car before impact, or correct for the slow out-of-lane swerve of a tired driver. Other software will guide the car in slow traffic, so that drivers can relax.

Helping older drivers is a particular concern in Toyota's home market, where over a quarter of people are over 65. But similar demographic crunches are coming elsewhere. "Imagine a car, one day, that is so good that

“it will never be responsible for a crash, no matter what the driver does,” says Gill Pratt, chief executive of the Toyota Research Institute (TRI), the carmaker’s research hub in Silicon Valley.

This incremental approach will not necessarily leave Toyota in the dust. As the Uber crash showed, fully automated driving is difficult, and is progressing slowly, despite the billions being thrown at it. Rodney Brooks, a roboticist who sits on TRI’s advisory board, recently predicted that no unrestricted robotaxi service would arrive in a big American city until 2032. Toyota’s caution may let it avoid waves of self-driving hype and disappointment, while still giving it the tools to develop fully autonomous cars in future.

A slower approach also lets Toyota build the high cost of gathering driving data into its existing business. Before their cars can drive in a particular area, robotaxi firms must map it in exquisite detail, manually and at great cost, by driving mapping cars around the area they wish to service. Those valuable data are used to teach AI algorithms about human behaviour in the area, as well as about road layouts.

Toyota plans to gather similar data cheaply through its fleet of consumer-driven cars (by 2025 this will number some 50m cars). Outward-facing cameras and radars, now being installed in all its new cars to make them safer, will also gather on-board data that can be used to train fully autonomous driving software. Information gathered on such a large scale will allow Toyota’s AI to learn to handle traffic events that are extremely unusual, the sort which robotaxi firms gathering data in lesser quantities may never see.

Lack of “lidar” (light detection and ranging) sensors in Toyota cars could prove a hindrance, however. Lidar works by emitting pulses of laser light

and watching for their reflections, thereby building a precise 3D map of the surroundings—essential for training today's automated driving software, since video and radar do not capture the environment in sufficient detail. Robotaxi firms gather lidar data in every patch of city in which they deploy their cars, but Toyota will not, for the foreseeable future, be able to do so. The firm will either need to find a way to add expensive lidar sensors to the cars it sells, or to advance its machine-learning software to the point where it can learn to drive without it.

Toyota also needs to ensure that all the cars it sells have internet connections to transmit data in real time. A new arm, Toyota Connected, is aiming for that by 2020 in the firm's two main markets, America and Japan.

All this adds up to a bet that massive scale and patience can beat being first to market. Toyota is not chasing the robotaxi dream directly. But it may nonetheless end up in the right place at the right time, and with the relevant data to cash in. ■



丰田和自主

限速

这家日本巨头对无人驾驶汽车态度谨慎

今年3月，优步的一辆无人驾驶汽车在亚利桑那州坦佩市（Tempe）撞死了一名女子，之后该公司暂停了对无人驾驶汽车的测试。这宗死亡事故再次凸显出汽车行业在发展无人驾驶汽车方面有多么急于求成。谷歌的姐妹公司Waymo计划今年在亚利桑那州推出机器人出租车（robotaxi）服务。通用汽车公司表示将于2019年在美国某城市推出完全自动驾驶的出租车服务，使用没有方向盘和踏板的汽车。大众将于2021年在它新推出的网约车服务Moia中引入无人驾驶汽车。福特也称到时将量产完全自动驾驶的汽车。

不过并非所有的汽车制造商都在以同样的速度推进。全球仅有三家汽车制造商年销量超千万辆，身为其中之一的丰田就没有做出类似的承诺。相反，这家日本公司正专注于利用人工智能和自动化技术来让传统汽车变得更安全、更有驾驶的乐趣。

它眼下的目标是运用纠错技术让更年长的老人也能安全地驾驶汽车。通过处理来自车载摄像头和雷达装置的数据，软件会留意即将发生的撞击并尽量及时停车，或者在疲惫的司机慢慢偏离车道时帮他修正。其他软件会在车流缓慢时引导汽车前进，让司机可以放松精神。

在丰田的本国市场日本，帮助老年司机是个尤为让人关切的问题，日本有四分之一以上的人口超过65岁。但其他地方也将出现类似的人口危机。丰田位于硅谷的研究中心丰田研究所（TRI）的首席执行官吉尔·普拉特（Gill Pratt）说：“想象一下，有一天会出现一辆特别棒的车，不管司机怎么开都不会出事故。”

这种渐进的方式并不一定会让丰田落后。正如优步撞人事件所示，要实现

完全自动驾驶很困难，且目前进展缓慢，尽管数十亿美元已经砸在这上面。丰田研究所顾问委员会成员、机器人专家罗德尼·布鲁克斯（Rodney Brooks）最近预测，不受限制的机器人出租车服务要到2032年才会在美国的大城市出现。丰田的谨慎或许能让它避过对无人驾驶的大肆炒作，也免得带来失望，同时仍让它获得了未来发展完全自主驾驶汽车的手段。

放慢脚步后，丰田还得以将收集驾驶数据的高额成本纳入到现有业务中。机器人出租车公司的汽车若要在特定区域行驶，公司必须先投入人力和巨大的成本，驾驶测绘车在它们想提供服务的区域行驶，从而绘制出精细无遗的地图。这些宝贵的数据会用来让人工智能算法学习该区域里人们的行为和道路布局。

丰田计划通过消费者驾驶的丰田车（到2025年将有约5000万辆）便宜地收集类似数据。为了提升安全性，现在丰田所有的新车都安装了向外的摄像头和雷达，这些设备也能收集行驶数据，可用来培训完全自动驾驶软件。如此大规模收集的信息能让丰田的人工智能学会处理极不寻常的交通事件，而收集数据不如丰田多的机器人出租车公司可能根本都不会见到这类情况。

不过丰田车上没有激光雷达（光探测和测距系统），这可能会成为一个障碍。激光雷达的工作原理是发射激光脉冲并测量其反射，从而构建一个精确的三维环境地图，如今这在训练自动驾驶软件时必不可少，因为视频和雷达捕捉不到环境方方面面的细节。机器人出租车公司通过部署在城市各个角落的汽车收集激光雷达数据，但在可预见的将来，丰田做不到这一点。丰田要么得找到办法为它销售的汽车加上昂贵的激光雷达，要么得升级它的机器学习软件，让它在没有激光雷达的情况下也能学习驾驶。

丰田还要确保自己销售的所有汽车都能连入互联网以实时传输数据。丰田公司的新部门Toyota Connected力求在2020年在美国和日本这两大主要市场实现这一目标。

所有这一切都表明丰田下了这样一个赌注：庞大的规模加上耐心可以胜过

先发优势。它没有直接追逐机器人出租车之梦。但它最终可能会在恰当的时间出现在恰当的地点，并拥有重要的数据来赚钱。■



Shoemaking

A load of new cobblers

Bringing bespoke footwear to the high street

AMONG the boutiques in the canal district of Amsterdam is a shoe shop, called W-21, that has a selection of stylish footwear in the window. A select group of customers were recently invited there to have their feet scanned by a laser, and then to spend 30 seconds walking on a modified treadmill in a special pair of shoes stuffed with accelerometers, pressure gauges, thermometers and hygrometers. All this generated a wealth of data, which was displayed on a large screen along with a model of how the walker's feet were moving.

From these data an algorithm determined the ideal soles for the customer's shoes. Upstairs, a couple of 3D printers began humming away to make those soles. In about two hours they were ready to be fitted to a new pair of shoes, uniquely tailored to each person's feet.

Some level of customisation is nothing new for buyers of apparel. But there is a big difference between clothes, which are relatively straightforward to tailor and alter, and shoes, which are solid and composed of lots of materials that require different skills and special equipment to produce. It is possible to acquire orthopaedic and specialist shoes, such as ski boots, in which the soles have been shaped to suit an individual's feet. Completely tailor-made shoes are also available if you have deep pockets and are patient. At the top end of the market, John Lobb, a London bootmaker established in 1866, will happily hand-stitch you a pair of Oxford brogues shaped around every dimple and bump in your feet, but they will cost £4,000 (\$5,500) and may take six months to deliver. What was going on in Amsterdam was an experiment by ECCO, a large Danish shoe brand that owns W-21, to bring

bespoke shoemaking to the mass-market high street.

Lobb, and firms like it, make shoes using patterns called lasts. These are solid blocks of wood carved precisely into the shape of a customer's feet. The time and labour required to create these lasts explain the cost and tardiness of the finished product. Though ECCO still uses shoes made in standard sizes, at least for now, it customises the midsole. This is the part of a shoe that fits between the outsole (the bottom of the shoe that comes into contact with the ground) and the insole (on which the foot rests). The midsole is the functional heart of a shoe, says Patrizio Carlucci, the head of ECCO's Innovation Lab, which is in charge of the project. On the basis of the laser scans, of data from the shoe sensors and treadmill tests, and of information about the customer (someone who stands around a lot may require a softer feel than does another who walks everywhere), individualised left and right midsoles are engineered to suit the person concerned.

Once the midsole designs are complete, the computer file describing them is transferred to the 3D printers. These are made by a firm called German RepRap and are adapted to print a type of silicone developed by the Dow Chemical Company for this purpose. The printers build layers of silicone into hundreds of closely packed cells. The shape and size of each cell varies throughout the midsole, to provide the required distribution of support. When complete, the midsoles are inserted into a pair of shoes chosen by the customer.

Further trials of the production system, which ECCO calls Quant-U, will be held in W-21 later this year and at other stores around the world as the company continues to develop the process and take account of feedback from customers who take part. At the moment, ECCO is charging a premium of around €100 (\$120) or so on top of the price of the shoes for the bespoke

sole-designing service. If all goes well, Quant-U could be introduced in some stores for walk-in customers.

Other shoemakers are also trying new production techniques. Big names such as Nike and Adidas are printing some of the components that go into their high-end trainers, although individual customisation has largely been limited to making running shoes for top athletes.

Smaller concerns, too, are showing an interest in bespoke automation. In Milan Andrea and Francesco Carpineti, and their colleague Michele Luconi, are trying to blend the new with the old. Their startup, Design Italian Shoes (DIS), provides shoe shops with a device they call the Totem Touch Screen. Customers place their feet in the bottom of this device to have them scanned. They then use a touchscreen to select a style of shoe and to customise it, from colours to materials, types of sole and even the eyelets and laces. Some 50m combinations are available. Personal monograms and inscriptions can be added.

Instead of sending the design to a 3D-printer, DIS passes it to a group of artisan shoemakers in the “shoes valley” of Le Marche, a region in eastern Italy that is famous for its cobblers. Which craftsman a pair of shoes is assigned to depends on the style to be made, for each has his specific areas of expertise. He will then make the shoes by hand, using a pair of existing lasts that are the closest match available to the data from the Totem. The Carpineti brothers claim that the firm can, in this way, rustle up a pair of handmade Oxfords in as little as ten days, for about €360—less than a tenth of Lobb’s price. The company hopes to offer completely bespoke sizes eventually, using feet scans to create digital lasts, which would generate patterns for leather and other components of a shoe.

The company decided to adopt this marriage of high-tech and low-tech, says Andrea Carpineti, to help preserve shoemaking jobs in Le Marche. So far,

15 shoe shops in Europe have Totems installed, and he expects the devices to be in several hundred stores in China soon. One way or another, then, shoemakers are striding towards a bespoke future. ■



制鞋

新式鞋匠闪亮登场

将定制鞋带到大众市场

阿姆斯特丹运河区精品店林立，其中有一家鞋店叫W-21，橱窗里陈列着各式时髦款式。最近，一小群顾客受邀到店接受了激光扫描足部，然后穿上一双特制的鞋在一台改装过的跑步机上步行30秒。这双鞋里塞满了加速计、压力计、体温计和比重计，它们生成的丰富数据在一个大显示屏上展示出来，屏幕上同时还有一个模拟顾客步态的模型。

算法会依据这些数据确定每个顾客最适合用什么样的鞋底。在楼上，两三台3D打印机开始嗡嗡作响，制作鞋底。大约两小时后，制成的鞋底就可以和鞋身结合，一双为一个人量“脚”定制的新鞋就诞生了。

对买衣服的人来说，享受某种程度的定制不是什么新鲜事。但衣服和鞋大不相同。衣服的定做和修改都相对简单，而鞋的形状固定，又是由大量不同材料制成，这些材料本身又要采用不同的技能和特殊设备来生产。人们可以选择定做矫形鞋和滑雪靴这类专业用鞋，它们的鞋底经过了调整，适合穿着者的脚型。如果你不差钱，又愿意等，也有完全定制的鞋供你选择。在最高端市场，成立于1866年的伦敦鞋店John Lobb很乐意为你手工缝制一双雕花牛津鞋，贴合你脚部每一处浅凹和隆起。不过你要为此花费4000英镑（5500美元），而且也许要等六个月。在阿姆斯特丹W-21开展的活动是该店的母公司爱步（ECCO）的一项实验。这个来自丹麦的鞋类大品牌想将定制鞋服务带到大众商业街上。

Lobb和其他与之类似的公司采用一种叫作鞋楦的成型模具来制鞋。鞋楦是由木头严格按顾客的脚型雕刻而成。正是因为要花大量人力和时间制作鞋楦，所以鞋的造价高、制作周期长。尽管爱步仍在使用标准尺码的鞋楦——至少目前是如此，但它提供中底的定制服务。中底位于大底（鞋底接触地面的部分）和内底（足底接触的部分）之间。负责爱步创新实验室

(Innovation Lab) 和上述项目的帕特里奇奥·卡鲁奇 (Patrizio Carlucci) 说，中底是一双鞋的功能核心。根据激光扫描、鞋内传感器以及跑步机测试生成的数据，以及关于顾客的信息（和大量走动的人比起来，长久站立的人可能需要更柔软的脚感），就可以设计出适合该顾客左、右脚的个性化中底。

中底的设计完成后，描述这些设计的计算机文件就会被传送至3D打印机。这些由German RepRap公司制造的打印机经过了改装，以陶氏化学公司专门为项目研发的硅基材料作为打印材料。打印机将这种材料打印成由数百个紧密排布的单元构成的蜂窝结构，再逐层累积。整个中底上的这些单元的形状和大小各不相同，以此按照不同位置的需要分配支撑力。打印完成后，再将中底置入顾客挑选好的鞋里。

爱步将这个生产体系命名为Quant-U。今年晚些时候，它将在W-21和全球其他门店对其展开进一步测试，并消化参与实验的顾客的反馈，继续研发完善。目前，爱步对这种设计中底的定制服务收取大约100欧元（120美元）的高昂费用，不包括鞋本身的价格。如果一切顺利，某些门店会开始向上门的顾客提供Quant-U服务。

其他制鞋企业也在尝试新的生产工艺。耐克和阿迪达斯之类的大公司已在为自己的高端运动鞋打印零部件，不过它们的个人定制服务基本上只限于为顶尖运动员制作跑鞋。

较小型的企业也开始显现出对自动化定制的兴趣。在米兰，安德雷亚·卡皮内蒂 (Andrea Carpineti)、弗兰西斯科·卡皮内蒂 (Francesco Carpineti) 和他们的同事米凯莱·卢科尼 (Michele Luconi) 正尝试将新技术和旧工艺相结合。他们的创业公司Design Italian Shoes (DIS) 向鞋店提供了一个名叫“图腾触摸屏” (Totem Touch Screen) 的设备。顾客将双脚置于该设备的底部以供扫描，然后在触摸屏上选一款鞋来定制，包括选择颜色、材质、鞋底类型，甚至鞋眼和鞋带。大约有五千万种组合可供挑选，此外还可以添加个性化的图案和刻字。

DIS并不是将设计传送给3D打印机，而是转交给马尔凯（Le Marche）“鞋谷”的手工制鞋匠。马尔凯位于意大利东部，以鞋匠著称。一双鞋会分配给哪位匠人取决于待制鞋的款式，因为每一位鞋匠都有自己拿手的领域。鞋匠会从已有鞋楦中挑选与“图腾”生成的数据最匹配的一个，然后开始手工制鞋。卡皮内蒂兄弟声称，采用这种方式，他们公司制作一双手工牛津鞋的周期可短至十天，售价约为360欧元——不到Lobb的十分之一。这家公司希望最终能提供完全定制服务，利用足部扫描创建数字鞋楦，然后生成皮革或其他零部件的款式。

安德雷亚·卡皮内蒂说，公司之所以决定采用这种高端科技和低端技术相结合的方法，是想帮助马尔凯保住制鞋业的工作机会。在欧洲，目前有15家店铺安装了图腾触摸屏，他期望该设备很快会出现在中国的几百家店铺里。总之，不管怎么说，制鞋公司都在朝着一个定制化的未来大步迈进。





A startup's rise and fall

Blood money

The saga of Theranos highlights the danger of glorifying novice entrepreneurs

A FEW years ago Elizabeth Holmes, boss of Theranos, dressed up as Queen Elizabeth I for the company's Halloween party. At the time she reigned over Silicon Valley's startup scene. In 2013-15 she raised around \$700m to fund her firm, which had supposedly developed a way to test blood with a single pinprick. Ms Holmes (pictured) was hailed as the next Steve Jobs and the youngest female self-made billionaire in history. At its peak, Theranos claimed a private valuation of \$9bn.

But the startup throne is precarious. "Bad Blood", an enjoyable book by John Carreyrou, an investigative journalist, charts Ms Holmes's rise and dramatic fall. It was Mr Carreyrou who first raised questions about Theranos, suggesting in the *Wall Street Journal* in 2015 that its testing technique yielded unreliable results. Earlier this year Ms Holmes settled civil charges brought by America's financial regulator, the Securities and Exchange Commission (SEC), of defrauding investors. A criminal inquiry is believed to be in train.

What went wrong? Mr Carreyrou suggests Ms Holmes cared less for patients than about advancing her own interests and personal brand. According to the SEC, she and Sunny Balwani, her deputy (and, says Mr Carreyrou, secretly her boyfriend), misled investors and other corporations about the state of Theranos's technology and sales. These falsehoods lured new partners. For example, Safeway, a grocery chain, and Walgreens, a pharmacy giant, respectively stumped up around \$400m and \$140m to collaborate with Theranos.

Ms Holmes is not the only one implicated in the debacle. It highlights the Valley's propensity to glorify lone, inexperienced entrepreneurs who promise to reshape an industry—and enrich those who spot them early. Ms Holmes's partners and investors desperately wanted to believe that a young woman could get to the top. Her face was plastered on magazine covers, even as she refused to reveal the details of her firm's technology. Too little scrutiny was offered by the older men on her board, who eventually included Henry Kissinger and George Shultz (both former secretaries of state). Mr Carreyrou says the board had been set to sack Ms Holmes in 2008, but she wangled another chance.

In reality, Theranos's tests were never as sound as the firm claimed. Instead of admitting that the technology was not ready to deploy, Theranos "hacked" a solution, using modified traditional devices from other manufacturers. Perhaps Ms Holmes was adhering to the Valley's spirit of disruption by improvising a fix. That might work for software and internet firms. In the health-care business, the stakes are higher.

The book is especially engaging on Ms Holmes's battle with the author himself. She tried to squelch Mr Carreyrou's initial exposé, going so far as to recruit Rupert Murdoch, the *Journal*'s proprietor, as an investor. (He put \$125m into Theranos in 2015, a stake that is now worthless.) Mr Carreyrou is weaker on Ms Holmes's psychology. He never got close enough to her or her confidants to illuminate her motives.

One striking oversight is an examination of her company's origins. Ms Holmes apparently wrote a patent application for a medical device after a year at Stanford University and a summer internship in Singapore. Mr Carreyrou recounts this creation myth without comment. Still, the story and its telling are not over yet. A Hollywood film starring Jennifer Lawrence as Ms Holmes is in the works. ■



一家创业公司的兴衰

血钱

Theranos的传奇凸显出美化创业新手的危险

几年前，Theranos公司的老板伊丽莎白·福尔摩斯（Elizabeth Holmes）曾打扮成女王伊丽莎白一世出席公司的万圣节派对。当时的她在硅谷创业圈呼风唤雨。2013年到2015年间，她为自己的公司融资约七亿美元。据称，该公司研发出了一种指尖轻轻一刺即能验血的方法。福尔摩斯（见照片）被誉为下一个乔布斯以及史上最年轻的白手起家的女性亿万富豪。在鼎盛时期，Theranos的估值达到90亿美元。

但这家明星创业公司岌岌可危。调查记者约翰·卡瑞尤（John Carreyrou）的《坏血》（Bad Blood）一书趣味横生，记录了福尔摩斯的发迹和戏剧性的陨落。第一个对Theranos提出质疑的人正是卡瑞尤。2015年，他在《华尔街日报》上发文，指出其测试技术得出的结果并不可靠。今年早些时候，福尔摩斯就金融监管机构美国证券交易委员会提起的欺骗投资者的民事指控达成了和解。据信刑事调查正在进行中。

是哪里出了问题？卡瑞尤认为，相比病人的福祉，福尔摩斯更关心的是如何给自己捞好处及打造个人品牌。美国证券交易委员会表示，她和副手桑尼·巴尔瓦尼（Sunny Balwani，据卡瑞尤说两人在暗中交往）在Theranos的技术和销售状况上误导了投资者和其他公司。这些谎言吸引了新的合作伙伴。例如，为了与Theranos合作，食品杂货连锁店西夫韦（Safeway）和药店巨头沃尔格林（Walgreens）分别掏了约4亿和1.4亿美元。

福尔摩斯并不是唯一卷入这场大溃败的人。它凸显出硅谷这样一种倾向：美化那些初出茅庐、承诺要重塑一个产业（并让那些一早发现他们的人获得财富）的孤胆企业家。福尔摩斯的合作伙伴和投资者拼命想去相信一位年轻女性能够登上顶峰。就在她拒绝透露公司的技术细节之时，她仍登上了杂志封面。她董事会里的年长者（两位前国务卿基辛格和乔治·舒尔茨

最终也加入了进来)给予的监督太少。卡瑞尤说,董事会在2008年几乎要解雇福尔摩斯,但她设法又挣得了一次机会。

事实上, Theranos的测试从来都不像它声称的那么好。Theranos没有承认其技术还不足以投入使用,而是“窃取”了一个解决方案:把其他制造商的传统设备拿来改一改。也许福尔摩斯是以随机应变坚持硅谷的颠覆精神。这对软件和互联网公司或许可行,但在医疗行业风险更大。

本书在描写福尔摩斯与作者本人的较量上尤其引人入胜。她试图压制卡瑞尤最初的曝光,为此甚至于拉拢拥有《华尔街日报》的默多克成为投资方(他于2015年向Theranos投资了1.25亿美元,这些股份现在一文不值)。不过,卡瑞尤对福尔摩斯的心理刻画欠缺火候。他从未足够地接近她或她的密友,因而无法很好地阐明她的动机。

作者的一个显著的疏忽是对公司起源的考查。据说,福尔摩斯在斯坦福大学就读一年并在新加坡参加了一次暑期实习之后,写就了一份医疗器械的专利申请。卡瑞尤不加评论地叙述了这个创业神话。不过,这个故事及其讲述尚未结束。一部拟由詹妮弗·劳伦斯(Jennifer Lawrence)担纲扮演福尔摩斯的好莱坞电影正在筹备之中。 ■



Economic and financial indicators

Remittances

Migrants from low- and middle-income countries sent home \$466bn in 2017

Migrants from low- and middle-income countries sent home \$466bn in 2017, an increase of 8.5% on the year before. That followed two consecutive years of decline. Remittance inflows increased in all regions last year; the same is expected in 2018, albeit at a slower pace. The rebound has been driven partly by faster global growth, and partly by better employment prospects for migrants in oil-exporting economies. Remittances are now worth more than three times the value of official development assistance, which came to \$159bn last year. India remains the top recipient in dollar terms; inflows totalled \$69bn. As a share of GDP, Kyrgyzstan comes top: remittances were a staggering 35% of output in 2017. ■



经济与金融指标

移民汇款

2017年，来自中低收入国家的移民向母国汇款4660亿美元

去年，经过连续两年的下滑后，来自中低收入国家的移民向母国的汇款再次回升，达4660亿美元，较2016年增长8.5%。去年世界所有地区接收汇款的数额都出现增长，预计2018年仍将如此，只不过增速会变慢。这次的反弹一定程度上是因为全球经济增长加速，另一个原因是移民在石油出口国就业前景的改善。如今移民汇款的数额相当于官方发展援助金额的三倍以上，去年官方发展援助金额为1590亿美元。以美元计算，印度仍是最大接收国，汇款流入总额为690亿美元。从占GDP的比例来看，则是吉尔吉斯斯坦居首：去年移民汇款占该国产出的比例高达35%。 ■



Chinese finance

Xi, make me chaste

Now that it has made progress in tackling its debts, China faces the real test

NEVER has China's bond market had such a stormy spring. It has already set a record for defaults in the second quarter. The cost of credit for firms has shot up. Even the state-owned companies that invest in infrastructure, previously sacrosanct, are seen as risks. What has gone wrong?

The answer is nothing at all. Defaults are progress for China, which needs to clear a backlog of accumulated debt. This year's casualties amount to a mere 0.1% of the bond market. But that is still an improvement on the recent past, when investors assumed that the government would rescue any big firm in trouble. The real worry is not that the defaults will go too far, but that officials will lose their nerve.

China needs to deleverage because, over the past decade, total debt has risen from 150% of GDP to nearly 300%. This is a cloud over the global economy: such a rapid increase often predicts financial trouble. Although it is far too early to relax, China has made headway in the past two years in stabilising its debt burden. Partly, that reflects a lucky rise in commodity prices, which has buoyed profits at struggling steel and coal firms. But the stockmarket crash of 2015 and the huge capital outflows in 2016 also persuaded President Xi Jinping that financial frailties were endangering national security and that the country needed a change in policy.

Some government actions have been dramatic, notably the arrests of tycoons who made lavish investments abroad. Others have been bureaucratic, such as a merger of bank and insurance watchdogs in order to improve oversight. The most important, though, has been the start of

a clean-up of the financial system. Banks have written off some 5trn yuan (\$780bn) of bad loans, raised almost 1trn yuan in fresh capital and are on course to raise another 1trn yuan. That adds up to an infusion about three-quarters the size of America's bank rescue after the financial crisis. Regulators are also reining in China's once-booming world of shadow banking. Banks have been ordered to bring off-balance-sheet loans back onto their books (see Finance section). Asset growth in the banking sector fell by nearly half last year.

Two risks darken this picture. The first is that the government will backtrack. The first bond default in China did not come until 2014 and today's failures are provoking cries of pain. Banks want an easing of strict new asset-management rules. Fitch, a rating agency, estimates that, if corporate debt stabilises, growth will slow to 4.4% by 2020 from nearly 7% last year. Milder slowdowns have scared the government off the path of prudence before. This time it must hold the line.

The second, less obvious, risk is that China will revert to a stodgily inefficient banking system. Entrepreneurs have flourished over the past decade, thanks in part to easier access to credit. Amid the clean-up, the concern is that banks will again favour state-backed borrowers. Defaults have so far been concentrated in the private sector.

If the government is to create a financial system that is safe without being sclerotic, it needs to change incentives. It should not bail-out state-owned firms (or, if that is too much, those in non-strategic sectors). It should let small, weak banks fail, because national lenders are less beholden to local interests. It should also distinguish between good and bad competition in finance. China is right to throttle undercapitalised shadow banks. But it also needs to allow for technology firms such as Tencent and Ant, Alibaba's financial affiliate, to compete against banks, so long as all comply with the same regulations. That goes for foreign lenders, too. The task for China is

not just to solve the problem of past excesses, but to lay the foundations for future growth. ■



中国金融

习，赐予我节制吧

中国在解决债务问题上取得了进展，现在要面临真正的考验了

中国的债券市场从未有过这样的多事之春。二季度违约规模已创下历史记录。企业信贷成本激增。投资基础设施的国有企业曾被奉若神明，如今连它们都被视为风险。问题出在哪里？

答案是根本就没出问题。对中国而言违约是一种进步，因为中国需要清理积压的债务。今年违约的企业仅占债券市场的0.1%，但与不久之前相比这仍是一种进步——那时投资者以为政府会向任何陷入困境的大企业伸出援手。真正令人担忧的不是违约数量会太多，而是官员会慌了阵脚。

中国需要去杠杆，因为在过去十年中，债务总额已经从占GDP的150%上升到近300%。这就像一片乌云压在全球经济之上：如此迅速的债务增长往往预示着财务问题。过去两年，中国在稳定债务负担方面已经取得了一定进展，尽管还远远未到可以放松的时候。这一方面有赖于大宗商品价格上涨的时运，提升了困境中的钢铁和煤炭企业的利润。但是，2015年的股市崩盘以及2016年的巨额资本外流也让习近平相信，金融系统的脆弱性正在危及国家安全，需要改变政策。

政府的某些举措很戏剧化，尤其是对某些在国外进行大笔投资的大亨实施的逮捕。另一些和管理架构有关，比如为了改进监督而将银行业和保险业的监管部门合并。不过，最重要的是中国已经开始清理金融体系。银行已经对约5万亿元的不良贷款做了减值处理，筹集了近1万亿元的新资本，而且还要再筹集1万亿元。这些新注入资本加起来大约相当于金融危机后美国对银行纾困规模的四分之三。监管机构也开始对一度大肆扩张的影子银行严加控制。银行已收到命令将表外贷款重新转入表内。去年，银行业资产增幅下降了近一半。

有两大风险会让前景黯淡。第一个是政府会走回头路。中国直到2014年才

出现首例债券违约，而目前的违约案例正在引发痛苦的哀号。银行希望严格的新资产管理规则能有所放松。评级机构惠誉（Fitch）估计，如果公司债务稳定下来，到2020年，经济增长将从去年的近7%放缓至4.4%。以前经济增速放缓幅度没这么大时，政府就吓得舍弃了审慎之路。这一次它必须坚守阵地。

第二个风险没那么明显，那就是中国将回归到一个僵硬而低效的银行体系。过去十年来创业蓬勃发展，一定程度上是因为信贷变得更易获得。在清理金融体系的过程中，令人担忧的是银行会再次偏向有国家支持的借款方。迄今为止违约一直集中在私营部门。

如果政府要建立一个安全但又不僵硬的金融体系，就需要改变激励机制。它不应再救助国有企业（如果这要求太高了，那么至少不要救助那些非战略性行业的企业）。政府应任由弱小银行倒闭，因为全国性银行和地方利益的瓜葛较少。政府还应在金融领域区分好的竞争与坏的竞争。中国遏制资本不足的影子银行是对的，但它也需要允许腾讯和蚂蚁金服（阿里巴巴的金融子公司）这样的科技公司与银行竞争，只要它们都遵守相同的规定。对外国银行也一样。中国的任务不仅仅是解决过去过度举债的问题，它也要为未来的发展奠定基础。 ■



The world economy

Don't crash it

A trade war is the worst of many threats to global growth

LOOK at the headlines, and you would struggle to believe that the global economy is in good health. President Donald Trump continues to fire off volleys in his inchoate trade war, throwing financial markets into turmoil and drawing retaliation. The Federal Reserve is raising interest rates—an activity that usually ends in a recession in America. Tighter credit and a rising dollar are squeezing emerging markets, some of which, such as Argentina, are under severe stress.

Yet the world economy is thriving. Growth has slowed slightly since 2017, but still seems to be beating the languid pace set in the five years before that. America may even be speeding up, thanks to Mr Trump's tax cuts and spending binge. A higher oil price, which in past economic cycles might have been a drag, is today spurring investment in the production of American shale. Some forecasts have growth exceeding 4% in the second quarter of 2018.

This sugar rush, however, brings dangers. The first is that it provides temporary political cover for Mr Trump's recklessness. The second is that, if America accelerates and the rest of the world slows, widening differentials in interest rates would push up the dollar still more. That would worsen problems in emerging markets and further provoke Mr Trump by making it harder for him to achieve his goal of balanced trade.

The trade war is the biggest threat to global growth (see Finance section). On June 15th the White House confirmed that a 25% tariff on up to \$50bn of Chinese imports would soon go into effect. Three days later, after China

promised to retaliate, the president expanded, by as much as \$400bn, the other goods America is threatening to tax. If he follows through, nine-tenths of roughly \$500bn-worth of goods imported from China each year will face American levies. Meanwhile, the European Union is poised to impose retaliatory tariffs in response to America's action against EU steel and aluminium. No wonder markets have caught the jitters.

The president is unafraid of escalating trade disputes because he believes he has a winning hand. America buys from China almost four times as much as it sells there, limiting China's ability to match tariffs. The White House hopes this imbalance will lead China to yield to its demands, some of which (cutting the theft of American firms' intellectual property) are more reasonable than others (shrinking the bilateral trade deficit).

But Mr Trump overestimates his bargaining power. If China runs out of American goods to tax, it could raise existing tariffs higher. Or it could harass American firms operating in China. More important, the president's mercantilism blinds him to the damage he could inflict on America. He thinks it is better not to trade at all than to run a trade deficit. This folly also dictates his tactics towards Canada, Mexico and the EU. Mr Trump could yet withdraw from the North American Free-Trade Agreement and slap tariffs on cars.

The problem is not that America depends on trade. In fact, it is a big enough free-trade area for the eventual damage to GDP, even from a fully fledged trade war, to be limited to a few percentage points (smaller, specialised economies are more dependent on trade and would suffer a lot more). Such self-inflicted harm would impose a pointless cost on the average American household of perhaps thousands of dollars. That would be bad, but it would hardly be fatal.

The bigger issue is the vast disruption that would occur in the transition

to more autarky. America's economy is configured for designing iPhones, not assembling their components; the innards of its cars and planes cross national borders many times before the final product is ready. Faced with tariffs, firms have to redirect labour and capital to replace imports.

Some analysts attribute Mr Trump's presidency to the economic shock from trade with China after 2000. The turmoil caused by reversing globalisation would be just as bad. One estimate puts American job losses from a trade war at 550,000. The hit to China would also be severe. Any adjustment would be prolonged by Mr Trump's unpredictability. Without knowing whether tariffs might rise or fall, what company would think it wise to invest in a new supply chain?

It is difficult to imagine such a realignment without a global recession. Tariffs temporarily push up inflation, making it harder for central banks to cushion the blow. The flight to safety accompanying any global downturn would keep the dollar strong, even as America's fiscal stimulus peters out after 2019.

So be wary. The trade war may yet be contained, to the benefit of the world economy. But America is the engine of global growth. In Mr Trump, a dangerous driver is at the wheel. ■



世界经济

不要撞车

全球经济增长面临的种种威胁中，贸易战是最严峻的一个

看看各种新闻标题，你很难相信全球经济状况良好。特朗普在初露苗头的贸易战中不断开火，让金融市场陷入混乱，并引发报复。美联储正在加息，在美国此举通常以引发衰退告终。信贷紧缩和美元上涨正在挤压新兴市场，阿根廷等国正经受严峻压力

但全球经济确实正在上行。自2017年后经济增长轻微放缓，但似乎仍高于这之前五年里的低迷速度。得益于特朗普减税和大幅增加开支，美国的增长甚至可能加速。油价上涨在以往的经济周期内可能是个拖累，如今却刺激了对美国页岩油生产的投资。一些预测认为2018年二季度的增速超过4%。

然而这一剂鸡血也带来了危险。首先，它为特朗普的鲁莽提供了暂时的政治掩护。第二，如果美国增长加速而其他国家增速放缓，它们之间利差的扩大会把美元推得更高。这将加剧新兴市场的问题，并使特朗普更难实现他的贸易平衡目标，进而愈发怒不可遏。

贸易战对全球增长的威胁最大。本月15日，白宫确认将很快对最高达500亿美元的中国进口商品加征25%的关税。三天后，也就是在中国宣布采取报复措施之后，总统先生又威胁将对另外高达4000亿美元的中国商品加征关税。如果他坚持到底，中国每年大约5000亿美元的对美出口中将有90%面临美国的关税制裁。同时欧盟也准备对美国的钢铝关税做出回应，开征报复性关税。难怪市场已经开始恐慌。

特朗普无惧贸易争端升级，因为他认为自己稳操胜券。美国从中国的进口几乎相当于它对华出口的四倍，这就限制了中国以同等关税手段反击的能力。白宫希望这种不平衡能迫使中国满足自己的要求，其中一些合情合理（减少窃取美国公司的知识产权），另一些则不尽然（缩减双边贸易赤

字）。

但特朗普高估了自己的谈判筹码。虽然可供中国征收关税的美国商品规模不足，但中方可以提高现有关税，或者还可以干扰在中国经营的美国公司。更重要的是，特朗普的重商主义让他看不到自己可能给美国带来怎样的伤害。他认为有赤字的贸易不如干脆不做贸易。这种愚蠢的想法也主导了他对加拿大、墨西哥和欧盟的策略。特朗普仍有可能退出《北美自由贸易协定》，并对汽车加征关税。

问题不是美国依赖贸易。实际上，美国本身就是一个足够大的自由贸易区，即使贸易战全面开打，对其GDP的最终伤害也不过几个百分点（更偏重特定产业的小型经济体更加依赖贸易，受贸易战的伤害也更大）。这种自残式的举动可能会让普通美国家庭平均增加几千美元的不必要开支。这很糟糕，但远不致命。

更大的问题是经济转向更自给自足的过程中会造成巨大的破坏。美国经济的架构更适合设计iPhone而非组装其部件；在它的汽车和飞机最终完成建造之前，其内部组件要跨越国境多次。一旦被征收关税，公司必须重新部署劳动力和资本以替代进口。

有些分析人士把特朗普的当选归因于2000年以后对华贸易带来的经济冲击。但全球化后退带来的混乱将同样糟糕。一项估算认为，贸易战将导致美国丢失55万个工作岗位。对中国的打击也会很严重。由于特朗普的反复无常，任何调整都可能旷日持久。在不知道关税是会升还是会降的情况下，哪家公司会认为投资新供应链是明智之举呢？

很难想象这样的调整不会引发全球衰退。关税会暂时推高通胀，令央行更难缓冲这种冲击。即使美国的财政刺激在2019年后逐步减少，任何全球性衰退引发的避险需求还是会推高美元。

所以要小心。贸易战可能还是会得到控制，因为这符合世界经济的利益。但美国是全球增长的火车头，而它现在正由特朗普这名危险的司机驾驶。





Global logistics

Thinking outside the box

Digitisation will not just transform how goods are moved around the world, but also how the world shops

THE *Munich Maersk*, which entered service in June 2017, is a testament to the technological marriage of information and transportation. Its bridge looks like a very spacious cockpit. Packed with computer screens, it is all glass, no brass—with a wheel that looks more like a pilot's control column. Sailing her 214,000 tonnes from port to port takes a crew of just 28. Loading and unloading the 20,000 containers she carries only needs the supervision of one crew member.

The *Munich Maersk*, though, is a high-end exception—one of the best ships in the up-to-the-minute fleet of the biggest shipping company in the world. It shows what can be done. But at the moment the industry's big issue is what is being left undone.

Between 1985 and 2007 trade volumes rose at around twice the rate of global GDP. In the 1990s the world's largest container ships only had space for 5,000 or so containers; now it boasts giants like the *Munich Maersk*. The global logistics industry had revenues of \$4.3trn (€3.3trn) in 2014, according to BCG, a consultancy.

But though the flows and the pipes have got bigger, the principles of the industry's plumbing have changed little since they took their modern form in the 1950s and 1960s. Use containers of standard sizes that can be loaded onto trains, lorries or ships as needed; use scale to cut costs; co-ordinate the whole thing with a physical paper trail. When in doubt, buy something bigger.

The economic slowdown following the global financial crisis hit this way of doing things hard. Although giants like Maersk continued to buy enormous ships, smaller lines with worse balance-sheets could not. Airbus, which had hoped to sell a freighter version of its A380 superjumbo, abandoned its plans. Freight rates plunged as demand for shipping did not keep up with supply. Between 2012 and 2016, the Shanghai Containerised Freight Index, a measure of prices, fell by 73%.

At the same time, the growth of e-commerce saw more aware, more demanding corporate customers insist on ever better handling of what is called logistics “last mile”—moving purchases from their distribution warehouses to the people who bought them. Though today’s talk is all of delivery drones and driverless vans, the key to this transformation has been not new equipment but new ways of handling data: knowing where hundreds of millions of things are and where they are going, and being able to act on that data as things change.

Now companies that have been crucial to these changes at one end of the distribution chain—Alibaba and JD, which are Chinese, and Amazon, which is American—are eyeing the rest of it. The business of moving goods internationally from factory to factory and warehouse to warehouse requires many more capabilities than shifting items from local warehouses to doorsteps. But it also accounts for 90% of the logistics’ industry’s global revenue. How far the intruders can displace the incumbents and what new business models come out of the struggle will help determine how much world trade can grow and who the winners and losers from that growth will be.

Firms looking to move components through their supply chain or finished goods to retailers have two main options. Express-delivery services such as DHL Express (part of Deutsche Post DHL), FedEx and UPS are fast and flexible—all the more so now they have embraced new data-management

systems. But they are also expensive—especially for long-distance air freight. Shipping a 70kg parcel from Shanghai to London with DHL Express takes three times longer, and costs four times as much, as buying a human of the same weight an airline ticket. The passenger gets a baggage allowance and free drinks, too.

So most goods wend their way across the world using the second option—containerised freight. The non-domestic cargo business has revenues of \$2.6trn a year, according to BCG. And a lot of those revenues go to middlemen. Dealing with customs clearances, insurance, transfers between sea and road and rail and all the other physical, procedural and bureaucratic hold-ups that freight is heir to requires the services of a freight forwarder. These companies account for over a fifth of the logistics industry's revenues (see chart 1); in some cases they receive as much as 45% of the total delivery cost. In 2016 Deutsche Post DHL's in-house freight-forwarder made over \$26bn in revenues. Its smaller rivals Kuehne + Nagel, of Switzerland, and DB Schenker, of Germany, made \$20bn and \$17bn respectively.

For the most part, freight-forwarding companies charge a percentage of the total cost of the shipment; this gives them little incentive to drive costs down. In a free and transparent market where all the shipping options were easily discoverable, this problem would be solved through competition. But the complicated world of shipping contracts is a long way from that ideal, and the incumbents have clear reasons for keeping it so. Zvi Schreiber, founder of Freightos, a website headquartered in Hong Kong that is introducing some transparency by allowing users to compare and book different options, says many firms may take two or three days to quote a price for taking an air-freight pallet or a shipping container from A to B. And forwarders are often unable or unwilling to say whether the goods will get from China to Europe in one month or two.

The industry's backwardness can be seen in its thrall to paperwork. Systems based on e-tickets that say who is entitled to go where, and how, have been mandatory in air-passenger transport for ten years. But half of air cargo still travels with paper "bills of lading" rather than e-tickets. In the world of containerised shipping things are even worse: freight forwarders deal with shipping firms, airlines and hauliers mainly by fax. The cargo on each voyage of the *Munich Maersk* generates a library of documents—many of which then need to be sent to the ship's destination by some other means. That secondary shipping is not foolproof, either: vessels and aircraft are often delayed in port because the paperwork has not caught up with the goods that they carry.

The cost of all this is enormous. Removing administrative blockages and outdated practices would, by some accounts, do more to boost international trade than eliminating tariffs. The UN reckons that putting all the Asia-Pacific region's trade-related paperwork online could slash the time it takes to export goods by up to 44%, cut the cost of doing so by up to 31%, and boost exports by as much as \$257bn a year.

The burden is felt throughout business. Two-thirds of the American importers who responded to a recent survey undertaken by Freightos said that over a quarter of their deliveries from abroad arrive late. Some 42% said they spend more than two hours on paperwork to arrange a shipment. And 83% said they struggle to track items as they move across the world. That leaves many frustrated. "Amazon Prime can deliver to your house from its warehouse at a set time," Mr Schreiber says. "Why can't you do the same with air and sea freight?"

One answer is regulation; there are a lot of institutional obstacles to reform. For instance, in 2008 a UN convention put electronic documents in international shipping on a firm legal footing. But for these "Rotterdam rules" to come into force, the agreement must be ratified by 20 countries.

Owing to a lack of interest in the subject among politicians the tally so far is just four: Cameroon, Congo-Brazzaville, Spain and Togo.

Poor communications used to be partly to blame, too, but that excuse has fallen overboard. Inmarsat, a company originally set up by the International Maritime Organisation to provide satellite services for ships at sea, today offers data rates for ships that are over 100 times faster than they were 20 years ago. Various companies rushing to provide new mobile-broadband services will improve things further. Not just ships and planes, but the individual packages and containers within them, can increasingly be tracked in real time.

Such data can help integrate the legs of a journey, for example by making sure that lorries do not wait for a ship that is behind schedule, or that they arrive early for one that's ahead. They open the possibility of redirecting items along quicker or cheaper routes as they become available—if the shipper can find out about them.

The hard-to-get information which lets people find spare shipping capacity will power the real revolution, according to Martin Stopford of Clarksons, a shipbroker. Matching spare capacity to cargo in need of transport on the fly would allow the “Uberisation” of the freight business. There are already signs of this in haulage. America’s lorries travel empty more than a quarter of the time: the wasted capacity is equivalent to 200,000 lorries travelling 1,000km every day. This is because it is hard for forwarders to find return cargoes using phone or fax. Now apps have appeared to match loads with drivers, just as the Uber app pairs passengers and drivers. Indeed Uber Freight is one of the contenders. Cargomatic, a startup based in Los Angeles, and Trucker Path, a rival in Texas that was bought by a Chinese firm in December, are competing with it for the freight business, while Amazon is testing “Amazon Flex” as a way of getting gig-economy drivers to make deliveries.

The vision of many in the industry is that such services will eventually cover all sorts of different transport modalities all over the world. In the past, realising the benefits of an integrated global network of ships, planes and lorries required owning such a network, a task too big for even the largest logistics firms. Maersk, one of the world's largest container-terminal firms as well as its largest containership operator, ran its sea- and road-logistics businesses almost entirely separately until 2016. Most companies chose to specialise and hand co-ordination over to the forwarders. Smartphones and sensors mean that, with the right platform or platforms, a freight forwarder, or a tech firm that had taken on such a role, could co-ordinate things much better than is possible today—and without any faxes.

One of those seeking such changes is Amazon. In 2017 it spent \$25bn on logistics. It thinks it could get better value for money by expanding what it does itself from last-mile to all-the-miles. It has created its own logistics division and acts as its own freight forwarder. Its cargo airline, Amazon Air, is still a tiddler compared with FedEx, with just 33 jets in its fleet. But the cargo hub in Cincinnati on which the company is spending \$1.5bn will have room for 100 jets. It has also been granted a licence to act as a maritime freight forwarder.

Freight forwarders and transport giants alike claim that they do not see Amazon's move into logistics as a threat. The explosion of e-commerce (see chart 2) allows DHL, FedEx and UPS to tell shareholders happy stories about their future. The demand for parcel delivery is growing by more than 7% a year, sufficient both to maintain jobs and survive competition, according to Frank Appel, the boss of Deutsche Post DHL. Automation may mean it will soon take a third fewer people to deliver a given volume of goods, he says—but the increase in demand will still make the industry a net job creator. And it will also mean that there will be room enough for both DHL and Amazon to grow.

Another reason for such optimism is that, so far, Amazon has mainly used its network to serve its own customers. But that will change. The companies with big e-commerce networks are keen to take on other firms' logistics, too. The idea is not to own all the ships and rolling stock—though they may own some particularly profitable bits of the system—but to control the platforms that make services available, and to bring the rest of the industry on board by simply being too big to refuse.

Perhaps the furthest down the road in this respect is Alibaba. Alibaba is a digital platform where buyers and sellers meet, rather than a retailer that holds inventory itself. It has thus always been focused on end-to-end logistics in a way that Amazon, which runs most of its business through warehouses to which goods are delivered by normal channels, is not. Alibaba says that last year it was the middleman in \$550bn of transactions within China, serving over 500m customers. Through its logistics platform, Cainiao, it delivers 70% of all e-commerce parcels in China.

Now Alibaba has its eyes set on international e-commerce. A study produced by Alibaba's research arm and Accenture, a consultancy, in 2016 predicted that cross-border e-commerce shipments worldwide could rise from \$400bn in that year to nearly \$1trn by 2020. Until recently, these international shipments tended to be restricted to fairly high-value goods. But Alibaba now ships cheap, bulky things like nappies and milk powder from manufacturers in America to consumers in China. Last September the company said it was going to invest \$15bn in boosting Cainiao's cross-border capabilities.

These developments should increase the total volume of goods shipped around the world yet further. But Rob Wolleswinkel of BCG counsels against seeing this as a rising tide for all boats. Amazon's logistics division, he suspects, will seek to "cherry pick" profitable undertakings such as managing the system, leaving only low-margin activities, such as basic

transport services, to the likes of Maersk and DHL. The newcomers, he notes, have two things on their side that previous would-be disrupters did not. One is that the company that owns the data owns the consumer. Amazon knows a great deal about the people who use its platform, which is a lot of people; logistics firms know next to nothing about anyone. Second is the size of the tech giants. DHL, FedEx and UPS have been big enough to bat away competition from startups. The e-commerce titans are another matter.

Some have woken up to the threat. Soren Skou, chief executive of Maersk, argues that it was a mistake for his firm to spend the past decade focusing so much on no-frills container freight between China and Europe. That allowed freight forwarders to scoop out the profit that Amazon and Alibaba now covet. Maersk must become more integrated to compete against Amazon, he says: he wants to make it “the DHL of the sea,” offering worldwide door-to-door delivery. He plans to replace paper bills of lading with digital ones secured using blockchain technology. The firm is already rolling out a digital “Maersk Line Operating System” to put shipping data into a common format. This promises to be hugely influential. As an executive at a smaller rival admits: “We just watch what Maersk does and copy it.”

In the past, the unreliability of container delivery has made it unsuitable for e-commerce; that has been good for other retailers, who can turn a profit importing items from China in bulk to Europe and America and selling them on. If Maersk, or anyone else, can make containerised shipping truly responsive and flexible it will have implications well beyond logistics.

It might seem fanciful to think of shipments on a behemoth like *Munich Maersk* being flexible in the way that vans tootling round suburbs with packages can be. But smart data management and good data analytics might get you a long way towards the goal. If you really know where all the goods

are and have control over where they will go, you do not necessarily need to wait for an order before you ship something. If you know roughly how many of the items in question the market is interested in, they can be shipped ahead of time, their e-ticket-like labels left deliberately vague. When an order is actually placed, the relevant label will be updated with a precise destination in transit. The ship takes on part of the job of the warehouse. Alibaba and Amazon are already pursuing this approach.

To the extent that it can be made to work, such magic will eat into retail and wholesale margins—which for books and toys can be over 50% of the price. This is already happening to some extent. In 2012 Amazon began to allow Chinese businesses to start selling through its marketplace programme, which fulfils third-party orders; they now outnumber American firms. And Amazon has slashed the cost of delivering small items ordered from China to America. It is now lower than the cost of shipping within the United States (though delivery is slower). Other American retailers, online and off, are angry at what they see as a subsidy to their competitors.

Some estimate that as many as 7.5m retail jobs will disappear in America over the next decade, in part because of the increased possibilities for e-commerce that better logistics will bring. Others are more optimistic. Michael Mandel of the Progressive Policy Institute, a think-tank in Washington, DC, has pointed out that in America jobs in logistics are increasing faster than retail employment is falling. Those new workers, though, are unlikely to be employed by old firms. As Mr Stopford notes, incumbents did badly last time technological change swept logistics. “Who today has heard of Blue Funnel Line?” he asks of the British firm which was one of the largest cargo lines in the world—before containers and Maersk came along. ■



全球物流

不同凡箱

数字化不仅会变革全球商品的流通手段，还会改变世界购物的方式

于2017年6月开始服役的“慕尼黑马士基”号（Munich Mærsk）集装箱船是信息与运输实现技术联姻的见证。她的舰桥看起来像一个非常宽敞的飞机驾驶舱，里面摆满了电脑屏幕，全部由玻璃制成，没有黄铜，而方向盘看起来更像是飞行员的操纵杆。从一座港口到另一座港口，21.4万吨体量的她只需28名船员。装卸她运载的2万个集装箱只需要一名船员的监督。

不过，“慕尼黑马士基”号是一个高端的例外——它是世界上最大的航运公司拥有的最先进船队中最好的船之一。它展示了我们能够达到什么样的水准。但这个行业目前的大问题是还有哪些事情没有做。

从1985年到2007年，贸易额增速约为全球GDP增速的两倍。90年代，世界上最大的集装箱船只能容纳约5,000个集装箱。现在，行业里已经拥有了像“慕尼黑马士基”号这样的巨人。根据咨询公司BCG的数据，2014年全球物流行业的营收达4.3万亿美元（3.3万亿欧元）。

但是，尽管流量和“管道”都已变得更大，自该行业在上世纪五六十年代达到现代形式以来，这套“管路系统”的原理却没有多大变化。使用能够按需要装上火车、卡车或轮船的标准尺寸集装箱；利用规模削减成本；用一堆纸质文件来协调整个流程。如果吃不准，买艘更大的船就对了。

全球金融危机之后经济放缓，让这种操作方式遭受巨大打击。虽然像马士基这样的巨头继续购买庞大的船只，但资产负债状况较差的小型船队却难以维继。本想销售A380巨型货机的空客公司放弃了这项计划。航运需求增长赶不上供应增长导致运费暴跌。2012年至2016年间，衡量价格的上海集装箱运价指数下跌了73%。

与此同时，电子商务的发展让更多更具革新意识、要求更高的企业客户开

始强调要更好地处理所谓的物流“最后一公里”——把采购的产品从分销仓库送到买家手中。尽管如今的热门话题都是关于无人机和无人车送货，但这种转变的关键不是新设备，而是处理数据的新方法：知道上亿件物品都在什么地方，要往哪里去，还要能够在情况有变时根据这些数据做出调整。

现在，一些深刻影响了分销链其中一端变化的公司——中国的阿里巴巴和京东，以及美国的亚马逊——开始把目光投向这个链条的其余部分。将货物跨国从一家工厂运到另一家工厂，从一个仓库运到另一个仓库，这种业务所要求的能力要比把货物从本地仓库送到家门口高得多。但它占到了物流行业全球收入的90%。这些入侵者能够取代在位者多少，以及这场斗争中会出现什么样的新商业模式，将在一定程度上决定世界贸易能有多大增长，以及增长带来的赢家和输家分别是谁。

如果有公司要在供应链中运送零部件，或是把成品送到零售商处，它们的选择主要有两类。DHL快递（德国邮政DHL的子公司）、联邦快递和UPS等快递服务快速而灵活——如今它们采用了新的数据管理系统后就更是如此。但它们也很贵，尤其是长途空运。用DHL快递把一个70公斤的包裹从上海送到伦敦，所花的时间相比给同样重量的人买一张飞机票要多三倍，价格则要翻两番。话说旅客还可以免费携带一定重量的行李和享受免费饮料呢。

所以，大多数商品都是利用第二种选择——集装箱货运——来缓缓横穿世界的。根据BCG的数据，非国内货运业务的营业额为每年2.6万亿美元。这些收入中很多都给了中间商。要处理海关清关、保险、海上与公路和铁路之间的转运，以及货运中会遇到的所有其他实体的、程序的和官僚的阻碍，就需要货运代理人的服务。这些公司的收入占整个物流业的五分之一以上（见图1），在某些情况下它们收取的费用占到了总运费的45%。2016年，德国邮政DHL的内部货运代理公司收入超过260亿美元。在比它规模小一些的竞争对手中，瑞士德迅集团（Kuehne + Nagel）和德国的德铁信可铁路（DB Schenker）分别赚取了200亿美元和170亿美元。

大多数情况下，货运代理公司会按照运货总成本的百分比收费，这导致它们没有什么动力来降低成本。如果有一个自由而透明的市场，让人们能够轻松发现所有的运输选择，那么这个问题就可以通过竞争来解决。但这个航运合同满天飞的复杂世界距离这样的理想还很遥远，而且既有企业有显而易见的理由来维持现状。总部位于香港的Freightos网站的创始人茨维·施莱伯（Zvi Schreiber）表示，要提供把空运货盘或集装箱从甲地运到乙地的报价，许多公司可能要花费两三天的时间。而且货运代理通常不能或不愿意担保说货物是否能在一两个月内从中国运到欧洲。

这个行业的落后从其受制于纸面文书就可见一斑。航空客运强制使用电子票已经有十年了，票上说明了谁有资格以什么方式去哪里。但是航空货运中仍然有一半使用纸张提货单而不是电子票。在集装箱运输部门，情况还要更糟：货运代理商主要是通过传真来和航运公司、航空公司以及陆路运输公司打交道。“慕尼黑马士基”号每次航行运载的货物都会生成一个文件库，其中许多文件需要通过其他方式发送到目的地。这项额外的运送同样并非万无一失——船舶和飞机经常在港口延误，因为其携带货物的文书还没有送到。

所有这些问题的成本是巨大的。根据一些人的估算，去除行政障碍和过时做法对国际贸易的促进作用比取消关税还要大。联合国认为，如果能将亚太地区所有与贸易有关的文书工作放到网上，出口商品所花费的时间可以缩短多达44%，成本可降低31%，同时推动出口每年增长2570亿美元。

这种负累整个行业都感受得到。在Freightos最近的一项调查中，回答问卷的美国进口商有三分之二表示，来自国外的产品有超过四分之一晚到。约42%的人表示安排一项发货需要在文书上花费两个多小时。83%的受访者表示他们很难追踪世界各地的在途货物。这让许多人倍感挫败。施莱伯说：“亚马逊Prime可以在约定的时间里从仓库发货到家，为什么空运和海运就做不到呢？”

一个答案是监管：改革面临很多体制性障碍。例如，2008年，联合国大会为国际航运的电子文件提供了坚实的法律基础。但是，要使这些“鹿特丹

规则”生效，该协议必须得到20个国家的批准。由于政客们对这个问题缺乏兴趣，迄今为止只有四个国家签署：喀麦隆、刚果布拉柴维尔、西班牙和多哥。

通讯不佳一度也是原因，但如今这个借口已经不成立了。国际海事卫星组织公司（Inmarsat）最初由国际海事组织设立，为海上船舶提供卫星服务。它在今天提供的数据速率已经比20年前快了100倍以上。各种急于提供新型移动宽带服务的公司将会进一步改进现状。不仅仅船和飞机越来越容易被实时跟踪，甚至它们内部的单个包裹和集装箱也一样。

这些数据可以帮助把旅程中的各个航段整合起来，以确保货车无需苦等晚到的船，或者提前迎接那些早到的。这就创造出一种可能性，即在更快或更便宜的路线出现时改变货物的运输路径——前提是发货人能够找出这些新路线。

这种难以获得的信息可以让人们找到闲置的运力，从而推动真正的革命，船舶经纪公司Clarksons的马丁·斯特福德（Martin Stopford）说。将闲置运力与需要运输的货物实时匹配起来，会带来货运业务的“优步化”。在陆路运输中已经有了这种迹象。美国的大货车有四分之一以上的时间都在空驶：浪费的运力相当于每天20万辆大货车行驶1,000公里。这是因为转运商很难通过电话或传真找到返程货车。现在，已经出现了将货物与司机匹配起来的应用，就像优步应用匹配乘客和司机那样。实际上，优步货运（Uber Freight）也是竞争者之一。总部位于洛杉矶的创业公司Cargomatic和得克萨斯州的竞争对手Trucker Path（去年12月被一家中国公司收购）正在与之争夺货运业务，而亚马逊正在测试“亚马逊Flex”来让打零工的司机送货。

行业内许多人的愿景是，这类服务最终将覆盖全世界所有不同的交通方式。过去，要实现这样一个由船舶、飞机和货车构成的综合全球网络的好处，就需要拥有这整个网络，而这即使是对最大的物流公司来说也太过艰巨。马士基是世界上最大的集装箱码头公司之一，也是最大的集装箱船运营商，直到2016年，它的海运和陆路物流业务仍几乎完全分开运营。大多

数公司选择专攻一项，而将协调的工作交给货运代理。智能手机和传感器的出现意味着一旦有了一个或多个恰当运作的平台，货运代理公司或承担这一角色的技术公司的协调能力将比现在好得多，也再不需要用到传真了。

寻求这种变化的公司之一是亚马逊。2017年，它在物流上花费了250亿美元。它认为，把自己所做的“最后一英里”拓展到“所有英里”，将可以获得更好的投资回报。它创建了自己的物流部门，充当自己的货运代理。它的货运航空公司“亚马逊航空”（Amazon Air）与联邦快递相比还只是个业余玩家，其机队仅有33架飞机。但公司投资15亿美元兴建的辛辛那提的货运枢纽将可容纳100架飞机。它还拿到了海运货运代理的许可。

货运代理和运输巨头们都声称自己并没有把亚马逊进军物流业看作威胁。电子商务的爆炸式增长（见图2）使DHL、联邦快递和UPS都能够给股东讲述关于自己未来发展的动人故事。根据德国邮政DHL的老板弗兰克·阿佩尔（Frank Appel）的说法，包裹递送的需求年增长超过7%，足以保住业内职位并让大家都在竞争中存活下来。他表示，自动化可能意味着递送给定数量物品所需的人数将减少三分之一，但需求的增长仍将使该行业的工作岗位实现净增长。而且这也意味着DHL和亚马逊都会有足够的发展空间。

如此这般乐观的另一个原因是，到目前为止亚马逊主要使用其网络来服务自己的客户。但这一点是会变的。拥有大型电子商务网络的公司也热衷于承接其他公司的物流环节。其构想并不是要拥有所有的船舶和机动车——虽然它们可能拥有系统中一些利润尤其丰厚的部分——而是要控制提供服务的平台，然后简单地通过变成“大到无法拒绝”而把整个行业拉进来。

也许在这方面走得最远的是阿里巴巴。阿里巴巴是把买家和卖家带到一起的数字平台，而不是拥有库存的零售商。因此，它始终专注于端到端的物流，这一点和亚马逊大为不同，因为后者的大部分业务运作时都是利用普通渠道把货物送到仓库。阿里巴巴说，去年它作为中介经手了中国境内

5,500亿美元的交易，为超过5亿客户提供服务。通过其菜鸟物流平台，它完成了中国70%的电子商务包裹的递送。

如今阿里巴巴开始重视国际电子商务。其研究部门和咨询公司埃森哲在2016年联合进行的一项研究预测，全球跨境电商出货量可能会从当年的4,000亿美元增加到2020年的近1万亿美元。不久前，这些国际货运往往还只限于相当高价值的商品。但阿里巴巴现在正把像尿布和奶粉这样廉价而笨重的东西从美国制造商那里送到中国消费者的手中。去年9月，该公司表示将投资150亿美元用于提升菜鸟物流的跨境运送能力。

这些发展应该还会进一步提升全球货运总量。但BCG的罗布·沃尔斯温克尔（Rob Wolleswinkel）反对将这看作是鸡犬升天的机会。他疑心亚马逊的物流部门会“精挑细选”最有利可图的业务，比如管理整个系统，而仅把基础运输服务等低利润业务留给马士基和DHL等公司。他指出，亚马逊这样的行业新来者有两个特点是先前的挑战者所没有的。一是拥有数据的公司也拥有消费者。亚马逊对使用其平台的庞大用户所知甚多，而物流公司几乎不了解任何人。其次是科技巨头的规模。虽然此前DHL、联邦快递和UPS已经大到可以打败创业公司的竞争，但电子商务巨头是另一回事。

有些人已经意识到了这种威胁。马士基的首席执行官索伦·斯库（Soren Skou）认为，他的公司在过去十年中太过专注于中国和欧洲之间的基础集装箱货运，实为错误决策。这让货运代理商攫取了亚马逊和阿里巴巴现在觊觎的那块利润。他表示，马士基必须进一步整合各项业务才能与亚马逊竞争，他希望把自己变成“海上的DHL”，提供遍及全球的门到门送货服务。他计划使用由区块链技术支持的数字提单取代纸质提单。该公司已经推出了数字版的“马士基航运操作系统”，将航运数据转为通用格式。这势必产生极大的影响力。一位较小竞争对手的高管承认：“我们无非是看马士基做什么，有样学样而已。”

过去，集装箱送货因其不可靠性，不适用于电子商务。这对其他零售商来说是件好事，他们可以从中国大量进口到欧美出售以赚取利润。如果马士基或其他任何人能够使集装箱运输真正变得响应快速而灵活，那么它的影

响力就远不止于物流了。

像“慕尼黑马士基”号这样的庞然大物，如果说它运起货来要能和在郊区穿梭送包裹的面包车一样灵活，似乎有点异想天开。但智能数据管理和良好的数据分析可能推动它向这个目标迈出一大步。如果你确切知道所有商品的位置，并且能够控制它们要去的地方，那么就未必需要等到订单出现才能发货。如果你大概知道市场对商品有多少兴趣，你就可以提前发货，并把它们类似于电子票的标签故意留白。当实际订单到来时，相关标签将在途中被更新为精确的目的地。船承担了仓库的部分工作。阿里巴巴和亚马逊已经在追求这种方式。

只要它能够发挥作用，这种魔法将蚕食零售和批发的利润——书籍和玩具的这部分利润可能超过价格的50%。这在某种程度上已经发生了。2012年，亚马逊开始允许中国企业入驻其电商平台marketplace开展销售，如今它们的数量已经超过了美国公司。亚马逊削减了把小商品从中国运到美国的成本，现在已经低于美国境内的运输成本（虽然送货较慢）。其他美国零售商，无论线上线下，都对这种在他们看来是对竞争对手的补贴感到愤怒。

有人估计，未来十年，美国将有多达750万个零售业职位消失，部分原因是物流的改善为电子商务带来了新的可能性。其他人则更乐观。华盛顿智库“进步政策研究所”（Progressive Policy Institute）的迈克尔·曼德尔（Michael Mandel）指出，在美国，物流业职位的增加快过零售业职位的减少。然而，这些新员工不太可能是被老公司聘用的。正如斯特福德指出的那样，技术变革上次横扫物流业时，既有企业表现得很糟糕。“今天还有谁听说过蓝烟通（Blue Funnel Line）？”他口中的这家英国公司曾经是世界上最大的货运航线之一——在集装箱和马士基出现之前。■



Technology and international trade

Pulp friction

The digitisation of trade's long trail of documents has been talked about for years. At last things are shifting

THE enormous ships steaming into and out of the world's ports do not only carry cargo. They also represent paperwork: bills of lading (BOLs), packing lists, letters of credit, insurance policies, orders, invoices, sanitary certificates, certificates of origin. Maersk, the world's biggest container-shipping line, found that a shipment of avocados from Mombasa to Rotterdam in 2014 entailed more than 200 communications involving 30 parties. A giant container vessel may be associated with hundreds of thousands of documents. "A Venetian merchant...would recognise some of our documentation," says John Laurens, head of global transaction services at DBS, a Singaporean bank.

According to the World Economic Forum, the costs of processing trade documents are as much as a fifth of those of shifting goods. Removing administrative blockages in supply chains could do more to boost international trade than eliminating tariffs. Full digitisation of trade paperwork, reckons the UN, could raise Asia-Pacific countries' exports by \$257bn a year.

After years of talk about digitisation, such a shift may at last be taking place. Banks, insurers, shippers, their corporate customers and governments, abetted by technology companies, are combining forces to digitise the paper trail. Lots of projects are under way, building platforms which the various actors can use. Several are based on the blockchain, or distributed-ledger technology.

Using blockchain means that everyone with access to a ledger—for that

consignment of avocados, say—sees the same, up-to-date version of the truth. Flows of goods, information and money are thus aligned. The ledger would contain the purchase order, certification that the fruit came from Kenya, its eligibility for a concessionary European tariff, an updated record of its physical condition, phytosanitary certificates, the BoL and so on. An embedded “smart contract” could trigger payment, in full or in part, once certain conditions were met. All sorts of details could be included, says Tyler Mulvihill of Viant, a blockchain startup, such as the provenance of fish or drugs, or a mining firm’s environmental credentials.

In January Maersk and IBM, a computing giant, unveiled a blockchain-based joint venture aimed at digitising the supply chain from end to end. Big companies, ports and the American and Dutch customs authorities have carried out trial projects. The platform will be open to all (and run independently of Maersk): the hope is that logistics firms, financial companies and other shippers will join.

TradeIX, a fintech startup, R3, another blockchain firm, and several banks are testing another open platform, Marco Polo. Last year eight European banks and IBM unveiled we.trade, a trade-finance conduit for small and medium enterprises. They expect to deploy it in the second quarter of 2018. In March Evergreen, a big Taiwanese container line, teamed up with Bolero, a provider of electronic BoLs. Bolero and essDOCS, its rival, have offered electronic BoLs for several years, but have made limited headway. Similarly, electronic letters of credit have been available for some time, but have not been widely used.

Go-ahead governments are also encouraging digitisation. Singapore is building a National Trade Platform (not based on blockchain), involving banks, shippers and technology firms. It will bring “the whole trade ecosystem onto a single platform”, says Satvinder Singh of International

Enterprise Singapore. Hong Kong is creating a trade-finance blockchain platform. In November the two Asian trading hubs said they would create a cross-border platform, the Global Trade Connectivity Network, which is due to go live next year.

Part of the gain from digitisation lies in cutting costs. Banks employ armies of people in back offices, looking for discrepancies that may betoken fraud or honest error. Digitisation should also free the flow of finance to firms starved of it, partly by helping banks' compliance with anti-money-laundering rules. The Asian Development Bank has put the gap between available trade finance and demand at \$1.5trn.

Thomas Olsen of Bain & Company, a firm of consultants, thinks that digitisation could also slow the trend away from formal letters of credit, which now account for about 15% of trade finance, down from half in 1970. "Open account" trade, in which exporters send goods to importers and trust that their invoices will be paid, now accounts for the bulk. That is fine for big corporations and companies familiar with one another; less so for SMEs. "There would be more risk mitigation if it weren't such a pain," Mr Olsen says.

Institutional obstacles to digitisation loom larger than technical ones. For instance, a UN convention adopted in 2008 extends the recognition of electronic documents. But to come into force it must be ratified by 20 countries. Only four have: Cameroon, Congo, Spain and Togo. Upgraded industry standards are essential. The International Chamber of Commerce, a standard-setter for trade since 1919, established a group last June to co-ordinate work on trade finance. A new initiative based in Singapore, Digital Standards for Trade, may also help push things along.

Bain's Mr Olsen thinks the co-ordination problem will not stop progress. "It's a misconception that a lot of people have to leap at the same time,"

he says. He expects competing blockchain initiatives to develop piecemeal. Some platforms will become utilities; some will specialise; some will fade. Paperwork will not vanish. But at a difficult time for traders, one burden should become a lot lighter. ■



技术与国际贸易

单据磨人

大量贸易单据的数字化问题已是老生常谈，现在终于有了进展

进出世界各个港口的巨轮不仅装载着货物，还伴随着一系列文书单据：提单（BOL）、装箱单、信用证、保险单、订单、发票、卫生检疫证书、原产地证书。世界最大的集装箱航运公司马士基（Maersk）发现，2014年从蒙巴萨运送一批牛油果到鹿特丹，要与30多个相关方进行200多次沟通。一艘巨型集装箱船可能牵涉数十万份文件。“我们的一些单据也许连从前的威尼斯商人都认得出。”新加坡星展银行的全球交易服务总监约翰·劳伦斯（John Laurens）说。

据世界经济论坛的数据，处理贸易单据占了货运成本的五分之一。扫除供应链中的行政阻滞比消除关税更能提振国际贸易。联合国估计，如果贸易单据完全数字化，亚太国家的出口每年可增加2570亿美元。

经过多年讨论，这样的转变可能终于要实现了。在科技公司的推波助澜下，银行、保险公司、航运公司、企业客户及政府正在合力推动贸易单据的数字化。许多项目已在进行中，目标是建造可供各方使用的平台。其中一些基于区块链，即分布式分类账技术。

运用区块链意味着能访问某一分类账（例如上文提到的那批牛油果的运货）的各方看到的会是相同版本的、最新的真实状况。货物流、信息流和资金流完全匹配。该分类账将包含采购订单、水果产自肯尼亚以及享受欧洲优惠关税资格的证明、货物物理状态的最新记录、植物检疫证书、提单，等等。只要满足特定条件，内嵌的“智能合约”就会启动全额或部分付款。区块链创业公司Viant的泰勒·马尔维希尔（Tyler Mulvihill）表示，各种详细信息都可以被包含在内，例如鱼或药物的原产地，或者是矿业公司的环保合格证书。

今年1月，马士基和计算巨头IBM联手成立了一个区块链合资企业，旨在实现供应链端到端的数字化。各大企业、港口、美国及荷兰的海关都已推出试验项目。该平台将对所有人开放（其运营独立于马士基之外），希望能吸引物流公司、金融机构及其他航运公司加入。

金融科技创业公司TradeIX、另一家区块链技术公司R3以及几家银行正在测试另一个开放平台马可波罗（Marco Polo）。去年，八家欧洲银行和IBM宣布联手打造中小型企业贸易融资平台we.trade，期望在2018年第二季度推出。3月，台湾大型集装箱航运公司长荣海运宣布与电子提单系统供应商Bolero合作。Bolero和竞争对手essDOCS提供电子提单服务已有好几年，但进展不大。同样，电子信用证问世也已有一段时日，但尚未得到广泛使用。

一些开拓进取的政府也鼓励数字化转型。新加坡正在打造一个国家贸易平台（National Trade Platform，并非基于区块链技术），连结银行、航运企业及科技公司。新加坡国际企业发展局（International Enterprise Singapore）官员萨德星（Satvinder Singh）表示，此举将把“整个贸易生态系统引到一个平台上”。香港则在创建一个贸易融资区块链平台。去年11月，这两大亚洲贸易中心表示将建立一个名为环球贸易联系网（Global Trade Connectivity Network）的跨境平台，预定于明年上线。

数字化的好处之一是降低成本。银行要雇用大量人员在后台核查单据，寻找那些或因欺诈或因失误而导致的不一致之处。数字化有助于银行的反洗钱合规操作，这在一定程度上能让资金短缺的公司更容易获得融资。据亚洲开发银行估计，目前贸易融资缺口为1.5万亿美元。

贝恩咨询公司的托马斯·奥尔森（Thomas Olsen）认为，数字化还可以减缓正式信用证使用减少的趋势。信用证融资在1970年时占到贸易融资的一半，现在只占15%。如今，“开放账户”贸易成为了主流，出口商直接向进口商发货，相信对方会按发票支付货款。这对大企业和彼此熟悉的公司来说是可行的，对中小企业来说挑战则更大。“要不是流程那么复杂，信用证其实更能缓释风险。”奥尔森说。

在数字化问题上，制度上的障碍比技术上的障碍更大。例如，联合国在2008年通过了一项公约，推动对电子单据的认可，但要生效必须得到20个国家的批准。目前只有四个国家签署：喀麦隆、刚果、西班牙、多哥。提升行业标准很关键。成立于1919年的世界贸易标准制定组织国际商会（International Chamber of Commerce）在去年6月成立了一个小组，负责统筹贸易融资工作。在新加坡发起的贸易数字标准（Digital Standards for Trade）也可能有助于推动事态发展。

贝恩的奥尔森认为，协调上的问题不会阻遏进展。他说：“人们有个误解，以为这需要大家齐步跳跃。”他认为，未来会有众多区块链项目出现，互相竞争，各自发展。有些平台会变成公用事业公司，有些会专门化，有些则会消失。单据文件并不会消失。但在贸易商处境艰难之时，有一项负担应该会大大减轻。 ■



All creatures great and small

Gotta count them all

A census of Earthly life shows humans are few, but mighty

BILLIONS of years ago a star began to die. In the process, it created something new: 65,500 billion tonnes of carbon that would later be incorporated into the nascent planet Earth. That carbon is still there, and nowadays a fair chunk of it makes up the bodies of living beings. A new study, published in May by Yinon Bar-On and others from the Weizmann Institute of Science, in Israel, provides a comprehensive estimate of how the Earth's carbon stock is distributed among its inhabitants.

By estimating the amount of carbon stored in organisms, otherwise known as biomass, the scientists were able to compare the relative abundance of different kinds of Earth's life, weighing both the microbes beneath the soil and the giraffes walking above it on the same scale. The mammals known as human beings like to imagine themselves the lords of the planet. But in terms of raw biomass, the results—published in *Proceedings of the National Academy of Sciences*—tell a different story.

No animal comes remotely close to the domination of plants, which account for 80% of the planet's biomass (see chart). That makes sense: plants convert sunlight into food, and thus lie at the base of almost every food chain. Land plants account for the majority of that total, despite the fact that water covers almost three-quarters of the planet's surface. Bacteria take second place, with approximately 13%. The remainder is distributed among fungi, archaea, protists, animals and viruses, in that order. Even within the animal count itself, there is little for humans to boast of. There is about as much biomass in one species of Antarctic krill, tiny shrimp-like crustaceans eaten by blue whales, as there is in all 7.6 billion human beings.

But size is not everything. Humans have had a profound impact on the prevalence of other species. Dr Bar-On's research indicates that over the short span of human history on Earth (specifically after a large period of extinction that began 50,000 years ago) the biomass of wild mammals has decreased to a sixth of its previous value. Meanwhile, the carbon count of domesticated poultry grew to three times higher than that of every species of wild bird combined. Humans and their livestock have come to outweigh all other vertebrates on the planet with the exception of fish. That is not to say fish were spared. The biomass of fish is thought to have decreased by around 100m tonnes during humanity's tenure. And the dominance of plants, although it is still overwhelming, was far greater before the start of human civilisation. Dr Bar-On suggests that the total biomass of plants has fallen to just half its previous level.

Of course, these numbers are estimates. Dr Bar-On and his team could not individually count each organism they reported. They relied on collating information from hundreds of other studies, public data when they were available, and their own analysis of the likelihood of a certain thing being in a certain place. They were able to be a lot more confident about visible organisms in well-explored ecosystems than they were about microscopic ones in the Earth's deep subsurface or the ocean's deep water, such as bacteria.

Future research may therefore change these numbers, possibly dramatically. But Dr Bar-On's portrait of the planet is an impressive achievement—and a welcome dose of perspective. ■



万物生灵

一个都不能少

一项地球生物普查显示，人类规模虽小却力量强大

几十亿年前，一颗恒星开始陨灭，过程中创造出了一些新东西：65.5万亿吨碳。这些碳后来成为地球这颗新生行星的一部分，一直存在至今，其中很大一部分如今构成了生物的躯体。5月，以色列威兹曼科学院

(Weizmann Institute of Science) 的伊农·巴龙 (Yinon Bar-On) 等人发表了一篇新的研究报告，全面估计了地球上的碳储存在各类生物中的分布情况。

通过估计生物体内的碳储量，也就是所谓的生物量，科学家们已经能够比较出地球上不同物种的相对多度，即用同一尺度衡量地下的微生物和地上行走的长颈鹿的规模。被称为“人类”的哺乳动物喜欢将自己想象为地球的主宰。但就纯生物量而言，巴龙等人在《美国国家科学院院刊》(Proceedings of the National Academy of Sciences) 上发表的这篇研究报告却给出了另一种结果。

植物占地球生物量的80%，它们的绝对优势让任何动物都远远不及（见图表）。这不难理解：植物将阳光转化为养料，因此位于几乎所有食物链的底部。陆生植物占据了植物总生物量的大部分，尽管水几乎覆盖了地球表面的四分之三。细菌位列其次，大约占地球生物量的13%。其余依次为真菌、古生菌、原生生物、动物和病毒。人类的生物量即使放在动物界内部也没什么可夸耀的。仅南极磷虾（一种很小的似虾的甲壳类动物，是蓝鲸的主要食物）这一个物种，就与76亿人的生物量相当。

但生物量大小并非一切。人类就已对其他物种的种群规模产生了深远的影响。巴龙的研究指出，在地球上人类出现以后的短暂停时间里（确切地说是在于五万年前开始的大灭绝期之后），野生哺乳动物的生物量已经下降到之前的六分之一。与此同时，家禽的生物量增长到所有野生鸟类的三倍。

人类及家畜的生物量已经超过了地球上除鱼类以外所有其他脊椎动物的生物量。这并不是说鱼类就得以幸免。自有人类以来，鱼类的生物量被认为已经减少了大约1亿吨。植物的生物量虽然仍有压倒性的优势，但也远不及人类文明开始之前的规模。巴龙认为，植物的总体生物量已经下降到仅为过去的一半。

当然，这些都只是估计数字。巴龙和他的团队无法逐一统计论文中记录的每个生物体。他们查对了数百份其他研究报告、可获取的公共数据，并自行分析了特定生物存在于特定地点的可能性，然后将这些信息整合起来。他们对熟知的生态系统中的可见生物体把握很大，对细菌等存在于地表深处或深海的微生物就差得多。

因此，未来的研究也许会改变这些数据，幅度或许很大。但巴龙描绘的这幅“地球肖像”是一项令人赞叹的成果，也提供了值得欢迎的新视角。■



Bartleby

Not working properly

A modern author rediscovers Parkinson's Law

SISYPHUS, king of Corinth, was condemned for all eternity to push a boulder up a hill, only to watch it roll down again. David Graeber, an anthropologist, thinks that many modern workers face the same fate today, forced to perform pointless tasks, or “bullshit jobs”, as his new book* calls them.

Mr Graeber defines a bullshit job as one “that is so completely pointless, unnecessary or pernicious that even the employee cannot justify its existence”, though they may have to pretend that they believe in it. This definition, and indeed much of the book, combines two categories of roles. In the first are jobs that Mr Graeber tends to think are socially worthless, such as corporate lawyers or investment bankers. (Some of those workers may take an equally dim view of the utility of anthropologists.) In the second group are jobs where employees find themselves with little or nothing to do and, worse, must still look as if they are frantically busy.

What is his evidence? The author places a lot of faith in anecdotes and a couple of opinion surveys which found that only 37-40% of workers in Britain and the Netherlands felt they “made a meaningful contribution to the world.” He doesn’t seem to allow for the possibility that modesty might govern their answers.

In any case, the contention that many of us are wasting much of our time at work is hardly a new one. C. Northcote Parkinson coined the idea that “work expands to fill the time available” in an essay in *The Economist* in 1955, adding that “there need be little or no relationship between the work

to be done and the size of the staff to which it may be assigned.” The futility of many middle-class jobs is also an old theme, being the plot driver of the 1970s British sitcom “The Good Life”.

Nor are feelings of boredom and pointless activity confined to the arena of work. Anyone who has been a schoolchild can remember being forced to write essays, or take tests, about subjects that seemed neither interesting nor likely to be of any use in later life. Indeed, many teachers are probably as bored marking the schoolwork as pupils are producing it.

Nevertheless, some workers will feel that Mr Graeber’s analysis is timely. Both meaningless job titles and mindless tasks seem to have proliferated. A study† by Gary Hamel and Michele Zanini, two management theorists, estimated that there are nearly 24m corporate “bureaucrats” in America, or about one for every 4.7 workers. Reassigning them to more productive tasks could give the American economy a \$3trn boost, they reckon.

Mr Graeber constructs some elaborate theories as to why this problem has arisen. He suggests that automation in recent decades did cause mass unemployment but that society conspired to create a bunch of illusory jobs to disguise the fact. He also argues that while executives in the Reagan/Thatcher era prided themselves on how many low-level workers they could lay off, they then hired lots of management flunkies to enhance their status. And he postulates that it is all part of a system of social control, in which young people are loaded up with debt and then pushed into meaningless jobs in order to pay it off, thereby keeping them docile.

But these explanations seem inherently unlikely. Modern executives are motivated by share options which usually require them to meet profit targets. They are pursued by activist investors, who may get them fired if they underperform. Given those threats, bosses would hardly employ lots of useless, profit-sapping staff.

Instead, the problem lies in the nature of a services company. In a factory, you can count the widgets made each day, which limits the scope for bullshit. In a service business, it is harder to monitor the quality and quantity of output. Like the old quip about advertising, executives may know that half of their workers' time is wasted, but not which half.

In response to this lack of knowledge, executives create a host of targets, and hold a lot of meetings to try to understand what is going on. As Messrs Hamel and Zanini put it, "A growing percentage of employee time gets consumed in efforts to keep the organisation from collapsing under the weight of its own complexity."

In other words, there is no need for Mr Graeber to construct elaborate theories about neoliberal conspiracies to explain the phenomenon of wasted effort. Parkinson nailed the issue six decades ago: "Officials make work for each other."

* "Bullshit Jobs: A Theory", published by Allen Lane. †"The \$3 Trillion Prize for Busting Bureaucracy (And How to Claim It)" ■



巴托比

徒劳的工作

一位现代作家重新发现帕金森定律

科林斯的国王西西弗斯被诸神惩罚将一块巨石推上山顶，再眼看巨石滚落，周而复始，永无止息。人类学家大卫·格雷伯（David Graeber）认为，今时今日，许多现代劳动者面临同样的命运，被迫执行毫无意义的任务。他在新书*中把它们叫做“扯淡的工作”。

格雷伯把扯淡的工作定义为“完全没有意义、没有必要，或有害的工作，连员工自己也不能证明它有理由存在”，不过，他们可能还是不得不装出一副对工作使命深信不疑的样子。他的这个定义——以及书的大部分内容——包含了两类工作。第一类是格雷伯认为毫无社会价值的工作，比如公司律师或投资银行家。（他们之中可能也会有人同样对“人类学家”的价值嗤之以鼻）。第二类工作是员工自己没多少事或者根本没事可做，更糟的是，还必须表现出一副忙得不可开交的样子。

他的证据是什么？作者大量采信了趣闻轶事和几个民意调查，这些民调发现在英国和荷兰只有37%到40%的劳动者认为自己“对世界做出了有意义的贡献”。他似乎没考虑到这些答案有可能是人们自谦的结果。

无论如何，这种认为许多人在工作上虚耗年月的观点并不新鲜。C·诺斯古德·帕金森（C. Northcote Parkinson）于1955年在《经济学人》发表了一篇文章，提出了“工作总会填满全部可用时间”的观点，并补充说“需要完成的工作与可能被指派来完成这项工作的员工数量之间关系不大，甚至毫无关系。”许多中产工作徒劳无功，这也是个老题材，上世纪70年代英国情景喜剧《美好生活》（The Good Life）的剧情就以此展开。

无聊和无意义的活动也不仅局限于工作领域。任何上过小学的人都会记得被迫写作文或参加考试的经历，题目或科目既无趣，在将来也不见得有什么用处。事实上，许多教师改作业时很可能跟学生做作业时一样无聊。

尽管如此，一些劳动者会觉得格雷伯的分析很适时。虚衔和机械盲目的任务似乎都已激增。两位管理学理论学家加里·哈默尔（Gary Hamel）和米歇尔·扎尼尼（Michele Zanini）的一项研究^{*}估计，美国有近2400万名企业“官僚”，即每4.7名劳动者供养一名企业“官僚”。他们认为，如果重新安排这些“官僚”从事更有生产力的工作，能给美国经济带来三万亿美元的增长。

格雷伯构建了详尽的理论来解释该问题的成因。他认为，近几十年来，自动化确实导致了人们大规模失业，但社会协力创造出一大堆虚职来掩盖这一事实。他还指出，虽然里根/撒切尔时代的高管们以成功裁撤大批底层员工为傲，他们随后又在管理层里聘用了一大群应声虫来巩固自身地位。他认为这是社会控制体系的一部分，在这一体系中，年轻人背负债务，然后被迫从事无意义的工作来偿还，从而被驯服。

但是这些解释似乎从根本上讲不通。现代高管拥有公司股票期权，这通常会促使他们追逐利润目标。维权投资者也紧盯着他们，如果他们表现不佳，可能就会被赶下台。鉴于这些威胁，企业老板们不大可能会聘请大量毫无用处而徒耗利润的员工。

相反，问题存在于一家服务型公司本身的特性中。在工厂中，你可以统计工人每天制造的产品数量，限制怠工程度。但在服务业，你很难监控产出的质量和数量。套用那句打趣广告业的老话就是，高管们可能知道员工们有一半的时间都虚耗掉了，但就是不知道是哪一半。

面对这种无知，高管们制定出一系列目标，大量开会以试图了解进展。正如哈默尔和扎尼尼所说的，“员工花费越来越多的时间来防止组织被自身的复杂性压垮。”

换言之，格雷伯没必要构建复杂的新自由主义阴谋论来解释劳动者做无功的现象。早在60年前，帕金森就已一语中的：“官员们彼此为对方制造工作。”

* 《扯淡的工作》，艾伦莱恩出版社出版。† 《打破官僚作风，赢取三万亿

美元奖金（以及如何兑奖）》 ■



Predictive policing and sentencing

Algorithm blues

Big-data justice holds promise and peril

EIGHT storeys above downtown Los Angeles, Sean Malinowski, deputy chief of the Los Angeles Police Department (LAPD), focuses intently on a computer map of his old stomping ground. Nestled between Burbank and Santa Clarita, the Foothill district is a hotch-potch of industrial and residential districts riven by highways. Mr Malinowski ran its police station before his promotion moved him downtown.

Colourful dots representing reported crimes freckle the map like psychedelic pimples. Adjacent to some of the dots are red squares. Each one represents a 250,000-square-foot (2.3-hectare) area that PredPol, a crime-prediction software used by the LAPD and at least 50 other law-enforcement agencies around the world, has flagged as being at risk of future criminal activity. Mr Malinowski says that, if he were still in charge of policing in Foothill, he would ask his officers to drive through those areas frequently, “so we’re there randomly—it throws the criminals off.” The idea is not to nab people red-handed, but to deter them through increased police presence.

PredPol is just one of a number of firms offering crime-prediction software to police forces. While the precise components of each firm’s algorithms probably differ, the broad idea is the same. They aim to help police allocate resources efficiently by using large amounts of data to predict (and therefore prevent) crime.

The use of algorithms to tackle complex problems such as urban crime, or to try to forecast whether someone is likely to commit another crime, is not inherently alarming. An algorithm, after all, is just a set of rules designed

to produce a result. Criminal justice algorithms organise and sort through reams of data faster and more efficiently than people can. But fears abound: that they remove decisions from humans and hand them to machines; that they function without transparency because their creators will not reveal their precise composition; that they punish people for potential, not actual, crimes; and that they entrench racial bias.

Defenders of such programmes argue, correctly, that police have always relied on prediction in some form. Officers line parade routes, for instance, because experience has shown that the combination of crowds, alcohol and high spirits create an increased public-safety risk. Eliminating prediction from policing would produce an entirely reactive force. All these programs do, defenders say, is harness more data from more sources to help police make better decisions.

But the algorithms on which police base their decisions are, as far as the public is concerned, black boxes. The companies that create and market them consider their precise composition trade secrets. “Algorithms only do what we tell them to do,” says Phillip Atiba Goff of John Jay College of Criminal Justice in Manhattan. If their creators feed them biased data they will produce results infected with bias. And predictive policing is just one way in which the criminal-justice system is using algorithms to help them make decisions.

New Jersey uses an algorithm based on past criminal history, age, past failure to appear at trial and the violence of the current offence to determine whether someone is suitable for bail—that is, whether he presents too great a risk of flight or of committing more crimes while awaiting trial. Several states use algorithms to provide sentencing recommendations. At least 13 American cities use them to identify people likely to become perpetrators or victims of gun violence.

The first time such approaches came to public notice was in the 1990s, when William Bratton introduced CompStat, a statistically driven management system, into the New York Police Department (NYPD), which he ran. CompStat involved regular meetings of commanding officers discussing prevention strategies and recent crime data from their precincts. As one former NYPD deputy commissioner says, CompStat encouraged police to ask, “What is the problem? What is the plan? What are the results to date?” and to use data to answer all of those questions.

But CompStat was largely reactive rather than predictive. It also used precinct-wide data, while software such as PredPol can target enforcement to specific blocks. Crime does not occur randomly across cities; it tends to cluster. In Seattle, for instance, police found that half of the city’s crime over a 14-year period occurred on less than 5% of the city’s streets. The red squares in Foothill cluster around streets near junctions to main roads—the better to burgle and run while homeowners are at work—as well as around businesses with car parks (lots of inventory, empty at night) and railway stations. Burglars who hit one house on a quiet street often return the next day to hit another, hence the red squares.

And, unlike CompStat, which used arrests as a measure of officers’ productivity, PredPol aims to prevent rather than punish crimes. “I’m more concerned about the absence of crime” than citations and arrests, says Mr Malinowski. “We don’t want mass incarceration for little crimes.” As for measuring productivity, that, too, has grown easier. LAPD patrol cars are geotagged, and the red boxes geofenced, so senior officers know precisely how long each car spends there.

Exactly what data get fed into the algorithms varies by company. Some use “risk-terrain modelling” (RTM), which tries to quantify what makes some areas crime-prone. One RTM algorithm uses five factors: prevalence of past

burglaries, the residence of people arrested for past property crimes, proximity to main roads, geographic concentration of young men, and the location of apartment buildings and hotels. Some include requests for police help, weather patterns and the proximity of bars or transport stations. PredPol uses reported, serious crimes such as murder, aggravated assault and various forms of theft, as well as the crime's date, time and location. Most of these algorithms use machine learning, so they are designed to grow more accurate the more predictions they make and the more data they take in.

Some analytic programmes suck in and link up more data. A joint venture between Microsoft and the NYPD called Domain Awareness System pulls data from the city's thousands of publicly owned CCTV cameras, hundreds of fixed and car-mounted ANPRs, and other data sources. The NYPD says its system can track where a car associated with a suspect has been for months past, and can immediately alert police to any criminal history linked with a flagged number plate.

So do these algorithms work? Do they accurately forecast where crime will occur and who will go on to commit future crimes? Here the evidence is ambiguous. PredPol touts its 21-month-long trials in Kent, an English county, and Los Angeles, which found that the programme predicted and helped to prevent some types of crime (such as burglary and car theft) more accurately than human analysts did. A trial in Louisiana of a different data-driven predictive-policing model, however, found no statistically significant reduction in property crimes compared with control districts.

But even if such approaches proved effective beyond a doubt, concerns over their potential to trample civil liberties and replicate racial bias would remain. These concerns are most acute for algorithms that implicate people rather than places. The Chicago police department has compiled a "strategic subject list" of people it deems likely to be perpetrators or victims of gun

violence (both groups tend to comprise young African-Americans from the city's south and west sides). Its central insight parallels that of geographic predictions: a small number of people are responsible for a large share of violent crime. The department touts its accuracy. In the first half of 2016, it says, 74% of gun-violence victims and 80% of those arrested for gun violence were on the list.

Police say they update the list frequently. When someone new shows up on it, officers will sometimes visit that person's home, thus promoting contact with police before a person has committed a crime. Nobody knows precisely how you end up on the list, nor is it clear how (short of being shot dead) you can get off it. One 22-year-old man, Robert McDaniel, told the *Chicago Tribune* that police came to his home and told him to straighten up—even though he had just a single misdemeanour conviction (he may have been earmarked because a childhood friend with whom he was once arrested was shot dead).

In a study of the first version of the list from 2013, RAND, a think-tank, found that people on it were no more likely to be victims of a shooting than those in a random control group. Police say the current list is far more accurate, but have still refused to reveal the algorithmic components behind it. And both Chicago's murder rate and its total number of homicides are higher today than they were when police started using the list in 2013.

Meanwhile, algorithms used in sentencing have faced criticism for racial bias. ProPublica, an investigative-journalism NGO, studied risk scores assigned to 7,000 people over two years in Broward County, Florida, and found black defendants twice as likely as whites to be falsely labelled at high risk of committing future crimes. It also found the questions predicted violence poorly: only around 20% of those forecast to commit violent crimes actually did so. Northpointe, the firm behind the algorithm, disputed ProPublica's findings.

But the questions on Northpointe's risk-assessment form illustrate how racial bias can infect an algorithm even without any direct questions about race. It asked how often a defendant, his family members and friends have been arrested. Those numbers will presumably be higher in poor, overpoliced, non-white districts than rich ones. It also asked whether friends were in gangs, how often the defendant has "barely enough money to get by" and whether it is "easy to get drugs in your neighbourhood"—all questions that ethnic minority defendants will, on average, answer affirmatively more often than white ones. More broadly, a proprietary algorithm that recommends a judge punish two people differently based on what they might do offends a traditional sense of justice, which demands that punishment fit the crime not the potential crime.

Another analytical system, called Beware, assigns "threat scores" in real time to addresses as police respond to calls. It uses commercial and publicly available data, and it has a feature called Beware Nearby, which generates information about potential threats to police near a specific address, meaning officers can assess the risk when a neighbour calls the emergency services.

This raises privacy concerns, but it could cause other problems, too. For instance a veteran who has visited a doctor and taken medicine prescribed for PTSD, who also receives gun catalogues in the post, could be deemed high risk. Police might then approach his house with guns drawn, and it is not hard to imagine that kind of encounter ending badly. Such threat scores also risk infection with bad data. If they use social-media postings, they also raise free-expression concerns. Will police treat people differently because of their political opinions?

Questions of bias also surround place-based policing. Using arrests or drug convictions will almost certainly produce racially biased results. Arrests reflect police presence more than crime. Using drug convictions is suspect,

too. Black and white Americans use marijuana at roughly similar rates, with the rate for 18- to 25-year-olds higher for whites than blacks. But blacks are arrested for marijuana possession at nearly three times the rate of whites across America—and even more often than that in some districts. Black people in Washington, DC, and Iowa are eight times likelier than whites to face arrest for marijuana. Charges for possession of that one drug comprise half of all drug arrests. Small wonder that a study by Kristian Lum of the Human Rights Data Analysis Group and William Isaac found that when a predictive algorithm was trained on historical drug-crime data in Oakland, California, it targeted black areas at twice the rate of white ones, and low-income neighbourhoods at twice the rate of high-income ones.

Place-based prediction also raises questions about reasonable suspicion. If police are on a residential block algorithmically predicted to be at risk of theft, and they drive past a man carrying a heavy satchel, does that justify stopping and searching him, especially when they might not do the same on another block?

Some accept that algorithms may replicate racial biases, but say they at least do not aggravate them. “It’s not a perfect world,” says one advocate of algorithm-based bail reform. You need to compare risk-based assessments with the status quo, he says. If a black and a white defendant came before a judge with the exact same record today, the judge might treat the black defendant worse. “At least with the risk assessment they’ll get the same score.” But that is a depressingly low bar to set.

Download the complete “data detectives” graphic novel at: econ.st/2JoNGzo ■



预测性警务与量刑

算法的忧伤

大数据司法前景广阔，但有危险

洛杉矶市中心的一座八层楼上，洛杉矶警察局（LAPD）副局长肖恩·马林诺夫斯基（Sean Malinowski）专心致志地在电脑地图上查看自己过去常去的地方。福特希尔区（Foothill district）坐落在伯班克和圣克拉丽塔之间，是一个被高速公路分割开工业和住宅区的大杂烩区。在升职并搬到市中心前，马林诺夫斯基就负责管理这里的警察局。

代表举报罪案的彩色圆点像光怪陆离的丘疹一样染上地图。一些点的旁边还有红色的方块。在LAPD和世界各地至少50家其他执法机构使用的PredPol犯罪预测软件中，每个方块都代表一个未来有犯罪活动风险的250,000平方英尺（2.3公顷）的区域。马林诺夫斯基说，如果他仍然负责福特希尔的警务工作，他会要求警官经常驾车巡视这些地区，“我们会随机出现——这会让犯罪分子却步。”目的不是为了抓现行，而是通过增加警察出现的频率来震慑他们。

PredPol只是众多向警方提供犯罪预测软件的公司之一。虽然每家公司的算法的具体组成可能不同，但整体想法是一样的。目标都是要通过使用大量数据来预测（从而预防）犯罪，帮助警方有效分配资源。

运用算法来处理诸如城市犯罪等复杂问题，或试图预测某人是否可能再次犯罪，这本身并不令人担忧。毕竟，算法无非是一组用来生成结果的规则。刑事司法算法能比人更快、更有效地组织和整理数据。但人们有诸多担心：它们将决策权从人类手中夺走交给了机器；它们的运作没有透明度，因为它们的创建者不会透露其确切的构造；它们按照潜在而非实际的罪行来惩罚人们；它们让种族偏见进一步加深。

这些算法的维护者辩称，警察总要依靠某种形式的预测。没错。例如，警官要排队护卫游行路线，因为经验表明人群、酒精和激动情绪的结合会增

加公共安全风险。在警务中禁用预测会让警察完全处于被动回应的状态。维护者说，这些程序所做的无非是利用更多来源产生的更多数据帮助警方做出更好的决策。

但对于公众而言，警方的决策所依赖的算法是个黑匣子。创造和销售它们的公司会将具体的构造视为商业秘密。曼哈顿的约翰·杰伊刑事司法学院的菲利普·阿提巴·戈夫（Phillip Atiba Goff）说：“算法只做我们让它们做的事情。”如果创造者给它们提供偏倚的数据，它们就会给出偏倚的结果。预测性警务只是刑事司法系统使用算法来辅助决策的方式之一。

新泽西州使用的算法根据犯罪历史、年龄、过去未能出庭的记录以及当前犯罪的暴力程度来确定某人是否适合获得保释，也就是说，看他是否有过高的逃跑风险，或在待审时进一步犯罪的风险。还有几个州使用算法提供量刑建议。至少有13个美国城市使用算法来识别可能成为枪击案肇事者或受害者的人。

这类方法在上世纪90年代首次公诸于众，当时威廉·布拉顿（William Bratton）将基于统计的管理系统CompStat引入了他执掌的纽约警察局（NYPD）。根据该系统的设定，指挥官们会定期开会，讨论预防战略和其辖区的最新犯罪数据。纽约警察局的一位前副局长说，CompStat鼓励警方提问：“问题是什么？计划是什么？迄今为止的结果是什么？”并使用数据来回答所有这些问题。

但是CompStat在很大程度上是回应式而非预测式的。而且它使用的是辖区这个大范围里的数据，而像PredPol这样的软件可以将执法聚焦到特定的街区。犯罪并不是在城市各处随机发生的，而往往集中在某些地带。例如，在西雅图，警方发现在14年的时间里，该市一半的犯罪行为发生在不到5%的街道上。福特希尔的红色方块集中在靠近主要路口附近的街道上，因为这里更易于在户主上班时入室盗窃并逃跑。此外，带停车场的商户（意味着有大量库存，而夜间无人）和火车站的周围也是红色方块集中区。在一条安静的街道上闯入一户人家的窃贼往往会在第二天回来盗窃另一户，因此会出现红色方块。

而且，与用逮捕数量来衡量警员工作成果的CompStat不同，PredPol旨在预防而不是惩罚罪行。马林诺夫斯基说，“我更关心的是犯罪的消失”而不是传唤和逮捕，“我们不希望对轻微犯罪进行大规模监禁。”而衡量工作成果也变得更加容易。LAPD的巡逻车带有地理位置标记，红色方块则有地理围栏，所以高级警官精确地知道每辆车在那里花了多长时间。

具体把哪些数据输入算法则因公司而异。有些公司使用“风险地形建模”（RTM），它试图量化某些地区犯罪率偏高的原因。有一种RTM算法使用了五个因素：历史盗窃率、曾因财产犯罪被捕者的居住地、与主干道的距离、年轻男性的地理集中度，以及公寓楼和酒店的位置。有些则包含了向警方求助、天气模式以及靠近酒吧或运输站的情况。PredPol使用了获举报的严重犯罪，如谋杀、重度袭击和各种形式的盗窃，以及犯罪的日期、时间和地点。这些算法大多使用机器学习，因此它们做的预测越多、获取的数据越多，就越准确。

一些分析程序会吸收并连结更多的数据。微软与纽约警察局合资创建了一个名为“区域感知系统”的公司，从该市数千个公有闭路电视摄像头、数百个固定和车载ANPR以及其他数据源提取数据。纽约警察局表示，它的系统可以追踪与犯罪嫌疑人相关的汽车在过去几个月的位置，并且可以立即将任何与被标记的车牌相关的犯罪记录告知警方。

那么这些算法管不管用呢？它们是否准确地预测出犯罪地点，以及谁将继续犯罪呢？这方面的证据尚不明确。PredPol吹嘘它在英格兰肯特郡和洛杉矶进行的一项长达21个月的试验，发现该程序比人类分析师更准确地预测出和帮助预防了某些类型的犯罪（如入室盗窃和偷车）。然而，在路易斯安那州开展的另一个数据驱动预测性警务模型的试验中，与对照区相比，没有发现财产犯罪的统计数字有显著下降。

但即使这类方法被证明效果无可置疑，人们依然担忧它们会践踏公民自由和复制种族偏见。那些涉及人员而非地点的算法引发的担忧最为强烈。芝加哥警察局已经编制了一份他们认为很可能成为枪支暴力肇事者或受害者

的“战略目标名单”（这两个群体都主要由城市南部和西部的年轻非裔美国人构成）。其核心观点与地理预测相似：少数人造成大量暴力犯罪。该部门对其准确性大加宣扬。据称，2016年上半年，74%的枪支暴力受害者和80%因枪支暴力被捕的人都在这个名单上。

警方称他们经常更新这个名单。当有新人上榜时，警察有时会登门造访，从而在一个人犯罪之前令其加强与警察的联系。没人确切知道你为何上了名单，也不清楚如何（如果没有被枪杀的话）能从名单中把名字拿掉。22岁的男子罗伯特·麦克丹尼尔（Robert McDaniel）告诉《芝加哥论坛报》，警察来到他家并告诉他要改过自新——尽管他只犯过一项轻罪（他被标记出来可能是因为与他共同被捕的一个童年朋友被枪杀了）。

智库兰德（RAND）对2013年第一版名单的研究发现，与随机对照组中的人相比，名单中的人成为受害者的可能性并不偏高。警方称目前的清单要准确得多，但仍拒绝透露其背后的算法组件。而今天芝加哥的谋杀率和杀人案总数都高于警方在2013年刚开始使用该名单时的情况。

与此同时，在量刑中使用的算法因种族偏见而遭到批评。ProPublica是一家开展调查报道的非政府组织，它研究了佛罗里达州布劳沃德县在两年内给7,000人的风险评分，发现黑人被告被误判为未来犯罪高风险人群的可能性是白人的两倍。它还发现这项算法在预测暴力行为方面表现很差：被预测暴力犯罪的人中只有约20%后来真的犯了罪。设计该算法的公司Northpointe对ProPublica的调查结果提出了异议。

但是，从Northpointe风险评估表上的问题可以看出，即使没有任何直接关于种族的问题，种族偏见依然会影响算法。它问被告人、其家人和朋友被捕的频率如何。可以想见，这些数字在贫穷、警察监管过度的非白人区会比富人区高。它还问是否有朋友在帮派中、被告“勉强度日”的频率，以及是否“容易在周边获得毒品”——平均而言，对所有这些问题，少数族裔都会比白人更常给出肯定的回答。更广泛来说，如果一种专有算法是根据人们可能会做什么来推荐法官对两个人给出不同的刑罚，那么它违背了传统的正义感。这种正义感要求刑罚与罪行相符，而非与潜在的犯罪相符。

另一个名为Beware的分析系统在警察接听电话时实时为地址分配“威胁分数”。它使用商业和公开数据，并有一个称为Beware Nearby的功能，会提供位于特定地址附近的警察面临潜在威胁的信息，这意味着警员可以在邻居拨打紧急电话时评估风险。

这引发了隐私担忧，但也可能导致其他问题。例如，一位曾经看过医生并服用创伤后应激障碍（PTSD）药物，还在邮件中收到过枪支目录的老兵可能被认为存在高风险。于是警察可能会拔枪向他的房子走去，不难想象这样的相遇可能以糟糕的结局收场。这类威胁评分也有被不良数据感染的风险。如果它们阅读社交媒体发帖，还会带来对言论自由权的担忧。警察会因为政治观点而对人区别对待吗？

基于地点的监管也有偏见问题。利用逮捕或毒品犯罪数据几乎肯定会产生种族偏见的结果。逮捕更多反映的是警察的存在而非犯罪。毒品犯罪的数据也不可靠。美国黑人和白人使用大麻的比例大致相似，而在18至25岁年龄段，白人使用毒品的比例比黑人更高。但在整个美国，黑人因持有大麻被捕的机会几乎是白人的三倍——在一些地区甚至还要更高。华盛顿特区和爱荷华州的黑人因大麻被捕的可能性是白人的八倍。持有大麻这一种毒品的指控占了所有毒品逮捕的一半。难怪人权数据分析小组的克里斯蒂安·拉姆（Kristian Lum）和威廉·艾萨克（William Isaac）的一项研究发现，使用加州奥克兰市的历史毒品犯罪数据来训练预测算法时，它将目标定位在黑人区的机会是白人的两倍，瞄准低收入社区的机会是高收入社区的两倍。

基于地点的预测也提出了关于合理怀疑的问题。如果警察身处一个算法预测出存在偷窃风险的住宅街区，在他们开车经过一个背着沉重挎包的人时是否有理由拦截搜查他，尤其是换做在另一个街区他们不大会这样做的情况下？

有些人承认算法可能会复制种族偏见，但称它们至少不会加重偏见。“这不是一个完美的世界。”一个倡导基于算法的保释改革的人这么说。他说，你需要拿风险评估算法和现状做比较。如果两名历史记录完全相同的

黑人和白人被告今天面见法官，法官可能会对黑人被告做出更不利的决定。“至少，使用风险评估他们会得到相同的分数。”但要求如此之低，着实令人沮丧。

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Free exchange

Trading peace for war

Sino-American interdependence has been a force for geopolitical stability

IN THE 1990S America and Europe had a trade dispute over bananas. No one worried that tanks might soon roll as a result. But trade is about more than economics. The European Union, the world's most ambitious free-trade area, was founded on the idea that trade integration would make war between members "not merely unthinkable, but materially impossible". As the risk of a serious Sino-American trade war grows, attention is mostly focused on the prospect of dearer iPhones and unhappy soyabean farmers. But the stakes are much higher.

China's economic miracle could not help but provoke geopolitical stress, given its size and illiberalism. Relations between America and China are built on mutual suspicion. Geopolitical rivalry has been moderated, however, by economic interdependence: a mutual entanglement some economics wags have dubbed "Chimerica".

As China opened up, American consumers hoovered up cheap Chinese goods. American firms built China into their supply chains, enjoying low labour costs and gaining a presence in a domestic market that would one day be the world's largest. Export-oriented development created vast numbers of Chinese jobs, and American investment allowed Chinese firms to gain technological expertise. As China grew richer, it purchased American bonds to keep its currency low and its exports competitive. That allowed America to consume beyond its means year after year. This circular flow of money saw America's current-account deficit grow in pace with China's surplus.

Both countries have strained at these ties. Even before Donald Trump became president, America bristled at the theft of its intellectual property, aggressive government support for Chinese industry, and the destabilising currency manipulation. China deplored its dependence on foreign technology and consumers. These vulnerabilities were highlighted by the financial crisis, when plummeting global demand threatened to plunge China into recession, even though it is quite separate from the global financial system.

Support within America for a tougher line with China has been building for a while. And China is ever keener to achieve technological self-sufficiency. The share of domestic value-added in its exports has been rising steadily. “Made in China 2025”, the national development strategy, aims to create high-tech substitutes for foreign products from computer components to robots, cars and planes.

Yet an end to Sino-American interdependence is not inevitable. China might yet hew more closely to rich-country trade rules, and intervene less in its economy and foreign-exchange markets. Trade between America and China could continue to grow, even as the technological gap between them, and their bilateral imbalance, shrink. Expensive goods, investment and services could flow both ways, as between America and Europe.

But this sunny future looks increasingly remote. America already limits some Sino-American trade on national-security grounds. Past spats over dumping and other unfair trade practices led to punitive duties on some goods, as allowed under WTO rules. An all-out trade war would blow the two economies apart.

The higher tariffs being mooted on half, or nearly all, of America’s imports of Chinese goods would cause serious economic pain in both countries. In America the prices of many goods would jump and those of others, like the

soyabeans exported to China by the shipload, would plummet. A sudden drop in China's trade surplus with America, now over 3% of Chinese GDP, would be a heavy blow. Even though a weaker currency would make it easier to export more to other countries, China would probably need both monetary and fiscal stimulus to avoid a socially disruptive rise in unemployment.

Then the real trouble would start. However warily American and Chinese leaders eye each other, economic self-interest keeps their most hawkish impulses in check. The interests of American consumers and firms constrain officials keen to keep sensitive technology out of Chinese hands (or snooping Chinese technology out of American households). China's dependence on American spending and technology limits diplomatic and military adventurism. The break-up of Chimerica would mean an end to those constraints.

It might also shove the world economy back towards mercantilism and competing spheres of economic influence. China is already cultivating its economic imperium via the Belt and Road Initiative, a plan to build infrastructure for trade and to invest heavily in resource-rich developing economies. Cut off from American consumers, China would seek to strengthen ties with its neighbours in the hope of selling them more stuff. As Mr Trump's economic sabre-rattling has grown louder, China has started to cultivate relations with Japan and South Korea. Mr Trump would probably view America's allies strengthening their trade ties with China as a strategic blow—even though he has picked trade fights with them, too. He might limit access to the American market for countries that do not join his anti-China campaign. A world of mutually beneficial trade could turn into one in which there are no winners without losers, and no victory without conflict.

America has become embroiled in trade spats with fast-growing upstarts before; with Japan in the 1980s, for example. But these involved democratic

countries grateful for American protection during the cold war—and American presidents with quite different characters. A closer analogy might be the early 20th century, when economic interdependence proved no match for rising nationalism and bad leadership. The fear is that Mr Trump's tariffs are less a way to correct legitimate trade grievances than a step towards a much darker world. ■



自由交流

弃和平换战争

中美之间的相互依存关系一直是一种稳定地缘政治的力量

美国和欧洲在上世纪90年代曾因香蕉发生过贸易争端。当时没有人担心坦克很快会因此开动起来。但贸易不仅仅事关经济。欧盟是世界上最雄心勃勃的自由贸易区，创立这一联盟的理念就是贸易一体化会让战争在成员国之间“不仅不可想象，而且实质上也不可能发生”。随着中美之间大打贸易战的风险不断增加，人们关注的焦点主要在未来iPhone会涨价、种大豆的农民会不满等事情上。但这其中的利害远不止于此。

鉴于中国之大和缺乏自由，它奇迹般的经济发展势必会引发地缘政治紧张。中美关系建立在相互猜疑的基础上，但两国之间的地缘政治竞争也因经济上相互依赖而缓解。一些经济学专家打趣地将二者这种彼此纠缠称作“中美国”。

中国开放市场后，美国消费者大量购买廉价的中国商品。美国企业将中国纳入它们的供应链，享受着中国低廉的劳动力成本，并在其国内市场——有朝一日将成为全球最大——占据了一席之地。以出口为导向的发展为中国创造了大量的就业岗位，而美国的投资让中国企业获得了专业技术能力。随着中国不断累积财富，它购买美国债券以保持人民币的低汇率和出口竞争力，这让美国年复一年入不敷出。这种资金的循环流动令美国的经常账户赤字与中国的盈余同步增长。

两个国家都尝试摆脱这种关系。早在特朗普当选总统之前，美国就因知识产权遭窃、中国政府对本国产业过分支持以及破坏全球稳定的货币操纵行为愤慨不已。中国也痛悟自己不该太过依赖外国的技术和消费者。金融危机凸显了这种依赖的脆弱性，当时的全球需求直线下降差点让中国陷入衰退，尽管中国的金融体系在很大程度上独立于全球金融体系。

一段时间以来，美国国内主张对中国采取更强硬政策的呼声不断高涨。而

中国也更热切地期望实现技术自主。中国出口产品的国内附加值一直在稳步上升。中国还推出了名为“中国制造2025”的国家发展战略，力求创造出可替代外国进口的高科技产品，从计算机零部件、机器人，到汽车和飞机。

然而，中美相互依存关系的结束并非无可避免。中国还是有可能进一步遵守富国的贸易规则，并减少对经济和外汇市场的干预。在中美技术差距缩小、双边贸易不平衡减少的同时，两国之间的贸易仍可能继续增长。高价的商品、投资和服务可能会像在美欧之间那样在中美之间双向流动。

但这样的光明前景似乎越发遥远了。美国已经以国家安全为由限制了一些中美贸易。过去在倾销等不公平贸易行为方面的争端导致一些商品在世贸规则允许的范围内被征收了惩罚性关税。全面的贸易战将令“中美国”解体。

美国正在考虑对一半或几乎所有进口的中国商品增加关税，这将给两国经济带来强烈痛楚。在美国，许多商品的价格将猛涨，而另一些商品的价格则会大幅下跌，例如经海路出口到中国的大豆等商品。中国对美贸易顺差现在超过中国GDP的3%，一旦骤降将对中国造成沉重打击。尽管人民币走弱会让中国更容易增加对其他国家的出口，但它可能仍需要采取货币和财政刺激措施，来避免失业率上升以及这对社会稳定造成的影响。

那时真正的麻烦才开始。不管美中领导人如何相互提防，对自身经济利益的考虑压制着他们采取最强硬行动的冲动。美国的官员虽然竭力避免敏感技术落入中国手中（或者防止中国技术进入并窥探美国家庭），但也受制于美国消费者和企业的利益。中国对美国消费者和美国技术的依赖限制了它在外交和军事上的冒险主义。中美国的解体意味着这些制约因素将不复存在。

这还可能推动世界经济重新走向重商主义，分化成一个个相互竞争的经济势力范围。中国已经在通过“一带一路”培育其经济统治权，该倡议旨在建设贸易基础设施，并在资源丰富的发展中经济体大量投资。失去了美国消

费者的中国会寻求加强与邻国的关系，希望能向它们出售更多的商品。随着特朗普开打经济战的叫嚣声越来越大，中国已开始培养与日本和韩国的关系。特朗普可能会视美国盟友加强与中国的贸易关系为一种战略上的失利，尽管他也向这些盟国挑起了贸易战。他可能会限制那些没与他一致对抗中国的国家进入美国市场。一个互利贸易的世界可能会不复存在，而是有赢家必有输家，有胜利必有冲突。

美国过去也曾与快速发展的新贵经济体发生过贸易争端，例如上世纪80年代的日本。但是这些国家都是民主国家，它们感激美国在冷战时期给予的保护，而且当时的美国总统也有着截然不同的性格。更适合做类比的时期可能是上世纪初，当时民族主义不断抬头、多国领导无方，对此各国之间相互依存的经济关系无力与之对抗。令人担忧的是，特朗普增加关税的做法不但无益于纠正那些引发了合理不满的贸易行为，还会把世界推向更黑暗得多的境地。 ■



Justice and the public

Watching the detectives

Rigorous oversight and an engaged citizenry will be essential to keep a check on police activity

ACOUSTIC sensors trained to recognise the sound of gunfire and send alerts to officers' mobile phones telling them when and where the shots were fired. Glasses that recognise faces and record everything. Drones equipped with high-definition video cameras. GPS readers and ANPRs, allowing for constant surveillance of entire swathes of a city. CCTV systems with embedded facial recognition that lets authorities track people in real time.

All of these new technological possibilities are upending a wide range of activities and the customs associated with them. Law enforcement is no different. But if citizens do not like how their doctor or hairdresser, or a social-media site, uses their data or tracks their purchases, they can go somewhere else. The state wields a monopoly on punishment through law enforcement. Police can arrest, and even kill, their fellow citizens. Judges have the power to imprison people. That makes transparency and public consent in the justice system essential.

There is no reason for the police to eschew the best available technology just because it can be used invasively. If criminals store information on their phones, police should be able to see it. If data can help police prevent crime, they should use them. But this needs to be done without impinging on people's civil liberties. Police and politicians cannot let the allure of new technology lead them to overlook how it will affect the people they serve. And citizens must hold them to account.

Such vigilance must extend to the sellers of these systems as well as their users. Some regimes have embraced emerging technologies the better to

control and surveil people: China, for instance, has blanketed its restive regions of Xinjiang and Tibet with facial-recognition cameras, iris scanners and other such kit. In January the European Parliament, following popular concern, imposed export controls on surveillance technology that regimes can use to spy on citizens.

In liberal countries, big-data policing is not about police chiefs sitting around strategising, says Andrew Ferguson, author of a book on the subject. “It’s tech companies selling them cool stuff, charging police departments for storage and data...[and] telling them, ‘We can help you solve more crimes with our cool tech.’” The companies give technology free to help police solve their problems, he says.

Mr Ferguson suggests five questions that departments should answer before buying new technology. Can you identify the risks that the technology addresses? Can you ensure accurate data inputs? How will the technology affect community relations and policing practice? Can it be tested to ensure transparency and accountability? And will police use the technology in a manner that respects the autonomy of the people it will affect?

Some places have begun to create institutions to answer those sorts of questions. Just like many tech firms, the cities of Seattle and Oakland have chief privacy officers, charged with vetting and managing the privacy implications of their cities’ policies. Oakland’s grew out of its privacy commission, a nine-member advisory body to the city council formally established in 2016, after citizens resisted its plan to introduce a domain-awareness system similar to the one Microsoft and the NYPD built in New York.

“We just started showing up and educating the council on the risks of this equipment,” says Brian Hofer, a member of the commission. The Oakland PD and the commission meet once a month to discuss surveillance and

the data of Oakland residents. They write tech-use policies together, and the department submits public annual reports on how often and for what purpose its surveillance tech was used. On May 1st Oakland's city council proposed a bill requiring that any new police technology be approved by the city council and privacy commission.

One might imagine that background—successfully stopping a planned surveillance programme in one of America's most liberal cities—would augur an oppositional relationship between the privacy commission and the police department. But the opposite is true, say both Mr Hofer and Tim Birch, who heads the Oakland PD's research and planning division.

Working with the commission “encourages us to think about what technology is really needed,” and to ask whether the benefits are worth the costs, says Mr Birch. Or as Mr Hofer puts it, “The police are aware that they have to behave differently because someone is watching.” He notes that the commission has never recommended the city council bar police from obtaining new technology that they want. “Technology itself isn't good or bad, as long as they tighten up their [usage] policies.”

Several other municipalities in California have passed surveillance-transparency requirements similar to Oakland's. Last February a state senator in California introduced legislation requiring that municipalities create and publicise policies for the use of surveillance technology, and restricting the sale or transfer of information gathered through surveillance.

Concerns over data-sharing have led cities in California to rethink contracts with Vigilant, an ANPR firm that recently signed up Immigration and Customs Enforcement (ICE), America's federal immigration police, as a client. Civil-liberties groups worry that ICE could tap into local law-enforcement ANPR data stored on Vigilant's servers to target undocumented

immigrants. Vigilant insists that would be impossible unless a local law-enforcement agency explicitly allowed it, which California's would not. But, according to Mr Birch of Oakland PD, the ICE contract "terrifies people". The prospect that the government could find a back door into Vigilant's massive database, or that a rogue officer who disagrees with California's liberal policies could share information from the database with federal police, was enough to make co-operation politically impossible for California's liberal cities.

New Orleans recently ended its relationship with Palantir, a company that built predictive-policing software for the city entirely outside public view. (Its founder, Alex Karp, is a non-executive director on the board of The Economist Group.) Palantir donated the product to the city, but civil-rights activists feared the firm was using New Orleans as a testing ground. Had the city acquired the services through the usual procurement process, it may not have caused a fuss. But a secretive deal for a predictive-policing program run with proprietary algorithms proved too much.

Local politicians upholding their communities' values is cause to cheer, particularly when it happens in the usually grey area of law-enforcement surveillance. This does not mean that the sort of strict oversight favoured by liberal, multi-ethnic northern California will fly everywhere. "It has to be local," says Mr Birch. "That's the only way these privacy commissions can work. They have to reflect local standards."

There are also benefits in sharing results of number-crunching with other arms of government and civil society. A map of crime is also a map of need. "What you're modelling is a host of factors, and you're only giving it to one publicly available resource, which is the punitive resource," says Mr Goff of John Jay College. "Why would you not also give this to social-service providers?"

Similarly, Andrew Papachristos, a sociologist whose research helped the Chicago PD create its strategic subject list, urged the police to share data, and wrote, “The real promise of using data analytics to identify those at risk of gunshot victimisation lies not with policing, but within a broader public-health approach.” The young men at risk of being shot may also need job training and counselling. Trained mediators could calm conflicts before they flare into violence.

Any number of interventions might benefit them and the community better than contact with the police. As Mr Ferguson writes, “Police may be the primary actors in the system to solve crime, but they do not have to be the primary actors in the system to reduce risk.” And if police can measure their success at driving down crime rates, surely cities can measure providers’ success at offering social services.

But they have to want to do it, and this, too, is a question of citizen involvement—not of oversight, but of political will. “Law and order” candidates win elections more often than “efficiently targeted social-services” candidates. New technology helps justice systems collect and organise data more efficiently. They can use it to punish. Or they can use it for the unglamorous, less politically rewarding work of dealing with the causes of crime.

Ultimately, citizens in open societies must decide for themselves what they are willing to tolerate. Technological change is inevitable, but does not have to happen without being questioned. Perhaps people want their neighbours to drive around in cars topped with facial-recognition cameras that report everything to police. If they do not, they need to speak up—forcefully, and now.

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正义与公众

监视警探

严格监管和公民参与对于约束警察活动将至关重要

经过训练的声音传感器可以识别枪声，并向警察的手机发出警报，告诉他们枪击的时间和地点。他们佩戴的眼镜能够识别人脸并记录一切。无人机配有高清摄像头。GPS读取器和自动车牌识别（ANPR）可以持续监控城市的整片区域。内置人脸识别功能的闭路电视系统可以让有关部门实时跟踪人员。

所有这些新的技术前景正在颠覆广泛的人类活动和与之相关的惯例。执法也不例外。但是，如果公民不喜欢他们的医生、理发师或社交媒体网站使用他们的数据或追踪他们购物的方式，他们可以换个地方。而国家通过执法垄断了处罚。警方可以逮捕甚至杀死其他公民。法官有权把人投入监狱。这意味着司法系统里的透明度和公众知情同意至关重要。

对于现有的最好的技术，警方没有理由仅仅因为它们可能被用于攻击性目的就弃之不用。如果罪犯在手机上存储信息，警方应该能够看到这些信息。如果数据可以帮助警方预防犯罪，警方就应该使用它们。但做这些的时候不能影响公民自由。警察和政治家不能任由自己被新技术吸引，而忽视它对自己服务的人的影响。而公民必须能够追究其责任。

这些系统的销售者以及用户也都必须有这种警惕。一些政权更积极地拥抱新兴技术来控制和监督人们。例如，在中国，人脸识别摄像头、虹膜扫描仪和其他类似工具已经覆盖了新疆和西藏这些不稳定的地区。今年1月，在这个问题受到普遍关注后，欧洲议会对那些让政府可以拿来暗中监视公民的监控技术实行了出口管制。

在自由主义国家，“大数据警务”并不是说那些警察局长已经运筹帷幄，安德鲁·弗格森（Andrew Ferguson）说。他写了一本关于这个话题的书。“它是说科技公司卖给警察局一些新奇玩意，向它们收取存储和数据费用

.....（并且）告诉他们，‘用我们这些很酷的技术可以帮你们破获更多罪案’。”他表示，这些公司免费提供技术来帮助警方解决问题。

弗格森提出警察局在购买新技术之前应回答五个问题：你能识别该技术需要应对的风险吗？你能确保数据的准确输入吗？这项技术将如何影响社区关系和警务实践？它是否可以通过测试来确保透明度和问责制？警方使用该技术的方式是否会尊重其涉及的人群的自主权？

一些地方已经开始建立机构来回答这些问题。就像在很多科技公司那样，西雅图和奥克兰的城市都设有首席隐私官，负责审查和管理城市政策对隐私的影响。奥克兰的这名官员来自该市的隐私委员会——一个由九人组成的市议会咨询机构。在市民抵制市议会引入区域感知系统（类似于微软和纽约警察局在纽约市建立的系统）的计划之后，该委员会于2016年正式成立。

“我们刚刚开始露面，并将这套设备的风险告知市议会。”委员会成员布莱恩·霍费尔（Brian Hofer）说。奥克兰警局和委员会每月会面一次，讨论监控和奥克兰居民数据。他们共同编写技术使用政策，且警察局提交关于其监控技术使用频率和用途的公共年度报告。5月1日，市议会提出了一项法案，要求任何新的警用技术都必须得到市议会和隐私委员会的批准。

有人可能会认为，一项设想中的监视计划在美国最自由主义的城市之一被成功阻止，这预示着隐私委员会与该市警察局之间的对立关系。但霍费尔和奥克兰警察局研究和规划部门负责人蒂姆·博奇（Tim Birch）都说，情况恰恰相反。

博奇说，与该委员会合作“鼓励我们思考什么技术是真正需要的”，并问问那些好处是否值得大笔花费。或者正如霍费尔所说，“警察知道有人在盯着他们，行为必须要有所收敛。”他指出，委员会从未建议市议会阻止警察获得他们想要的新技术。“技术本身并无好坏，只要他们收紧（使用）政策就行。”

加州其他几个城市已经通过了与奥克兰相似的监督透明度要求。去年2月，加州一位州参议员提出立法，要求市政当局制定和公布使用监视技术的政策，并限制销售或转让通过监视收集的信息。

数据共享方面的担忧促使加州的城市重新考虑与ANPR公司Vigilant的合同。美国的联邦移民警察——移民和海关执法局（ICE）——刚刚签约成为该公司的客户。民权团体担心，ICE可能会借助存储在Vigilant服务器上的本地执法ANPR数据来锁定非法移民。Vigilant坚称这绝不可能，除非有当地执法机构明确允许，而加州必然拒绝。但是，奥克兰警察局的博奇认为，ICE合同“让人恐惧”。政府也许会在Vigilant庞大的数据库中找到后门，或者某个不认同加州自由派政策的流氓官员会把数据库信息分享给联邦警察，这些可能性从政治上足以使得加州的自由派城市无法与该公司合作。

新奥尔良最近结束了与Palantir的关系，该公司为该市编写预测性警务软件，完全在公众视野之外。（其创始人[Alex Karp]是经济学人集团董事会中的非执行董事。）Palantir将产品捐赠给该市，但民权活动人士担心该公司将新奥尔良作为试验场。如果新奥尔良通过正常的采购程序获得服务，可能不会引起多大的波澜。但是它是通过秘密交易来购买使用专有算法的预测性执法程序，令人难以接受。

维护本地社区价值观的地方政客值得我们叫好，特别是当这种情况发生在通常是执法监督的灰色地带时。这并不意味着自由派、多种族的北加州所喜欢的那种严格监管会广受欢迎。“它必须是本地的，”博奇说，“这是这类隐私委员会有可能取得成功的唯一办法。它们必须反映地方标准。”

与其他政府部门和民间团体分享数据分析结果也有好处。犯罪地图也是需求地图。“你所做的建模涉及一系列因素，你只是把它提供给了一个公共资源，也就是惩罚性资源，”约翰·杰伊学院的高夫说，“你为什么不把它也提供给社会服务机构呢？”

同样，社会学家安德鲁·帕帕克里斯托斯（Andrew Papachristos）的研究

帮助芝加哥警察局制定战略项目列表，他敦促警方分享数据，并写道：“利用数据分析识别出面临枪击风险的人，这种技术的真正应用前景不在警务，而在于更广泛的公共卫生手段。”可能被枪杀的年轻人也可能需要工作培训和咨询。训练有素的调解员可以在冲突上升为暴力之前将其平息。

任何干预都可能比与警方接触更有益于这些人群和社区。弗格森写道：“警方可能是体制中解决犯罪的主角，但他们不必是体制中降低风险的主角。”而如果警方能够衡量自己在降低犯罪率方面的业绩，那么城市当然也可以衡量供应商在提供社会服务方面的表现。

但它们必须首先想要这样做，而这又是一个公民参与的问题——不是监督，而是政治意愿。叫嚣“法律与秩序”的候选人比提倡“有效的针对性的社会服务”的候选人更容易在选举中胜出。新技术帮助司法系统更有效地收集和组织数据。它们可以用它来惩罚，也可以用来研究犯罪的原因，但后者默默无闻，政治上的回报不大。

说到底，开放社会中的公民必须自己决定愿意容忍什么。技术变革不可避免，但它的发生并非不容置疑。也许人们希望他们的邻居开着装有人脸识别摄像头的汽车四处转悠，将一切报告给警方。但如果他们不想这样，他们就得说出来——大声地，现在。

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Street-level surveillance

Walls have eyes

Police have many new ways of monitoring people

ON AUGUST 25th 2017 Johnnie Rush was walking home after a 13-hour shift washing dishes at Cracker Barrel, a restaurant in Asheville, North Carolina. Police watched Mr Rush cross a street without using a zebra crossing. They waited for him to buy beer and then confronted him about the jaywalking, an offence in that state. When he argued and ran away, they knocked him to the ground, used a Taser and punched him in the head.

Eight months later, following a lawsuit, officials in Asheville released nine videos from the officers' bodycams. These cameras are usually clipped to the front of an officer's uniform or used as a headset. They record audio and video, often with date and time stamps as well as GPS co-ordinates. They can also be Bluetooth-enabled and set to stream in real time. Some have to be turned on manually, others can be triggered automatically by, for instance, an officer unholstering his weapon.

Bodycams are just one way that what officers on the street can see, store and search is changing. These new technologies help in investigations and also offer benefits such as accountability. They make it more difficult for police and citizens to lie about contested encounters, or whether a person or car was at the scene of a specific incident. Yet they are still controversial. Evidence of whether bodycams reduce bad behaviour by police officers is ambiguous. And the potential for abuse of facial-recognition technology is vast, allowing, as it does, real-time deep surveillance.

The videos of the assault on Mr Rush are sickening. The officer who punched him resigned in January, reportedly just before the department

could fire him. Another officer was reassigned, a third disciplined, and Asheville released a statement condemning their behaviour. In a narrow sense, this represented a victory for bodycam advocates. But that does little for Mr Rush's battered head. Bodycams are not just supposed to record bad behaviour. The threat of recording is supposed to impel good behaviour, from both officers and citizens.

The first large randomised study of the issues was in 2012. It found that police use of force and citizen complaints in Rialto, California, dropped markedly when officers wore bodycams. A study conducted in Britain and California by Cambridge University two years later found similar results: wearing bodycams was associated with a 93% drop in complaints about police behaviour.

But these effects appeared only when cameras recorded entire encounters. Another study of eight British and American police forces conducted by Cambridge criminologists found that rates of assault against police were 15% higher when an officer turned his bodycam on in the middle of an encounter compared with officers who wore no cameras—suggesting that turning on a bodycam may represent an escalation. And a randomised study of officers in Washington, DC, found that wearing bodycams had no statistically significant effect on police use of force or citizen complaints.

Not everyone has embraced bodycams. City officials often balk at the cost: cameras cost as much as \$1,000 each, with an additional \$100 per month per camera for video-storage fees. Police unions have expressed privacy concerns. Some civil libertarians fear they will be used to surveil already heavily policed communities. Policies governing public access to, and retention of, bodycam footage vary widely. Still, usage is growing. One in five American police departments uses them, and nearly all others plan to do so. By some estimates the market for bodycams and data management is \$1bn a year in America alone.

It should give Westerners no comfort that China—a one-party state obsessed with social order—is at the forefront of developing bodycams. One Beijing company says it has invented a shoulder-worn, networked model that can recognise faces. Another Chinese firm has equipped police with facial-recognition cameras embedded in glasses that are meant to let officers know in real time if they are looking at someone on a police blacklist. One estimate values China's surveillance-tech market in 2018 at \$120bn. Human-rights campaigners fear that such technology has already been used to monitor activists, enabling arbitrary detention.

Cameras do not have to be worn by policemen. London has one fixed camera for every 20 people. Washington, DC, has about one for every 22. But the data they provide are not always usable. Sometimes their images are poor quality, their formats are not always uniform, and there is often too much to sort through quickly. After the terrorist bombing of a concert hall in Manchester in 2017, British police had to wade through more than 16,000 hours of CCTV footage.

According to Mick Neville, who spent 28 years with London's Metropolitan Police before leaving to found his own forensic facial-recognition firm, police find usable CCTV images in only 2% of reported crimes in London. "That's because they don't have systems in place," says Mr Neville. "There are too many cameras, too many formats, maybe they're working; maybe not." Don't blow money on gear without systems to extract the data, he advises.

Entrepreneurs have noticed the new market: startups that can analyse CCTV footage in nearly any format are now offering their wares to video-addled forces around the world. The ideal, says one facial-recognition startup founder, is "one to many in the wild", meaning that a successful platform will be one that can compare a single face to its full database of faces, all with non-posed images, looking up or down, or half in shadow.

Machine learning and neural networks—software modelled on the human brain that learns from observational data and inference as humans do—power today's facial-recognition products. They could make tomorrow's even more powerful as they incorporate data on body mass, gait and gestures, rather than just the standard metrics such as distance between the eyes and width of nose. These platforms can also be trained to recognise objects, such as bags or a wristwatch, and to link them to people.

Roughly half of all American adults—the vast majority non-criminal—have images of their faces stored in FBI-accessible databases, according to Georgetown University Law Centre. Other countries are expanding biometric storage. This raises questions of racial bias. People from minority groups with disproportionately high arrest rates are more likely to be in such databases, and so disproportionately likely to be targeted by dragnet surveillance.

But citizens are also staring back at police. The American Civil Liberties Union, a watchdog, has released an app through which citizens can automatically send it recordings of police interactions. Mobile-phone cameras have recorded the deaths of a number of African-Americans killed by police. Footage of the death of one, Walter Scott, led to the indictment of the officer who shot him.

ANPRs raise concerns similar to those about facial-recognition databases. Police drive around, collecting and storing images of number plates registered to people not suspected of any crime. Vigilant Solutions, an ANPR firm, has a database of at least 7bn data points from number plates, most of which presumably belong to the innocent. If they become suspects, police can then trawl through ANPR data to create detailed portraits of their lives.

Supporters also say that they do nothing more than collect publicly available information, and that it is securely stored. Yet even that is not always true

because rules governing storage and information-sharing vary. In 2015 a journalist in Boston found the city's entire number-plate database online, including the addresses of everyone with a city parking permit, and the names of thousands of people suspected of being terrorists or gang members.

Such data can be abused personally as well as constitutionally. A policeman in Washington, DC, was convicted of extortion for blackmailing the owners of cars parked near a gay bar. ANPR firms insist what they do is constitutional—in America the First Amendment protects public photography. But not everything constitutional is desirable. Even the International Association of Chiefs of Police has admitted that ANPRs could have an impact on freedom by recording vehicles going to political gatherings, abortion clinics or other sensitive venues.

The argument is that ANPRs and CCTV with facial recognition give the state a time machine. If they connect a suspect (or a car) with a crime, they can simply track him through footage recorded before he became a suspect. Police argue that they try to do that anyway by digging into a suspect's history; the new technology just makes it easier to do it better, and sometimes deeper. But you can be sure that, if police had real time machines—based, perhaps, in old-fashioned blue phone boxes—regulators would be all over them. With virtual time machines, not so much.

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街头监控

墙上有眼

警察有许多监控民众的新方法

去年8月25日，在北卡罗莱纳州的阿什维尔（Asheville），洗碗工约翰尼·拉什（Johnnie Rush）在Cracker Barrel餐馆上班13小时后走路回家。警察看到他横穿了一条马路而没有走斑马线。他们等他去买了啤酒，然后上前告诉他，他被抓到乱穿马路——在北卡这是违法的。拉什争辩后试图逃跑，他们将他击倒在地，用上了泰瑟枪，还猛击他的头。

八个月后，在这些警察被告上法庭后，阿什维尔的官员发布了从他们身上佩戴的摄像头截取的九段视频。这些摄像头通常被夹在警员胸前或戴在头上。它们录下音频和视频，通常带有日期和时间戳以及GPS坐标。它们也可以支持蓝牙并实时传输播放。有些必须手动开启，另一些可自动触发，比如在警员拔枪时。

“身体摄像头”只是道路巡警看到、存储和搜索信息的方式改变的一个方面。这些新技术有助于调查，还有便于问责等好处。对有争议的对抗或某人、某辆车是否曾出现在特定事件现场等问题，技术让警察和民众更难撒谎。但它们本身仍有争议。有关摄像头是否减少了警察不良行为的证据并不明确。而滥用面部识别技术的可能性极大，它使得深度监视成为可能，而这已经发生。

警员袭击拉什的录像令人震惊。殴打他的警员在今年1月辞职——据报道就在他将被警局解雇前夕。另一名警员被调换岗位，还有一名警员受处罚。阿什维尔当局发表了一则声明，谴责他们的行为。狭义上来说，这是身体摄像头倡导者的胜利。但它对于拉什重伤的头部来说无甚用处。身体摄像头不应只是记录不良行为，被拍摄的威胁应该促成良好的行为——不论警察还是公民。

首个探究这类摄像头效用的大型随机研究在2012年展开。研究发现，在加

州里亚尔托（Rialto），当警察佩戴摄像头时，他们使用武力的情况以及公民投诉都显著下降。两年后，剑桥大学在英国和加州开展的一项调查发现了类似的结果：佩戴身体摄像头后，对警察行为的投诉减少了93%。

但这些效果只有在摄像头记录下整个互动过程时才会出现。剑桥大学的犯罪学家对英国和美国的八个警队的一项调查发现，假如警员是在与民众互动的中途把身体摄像头打开，那么他们被袭击的几率要比不佩戴摄像头的警员高出15%。这表明，打开身体摄像头可能意味着冲突升级。而对华盛顿特区警员的一项随机调查发现，佩戴身体摄像头对警察使用武力或公民投诉在数据上都没有显著的影响。

并非每个人都欢迎身体摄像头。市政官员往往因为它们成本高昂而犹豫：购买一个摄像头要花1,000美元，此外每个摄像头每月要支付100美元的视频存储费。警察工会表达了对隐私的担忧。一些公民自由主义者担心它们将被用来监视本已受到警方严格管辖的社区。有关公众获取和保留身体摄像头录像的政策差异很大。但这类摄像头的使用量还是在增长。五分之一的美国警局使用它们，而其他警局几乎也都计划要这么做。一些人估计，身体摄像头和数据管理的市场仅在美国每年就达到10亿美元。

有件事会让西方社会感到不安：中国这个痴迷于维持社会秩序的一党专政国家走在研发身体摄像头的最前沿。北京一家公司表示，它已经发明了一种可以识别脸部的肩戴式网络摄像头。另一家中国公司已向警方提供了一种镶嵌在眼镜中的面部识别摄像头，让警察能实时在视野中识别出警方黑名单上的人。有估计称2018年中国监控技术市场价值达1,200亿美元。人权活动分子担心这类技术已被用于监控活动人士，可实施任意拘留。

摄像头不一定要由警察佩戴。伦敦每20人就有一个固定摄像头。华盛顿特区大约每22人一个。但它们提供的数据并非总是有用。有时图像质量很差，格式也不总是一致，而且常常会因为数据太多而无法快速排查。2017年曼彻斯特一个音乐厅发生恐怖爆炸袭击后，英国警方不得不查看了长达16,000多个小时的闭路电视监控（以下简称CCTV）录像。

在伦敦大都会警局工作28年后，米克·内维尔（Mick Neville）离职创建了自己的法医鉴定面部识别公司。他说，伦敦警方仅在该市2%的获举报犯罪中发现了可用的闭路电视监控图像。“那是因为他们没有数据提取系统，”他说，“摄像头太多了，格式也太多。它们也许在工作，也许没有。”他建议，在没有系统提取数据的情况下，别把钱浪费在设备上。

企业家们已经注意到了这个新市场。一些创业公司可以分析几乎任何格式的闭路电视视频，它们正向世界各地为大量视频犯难的安全部门提供设备。一位面部识别创业公司的创始人说，理想情况是“一个比对大千世界”，意思是一个成功的平台将可以拿单张人脸和一整个人脸数据库做比对，所有的图片都无需摆拍，向上或向下看，或一半被遮住都没问题。

机器学习和神经网络（模拟人类大脑的软件，像人类那样从观测到的数据中学习并做出推论）驱动了当今的面部识别产品。它们可以使未来的这类产品变得更加强大，因为它们可以包含体重、步态和手势等数据，而不仅仅是眼间距和鼻宽之类的标准衡量指标。这些平台还可以被训练来识别手袋或手表等物体，并将这些物体和人挂钩。

根据乔治城大学法律中心的数据，约半数美国成年人（绝大多数不是犯罪分子）的脸部图像被存储在可由FBI访问的数据库中。其他国家正在扩大生物识别信息存储。这引发了存在种族偏见的质疑。有些少数群体的逮捕率非常高，来自这些群体的人们更有可能出现在这类数据库中，因而更可能成为拉网式监视的目标。

但公民也正在“回视”警察。监督机构美国公民自由联盟（The American Civil Liberties Union）已经发布了一款应用，公民可以向该应用自动发送警民互动记录。手机摄像头已经记录下了一些非裔美国人被警察杀害的事件。其中有关沃特·斯科特（Walter Scott）死亡的录像导致向他开枪的警员被起诉。

ANPR引发了和面部识别数据库类似的担忧。警方驱车到各地搜集并存储那些登记在未涉嫌犯罪者名下的车牌图像。ANPR公司Vigilant Solutions拥

有的数据库至少有70亿个车牌数据点，其中大部分应该是来自无辜的民众。如果他们成为犯罪嫌疑人，那么警方就可以查看ANPR数据来创建一幅描绘他们生活的详细图景。

这类技术的支持者还表示，它们只是收集公开可用的信息，并且安全存放这些信息。但即便这一点也不总能确保，因为有关信息存储和共享的法规千差万别。2015年，波士顿一名记者在网上发现了该市的整个车牌数据库，其中包括所有拥有城市停车许可证的市民住址，以及成千上万被怀疑为恐怖分子或帮派成员的市民名单。

这些数据可以被个人或以符合宪法的名义滥用。华盛顿特区的一名警察因为敲诈停在一间同性恋酒吧附近的车辆的车主而被定罪。ANPR公司坚称自己所做受宪法保护——在美国，第一修正案保护在公共场所拍摄的权利。但并非所有符合宪法的行为都是可取的。就连国际警察总长协会（International Association of Chiefs of Police）也承认，ANPR可能会因为记录下车辆前往政治集会、堕胎诊所或其他敏感场所的信息而影响公众自由。

这是因为ANPR和带有面部识别功能的闭路电视给了国家机器一台时光机。如果这些设备把犯罪嫌疑人（或一辆车）和一宗罪案联系起来，它们可以简单地翻看他成为疑犯之前的影像来追查他。警察们说，他们原本也是要挖掘疑犯的过去的，新技术不过是让他们能更得心应手地做这件事，有时挖得更深入。但是可以肯定的是，如果警察真的拥有时光机——或许是一个老式的蓝色电话亭——那监管机构可要拽着他们不放了。现在他们用的是一台虚拟时光机，情况就要好多了。

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Encryption and analysis

Read my phone

Police can bypass encryption and monitor almost anything. The law is not keeping up

“YOU can tell me who you are,” says Leeor Ben-Peretz, an executive at Cellebrite, an Israeli security-tech company, “But give me 15 minutes with your phone and I can tell you who you really are.” Mr Ben-Peretz’s office windows have a lovely vista of the low-slung skyline of PetahTikva and the burnished mountains beyond, but the real view is on a large monitor in front of him.

A young engineer connects a smartphone to what looks like a desktop computer with several ports on the front. After a quick login and a few clicks, the computer identifies the phone type. The user can then bypass the locked phone’s passcode and continue to use one of several extraction methods. “Logical extraction” reveals immediately accessible data: stored text messages, e-mails, pictures and instant messages. With more time, Cellebrite’s machines can also perform a “physical extraction”, revealing more information, including data that may have been deleted. The neatly organised, labelled data can then be viewed, saved, shared, filtered and searched.

Police officers can also carry with them a tablet-sized device that does a basic device search—a sort of digital triage that lets them decide quickly whether a fuller investigation and extraction is merited. “Crime scenes in the past were about fingerprints and footsteps,” says Mr Ben-Peretz. “Today it’s digital: mobile devices, connected cars and tablets. Our digital footprint: this is the strongest indicator for what really happened.”

The spread of such technology—more than 10,000 law-enforcement

agencies in 150 countries use Cellebrite's services—raises profound privacy concerns. Most countries have laws offering people's homes protection from intrusive searches. But laws governing devices are not nearly so clear. Cloud computing makes things ever more complex. As Adam Ghetti, a cyber-security entrepreneur, points out, "The law and the constructs that it was built on were written at a time when everything you had was near you and could be touched." That is no longer the case, he says. "The average human in a developed country has more data that they created in a faraway place than in a tactile place at home."

One response is encryption, which has grown from a niche market to a standard feature of digital life. As one veteran European intelligence analyst puts it: "Encryption was dodgy when I joined. Now the modern economy runs on it." WhatsApp, Signal, Telegram and Facebook Messenger offer end-to-end encryption, meaning that messages can be read only by the sender and the receiver; they cannot be intercepted in transit, nor can the companies themselves read them. The easiest way for law enforcement to read encrypted messages is to gain access to the phone of the sender or receiver.

Users can protect mobile phones by setting passcodes that restrict access. And not all phones are created equal. "Your best bet for default privacy is, hands down, getting a modern iPhone," says Mr Ghetti. "There's no close second." What sets Apple apart is not just the quality of its encryption but also its commitment to user security. After a mass shooting in San Bernardino, California in 2015, the FBI asked Apple to build an operating system to install on a recovered iPhone in order to bypass its encryption. Fearful of setting a precedent that, as Tim Cook, Apple's chief executive, wrote, "would hurt only the well-meaning and law-abiding citizens who rely on companies like Apple to protect their data", the company fought the order in court. A six-week battle ended when the FBI found another way to extract the data.

What that method was and who did it (a source outside government, according to the FBI) remains a mystery. But bypassing encryption appears to involve tricking a phone's co-processor—the part that limits the number of times a user can guess a passcode—into allowing unlimited guesses without triggering the phone's security measures. Those measures may involve destruction of its encryption keys, which makes accessing the phone's data impossible, or exponential increase in the time required between each guess, making brute-force guessing not worth the time.

The method required for physical extraction varies with each phone. Cellebrite has a large research department and a laboratory filled with thousands of different mobile-phone models stacked in drawers, floor to ceiling. Some are easier to crack than others. Over the past few years iPhone models have included an upgraded co-processor with an additional level of encryption. Cellebrite may have found a way to bypass it but, if so, Apple will no doubt patch the weakness, and encryption-bypassers will hunt for another.

Pulling metadata from a phone is much easier. Police can use fake mobile-phone towers (colloquially known as "Stingrays"), which trick mobile phones into connecting to them rather than to a real tower. Police can then learn which websites a user visited, and whom he texted and called, as well as the International Mobile Subscriber Identity, a unique number associated with the phone. It can also give the police a precise user location.

According to the American Civil Liberties Union (ACLU), a watchdog, at least 73 agencies in 25 states in America use Stingrays, though the true number is probably much higher. Police rarely seek approval or admit to using them, and indeed agencies that buy them generally keep them secret, on the basis that public knowledge of their use will render them ineffective.

Privacy advocates cite two problems with Stingrays. First, they suck up

information about all phones in a certain location, not just that of a suspect; and second, they can pinpoint phones in homes and pockets that privacy laws often protect from warrantless searches. Though governments claim they need Stingrays to catch suspected terrorists and drug kingpins, they are more often used in routine police work, without warrants or oversight.

Police also monitor what people do on their mobile phone through social-media analytics. Most users expect their postings and preferences to be tracked and analysed. But in 2016 Geofeedia, an analytics firm, had its access to Facebook and Twitter removed after revelations that it marketed itself to law enforcement as a way to monitor “overt threats” such as unions and activist groups. Shortly after they bought it, police in San Jose, California, used the service to surveil Sikh and Muslim protesters.

Some argue that because social-media posts are public, police monitoring of them does not have the same privacy implications as, say, tracking your phone’s metadata, or using a GPS tracker to follow all your movements. But, says Matt Cagle of the ACLU of Northern California, users do not expect or desire law enforcement to conduct surveillance of their social-media posts.

Mr Cagle’s statement hints at a broader confusion over privacy in the digital age. To what extent do—or should—people expect that privacy norms and laws written for the landline and newspaper age protect their digital data? Laws are changing. The European Court of Justice ruled in 2016 that blanket metadata collection and retention violates privacy laws, and America’s Supreme Court ruled in 2014 that police need a warrant to search an individual’s mobile phone. But they are not changing as quickly as human habits. As people move more of their lives online, they will demand the same level of protection for their data as for their personal papers at home. Mobile phones, after all, are not simply communication devices; they are also personal filing cabinets. They are just not kept behind locked doors.

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加密和分析

读机术

警方可以绕过加密来监控几乎任何事。法律还没有跟上

“你可以告诉我你是谁，”以色列安全技术公司Cellebrite的高管利尔·本佩雷茨（Leeor Ben-Peretz）说，“但是，给我15分钟和你的手机，我就可以告诉你你真正是谁。”从本佩雷茨办公室的窗户往外看，佩塔提克瓦低矮的天际线和更远处熠熠生辉的群山组成了一幅美妙的风景。但是，真正的景观却在他面前那台大型监视器上。

一位年轻的工程师将一部智能手机连接到了一台看似在前方加了几个端口的台式计算机上。快速登录并点击几下后，计算机识别出了手机的类型。工程师而后可以绕过这部锁定的手机的密码，在若干提取方法中选用一种。“逻辑提取”获得了可立即访问的数据：存储的文本消息、电子邮件、图片和即时消息。再花点时间，Cellebrite的机器还可以执行“物理提取”，揭示出更多信息，包括那些可能已经被删除的数据。而后，这些排列有序、标记清楚的数据可被查看、保存、分享、过滤和搜索。

警察还可以随身携带一台平板电脑大小的设备来执行基本的设备搜索。这是一种数字分流法，可以让他们迅速决定是否需要更全面的调查和数据提取。“过去的犯罪现场看的是指纹和脚印，”本佩雷茨说，“今天则是数字化的：移动设备、联网汽车和平板电脑。我们的数字足迹：这才是真正发生过什么的最有力证据。”

如今已有150多个国家的超过一万个执法机构使用Cellebrite的服务。这种技术的传播引发了对隐私的深度关切。大多数国家都有法律保护人们的住所免遭侵入式搜索。但管控设备的法律远没有那么明确。云计算还让事情变得更复杂。就像网络安全企业家亚当·盖蒂（Adam Ghetti）指出的：“相关法律以及法律背后的构架，都是在你所拥有的一切都在身边而且看得见摸得着的时代编写的。”然而今非昔比，“发达国家的一个普通人在遥远的

地方创造的数据，要比在自己家中一个触手可及的地方创造的还多。”

一个应对方法是加密，它已经从一个小众市场发展成数字生活的标准特征。一位资深欧洲情报分析师说：“当我加入这个圈子时加密技术还不可靠。现在，它是现代经济运行的基础。”WhatsApp、Signal、Telegram和Facebook Messenger提供端到端加密，意味着消息只能由发送方和接收方读取，不能在途中被拦截，连这些公司本身也无法查看。执法人员读取加密信息的最简单方法是拿到消息发送者或接收者的手机。

用户可以通过设置限制访问的密码来保护手机。但并非所有手机都一样。“对于默认隐私保护而言，最保险的选择毫无疑问是一部现代iPhone。”盖蒂说，“其他手机都还差得太远。”让苹果与众不同的不仅仅是其加密的质量，还包括它对用户安全的承诺。2015年加州圣贝纳迪诺（San Bernardino）发生大规模枪击案后，FBI要求苹果公司制作一个操作系统，安装在FBI找回的一部iPhone上以绕过其加密。苹果害怕这会开创一个先例，正如首席执行官蒂姆·库克写道：“它只会伤害那些依赖像苹果这样的公司来保护其数据的善意而守法的公民。”因此在法庭上反对FBI的命令。双方僵持了六周，最终以FBI找到了另一种数据提取方法收场。

FBI到底用了什么方法、又是谁做到的（据FBI称是政府外的一个供应商），至今仍是个谜。但是，绕过加密似乎需要骗过手机的协同微处理器（限制用户猜测密码次数的那个部件），让你可以无限次地猜测密码而不触发手机的安全措施。这些措施可能包括破坏加密密钥，让你无法访问手机数据，或者让你每次猜密码之间相隔的时间呈指数级增长，使得蛮力猜测耗费不起时间。

物理提取所需的方法因手机而异。Cellebrite拥有一个大型研究部门和一个实验室，成千上万各种型号的手机摞在一个个抽屉里，这些抽屉从地板一直堆到天花板。有些比其他一些更易破解。过去几年中，iPhone机型已经包含了带有额外一层加密的升级版协同微处理器。Cellebrite可能已经找到了绕过它的办法，但果真如此的话，苹果无疑会修补这个漏洞，而工程师又会寻找另一个绕过的办法。

从手机中提取元数据要容易得多。警方可以使用伪造的手机塔（俗称“魔鬼鱼”）来欺骗手机连接到它们而不是真正的基站上。然后，警方可以了解用户访问过哪些网站，给谁发过消息和打过电话，还可以拿到国际移动用户识别码（IMSI）这个每部手机独一无二的号码。警方还能获得用户的精确位置。

据监管机构美国公民自由联盟（ACLU）称，在美国25个州至少有73家机构使用魔鬼鱼，真实数字可能还要高得多。警方很少会为此寻求许可或承认使用它们，实际上，购买它们的机构通常都对此保密，因为一旦被公众知晓就不好用了。

隐私倡导者认为魔鬼鱼有两个问题。首先，它们会获取某个地点所有手机的信息，而不仅仅是嫌疑犯的。其次，它们可以瞄准居所和衣服口袋中的手机，而隐私法律通常都保护这些手机免遭无授权搜查。尽管各国政府声称他们需要魔鬼鱼来抓捕恐怖分子和大毒枭，但它们更常被用于日常警务，无需搜查令也不受监督。

警方还通过社交媒体分析来监控人们在手机上做什么。大多数用户都知道他们发布的帖子和个人喜好等内容会被追踪和分析。但是，2016年，分析公司Geofeedia被曝光向执法部门推销自己能监控工会和活动人士团体等“明显威胁”，这之后Facebook和推特禁止该公司继续访问网站。加州圣何塞的警局在购买这家公司的服务后不久就用它来监视锡克教和穆斯林的示威者。

有些人认为，社交媒体上的帖子是公开的，所以警察对它们的监控并不像跟踪手机元数据或使用GPS跟踪器来跟踪一个人的所有行踪那般侵犯隐私。但是，ACLU北加州分部的马特·卡格尔（Matt Cagle）说，用户并不预期或希望执法部门监视他们在社交媒体上发布的内容。

卡格尔所言显示出数字时代围绕隐私问题的更广泛的困惑。对于那些为固定电话和报纸的时代所撰写的隐私准则和法律，人们期望，或应该期望它们在何种程度上保护自己的数字数据呢？法律也在改变。欧洲法院于2016

年裁定，无差别收集和保留元数据违反隐私法；美国最高法院于2014年裁定警方需要授权令才能搜查个人手机。但它们改变的速度跟不上人类习惯改变的速度。随着人们将更多生活转移到网上，他们会要求自己的数据受到和放在家中的个人文件同等的保护。毕竟，手机不仅仅是通讯设备，它们也是私人档案柜。它们只是没有放在上了锁的门背后而已。

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Data for detectives

I know what you'll do next summer

Unparalleled surveillance capacity and vast amounts of data are radically transforming criminal-justice systems, says Jon Fasman

ON WHAT does the administration of justice depend? Devotees of the Old Testament might say wisdom, as displayed in King Solomon's judgment. Others might say a dispassionate objectivity. It also requires the threat of punishment—the basis of the modern state's coercive power to enforce laws. But John Fielding knew that, before administrators of justice could mete out punishment or exercise wisdom, they needed something else: information.

Together with his half-brother Henry (a magistrate better remembered as the author of "Tom Jones"), in 1749 Fielding founded the Bow Street Runners, London's—and the world's—first professional police force, paid for largely with public funds. Information was at the centre of everything Fielding did. He retained descriptions of suspected criminals, for instance, as well as a "watch book", which contained details of expensive timepieces to help prevent their resale if stolen.

The world's most famous detective shared Fielding's view; Sherlock Holmes retained an extensive indexed library of criminals and their crimes. The delight readers took in following him—a delight that makes crime fiction one of the great literary genres—also had information at its heart. What is a clue? What is a red herring? How does justice work? We pay homage to that tradition with the graphic story that illustrates these pages.

In fact as in fiction, the trend has continued. The Metropolitan police department, which has patrolled Washington, DC, since 1861, retains annual reports detailing crimes in each precinct. American homicide detectives

record details of their cases in “murder books”, which are then filed for future consultation.

Historically, gathering information was an arduous process, requiring innumerable conversations, many of which later proved to be irrelevant; hours staking out a subject; researching documents and testimony; and reams of tedious paperwork. In illiberal countries, where governments do not care about their citizens’ civil rights, police could easily tap phones and open letters. Liberal countries make that harder; police who want to listen to someone’s phone calls can do so only for limited periods and specific purposes, and then only with judicial approval.

Now the relationship between information and crime has changed in two ways, one absolute, one relative. In absolute terms, people generate more searchable information than they used to. Smartphones passively track and record where people go, who they talk to and for how long; their apps reveal subtler personal information, such as their political views, what they like to read and watch and how they spend their money. As more appliances and accoutrements become networked, so the amount of information people inadvertently create will continue to grow.

To track a suspect’s movements and conversations, police chiefs no longer need to allocate dozens of officers for round-the-clock stakeouts. They just need to seize the suspect’s phone and bypass its encryption. If he drives, police cars, streetlights and car parks equipped with automatic number-plate readers (ANPRs, known in America as automatic licence-plate readers or ALPRs) can track all his movements.

In relative terms, the gap between information technology and policy gapes ever wider. Most privacy laws were written for the age of postal services and fixed-line telephones. Courts give citizens protection from governments entering their homes or rifling through their personal papers. The law on

people's digital presence is less clear. In most liberal countries, police still must convince a judge to let them eavesdrop on phone calls.

But mobile-phone "metadata"—not the actual conversations, but data about who was called and when—enjoy less stringent protections. In 2006 the European Union issued a directive requiring telecom firms to retain customer metadata for up to two years for use in potential crime investigations. The European Court of Justice invalidated that law in 2014, after numerous countries challenged it in court, saying that it interfered with "the fundamental rights to respect for private life". Today data-retention laws vary widely in Europe. Laws, and their interpretation, are changing in America, too. A case before the Supreme Court will determine whether police need a warrant to obtain metadata.

If you drive in a city anywhere in the developed world, ANPRs are almost certainly tracking you. This is not illegal. Police do not generally need a warrant to follow someone in public. However, people not suspected of committing a crime do not usually expect authorities to amass terabytes of data on every person they have met and every business visited. ANPRs offer a lot of that.

To some people, this may not matter. Toplines, an Israeli ANPR firm, wants to add voice- and facial-recognition to its Bluetooth-enabled cameras, and install them on private vehicles, turning every car on the road into a "mobile broadcast system" that collects and transmits data to a control centre that security forces can access. Its founder posits that insurance-rate discounts could incentivise drivers to become, in effect, freelance roving crime-detection units for the police, subjecting unwitting citizens to constant surveillance. In answer to a question about the implications of such data for privacy, a Toplines employee shrugs: Facebook and WhatsApp are spying on us anyway, he says. If the stream of information keeps people safer, who could object? "Privacy is dead."

It is not. But this dangerously complacent attitude brings its demise ever closer. One of the effects technology has on law enforcement is to render its actions less visible. You would notice if a policeman took photos of every parked car and pedestrian on your street. But ANPRs and body-worn cameras (“bodycams”) let officers do that as an unnoticed matter of course. That makes speaking up about privacy concerns more important, not less.

Technology used responsibly and benignly by one country or agency can be used for sinister purposes by another. Activists in, say, Sweden or New Zealand may have few concerns that police will use their technological prowess to arrest them on trumped-up charges, because rule of law is strong and those governments generally respect citizens’ civil liberties. Activists in China or Russia have far more to fear.

Some people argue that those who have done nothing wrong need not worry. But that justifies limitless state surveillance, and risks a chilling effect on citizens’ fundamental civil liberties. After all, if you are not planning crimes while talking on the phone, why not just let police officers listen to every call? Police need oversight not because they are bad people but because maintaining the appropriate balance between liberty and security requires constant vigilance by engaged citizens. This is doubly true for new technologies that make police better at their jobs when policy, due process and public opinion have not caught up.

This report will examine the promise and the dangers of those technologies. It explores several arenas in which technology is radically changing how the justice system operates—in street-level surveillance, the ease with which law enforcement can bypass encryption, the use of electronic monitoring as an alternative to prison, and the introduction of algorithms by police and courts.

It examines technology's effects on crime and criminals, and on innocent people caught up in a tech-dominated approach to policing. The report does not demand the wholesale rejection of these technologies. Instead it calls for rigorous oversight, which has been shown to benefit both citizens and law enforcement, and which is the only way to ensure that, in their quest for security, societies do not inadvertently surrender too much liberty.

Download the complete “data detectives” graphic novel at: econ.st/2JoNGzo ■



破案的数据

我知道明年夏天你会干什么

本专题作者乔恩·法斯曼（Jon Fasman）说，无与伦比的监控能力和海量的数据正在彻底改变刑事司法系统

司法倚赖什么？旧约的信徒可能会说是智慧——所罗门的审判中彰显的品质。另一些人可能会说是不带情感和偏见的客观。另外，它还需要会被惩罚的威胁——现代国家强制执法权的基础。但是，约翰·菲尔丁（John Fielding）知道，在司法人员能够做出判罚或动用智慧之前，他们还需要一样东西：信息。

1749年，菲尔丁和他同父异母的哥哥亨利（一名区治安法官，因著作《汤姆·琼斯》为世人铭记）一起创建了“弓街捕快”（Bow Street Runners），这是伦敦乃至世界上第一支专业警察部队，主要由公共资金支持。菲尔丁所做一切的核心就是信息。比如，他保存了对嫌疑犯的描述，以及一本载有昂贵计时器详细资料的“名表录”，让它们在遭窃后难以出手转卖。

英雄所见略同。世界上最著名的侦探福尔摩斯存有一个有关罪犯及其罪行的庞大检索资料库。读者在跟随福尔摩斯探案的过程中深感愉悦。这种愉悦感是侦探小说成为主要文学体裁之一的原因，而其核心也关乎信息。什么是线索？什么只是转移注意力的把戏？公义公正如何实现？本刊在此用一本漫画来再现这些情节，向这一传统致敬。

而在现实中，收集留存大量信息的做法也得以延续。华盛顿特区的大都会警局自1861年开始在当地执法，它保留了每年有关各个辖区罪案的详细报告。美国的凶杀案侦探在“谋杀档案”中记录下他们经手案件的细节，而后归档供日后办案参考。

收集信息曾经是一个艰苦繁难的过程：要展开无数对话，其中许多到头来发现毫不相关；长时间监视某人；研究文件和证词；大量枯燥乏味的文书工作。在不自由的国家，政府不关心公民权利，警方很容易就能监听电话

和查看私人信件。在自由国家这要更难一些。警察若想监听谁打电话，只能是在有限的时间出于特定的目的这么做，而且还必须得到司法部门批准。

现在，信息和犯罪的关系在两个层面发生了变化，一个是绝对的，另一个是相对的。从绝对层面看，人们产生的可搜索信息比以前更多。智能手机被动跟踪和记录下人们去哪里、和谁聊天以及聊了多久。人们使用的应用程序揭示出更微妙的个人信息，比如政治观点、喜欢阅读和观看的内容，以及如何花钱。随着越来越多电器和设备连接到网络上，人们在不经意间创造的信息量将持续增长。

若要跟踪嫌疑人的行踪和谈话，警察局长不再需要调动数十名警员展开24小时监控。他们只要没收嫌疑人的手机并绕过加密就可以了。如果嫌疑人开车，配备车牌自动识别系统（以下简称ANPR，在美国叫ALPR）的警车、路灯和停车场可以追踪他的所有行踪。

而从相对的层面看，信息技术和政策之间的鸿沟在日益扩大。大多数隐私法律是在邮政服务和固定电话的年代制定的。法院给予公民保护，令政府不得随意进入他们的住处或翻看他们的私人文件。而有关人们数字足迹的法律还不那么清晰明确。在大多数自由国家，警方仍须说服法官允许他们窃听电话。

但手机的“元数据”所受的保护不是那么严格。它不是实际的对话内容，而是关于电话打给谁、拨打的时间等数据。2006年，欧盟发布了一项指令，要求电信公司保留客户的元数据长达两年以用于未来的犯罪调查。2014年，欧洲法院宣布该法无效，因为许多国家在法庭上对它提出质疑，称它干涉了“尊重私人生活的基本权利”。今天，要求留存数据的法律在欧洲各地的差别很大。而在美国，法律以及对法律的解释也在发生变化。目前，一宗提交到最高法院的案件将确定警方是否需要授权令才能查看元数据。

如果你在发达国家的任何一个城市开车，ANPR几乎肯定会跟踪你。这并

不违法。警察通常不需要许可就可以在公共场合跟踪某人。然而，没有涉嫌犯罪的人通常不会料想当局会收集关于他们见过谁和去过哪些商家的大量数据。而ANPR提供了很多这类信息。

对一些人来说，这可能无关紧要。以色列的一家ANPR公司Toplines想给自己生产的支持蓝牙的摄像头添加语音和面部识别功能，并把它们安装在私人车辆上，把道路上的每一辆车都变成一个“移动广播系统”，收集数据并将它们传输到一个控制中心，供安全部门访问。公司创始人认为，车险折扣会激励司机们成为警方的特约移动侦查兵，使不知情的公民受到持续的监控。当被问及这类数据对隐私的影响时，Toplines的一名员工耸耸肩说，Facebook和WhatsApp反正都已经在监视大家，如果这样的信息流让人们更安全，谁能反对呢？“隐私已死。”他说。

隐私并没有死，但这种安于现状的危险态度让我们距离隐私之死更近了一步。技术对执法的影响之一是令执法行动变得不那么显而易见。如果一名警察拍摄下你居住的街区上停着的每辆车和行经的每个人，你会注意到他。但ANPR和佩戴式摄像头（也叫“身体摄像头”）让警察们理所当然又不被注意地做了这件事。这就让提出隐私担忧变得更加重要了。

在某个国家或机构被负责又善意地使用的一项技术，在另一个国家或机构却可能被用于邪恶的目的。例如，瑞典或新西兰的活动人士可能很少担心警方会利用技术能力以捏造的罪名逮捕他们，因为法治的力量强大，而这些政府总体上尊重公民的自由。中国或俄罗斯的活动人士需要担心的要多得多。

有些人说，没做错事的人不用担心。但这是在为无限制的国家监控开脱，并且可能对基本的公民自由权造成寒蝉效应。毕竟，如果你在打电话时并没在计划什么犯罪活动，为什么不索性让警察监听你所有的通话呢？警察需要被监督，这并非因为他们是坏人，而是因为，要维持自由和安全之间的恰当平衡需要公民的积极参与和时刻保持警觉。当政策、正当程序以及公众舆论还未能跟上时，新技术让警察的工作更加得心应手，这时就需要

加倍的警惕。

本专题将审视这些技术将带来的益处和危险。我们将探讨技术正在彻底改变司法系统运作的几大领域：街头监控、执法机构轻松绕过加密、使用电子监控替代坐牢，以及警察和法庭引入算法。

我们将考察技术对犯罪和罪犯的影响，以及一个以技术为主导的执法体系对无辜的民众意味着什么。我们并不要求大家屏蔽这些技术，而是呼吁强有力的监督——这已被证明对公民和执法都有裨益，而且，这也是确保社会在追求安全之时不会在无意中放弃过多自由的唯一途径。

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Electronic monitoring

Home, home within range

You don't have to go to prison to go to prison

KARL'S troubles began, as troubles often do, in a pub. He and his daughters, both in their early 20s, went out drinking near their home in Stockholm. His daughters got into a scrap with some other young people. He stepped in. "I was dragged down to the ground and it all happened so quick," he explains. "My side of the story is I was defending my two girls. But the other girls reported me for assaulting them." The other girls prevailed in court; Karl was sentenced to six months' imprisonment for assault.

Under Swedish law, anyone sentenced to six months or less can apply to the Prison and Probation Service to serve that sentence at home, under electronic monitoring (EM). Karl's application was successful. He is 45, runs a painting firm with 23 employees, and has no previous convictions—all factors in his favour. "It would have been a disaster if they had put me into jail," Karl says. "Financially, economically, and I don't know what would have happened to my marriage...This works pretty good for me."

EM works well for Sweden, too, saving the taxpayer money. According to Helena Lundberg, a criminologist who works for the justice ministry, prison costs SKr3,000 (\$365) per prisoner per day, compared with just SKr450 under EM. Also, gainfully employed people such as Karl continue to work, contributing to the economy rather than draining it. It also helps keep staff costs down in low-security prisons, where EM replaces guards: an alarm sounds if a prisoner crosses the facility's boundary.

EM's success in Sweden shows how technology, combined with enlightened public policy, can cut public spending while also benefiting society. Some

worry that its ease and cost efficiency might lower barriers to putting more people under state supervision. But it remains preferable to sending lots of nonviolent criminals to prison.

The wherewithal to get an offender to wear a rubber anklet with a radio-frequency identification (RFID) transmitter that sends a signal to fixed units in his home and workplace is not new. The technology was already a decade old when Sweden introduced it in 1994. There have been innovations, though. Some offenders are now given GPS trackers which tell police precisely where a subject is, log and store a person's movements and can also be used to "geofence" restricted areas, alerting police when, say, a sex offender gets too close to a school, or a domestic abuser to his victim's home or office.

EM sentences in Sweden come with strict schedules. Except for agreed-upon free hours for errands or family, the offender must either be at home or at work. Karl, for instance, has designated working hours of 6am to 5pm, so must leave his house at 5.45 every morning. The service also has a mobile RFID unit. Officers drive or walk randomly past offenders' homes and places of work to ensure that they are where they should be. They also make unannounced visits to test offenders for drugs and alcohol, both of which are forbidden.

In addition to offering EM as a replacement for prison time, Sweden also allows long-term prisoners (those who have served at least six years) to use it to complete the last six months of their sentence at home. Although few violent criminals get "front-end" EM—in 2016 most of those who successfully applied had been sentenced for drunk driving or drug crimes—no such limits apply to those serving the end of long sentences at home. They can be rapists or murderers. One probation officer explains, "The system knows them. They have good behaviour [in prison]...They understand schedules. And they have a goal: 'I want to go home with my

family and go to work.”

Sweden is not the only place to use EM. At least 27 countries in Europe do so, as well as all 50 American states. Frequency of use varies. Scandinavian countries use it as Sweden does, to reduce imprisonment for the many short sentences their judicial systems impose. Britain uses it to impose curfews on probationers, to let prisoners serve the last parts of their sentences at home, and as a condition of bail. Parts of Britain have also used EM with transdermal drug and alcohol monitors, as opposed to the Swedish inperson drug-testing model. Germany, by contrast, remains relatively resistant. Prosecutors there see EM as too lenient, while many in the probation service see house arrest and the conditions imposed by monitoring with RFID as too punitive.

Across Europe, however, the judicious use of EM is associated with long-term reductions in prison populations and imprisonment rates. In America, it remains relatively rare, accounting for only 2% of all of those under correctional control. It is used there not as a substitute for imprisonment but to monitor those on probation and on parole, as well as for pre-trial monitoring. Yet, in 2005-15, its use in America grew by 140%, driven mainly by the growth in GPS-enabled monitoring. Much of Europe might balk at placing under state supervision people who have not been convicted. But in America it happens all the time. Jails are full of pre-trial detainees (“jail” being where people are held before trial or for short periods, while “prison” is for post-conviction sentences).

EM’s use in America looks set to rise further. Despite Donald Trump’s law-and-order bombast, America’s prison population is falling, even in Republican-controlled states, as the system realises that jailing people is an expensive way to turn them into better criminals. Monitoring them remotely is much cheaper and avoids the criminogenic effects of prison.

Yet Mats Johanssen, a senior officer with Sweden's PPS, cautions, "If you want to change someone, EM alone won't do it." It is impressive that just 17% of Swedes sentenced to EM reoffend within a year, compared to over half of those who do six months or less in prison. That reflects not just the sort of criminals who get the two types of sentence, but also the host of interventions such as counselling and job training that come along with EM in Sweden. These are in keeping with the country's overall attitude that prison should rehabilitate rather than just punish, and its overarching goal that people who go to prison do not return there.

If EM can help keep people out of jails while awaiting trial, that could also have long-term benefits: a study from Harris County, Texas, found that defendants jailed before their trials are more likely to plead guilty, serve longer sentences and reoffend than those who are released. That could just mean that police are jailing the right people. But defence lawyers say that people jailed before their trial cannot participate effectively in their own defence, and often plead guilty just to avoid a long pre-trial wait in jail. EM has also shown benefits on the other end. A study from Florida found that it reduced the risk of released felons failing to meet their parole terms by 31%. Another analysis in Washington, DC, reached similar conclusions.

But an intriguing study from Argentina suggests Mr Johanssen may be overstating the need for supplemental programmes and judicious selection of EM recipients. It looked at detainees accused of serious offences who received EM more or less at random, and found that it cuts the risk of reoffending nearly in half, compared with a prison sentence. Moreover, the offenders received no counselling, education, training or other programmes—suggesting that the easiest way to keep people out of prison may be not to send them there in the first place.

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电子监控

家， 监控下的家

不入狱也能服刑

卡尔的麻烦是在麻烦的高发地——酒吧——开始的。他和他两个20岁出头的女儿一起出去喝酒，就在他们位于斯德哥尔摩的家附近。他的女儿们和其他几个年轻人起了争执。他出手了。“我被拽倒在地，一切都发生得很快，”他解释说，“我认为我是在保护两个女儿。但其他女孩报警说我袭击她们。”其他女孩的说法在法庭上占了上风，卡尔因袭击罪被判六个月监禁。

根据瑞典法律，被判处六个月或以下刑罚的人都可以向监狱和缓刑局申请在家服刑，但要戴上电子监控（以下简称EM）设备。卡尔的申请被批准了。他现年45岁，经营着一家有23名员工的油漆公司，也没有犯罪记录——所有的因素都对他有利。“如果他们把我关进监狱，那将是一场灾难，”卡尔说，“不论是财务上还是经济上。我的婚姻也不知会怎样……现在这样对我来说很好。”

EM对瑞典也有好处：能节省纳税人的钱。根据为司法部工作的犯罪学家海伦娜·伦德伯格（Helena Lundberg）的说法，每名囚犯每天的监狱开支达3000瑞典克朗（365美元），而EM的费用仅为450瑞典克朗。而且，像卡尔这样有工作有收入的人会继续工作，能为经济做出贡献而不是纯消耗。它还有助于削减那些安保级别较低的监狱的员工成本，让EM替代警卫：如果有囚犯穿越监狱大楼的边界，警报就会响起。

EM在瑞典的成功表明，技术与开明的公共政策相结合可以削减公共开支，同时造福社会。有人担心它的便捷和经济可能会降低门槛，把更多人置于国家监视之下。但这还是比把大量非暴力犯罪分子送入监狱要好。

让罪犯戴橡胶脚环的手段并不新鲜，这些脚环利用无线射频识别（RFID）发射器向家中和工作场所的固定单元发送信号。瑞典在1994年引入这项技

术时，它已经面世出现十年了。不过创新还是有的。现在会给一些罪犯戴上GPS追踪器，它可以准确告诉警察罪犯所在的位置，并记录和存储罪犯的动作，还可以用来对限制区域创建“地理围栏”。比如当性犯罪者距离学校太近时，或家暴者靠近受害者的家或办公室时就会通知警察。

瑞典的EM刑罚有严格的时间表。除了约定好的用于出门办事或家庭的自由活动时间外，罪犯必须留在家中或工作场所。例如，卡尔指定的工作时间为早上6点到下午5点，因此他必须在每天早上5:45离开家。管理机构还有一个移动RFID小队。警官会随机驾车或步行经过罪犯的家和工作场所附近，以确保他们待在他们应该在的地方。警察还会对罪犯进行毒品和酒精突击检查，这两者都是禁止的。

除了提供EM来替代狱中服刑外，瑞典还允许长刑期犯人（至少已服刑六年者）在家中服完最后六个月刑期。虽然很少有暴力犯罪分子获得“前期”EM——2016年大多数成功的申请者都是因醉驾或毒品犯罪被判刑——在家完成长刑期最后一段的人并没有这些限制。他们也许是强奸犯或杀人犯。一名缓刑监视官解释说：“系统知道他们。他们[在狱中]行为良好……他们了解时间表。而且他们有个目标，‘我想回家和家人一起，并去工作。’”

瑞典不是唯一使用EM的地方。欧洲至少27个国家以及美国所有50个州都在使用它。但使用的频率各不相同。斯堪的纳维亚国家的使用方式与瑞典一样，利用它来让各自司法系统判处的许多短期刑免于监禁。英国用它来对缓刑犯实施宵禁，让囚犯在家中完成刑期的最后一段，也用作保释条件。英国还有一些地方使用带有透皮药物和酒精监测仪的EM，而不像瑞典那样当面做药物测试。相比之下，德国对此仍相对抗拒。德国检察官认为EM太过宽松，而许多缓刑服务机构又认为软禁以及RFID监控附带的条件惩罚性太强。

然而在整个欧洲，对EM的审慎使用与监狱人口和入狱率的长期下降有关。在美国，EM的使用仍然比较罕见，仅占所有受改造控制者的2%。它不是用来代替监禁，而是用于监视缓刑犯、假释犯以及审前监控。尽管如

此，2005年到2015年间，它在美国的使用增长了140%，主要是由GPS监测的增长所推动。欧洲大部分国家可能不愿意将未被定罪的人置于国家监控之下，但在美国这是普遍情况。看守所里满是在押候审者（“看守所”是关押候审嫌犯或刑期较短的罪犯的地方，而“监狱”用于定罪后的刑罚）。

看起来，EM在美国的应用必将进一步扩大。尽管特朗普夸夸其谈“法律和秩序”，美国的监狱人口正在下降，即使在共和党控制的州也是如此。这是因为其司法系统认识到，监禁是用昂贵的成本把罪犯变成犯罪高手。远程监控要便宜得多，并且避免了监狱引发犯罪的效应。

不过，瑞典监狱和缓刑局的高级官员马茨·约翰森（Mats Johanssen）警告说：“如果你想改变某人，单靠EM是做不到的。”令人印象深刻的一点是，被判处EM刑的瑞典人中只有17%在一年内再次犯罪，而这个比例在监禁六个月或更短时间的人中达到了一半以上。这不仅仅反映出得到两种不同判决的罪犯本身的差异，也体现了瑞典的EM所配备的咨询和职业培训等干预措施的效果。这符合该国关于监狱应该重改造而非单纯惩罚的整体态度，以及让入狱者避免再次入狱的总体目标。

如果EM能够让人们在等待审判期间免进看守所，这还可能带来长期的益处：得克萨斯州哈里斯县的一项研究发现，在待审时被拘留的被告相比被释放者更可能认罪，服刑时间更长，而且更容易再次犯罪。这可能单纯意味着警方拘留了正确的人。但是辩护律师们说，在审判之前被拘留的人不能有效地参与为自己辩护，并且常常纯粹是为了避免在看守所中等待审判太久而认了罪。EM在其他方面也体现出了好处。佛罗里达州的一项研究发现，它把重罪假释犯未能满足假释期间要求的风险降低了31%。华盛顿特区的另一项分析得出了类似的结论。

但是，来自阿根廷的一项有趣的研究表明，约翰森可能夸大了辅助项目和审慎选择EM获刑者的必要性。研究追踪了一些待审犯人，他们被控严重罪行，并基本上随机接受了EM。结果发现，与狱中服刑相比，EM将再次犯罪的风险降低了近一半。这些犯罪者没有得到除此之外的任何咨询、教育、培训或参与其他项目——这表明让人们免于入狱的最简单方法也许是

一开始就要把他们送进那里。

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Sidewalk Labs

Streets ahead

An Alphabet subsidiary designs a wired, robot-served neighbourhood

QUAYSIDE, an area of flood-prone land stretching for 12 acres (4.8 hectares) on Toronto's eastern waterfront, is home to a vast, pothole-filled parking lot, low-slung buildings and huge soyabean silos—a crumbling vestige of the area's bygone days as an industrial port. Many consider it an eyesore but for Sidewalk Labs, an “urban innovation” subsidiary of Google’s parent company, Alphabet, it is an ideal location for the world’s “first neighbourhood built from the internet up”.

Sidewalk Labs is working in partnership with Waterfront Toronto, an agency representing the federal, provincial and municipal governments that is responsible for developing the area, on a \$50m project to overhaul Quayside. It aims to make it a “platform” for testing how emerging technologies might ameliorate urban problems such as pollution, traffic jams and a lack of affordable housing. Its innovations could be rolled out across an 800-acre expanse of the waterfront—an area as large as Venice.

First, however, Sidewalk Labs is planning pilot projects across Toronto this summer to test some of the technologies it hopes to employ at Quayside; this is partly to reassure residents. If its detailed plan is approved later this year (by Waterfront Toronto and also by various city authorities), it could start work at Quayside in 2020.

That proposal contains ideas ranging from the familiar to the revolutionary. There will be robots delivering packages and hauling away rubbish via underground tunnels; a thermal energy grid that does not rely on fossil fuels; modular buildings that can shift from residential to retail use;

adaptive traffic lights; and snow-melting sidewalks. Private cars are banned; a fleet of self-driving shuttles and robotaxis would roam freely. Google's Canadian headquarters would relocate there.

Undergirding Quayside would be a "digital layer" with sensors tracking, monitoring and capturing everything from how park benches are used to levels of noise to water use by lavatories. Sidewalk Labs says that collecting, aggregating and analysing such volumes of data will make Quayside efficient, liveable and sustainable. Data would also be fed into a public platform through which residents could, for example, allow maintenance staff into their homes while they are at work.

Similar "smart city" projects, such as Masdar in the United Arab Emirates or South Korea's Songdo, have spawned lots of hype but are not seen as big successes. Many experience delays because of shifting political and financial winds, or because those overseeing their construction fail to engage locals in the design of communities, says Deland Chan, an expert on smart cities at Stanford University. Dan Doctoroff, the head of Sidewalk Labs, who was deputy to Michael Bloomberg when the latter was mayor of New York City, says that most projects flop because they fail to cross what he terms "the urbanist-technologist divide".

That divide, between tech types and city-planning specialists, will also need to be bridged before Sidewalk Labs can stick a shovel in the soggy ground at Quayside. Critics of the project worry that in a quest to become a global tech hub, Toronto's politicians may give it too much freedom. Sidewalk Labs's proposal notes that the project needs "substantial forbearances from existing [city] laws and regulations".

It is not yet known what business model Sidewalk Labs plans for Quayside. Rohit Aggarwala, its head of urban systems, said at a public meeting in March that it is "frankly a little unclear" what it will be. Mr Doctoroff says the

firm might make money by licensing the products and services it develops in Toronto and selling them to other cities. It is uncertain whether Torontonians who contributed data to hone the services would share the revenue.

Privacy concerns will doubtless arise—over what data the sensors at Quayside will hoover up, who will own them, where they will be housed and so on. For now, Sidewalk Labs has said it will not use or sell personal information for advertising purposes and that the data will be subject to “open standards”, allowing other firms and agencies to make use of it. Sidewalk Labs and Waterfront Toronto have brought in a former federal privacy commissioner and a former privacy commissioner of Ontario as advisers.

But privacy experts call such assurances insufficient, because Canada’s legal frameworks for data privacy and security lag behind the latest innovations from tech firms. “You can always choose whether or not to download an app on your phone,” says Kelsey Finch at the Future of Privacy Forum, a think-tank. “You can’t easily opt out of the community that you live in.” ■



人行道实验室

未来街区

Alphabet的子公司设计了一个由机器人服务的联网智慧社区

码头区（Quayside）位于多伦多东部水滨，是一片绵延12英亩（4.8公顷）的易涝地带，这里有一个遍地坑洼的宽阔停车场、若干低矮的建筑物和巨大的大豆筒仓——从这片破败的景观中可以窥见这里作为工业港口的过往。许多人认为此地有碍观瞻，但对于谷歌母公司Alphabet旗下从事“城市创新”的子公司人行道实验室（Sidewalk Labs）来说，这里是兴建世界“首个建于互联网之上的街区”的理想之地。

人行道实验室正与代表联邦、省和市政府负责开发这一地区的多伦多滨水公司（Waterfront Toronto）合作，实施一个耗资5000万美元的项目对码头区进行大改造。目标是把该地区打造成一个“平台”，用于测试新兴技术能如何缓解污染、交通堵塞和廉价住房稀缺等城市问题。创新成果可以被推广至占地800英亩的大片滨水地区——和威尼斯差不多大。

不过，人行道实验室计划首先于今夏在多伦多各地开展项目试点，以测试它希望在码头区部署的一些技术。这样做一定程度上是为了让居民对项目放心。如果其详细计划在今年晚些时候能得到多伦多滨水公司及各个政府部门的批准，它可于2020年在码头区动工。

相关方案既包含常见的设计，也有革命性的创意。那里将有：通过地下隧道递送包裹和清运垃圾的机器人；一个不依赖化石燃料的热电网；可把住宅变成零售店面的模块化建筑；自适应的交通信号灯；能自行融化积雪的人行道。私家车将被禁行，无人驾驶班车和机器人出租车队会在路上自由穿行。谷歌的加拿大总部将迁到那里。

支撑码头区的将是一个“数字层”，用传感器跟踪、监测和捕捉所有事物，从公园长椅的使用情况，到噪音水平，再到厕所的用水量。人行道实验室表示，收集、汇总和分析如此庞大的数据将使码头区变得高效、宜居和可

持续。数据也将被输入到一个公共平台上供居民使用，比如他们可以在上班时让维修人员进家门。

阿联酋的马斯达城（Masdar）和韩国的松岛新城（Songdo）等类似的“智慧城市”项目都引发过热议，却未被视为巨大的成功。斯坦福大学的智慧城市专家陈逸坚表示，由于政治和金融风向的改变，或因为工程负责人未能让当地居民参与到社区的设计中，许多项目都有拖延的情况。人行道实验室的负责人丹·多克托洛夫（Dan Doctoroff）在迈克尔·布隆伯格（Michael Bloomberg）担任纽约市市长时曾是他的副手。他认为，大多数项目之所以失败是因为它们没能跨越一道“规划-技术分歧”。

在人行道实验室在码头区开工之前，同样需要消除技术人员和城市规划专家之间的分歧。该项目的批评者担心，在多伦多寻求成为全球科技中心的过程中，这里的政客可能会给予它太多的自由。人行道实验室的方案指出，该项目需要“现有的（城市）法律和法规给予大量宽容”。

目前尚不知道人行道实验室计划在码头区采取何种商业模式。该公司负责城市体系的罗西特·艾格瓦拉（Rohit Aggarwala）在3月份的一次公开会议上透露，“坦白说这方面还不太清楚”。多克托洛夫表示，公司可能会通过把在多伦多开发的产品和服务授权并出售给其他城市来赚钱。尚不清楚贡献数据来打造这些服务的多伦多人是否能从中分得一杯羹。

隐私问题将引发关切，这一点毫无疑问。人们将担忧码头区的传感器会收集什么数据，谁将拥有这些数据，数据将存放何处，等等。目前，人行道实验室已经表示，它不会出于广告宣传的目的使用或出售个人信息，并且数据将服从“开放标准”，允许其他企业和机构使用。人行道实验室和多伦多滨水公司已请到一位前联邦隐私专员和一位前安大略省隐私专员作顾问。

但隐私专家称这些保证并不充分，因为加拿大在数据隐私和安全方面的法律框架滞后于科技公司最新的创新。智库未来隐私论坛（Future of Privacy Forum）的卡尔希·芬奇（Kelsey Finch）说：“你总能选择是否在

手机上下载一个应用。但你不能轻易退出你居住的社区。”■



Fashion sharing

Something rented, something new

The business of renting clothes is complicated but promising

AT ABOUT 4.30am the first of thousands of black garment bags arrive by truck at a vast warehouse less than ten miles (16km) from Lower Manhattan. The bags brim with designer dresses and other trendy clothing and accessories. Workers begin inspecting the garments. A billowy, patterned blouse smells a bit ripe. A floor-length red gown has a tear. A stain sullies the floral pattern of a silk sundress.

Turnaround is quick. The blouse is sent to washing machines, the gown goes to one of the 75 seamstresses lined up next to a wall of thread, zippers, buttons and other adornments in every imaginable colour and the silk dress makes its way to the “spotters”: experts who know how to get tough stains out of delicate fabrics. Most items are in and out in less than a day.

Such efficiency is essential for Rent the Runway (RTR), a New York-based, privately-owned startup with a value of almost \$800m that rents out clothes, handbags and jewellery. Its dry-cleaning warehouse is the world’s biggest, processing 2,000 items per hour. RTR started with formal dresses that women rented for weddings and other events. Now nearly three-quarters of its 9m clients across America use it for work clothes. For \$159 a month, its “unlimited” and most expensive plan, subscribers can rent four items at any one time.

Constant novelty seems to outweigh the “yuck” factor of wearing something that rubbed against someone else’s skin not long ago. Some two-fifths of American women who have heard of the service (or any of its younger competitors) say they would be willing to rent outfits. Renting a ball gown

when an occasion arises runs at about a sixth of what it would cost to buy it. Cleaning and insurance for minor damages are always included.

To lure more customers, RTR has opened bricks-and-mortar shops in New York, Chicago, San Francisco, Los Angeles and Washington, DC. Foot traffic is up by 80% from the same time last year, says Anushka Salinas, who oversees sales. The firm had revenues of over \$100m in 2016, the latest year for which it gives numbers, and says it is profitable at the level of operating earnings. At the Manhattan shop at 9am on a Wednesday, two women in their twenties explain that they often drop in on their way to work to pick up clothes to wear that day and change at the office. Another young woman who chooses casual outfits for the weekend says her subscription is a money-saver because she has stopped buying clothes.

Customers do have niggles. Sometimes monthly subscribers receive frocks that have not been pressed or cleaned. A bridesmaid's dress rented by Reagan Sims, a customer in Washington, DC a couple of years ago worked well. But more recently a dress she ordered for an annual ball that she organises came in a size she could barely squeeze into (RTR gave her a full refund).

Another snag can be shipping. RTR has a strict policy for non-returns, charging customers a late fee of \$50 per day after a 24-hour grace period. These charges accrue and can match the retail price. Late arrivals are another headache for customers, as well as patchy inventory. Ms Salinas admits that when RTR introduced its subscription services it did not have enough inventory to meet demand. RTR has since scaled up its supply, and there are now hundreds of units of each style and size.

Other brands are expanding upon RTR's model. Christine Hunsicker, co-founder of Gwynnie Bee, a RTR rival with a niche in plus-sizes, is launching

a service for conventional retailers looking to rent some inventory. The deal includes the digital technology, cleaning and warehousing services needed to run a clothes-rental business. Several American clothing brands, including Ann Taylor (popular for business attire) and NY&Co (a fixture in shopping malls) are testing the package. Rakesh Tondon, the boss of Le Tote, another rental startup, predicts that more retailers will launch rentals in the next five years as they see the potential.

Jennifer Hyman, RTR's chief executive, once said that she wants to put Zara and H&M, the giants of high-street retail, out of business. She is nowhere near that. But her clothes-renting model looks more than just the latest fad. ■



时尚共享

租衣新时尚

服装租赁的生意复杂但前景光明

凌晨四点半左右，数千个黑色服装袋中的第一批由卡车运抵距曼哈顿下城不到10英里（16公里）的一个巨大仓库。袋子里塞满了设计师品牌服装和另一些时髦衣服及配饰。工人们开始检查这些服饰。一件印花蓬蓬衫有点难闻。一件及地红色礼裙上有个破洞。一条真丝无袖背心裙的花朵图案上有块污渍。

处理过程很快。蓬蓬衫被送进洗衣机；礼服裙交给75位女裁缝中的一位，她们一字排开工作，背后是一整面墙的丝线、拉链、纽扣和其他饰品，你能想到的颜色应有尽有；真丝裙交给“去渍人”处理，他们是知道怎么去除精细面料上顽固污渍的专家。很多货品从进到出不到一天。

这样的效率对于Rent the Runway（RTR）来说至关重要。这家位于纽约的私营创业公司价值近8亿美元，出租服装、手袋和珠宝。它有世界上最大的干洗仓库，每小时处理2000件衣物。RTR从出租供女士在婚礼和其他场合穿着的正装礼服起家。如今它在全美有九百万客户，其中近四分之三向它租用上班穿的衣服。按它最贵的“无限”套餐，用户每月支付159美元可以在任何时候一次租用四件衣物。

把不久前还跟别人“亲密接触”的衣服穿在身上，想想就让人恶心，但再想想持续不断的新鲜感，似乎就利大于弊了。听说过RTR（或是它的任何一家年轻竞争对手）的美国女性中约有五分之二表示愿意租衣服穿。需要出席某些场合时，租一件晚礼服的价格大约是买一件的六分之一。清洁费和小破损的保险费通常都已包含在租金里。

为了吸引更多顾客，RTR在纽约、芝加哥、旧金山、洛杉矶和华盛顿特区开设了实体店。负责销售的安努斯卡·萨利纳斯（Anushka Salinas）说，

客流量比去年同期增长了80%。根据RTR给出的最新数据，2016年公司收入超过1亿美元，而且按营业利润计算是盈利的。某个周三的上午9点，曼哈顿门店里两位20来岁的女士解释说，她们经常在上班的路上顺便来逛逛，挑选当天要穿的衣服，到了办公室再换上。另一位为周末选择休闲装的年轻女士则说，成为会员很省钱，因为她已经不再买衣服了。

顾客的确会有小抱怨。有时包月会员会收到未经熨烫或清洗的连衣裙。华盛顿特区的一位顾客里根·西姆斯（Reagan Sims）几年前租过一件伴娘礼服，效果不错。但最近她为自己组织的年度舞会租了一条裙子，尺寸偏小，费了好大劲才穿上（RTR给了她全额退款）。

另一个麻烦是运送。RTR对不及时送回衣物有严格的政策，在24小时的宽限期后，每天向顾客收取50美元的滞纳金。这些费用累计起来能赶上零售价。对顾客来说，送货迟到是另一个令人头疼的问题，库存短缺也一样。萨利纳斯承认，当RTR开始推出会员服务时并没有足够的库存来满足需求。之后RTR已经增加了供应，现在每个款式和尺寸都有几百件库存。

其他品牌在RTR模式的基础上进一步拓展。克里斯汀·亨斯克（Christine Hunsicker）是Gwynnie Bee的联合创始人，这家RTR的竞争对手在大码服装上发现了利基市场。目前她正针对想要出租部分库存的传统零售商推出一项服务，为它们提供运营服装租赁业务所需的数字技术、清洁和仓储等。包括安·泰勒（Ann Taylor，很流行的商务装品牌）和NY&Co（购物中心的常驻品牌）在内的几家美国服装品牌都在试用这项服务。另一家租赁创业公司Le Tote的老板拉克什·唐顿（Rakesh Tondon）预计，今后五年会有更多零售商看到潜在商机并推出租赁服务。

RTR的首席执行官詹妮弗·海曼（Jennifer Hyman）曾说过，她想扳倒Zara和H&M这两家平民服饰零售巨头。她离这一目标还差得远。但她的租衣模式看起来不仅仅是一时的风潮。■



Buttonwood

Mind games

The right way for investors to use financial technology

TECHNOLOGY has transformed finance. Consumers bank and buy their insurance policies online. They use technology to manage their pensions and other investment portfolios. But can tech improve returns? Only if it is used wisely.

If it is cheaper to trade, then costs will take a smaller chunk out of long-term returns. Technology also allows fund managers to replicate stockmarket indices, giving investors access to broadly diversified equity portfolios for a fraction of a percentage point in annual fees.

But the ease and cheapness of trading, along with the vast range of options available, create a terrible temptation. Worldwide there are nearly 7,400 exchange-traded funds (ETFs) and related products. These funds are not used only by “buy and hold” investors. Nearly half of the top 20 traded securities on American markets, by value, are ETFs.

Just because you can trade does not mean you should. And just because there is a fund specialising in smaller Vietnamese companies, or one that bets on trends in volatility, does not mean you have to buy it. Men aged over 50 can go shirtless on sunny days or wear flip-flops. But that does not mean it is wise for them to do so.

Some professional investors make a virtue of incessant trading, with a holding period for shares of milliseconds rather than years. They can use computers to crunch data faster than anyone else and to exploit small differences in securities prices. This is a Darwinian business, in which everyone is incessantly improving their infrastructure and their algorithms

to get an edge on the competition.

But by definition a majority of investors cannot beat the market, whether with frequent trading or any other strategy. Instead of chasing this chimera, ordinary investors should use technology to correct for their innate flaws.

First of all, many people underestimate how much they need to save to meet their long-term needs. Some of this is down to the difficulties involved in the calculations, which require people to make assumptions about longevity, inflation and future investment returns. Another problem is the natural human inclination to spend money today rather than to save for a distant, and uncertain, future.

Either way, such short-sightedness creates a problem. Take Americans aged between 40 and 55. The median balance in their private pension plans is just \$14,500. Low interest rates were adopted by central banks in the aftermath of the financial crisis in order to discourage people from saving, and to help revive the global economy. The paradox is that low interest rates mean that savers need a bigger pension pot on retirement. They must save more, not less.

Technology can help deal with this issue. A good statistical model can tell individuals what pension pot they will need at retirement; what investment return they can reasonably expect; and whether they are on track for the target. If they find they are falling short of their goal, investors can save more or adjust their planned retirement date. Just being aware of the scale of the task can make investors change their behaviour.

Secondly, technology can help investors choose a strategy that avoids incessant trading. It is easy for investors to fall into one of two traps: making an arbitrary selection of assets in their 20s and never changing it, or relentlessly fiddling with their portfolio. Too many people fall into the trap

of enthusing over fashionable sectors or hot mutual funds. If a sector is in vogue, it has already risen in price, so it is quite likely to be expensive relative to its history. By the same token mutual funds become hot because of their past performance, but there is very little evidence of persistence in returns.

An automated system can impose discipline. One possible approach would involve setting up a strategic asset allocation: say 20% to domestic equities, 40% to international shares, 20% to inflation-linked bonds and 20% to corporate debt. The portfolio could be automatically rebalanced once a year, or if the asset allocation strayed a long way from the target in the meantime. Such an approach would have the merit of buying assets when they have fallen in price (and are cheap) and selling them when they are dear.

In short, investors should not treat technology as the equivalent of a “diet pill” that will help them to lose weight effortlessly and instantly. Instead, they should view it as a tool to encourage the behaviour (the investment equivalent of exercising more and eating less) that will lead to long-term success. Think of fintech as one of those step-counting apps, nagging you to financial fitness. ■



梧桐

心理战

投资者要正确运用金融科技

科技改变了金融。消费者使用网上银行，在线购买保险。他们运用科技管理养老金和其他投资组合。可是科技能提高收益吗？那得运用得当才行。

如果交易成本更低，那么所付出的费用在长期投资收益中的占比就会更小。拜科技所赐，基金经理还可以复制股市指数，让投资者能够以零点几个百分点的年费获得广泛多元的股票投资组合。

但是交易的简便、低成本以及广泛的可选方案却形成了可怕的诱惑。全世界有将近7400只ETF（交易所交易基金）和相关产品。这些基金不只被“买入并持有”的投资者使用。按交易价值计算，美国市场前20大交易证券中近一半都是ETF。

但可以交易并不代表就应该交易。不能因为有一只专门投资越南小型公司或一只押注于市场波动的基金，就一定要出手购买。50多岁的男人可以在大晴天光着膀子或者穿人字拖，但并不代表这就是明智之举。

一些专业投资者通过不停的交易获利，他们持有股票的时间以毫秒而不是以年计算。他们能够使用电脑比其他所有人更快地处理数据并且抓住微小的证券价差。这是桩达尔文式的买卖，其中每个人都在不断改进自己的基础设备和算法，以期在竞争中胜人一筹。

但是，无论采取频繁交易还是其他策略，大多数投资者注定无法跑赢大市。普通投资者应该运用科技来矫正他们的固有缺陷，而不是水中捉月。

首先，很多人低估了满足远期需求所需要的储蓄水平。这一定程度上是因为计算困难，它要求人们对寿命、通胀以及未来的投资收益等做出假设。另外，人的天性就是今朝有酒今朝醉，而不是为遥远而不确定的未来储

蓄。

不论哪种原因，这种短视都会造成一个问题。以40到55岁的美国人为例。他们私人养老金计划的余额中位数仅为1.45万美元。金融危机促使各国央行抑制储蓄、帮助重振全球经济而实行低利率政策。但矛盾的是，低利率意味着储户要为退休存下更多的养老金。他们需要增加而不是减少储蓄。

科技能够帮助解决这一问题。一个好的统计模型可以告诉每个人退休时需要的养老金总额，他们应该期待的投资收益水平，以及他们的目标能否按计划实现。如果发现达不到自己的目标，投资者可以增加储蓄或者调整原本计划的退休时间。只要意识到任务的艰巨性，投资者就能改变自己的行为方式。

其次，科技可以帮助投资者选择一种频繁交易之外的策略。投资者很容易落入这两个陷阱中的一个：20来岁时随意选择资产，此后再无改变，或者没完没了地折腾自己的投资组合。太多的人陷入对流行行业或热门共同基金的迷恋。如果一个行业正当红，它的价格已经上涨，因此价格很可能比以往都高。同样，共同基金之所以热门是因为它们过去的表现，但很难证明同样的收益会一直持续。

一个自动交易系统可带来约束。一种可能的方法是设立一个战略资产配置：比如20%的国内股票，40%的海外股票，20%的通胀挂钩债券，以及20%的公司债券。每年，或者其间资产配置与目标偏离太远时，投资组合会自动调整一次。该方法有“低（价格便宜）买高卖”的优点。

简而言之，对投资者来说，科技不是能帮助他们又快又轻松瘦身的“减肥药”，而是一种鼓励他们采取能带来长期成功的投资行为（相当于少吃多锻炼）的工具。将金融科技看作一种计步应用吧，它会温和地推动你追求财务健康。■



Football penalties

The lucky 12 yards

There is an optimal strategy to penalty shoot-outs

WHEN the World Cup, now under way in Russia, progressed to the knockout phases of the competition on June 30th attention started to focus on the dreaded penalty shoot-out. Forty years ago, if a game was level after 120 minutes, the winner was decided by luck: a simple coin-flip. But in 1978 the rules were changed to create results that, at least in some sense, depend on skill. The question is, how much skill? Since 1982, the first competition in which penalty shoot-outs actually happened, there have been 26 of them—with seven of the 18 teams in the nine pertinent finals having arrived there thanks to success at penalties, and two of the finals themselves having been decided by them.

The format of a shoot-out is simple. Teams take it in turn to try to kick five penalties past the opposing team's keeper into the goal. If the score is even after five penalties a side then “sudden death” ensues: victory is achieved by a single winning kick that is not successfully replied to. Whether this is truly less dependent on luck is moot. Analysis suggests that no relationship exists between a team's general quality and its success in such shoot-outs. What analysis does suggest, though, is ways to improve the odds of victory.

The first is to go first, if given the option. That option is, admittedly, dependent on the toss of a coin. But if you win the coin toss you should take it, according to Ignacio Palacios-Huerta of the London School of Economics. After analysing data on 1,000 penalty shoot-outs in the World Cup and other competitions, Dr Palacios-Huerta found that teams which kick first win 60% of the time. Moreover, toss-winning captains do usually take this option, so FIFA, world football's governing body, is trying out a system

similar to a tiebreak in tennis, in which teams A and B take turns to shoot first: AB then BA then AB and so on. The current World Cup, however, will keep the AB then AB format.

The toss having been won or lost, the teams decide the order in which players will take their kicks. Coaches typically select the best players to kick first, leaving the worst until last. Kickers are successful three-quarters of the time, on average, according to an analysis of penalties by *The Economist*. Yet the success rate falls by 12 percentage points for the fourth of the five pre-sudden-death penalties. This is where first-mover advantage appears to matter. The success rate in the fourth penalty for the team shooting first is 70%, whereas for the team shooting second it is just 56%. Thorough analysis of player sequencing by Dr Palacios-Huerta suggests that the importance of the five penalties is U-shaped: the first and fifth matter most; the third, least. So the best penalty takers, either in technique or those who can cope with stress, should be selected with that in mind.

Once the sequence of kickers is settled the ball is placed on the spot, 11 metres (36 feet) from the goal, the mouth of which is 2.4 metres high and 7.3 metres wide. A well-struck ball arrives at the goal line in just half a second, meaning that the goalkeeper must dive pre-emptively in the direction that he expects the kicker to shoot. Goalkeepers find high balls the hardest to deal with—just 3% of penalties aimed halfway up the goal or more are saved. Yet there is a tendency for these shots to miss the target: 18% of high shots do so, as opposed to 5% of low shots. Overall, though, allowing for misses and saves, high shots are successful 79% of the time compared with 72% for low shots (see chart).

As to the direction, left, right or centre, of both the kicker's shot and the goalkeeper's pre-emptive dive, it is best to be as unpredictable as possible. The data suggest there is little difference in success rates between shots that

are aimed left, right or down the middle. Yet it is easier for a right-footed player to give the ball speed by aiming towards what is, from his point of view, the left-hand side of the goal (the keeper's right), and vice versa for left-footed players. On average, kickers strike the ball in this more natural direction 25% more frequently than in the other direction. Goalkeepers know these preferences and dive in those directions in matching proportions, in an attempt to exploit this bias.

Preparation helps, too. The Netherlands substituted in a specialist penalty stopper, Tim Krul, just ahead of their shoot-out with Costa Rica in the 2014 World Cup. It worked. He dived in the correct direction all five times and saved two penalties. Conversely, there is no substitute for kicking accuracy. Germany, with an 86% penalty success rate, has the best record of any top international team. England's record, by contrast, is a dismal 66%. ■



点球

幸运12码

点球决胜的最优策略

俄罗斯世界杯激战正酣，6月30日进入淘汰赛阶段后，人们的注意力集中到了令人心惊胆颤的点球大战上。40年前，如果一场比赛在120分钟内打平，要胜出就要靠运气了：胜负完全由掷硬币决出。但1978年修改规则后，比赛结果至少在一定程度上取决于球技。问题是程度有多高？自1982年世界杯赛场上第一次真正出现点球大战以来，总共已进行了26次点球决胜，其中，参加了九场决赛的18支球队中有七支是通过点球获胜打入决赛的，而且有两场决赛本身是用点球定胜负的。

点球决胜的规则很简单。双方球队各有五次罚点球机会，轮流尝试战胜对方门将破门。如果五轮点球后仍为平局，那么就将以“突然死亡”定输赢：双方继续互罚，如果某一轮一方罚进而一方未罚进，则罚进方即刻获胜。用点球决胜，运气的成分是否真的比掷硬币少？答案见仁见智。分析表明，一支球队的总体水平和它在点球大战中的胜败毫无关联。不过分析又显示，有办法提高点球胜算。

首先，如果有得选，要先罚球。诚然，这又取决于掷硬币的结果。但伦敦政经学院的伊格纳西奥·帕拉西奥斯-韦尔塔（Ignacio Palacios-Huerta）表示，如果掷硬币胜出，就应该选择先罚。他分析了世界杯及其他赛事中共1000次点球大战的数据，发现先罚一方获胜的概率是60%。而掷硬币胜方的队长通常也会选择先罚，所以世界足球管理机构国际足联正在试验一种类似于网球抢七的规则，让A、B两队轮流先罚：即AB-BA-AB.....的模式。但本届世界杯将继续采用AB-AB.....的模式。

在掷硬币确定先后之后，双方就要决定罚球队员的上阵顺序。教练通常会选最好的球员打头阵，把最差的留在最后。根据《经济学人》对点球的分析，平均而言，球员射门的成功率为四分之三。但在“突然死亡”之前的五

轮罚球中，第四轮的成功率会下降12个百分点。先罚优势在此时显现出来。第四轮罚球中先罚一方的成功率为70%，而后罚一方的成功率仅为56%。帕拉西奥斯-韦尔塔对罚球队员上阵顺序的深入分析表明，五轮罚球的重要性呈U形：最关键是第一球和第五球，第三球最不重要。因此，在分配最好的点球手时——无论是看球技还是看抗压能力，应该考虑这一点。

定好球员上阵顺序后，皮球会被放置在距球门11米的罚球点上。球门高2.4米，宽7.3米。正常踢出的足球半秒内便可抵达球门线，这意味着守门员必须先发制人，提前向他认为罚球者将踢出的射门方向扑救。对守门员而言，高球射门最难扑救——球门中部或以上高度的罚球只有3%被扑出。但这样的射门也容易射偏：18%的高球射门会射偏，而低球射偏的几率只有5%。不过，总体而言，综合射偏和被扑出的概率，高球射门的成功率为79%，低球射门为72%（见图表）。

至于球员射门和守门员扑救的方向——左、右或中路，越出其不意越好。数据表明，瞄向左、右侧或中路的射门在成功率上无甚区别。但右脚球员瞄准球门左侧（即守门员的右侧）、左脚球员瞄准球门的右侧更利于他们高速射门。平均而言，罚球队员会更多地按这种对他们而言更自然的方向射门，几率比按相反方向高出25%。守门员对此也心知肚明，他们试图利用这种倾向，因而也以对应的几率朝这些方向扑救。

事先准备也有帮助。在2014年世界杯上，荷兰队在与哥斯达黎加队互射点球前换上了擅长扑点球的门将蒂姆·克鲁尔（Tim Krul）。结果很成功。五轮点球他全部扑对了方向，并扑出两球。反过来，要准确射门并没有替换人选可言。德国队的点球成功率为86%，居世界强队之冠。相比之下，英格兰队只有惨淡的66%。 ■



Technology politics

Playing with fire

Google runs into more flak on artificial intelligence

DISCOVERING and harnessing fire unlocked more nutrition from food, feeding the bigger brains and bodies that are the hallmarks of modern humans. Google's chief executive, Sundar Pichai, thinks his company's development of artificial intelligence trumps that. "AI is one of the most important things that humanity is working on," he told an event in California earlier this year. "It's more profound than, I don't know, electricity or fire."

Hyperbolic analogies aside, Google's AI techniques are becoming more powerful and more important to its business. But its use of AI is also generating controversy, both among its employees and the wider AI community.

One recent clash has centred on Google's work with America's Department of Defence (DoD). Under a contract signed in 2017 with the DoD, Google offers AI services, namely computer vision, to analyse military images. This might well improve the accuracy of strikes by military drones. Over the past month or so thousands of Google employees, including Jeff Dean, the firm's AI chief, have signed a petition protesting against the work; at least 12 have resigned. On June 1st the boss of its cloud business, Diane Greene, conceded to those employees that the firm would not renew the contract when it expires next year.

The tech giant also published a set of seven principles which it promises will guide its use of AI. These included statements that the technology should be "socially beneficial" and "built and tested for safety". More

interesting still was what Google said it would not do. It would “proceed only where we believe that the benefits substantially outweigh the risks,” it stated. It eschewed the future supply of AI services to power smart weapons or norm-violating surveillance techniques. It would, though, keep working with the armed forces in other capacities.

Google’s retreat comes partly because its AI talent hails overwhelmingly from the computer-science departments of American universities, notes Jeremy Howard, founder of Fast.ai, an AI research institute. Many bring liberal, anti-war views from academia with them, which can put them in direct opposition with the firm in some areas. Since AI talent is scarce, the firm has to pay heed to the principles of its boffins, at least to some extent.

Military work is not the only sticking-point for Google’s use of AI. On June 7th a batch of patent applications made by DeepMind, a London-based sister company, were made public. The reaction was swift. Many warned that the patents would have a chilling effect on other innovators in the field. The patents have not yet been granted—indeed, they may not be—but the request flies in the face of the AI community’s accepted norms of openness and tech-sharing, says Miles Brundage, who studies AI policy at the University of Oxford. The standard defence offered on behalf of Google is that it does not have a history of patent abuse, and that it files them defensively in order to protect itself from future patent trolls. DeepMind’s patent strategy is understood to be chiefly defensive in nature.

Whatever Google’s intent, there are signs that the homogeneity of the AI community may lessen in future. New paths are being created to join the AI elite, other than a PhD in computer science. Hopefuls can take vocational courses offered by firms such as Udacity, an online-education firm; the tech giants also offer residencies to teach AI techniques to workers from different backgrounds. That might just lead to a less liberal, less vocal AI community. If so, such courses might serve corporate interests in more

ways than one. ■



技术政治

玩火

谷歌在人工智能领域遭遇更多抨击

火的发现和利用让人类从食物中获得了更多的营养，来供养更大的大脑和身体这些现代人类的标志。谷歌的首席执行官桑达尔·皮查伊（Sundar Pichai）认为，他的公司对人工智能（AI）的开发比火的意义还要大。“AI是人类正在做的最重要的事情之一，”今年早些时候他在加州的一次活动上说，“我猜，它的影响比电或火更加深远。”

撇开这种夸张的类比不说，谷歌的AI技术确实正变得愈发强大，对其业务也愈加重要。但它对AI的应用也引发了争议，无论是在其员工内部还是在更广泛的AI圈里。

最近的一次争论围绕谷歌与美国国防部的合作展开。2017年谷歌与国防部签署合同，为其提供名为计算机视觉的AI服务，用来分析军事图像。这很可能会提高军用无人机打击的精准度。在过去一个月左右的时间里，包括谷歌AI主管杰夫·迪恩（Jeff Dean）在内的数千名公司员工签署了一份反对这项工作的请愿书，已有至少12人辞职。6月1日，谷歌云计算业务主管戴安·格林（Diane Greene）向这些员工做出让步，表示明年这份与国防部的合同到期时将不再续签。

这家科技巨头还发布了七大原则，承诺将以此指导公司对AI的应用。其中包括AI技术应该“对社会有益”、“开发及测试要以安全为导向”。更有趣的是谷歌称自己不会做的事。它表示将“只在我们确信好处大大超过风险的领域继续推进AI”。它还表示，未来不会提供AI服务来支持智能武器或违反普遍准则的监视技术。不过，它仍将在其他领域继续与军方合作。

AI研究机构Fast.ai的创始人杰里米·霍华德（Jeremy Howard）指出，谷歌做出让步一定程度上是因为它的AI人才大多来自美国各大高校的计算机系。许多人从学术界带来了自由、反战的观点，这可能会令他们在某些领

域与公司直接对立。由于AI人才稀缺，谷歌必须认真理会技术专家们的这些信条，至少在一定程度上得如此。

军事项目并不是谷歌运用AI的唯一分歧点所在。6月7日，它位于伦敦的妹妹公司DeepMind的一批专利申请被公开。各方迅速作出反应。许多人警告说，这些专利会对该领域的其他创新者产生寒蝉效应。牛津大学研究AI政策的迈尔斯·布伦戴奇（Miles Brundage）表示，这些专利尚未获批，实际上可能也不会获批，但是这些申请公然违反了AI圈开放与技术共享的公认准则。那些为谷歌说话的人提出的理由都围绕着一点：谷歌不曾滥用专利权，它是为防范未来遭专利流氓侵扰而做出的防御举动。他们认为DeepMind的专利战略在本质上主要是防御性的。

无论谷歌的意图如何，有迹象表明AI圈的同质性在未来可能有所减弱。除了拿到计算机科学的博士学位，一些跻身AI精英圈子的新途径正被开拓出来。种子选手们可以选择在线教育公司优达学城（Udacity）等企业提供的职业课程；科技巨头们也提供培训项目，向不同背景的员工教授AI技术。这可能会导致AI圈变得不那么自由开放，也没那么勇于发声。如果是这样，那么这些课程可能会在很多方面都为公司的利益服务。■



Medicine

From A&E to AI

Artificial intelligence will improve the speed and precision of medical treatments

FOUR years ago a woman in her early 30s was hit by a car in London. She needed emergency surgery to reduce the pressure on her brain. Her surgeon, Chris Mansi, remembers the operation going well. But she died, and Mr Mansi wanted to know why. He discovered that the problem had been a four-hour delay in getting her from the accident and emergency unit of the hospital where she was first brought, to the operating theatre in his own hospital. That, in turn, was the result of a delay in identifying, from medical scans of her head, that she had a large blood clot in her brain and was in need of immediate treatment. It is to try to avoid repetitions of this sort of delay that Mr Mansi has helped set up a firm called Viz.ai. The firm's purpose is to use machine learning, a form of artificial intelligence (AI), to tell those patients who need urgent attention from those who may safely wait, by analysing scans of their brains made on admission.

That idea is one among myriad projects now under way with the aim of using machine learning to transform how doctors deal with patients. Though diverse in detail, these projects have a common aim. This is to get the right patient to the right doctor at the right time.

In Viz.ai's case that is now happening. In February the firm received approval from regulators in the United States to sell its software for the detection, from brain scans, of strokes caused by a blockage in a large blood vessel. The technology is being introduced into hospitals in America's "stroke belt"—the south-eastern part, in which strokes are unusually common. Erlanger Health System, in Tennessee, turned on its Viz.ai system in June.

The potential benefits are great. As Tom Devlin, a stroke neurologist at Erlanger, observes, “We know we lose 2m brain cells every minute the clot is there.” Yet the two therapies that can transform outcomes—clot-busting drugs and an operation called a thrombectomy—are rarely used because, by the time a stroke is diagnosed and a surgical team assembled, too much of a patient’s brain has died. Viz.ai’s technology should improve outcomes by identifying urgent cases, alerting on-call specialists and sending them the scans directly.

Another area ripe for AI’s assistance is oncology. In February 2017 Andre Esteva of Stanford University and his colleagues used a set of almost 130,000 images to train some artificial-intelligence software to classify skin lesions. So trained, and tested against the opinions of 21 qualified dermatologists, the software could identify both the most common type of skin cancer (keratinocyte carcinoma), and the deadliest type (malignant melanoma), as successfully as the professionals. That was impressive. But now, as described in May in a paper in the *Annals of Oncology*, there is an AI skin-cancer-detection system that can do better than most dermatologists. Holger Haenssle of the University of Heidelberg, in Germany, pitted an AI system against 58 dermatologists. The humans were able to identify 86.6% of skin cancers. The computer found 95%. It also misdiagnosed fewer benign moles as malignancies.

There has been progress in the detection of breast cancer, too. In May Kheiron Medical Technologies, a firm in London, received news that a study it had commissioned had concluded that its software exceeded the officially required performance standard for radiologists screening for the disease. The firm says it will submit this study for publication when it has received European approval to use the AI—which it expects to happen soon.

This development looks important. Breast screening has saved many lives, but it leaves much to be desired. Overdiagnosis and overtreatment are

common. Conversely, tumours are sometimes missed. In many countries such problems have led to scans being checked routinely by a second radiologist, which improves accuracy but adds to workloads. At a minimum Kheiron's system looks useful for a second opinion. As it improves, it may be able to grade women according to their risks of breast cancer and decide the best time for their next mammogram.

Efforts to use AI to improve diagnosis are under way in other parts of medicine, too. In eye disease, DeepMind, a London-based subsidiary of Alphabet, Google's parent company, has an AI that screens retinal scans for conditions such as glaucoma, diabetic retinopathy and age-related macular degeneration. The firm is also working on mammography.

Heart disease is yet another field of interest. Researchers at Oxford University have been developing AIs intended to interpret echocardiograms, which are ultrasonic scans of the heart. Cardiologists looking at these scans are searching for signs of heart disease, but can miss them 20% of the time. That means patients will be sent home and may then go on to have a heart attack. The AI, however, can detect changes invisible to the eye and improve the accuracy of diagnosis. Ultromics, a firm in Oxford, is trying to commercialise the technology and it could be rolled out later this year in Britain.

There are also efforts to detect cardiac arrhythmias, particularly atrial fibrillation, which increase the risk of heart failure and strokes. Researchers at Stanford University, led by Andrew Ng, have shown that AI software can identify arrhythmias from an electrocardiogram (ECG) better than an expert. The group has joined forces with a firm that makes portable ECG devices and is helping Apple with a study looking at whether arrhythmias can be detected in the heart-rate data picked up by its smart watches. Meanwhile, in Paris, a firm called Cardiologs is also trying to design an AI intended to read ECGs.

Eric Topol, a cardiologist and digital-medicine researcher at the Scripps Research Institute, in San Diego, says that doctors and algorithms are comparable in accuracy in some areas, but computers have the advantage of speed. This combination of traits, he reckons, will lead to higher accuracy and productivity in health care.

Artificial intelligence might also make medicine more specific, by being able to draw distinctions that elude human observers. It may be able to grade cancers or instances of cardiac disease according to their risks—thus, for example, distinguishing those prostate cancers that will kill quickly, and therefore need treatment, from those that will not, and can probably be left untreated.

What medical AI will not do—at least not for a long time—is make human experts redundant in the fields it invades. Machine-learning systems work on a narrow range of tasks and will need close supervision for years to come. They are “black boxes”, in that doctors do not know exactly how they reach their decisions. And they are inclined to become biased if insufficient care is paid to what they are learning from. They will, though, take much of the drudgery and error out of diagnosis. And they will also help make sure that patients, whether being screened for cancer or taken from the scene of a car accident, are treated in time to be saved. ■



医学

从急诊到AI

人工智能将提升治疗的速度和准确性

四年前，一位30出头的女士在伦敦被车撞倒，需要做紧急手术减轻颅内压。负责手术的外科医生克里斯·曼西（Chris Mansi）记得当时手术进展顺利。但伤者最终死亡。曼西想知道原因。他发现了问题所在：她从一家医院的急诊室转入他所在医院的手术室，耽误了四个小时。而这又是因为没有及时从医学扫描图像发现她脑中有严重血栓而导致的——她当时需要立即治疗。为免重蹈这种延误诊治的覆辙，曼西参与建立了一家名为Viz.ai的公司。该公司想运用机器学习这种人工智能（AI）来分析病人送医时的大脑扫描，以分辨哪些人要马上救治，哪些等等也无妨。

像这样想要利用机器学习来改变医生救治方式的项目已经大量涌现。虽然具体方式各不相同，但它们的目标一致——在合适的时间为病人找到合适的医生。

Viz.ai公司正在这方面取得进展。2月，美国监管机构批准该公司销售一款软件，可以从大脑扫描中检测出因大血管堵塞导致的中风。美国“中风带”（中风高发的美国东南部）的医院正引入该技术。田纳西州的厄兰格医疗系统（Erlanger Health System）6月启用了Viz.ai系统。

这可能带来巨大的益处。厄兰格医疗系统的脑中风神经内科医生汤姆·德夫林（Tom Devlin）说：“我们知道，只要脑内出现血栓，每分钟就会有两百万个脑细胞死亡。”虽然溶栓药物和名为“血栓切除术”的手术能改变结果，但这两种疗法很少派上用场，因为等到确诊中风并召集来外科手术团队时，患者的大脑很大一部分已经死亡。Viz.ai的技术能识别紧急病情，呼叫值班的医疗专家并直接向他们发送扫描结果，应该可以改善救治结果。

另一个已经适合运用AI辅助技术的领域是肿瘤学。去年2月，斯坦福大学

的安德烈·埃斯塔瓦（Andre Esteva）和同事们使用近13万张影像来训练一个人工智能软件给皮肤病变分类。比照21位执业皮肤科医生的意见后发现，这款软件可以像医生那样准确地识别出最常见的皮肤癌（角化细胞癌）和最致命的类型（恶性黑色素瘤），令人眼前一亮。而现在，一个判断力优于大多数皮肤科医生的AI皮肤癌检测系统已经出现，5月发表在《肿瘤学年鉴》（Annals of Oncology）上的一篇论文对此做了介绍。德国海德堡大学的霍尔格·赫恩斯勒（Holger Haenssle）比对了一个AI系统与58名皮肤科医生的诊断。结果发现，人类识别出了86.6%的皮肤癌，计算机识别出了95%；计算机把良性痣误诊为恶性肿瘤的情况也更少。

乳腺癌检测方面也取得了进展。5月，伦敦的喀戎医疗技术公司（Kheiron Medical Technologies）收到消息，它委托进行的一项研究得出结论，其软件筛查乳腺癌的准确度超过了官方对放射科医师的要求标准。该公司表示，将在获欧洲监管机构批准使用此项AI技术后（估计很快能实现）发表该研究成果。

这看来是一项重要进展。乳腺癌筛查挽救了许多生命，但仍有很多改进空间。过度诊断和过度治疗很常见。但反过来，有时又会漏诊真肿瘤。在许多国家，这些问题导致需要第二位放射科医师对扫描影像做常规复查。准确性是提高了，但也增加了工作量。喀戎的系统至少可以提供第二个诊断意见。随着技术改进，该系统也许可以根据患乳腺癌的风险对接受筛查的女性分级，并确定下一次接受乳房X光检查的最佳时间。

其他医疗领域也在努力研究运用AI改善诊断。在眼科疾病方面，谷歌母公司Alphabet在伦敦的子公司DeepMind拥有一种分析视网膜扫描图像的AI技术，用于筛查青光眼、糖尿病型视网膜病变和老年性黄斑病变等疾病。该公司也在研发分析乳房X光片的AI技术。

心脏病是另一个受关注的领域。牛津大学的研究人员一直在开发能解读超声心动图的AI技术。心脏病专家会从这些扫描影像中寻找心脏病征兆，但漏诊几率高达20%。这意味着有些患者会被打发回家，继而心脏病发作。但AI却可检测到肉眼看不见的变化，提高诊断的准确性。牛津一家公司

Ultromics正打算将这项技术商业化，预计今年晚些时候在英国推出。

还有一些研究尝试用AI检测心律不齐，特别是心房颤动，这种病症会增加心力衰竭和中风的风险。斯坦福大学由吴恩达带领的研究团队已经证明，相比专家，AI软件能更好地通过心电图识别心律不齐。该团队已与一家生产便携式心电图设备的公司合作，并协助苹果公司研究是否可通过苹果的智能手表获取的心率数据检测心律不齐。与此同时，巴黎一家名为Cardiologs的公司也在尝试设计一款解读心电图信息的AI软件。

圣地亚哥的斯克里普斯研究所（Scripps Research Institute）的心脏病专家和数字医疗研究员埃里克·托普尔（Eric Topol）表示，在某些领域，医生和算法的准确度相差无几，但计算机拥有速度优势。他认为，这些特点的结合将提高医疗诊治的准确性和效率。

AI能辨别人类观察者察觉不到的差异，因而可能使治疗更细化。它也许能够根据风险大小对癌症或心脏病分类，例如，区分哪些前列腺癌会迅速致命，因而亟需治疗，哪些可以暂缓治疗。

医用AI无法做到的（至少在很长时间内无法做到）是让它所介入领域里的人类专家下岗。机器学习系统只适用于种类有限的任务，在未来多年里仍需要人类密切监督。它们是“黑匣子”，因为医生们并不确切知道这些机器是如何得出诊断结果的。假如不注意选择合适的训练数据，它们往往会展出偏颇的结论。尽管如此，这些AI设备将有助于减少诊断过程中的辛劳和错误，也将有助于确保病人——无论是筛查癌症的患者还是从车祸现场送到至医院的伤者——都能及时得到救治。■



Now for the investment war

Safe and secure

How the Trump administration will clamp down on Chinese investment

PRESIDENT Donald Trump's view of investment depends on who is doing it. On June 22nd he railed against Europeans exporting cars to America, demanding that they "build them here!" On June 26th he tweeted that all Harley-Davidson motorcycles should be made in America. But when it comes to Chinese investors buying American technology, Mr Trump would prefer a frostier approach.

Investors have feared a clampdown since March, when the administration concluded that China's unfair actions against American companies merited retaliatory restrictions on Chinese investments in "industries or technologies deemed important to the United States". Mr Trump directed Steven Mnuchin, the treasury secretary, to come up with options. On June 24th it appeared policy might tighten dramatically, with reports of plans to limit investment in America in the sectors targeted by China's "Made in China 2025" development policy, from aerospace to robotics.

Those plans were quickly shelved, perhaps because of market falls on June 25th. On June 27th the White House confirmed that there would be no new China-specific restrictions. Instead, it would rely on the Committee on Foreign Investment in the United States (CFIUS), an intra-agency committee that reviews inbound investment. Mr Trump also told the Commerce Department to review export controls.

What might look like a non-event is in fact an attempt to avoid a duplication of effort. Both America's inbound-investment restrictions and its export controls are being beefed up by the Foreign Investment Risk Review

Modernisation Act (FIRRMA), a bill with bipartisan support that should become law in the coming months. It would expand CFIUS's scope of review and strengthen controls on exports of technologies deemed particularly sensitive. A version was approved overwhelmingly by the House of Representatives on June 26th.

So the Trump administration's decision not to set up new constraints does not signal a change of heart towards China. Rather, it reflects a desire shared with Congress to block Chinese cash. China's share of direct investment into America is still small, but has risen quickly (see chart). Of \$137bn in the ten years up to 2017, 24% was invested by state-owned enterprises, fuelling widespread concern that the purchases are part of a Chinese government strategy to dominate America economically.

That concern has been reflected in CFIUS's activities. Of the 387 transactions it reviewed between 2013 and 2015, 74 involved Chinese investors. Of the five transactions it has ever recommended to be blocked, four involved Chinese buyers. Investment from China has already fallen from its peak in 2016, pulled down by Chinese capital controls and tougher American scrutiny. Since FIRRMA was drafted with China in mind, opportunities for such scrutiny will only increase.

Historically, Congress has not been shy about calling for a tough approach towards America's economic rivals. CFIUS was set up in the 1970s in response to concerns that members of OPEC, the oil producers' cartel, were hoovering up American assets for political ends. Congress granted the president authority to review investments in the 1980s, amid fears over Japan's economic rise and its firms' attempts to buy up American makers of semiconductors. The first set of concerns has since faded; the second now focuses on China.

But policymakers have tried to avoid discouraging investment in America. In the 1980s Ronald Reagan fought against broadening the scope of CFIUS to include “essential commerce” as well as “national security”. Handing the power of approval to the president rather than Congress was supposed to depoliticise the process, and so protect ordinary businesses.

Today, as Mr Trump seems eager to hit China where it hurts, these roles may be reversed. Congress has softened the most draconian parts of the bill. An earlier version of FIRRMA would have led to CFIUS being able to review any outbound transfer of intellectual property between companies in joint ventures or licensing deals. But it was pared back after companies voiced fears that this could interfere with their everyday operations, by leaving even the most vanilla transactions exposed to a cumbersome review process.

New, vaguely worded China-specific restrictions from the administration could have increased the uncertainty swirling around multinationals. In the run-up to June 27th, some had worried that ordinary cross-border business could be hit. Could an engineer sharing information with another in a foreign subsidiary count as a transfer of America’s intellectual resources? The news that Mr Trump’s push for investment restrictions had narrowed to CFIUS and FIRRMA, therefore, was a relief to some. When it became public, the S&P 500 ticked up. ■



投资战开打

靠谱一些

特朗普政府将如何打压中国投资

美国总统特朗普对投资的看法因投资方而异。6月22日，他谴责那些向美国出口汽车的欧洲厂商，要求他们“在美国制造这些车！”6月26日，他在推特上发帖子说，所有哈雷戴维森摩托车都应该在美国制造。但如果是购买美国技术的中国投资者，特朗普的态度就更冷淡了。

今年3月，特朗普政府认定，基于中国对美国公司的不公正对待，有理由对中国在“美国认为重要的行业或技术”的投资实施报复性限制。这之后投资者一直担心将受到打压。特朗普指示财政部长史蒂文·梅努钦（Steven Mnuchin）准备多个方案。6月24日传出政策可能会大幅收紧的消息，据称特朗普政府计划限制中国在美投资涉及“中国制造2025”发展规划中罗列的重点行业，从航空航天到机器人技术等。

那些计划很快被搁置了，可能跟6月25日美国股市下跌有关。6月27日，白宫确认不会做出专门针对中国的新限制。相反，它将依赖美国外国投资委员会（以下简称CFIUS）来把关。这个政府内部委员会负责审查美国境内外来投资。特朗普还指示商务部检视出口管制措施。

表面上好像是一次虚张声势，实际上是为了避免重复行动。美国正在寻求通过《外国投资风险评估现代化法案》（以下简称FIRRMA）来加大外来投资限制和出口管制。该法案已经得到两党支持，预计未来几个月内将成为法律。它将扩大CFIUS的审查范围，加强对特别敏感技术的出口管制。6月26日众议院以压倒性多数通过了该法案的一个版本。

因此，特朗普政府决定不设置新的限制措施，并不代表它对中国回心转意。实际上，它反映出国会和政府想法一致，都要阻止来自中国的投资。目前中国在所有对美直接投资中所占的份额仍然很小，但增长迅速（见图表）。截至2017年的十年间，中国总共投资了1370亿美元，其中24%来自

国有企业，这让人们普遍担忧这些收购是中国政府战略行动的一部分，目的是主导美国经济。

CFIUS的行动反映了这种担忧。2013年至2015年间，它审查的387宗交易中有74宗涉及中国投资者。它建议阻止的五宗交易中有四宗涉及中国买家。受到中国资本管制和美国收紧审查的牵制，中国在美投资已从2016年的高峰滑落。由于FIRRMA就是针对中国起草的，这类审查只会有增无减。

一直以来，美国国会从不避讳主张对美国的经济对手采取强硬手段。上世纪70年代，由于担忧石油输出国组织欧佩克的成员国出于政治目的大量购买美国资产，CFIUS成立。80年代，日本经济崛起，由于担心日本企业大举收购美国半导体制造商，国会授权总统审查投资项目。前一轮担忧已经消退，后一轮现在变成了集中提防中国。

但政策制定者们一直努力避免吓跑对美国的投资。80年代，里根总统反对把CFIUS的权限扩大到“基本商业”和“国家安全”领域。把审批权交给总统而非国会是想把该过程非政治化，从而保护普通企业。

到了今时今日，特朗普似乎急切地想要痛击中国的要害，因此这种角色分配可能发生逆转。国会已经放宽了FIRRMA法案中最严苛的部分。要是按照早期的一个版本，CFIUS有权审查任何发生在合资公司或签署授权协议中的公司之间的知识产权对外转让。但在后来的版本中，CFIUS的权力有所削弱，因为企业表示担心自己的日常运营会受到干扰，连最平常的交易也要经受繁琐的审查流程。

如果特朗普政府对中国做出表述含糊的新限制，可能会加大围绕跨国公司的不确定性。临近6月27日时，有些人曾担心普通跨境业务会受到打击。假如一位美国工程师与外国子公司的一位工程师分享信息，是否也算美国知识资源的转移？所以，特朗普力主的投资限制措施缩窄为CFIUS和FIRRMA，让好些人舒了一口气。消息公布后，标普500指数应声上涨。■



Banyan

Chain reaction

Asia is at last waking up to the threat of a trade war

IT IS hard to argue that the United States and China are not on the brink of a trade war. President Donald Trump is threatening to impose higher tariffs on \$450bn of imports from China, with the first tranche, on \$34bn of Chinese goods, due to take effect on July 6th. Mr Trump expects China to blink. But what if it doesn't? Other countries in Asia are only now starting to ask that as they realise how much is at stake.

Nowhere would a rupture of global supply-chains have more impact than in East and South-East Asia, which sit at the heart of them. Intermediate goods account for more than half of Asian countries' exports, on average, and more than three-fifths of their imports. The region is deeply integrated, in often underappreciated ways, argues Deborah Elms of the Asian Trade Centre, which advises governments and business. South Korean screens and Taiwanese chips famously head to China for assembly into iPhones for American end-users; there are countless similar examples. Many Asian companies, Ms Elms says, may not even realise where their products end up. They may still not be aware that they are at risk from the looming trade war.

Political leaders appear to be ahead of local businesses in thinking about the consequences. Mr Trump's lambasting of America's traditional allies at a vitriolic G7 summit in Canada in early June belatedly triggered alarms across Asia. Since then leaders have rushed to show their commitment to an open, rules-based trading order—one without America if need be.

One example is the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), a gold-standard free-trade pact involving 11

countries on both sides of the Pacific. A successor to the Trans-Pacific Partnership, which Mr Trump pulled America out of in early 2017, the CPTPP was signed in March. But several of its members had seemed in no particular rush to ratify it. No longer. Canada, Australia and Japan have all said they will speed up the process. South Korea, which was forced by Mr Trump to renegotiate a bilateral trade pact (and which also has concerns about the strength of its military alliance with America), looks set to apply to join the CPTPP.

Japan's prime minister, Shinzo Abe, once hoped he might persuade Mr Trump to bring America back in to the pact. Instead, Mr Trump has repeatedly humiliated him, not least by refusing to exempt Japan from steel and aluminium tariffs, even though other allies have won a reprieve. Now Mr Abe is mending bridges with China. And he is continuing to fly the multilateral flag with another regional initiative.

On July 1st Mr Abe hosts trade ministers from the ten countries of the Association of South-East Asian Nations (ASEAN), plus the countries in the region with which ASEAN signed bilateral free-trade deals: Australia, China, India, Japan, New Zealand and South Korea. Negotiations over the so-called Regional and Comprehensive Economic Partnership (RCEP) have for years crawled along at a snail's pace. But the meeting in Tokyo signals a quickening—and is the first big RCEP meeting to be held outside ASEAN.

In terms of rigour, RCEP falls far short of CPTPP. It includes China, which was pointedly excluded from TPP, in which the previous American administration explicitly set out to design a template for open trade that would not be diluted by China's questionable commitment. RCEP was seen at the time as the lowest common denominator—a pointless or even counterproductive distraction. But today its backers promote it as a useful step towards regional integration. With America now hostile to open trade, every initiative has fresh worth to countries whose prosperity was built on

commerce.

Collateral damage from trade tensions between America and China seems inevitable. Even if a full-blown trade war is averted—because either country backs down—both sides would not return to the rules-based trade order that has prevailed until now. Rather, a deal would involve some kind of managed trade. That is certainly better than full-blown conflict. But it repudiates that order, while diverting trade and investment.

As for a full-blown war, it could upend the world-spanning supply chains which epitomise Asian economies. Above all, Mr Trump's trade nationalists hate it that, in their search for efficiency, savings and speed, American businesses have internationalised their operations over the past four decades. If the administration's belligerence on trade unsettles American firms and forces them to “onshore” production, Asia would be an early victim.

Yet some spy a silver lining. Led by China and Japan, Asian countries are at last opening to one another. They are striking bilateral trade deals among themselves, as well as with the European Union. And that begs a question: if the Trump administration succeeds in smashing existing supply-chains, why assume manufacturing will return to America? Might more links in the chain simply relocate within Asia instead? After all, as Japanese policymakers point out, America does not have a monopoly on tech. Reforming Vietnam, which is a member of the CPTPP and has eight bilateral free-trade agreements, including with the EU, has great allure as a production base. Recently President Joko Widodo of Indonesia, which does not typically make life easy for foreign investors, has been asking visitors whether there might be an upside for his country.

Even American multinationals are accountable to shareholders, not to Mr Trump. And America's 326m potential consumers, walled up behind trade

barriers, may not prove such an appealing market as Asia's nearly 4bn consumers at a time when dynamic Asian economies are opening to each other. It's an interesting time, as Ms Elms puts it, to experiment with resetting trade patterns. Not that anyone would wish an all-out trade war to be the occasion to experiment. ■



榕树

连锁反应

亚洲终于意识到贸易战的威胁

美国和中国正处于贸易战的边缘——这一点现在已经很难驳斥了。美国总统特朗普威胁要对从中国进口的4500亿美元产品征收更高的关税，其中第一批针对340亿美元商品的关税将在7月6日生效。特朗普希望中国退缩。但如果事与愿违呢？亚洲其他国家现在才开始问这个问题，因为它们意识到了危险有多大。

受全球供应链断裂影响最大的莫过于东亚和东南亚，因为它们正位于供应链的核心。中间产品平均占亚洲国家出口的一半以上，占其进口的五分之三以上。为政府和企业提供咨询的亚洲贸易中心（Asian Trade Centre）的德博拉·埃尔姆斯（Deborah Elms）认为，该地区整合程度很深，而这一点常常没有得到足够的重视。一个著名的例子是韩国的屏幕和台湾的芯片被运往中国，为美国的终端用户组装iPhone。类似的例子不计其数。埃尔姆斯说，许多亚洲公司甚至可能都没有意识到他们的产品最终会去向哪里。它们可能仍然没有意识到自己正面临迫在眉睫的贸易战的威胁。

在考虑后果方面，政治领导人似乎领先于本地企业。特朗普6月初在加拿大举行的一场火药味十足的G7峰会上猛烈抨击美国的传统盟友，终于使亚洲各地响起姗姗来迟的警报。从那时起，各国领导人纷纷迫不及待地展示自己致力于开放、基于规则的贸易秩序——如果需要的话，可以没有美国。

其中一个例子是全面与进步跨太平洋伙伴关系协定（CPTPP），这是一项涉及太平洋两岸11个国家的金标准自由贸易协定。特朗普于2017年初让美国退出了跨太平洋伙伴关系，CPTPP是其后续版，于今年3月签署，但其中一些成员那会儿似乎并不急于批准它。现在不一样了。加拿大、澳大利亚和日本都表示将加快进程。韩国被特朗普强迫重新谈判一项双边贸易协

定（该国同时也在担心它与美国的军事联盟的实力），看起来已经准备好了要加入CPTPP。

日本首相安倍晋三曾希望他能说服特朗普让美国重新参与该协议。结果特朗普一再羞辱他，尤其还拒绝为日本免除钢铁和铝关税，哪怕其他盟友已经获得暂缓。现在安倍正在修补与中国的关系。他还继续通过另一项区域动议来倡导多边主义。

本月1日，安倍接待了多国贸易部长，包括东南亚国家联盟（东盟）十国以及与东盟签署了双边自由贸易协定的周边国家：澳大利亚、中国、印度、日本、新西兰和韩国。围绕所谓区域全面经济伙伴关系协定

（RCEP）的谈判多年来一直只有龟速进展。但此次在东京举行的会议标志着一次加速，而且是第一次在东盟以外的地区举行的RCEP大型会议。

就严格程度而言，RCEP远远不如CPTPP。它包括被点名排除在TPP之外的中国，而美国前政府明确表示要将TPP设计成一个开放贸易模板，不会让它被中国可疑的承诺所削弱。RCEP在当时被视为最低水平的共识——是个毫无意义甚至适得其反的干扰。但今天，它的支持者称其是区域一体化迈出的有益一步。由于美国现在对开放贸易持敌对态度，对那些繁荣建立在商业上的国家来说，每一项此类举措都有新的价值。

中美贸易紧张局势造成的连带损害似乎不可避免。即使全面贸易战得以避免——中美任一方退缩——双方都不会回到迄今占主导的基于规则的贸易秩序。相反，达成的交易都会涉及某种被管控的贸易。这无疑比全面冲突要好。但它否定了这种秩序，并让贸易和投资转向。

如果贸易战全面爆发，它可能会颠覆遍布全球的供应链，而这些供应链是亚洲经济的缩影。最重要的是，特朗普的贸易民族主义者们憎恨它，因为过去40年里，美国企业在寻求效率、节约和速度的过程中让它们的运营国际化了。如果政府在贸易方面的好战让美国公司感到不安并迫使它们“在岸”生产，那么亚洲将是首当其冲的受害者。

然而有人还是看到了一线希望。在中国和日本的带领下，亚洲国家终于相

互开放。亚洲各国以及与欧盟之间都在达成一个个双边贸易协议。这就引出了一个问题：如果特朗普政府成功地粉碎了现有的供应链，为什么认定制造业就会重返美国呢？供应链中的更多环节会不会只是在亚洲内部重新定位呢？毕竟，正如日本的政策制定者指出的那样，美国并没有垄断技术。正在实行改革的越南是CPTPP的成员，签订了8项双边自由贸易协定（包括与欧盟），作为生产基地来说具有很大的吸引力。印度尼西亚通常不会让外国投资者日子很好过，但最近总统乔科·维多多（Joko Widodo）一直在问来访者，他的国家是否有什么优势。

即便是美国跨国公司也要对股东而不是特朗普负责。在充满活力的亚洲经济体相互开放的时代，被贸易壁垒包围的3.26亿美国潜在消费者的市场吸引力可能比不上亚洲的近40亿消费者。正如埃尔姆斯所说，这是一个尝试重新设定贸易模式的好时候。当然，并不是所有人都希望让全面贸易战成为实验的良机。 ■



Schumpeter

Raging against Beijing

Just how badly has USA Inc been treated by China?

ONE of the naughty secrets about America's trade war with China is that it has the tacit support of much of America's business establishment. For the past 20 years big firms' default mode has been Sino-infatuation. Schumpeter attended a dinner in 2016 between the captains of USA Inc and Li Keqiang, China's premier, and you could taste the deference in the air more keenly than the beef on the plates. But lately bosses' mood has flipped into a hostility that risks becoming jingoistic and unhelpful.

While a few Sino-dependent companies such as Apple and Boeing want to lower the temperature, many others consider themselves mistreated by China; for them, it is payback time. This stance has two flaws. The sense of victimhood is over the top; American firms have done reasonably well in China. And it is stoking the White House to escalate a conflict that may spill over from trade tariffs into a war over investment by multinationals.

China may have been bad for steel workers in Cleveland but the calculation for companies is different. Globalised production has lowered labour costs. Since China's entry into the World Trade Organisation in 2001, profit margins in America have been 22% above their 50-year trend. And companies engage not just in trade, but in cross-border investment too.

It is this investment that riles American firms. China originally promised to open up its vast market, bosses complain, but today it bars companies from some industries and forces them into joint ventures with partners that steal their intellectual property. Chinese firms get cheap state loans. The "Made in China 2025" plan envisions that foreign firms are excluded from

new areas such as artificial intelligence. The overall result, bosses grumble, is that American firms are puny in China, making 4% of their global sales there. Champions such as Amazon and Goldman Sachs have either flopped or been largely excluded. Only perhaps a dozen companies make over \$1bn of profits a year from China, including General Motors and a few tech-hardware stars.

Such complaints are valid, but the picture is lopsided. Most bosses love China's state-run model when it involves them getting privileged access to its omnipotent leaders. Other big countries have infuriating investment curbs, both explicit and tacit, including India and France. The transfer of know-how from rich countries to poorer ones, by hook or crook, is an integral part of economic development. Firms often fail abroad—there is no God-given right to triumph. And few bosses bother to calibrate their China problem. They should ask themselves how big their business in China ought to be—or, what would “fair” look like?

Schumpeter has considered four measures of Chinese corporate unfairness, using data from Morgan Stanley and Bloomberg. The first is the weight of China in the foreign sales that American firms bring in. It stands at 15%; if it was in line with China's share of world GDP, it would be 20%. This shortfall amounts to a small 1% of American firms' global sales (both foreign and domestic). America Inc is similarly underweight in the rest of Asia, but there is much less fighting talk about South Korea or Japan.

The second test is whether there is parity in the commercial relationship. Firms based in China make sales to America almost exclusively through goods exports, which were worth \$506bn last year. American companies make their sales to China both through exports and through their subsidiaries there, which together delivered about \$450bn-500bn in revenue. Again, there is not much of a gap. American firms' aggregate market share in China, of 6%, is almost double Chinese firms' share in

America, based on the sales of all listed firms.

The third yardstick is whether American firms underperform other multinationals and local firms. In some cases failure is not China-specific. Walmart has had a tough time in China, but has also struggled in Brazil and Britain. Uber sold out to a competitor in China, but has done the same in South-East Asia. American consumer and industrial blue chips are typically of a similar scale in China to their nearest rivals. Thus the sales of Boeing and Airbus, Nike and Adidas, and General Electric and Siemens are all broadly in line with each other. Where America has a comparative advantage—tech—it leads. Over half of USA Inc's sales in China are from tech firms, led by Apple, Intel and Qualcomm. Overall, American firms outperform. For the top 50 that reveal data, sales in China have risen at a compound annual rate of 12% since 2012. That is higher than local firms (9%) and European ones (5%).

The final measure is whether American firms are shut out of some sectors. This is important as China shifts towards services and as the smartphone market, a goldmine, matures. The answer is clearly “yes”. Alphabet, Facebook and Netflix are nowhere, and Wall Street firms are all but excluded from the mainland. Chinese firms, however, can make a similar complaint. The market share of all foreign firms in Silicon Valley's software and internet activities, and on Wall Street, is probably below 20%. America's national-security rules, thickets of regulation, lobbying culture and political climate make it inconceivable that a Chinese firm could play a big role in the internet or in finance there.

Far-sighted bosses know their stance on China must reflect a balanced assessment, not a delusional vision of globalisation in which anything less than a triumph is considered a travesty. But their voices are being drowned out. The shift of the business establishment to hawkishness on China has probably emboldened the White House and also led the Treasury and

Department of Commerce to be more combative. Most big firms are blasé about tariffs; they can pass on the cost to clients. Few export lots to China. But soon China will run out of American imports to subject to retaliatory tariffs; in a tit-for-tar war, beating up American firms' Chinese subsidiaries is a logical next step. USA Inc's Sino-strop would then end up enabling the opposite of what it wants. ■



熊彼特

怒火攻京

中国到底怎么虐待了美国的公司？

美中贸易战背后肮脏的秘密之一，是它其实得到了美国大部分商业机构的默许。过去20年里，美国大企业一贯是“中国迷”。2016年，本专栏作者参加了美国商业领袖和中国总理李克强的交流晚宴，在空气中闻到的毕恭毕敬的味道比盘子里的牛肉味还要浓烈。但最近，老板们的情绪转变成了一种强烈的敌意，这种敌意可能会发展成一种无益的极端民族主义。

尽管有少数依赖中国的企业——比如苹果和波音——想给这种怒火降温，但还有其他许多企业认为自己遭受了中国不公正的对待，现在到了算账的时候。这种立场存在两点谬误：过于夸张的受害者心理——实际上美国企业在华的日子一直还挺不错；而且它在刺激白宫把冲突进一步升级，可能会把关税纠纷发展成一场打击跨国公司投资的战争。

中国可能确实损害了克利夫兰那些钢铁工人的利益，但企业该算的是另一笔帐。全球化生产降低了劳动力成本。自2001年中国加入世贸组织以来，美国的利润率已经比其50年趋势高了22%。而且企业不仅从事贸易，也开展跨境投资。

正是这类投资让美国老板们生气。他们抱怨说，中国原先承诺向他们开放广阔的国内市场，如今却禁止他们进入某些行业，又迫使他们与中国公司建立合资企业，以此窃取他们的知识产权。中国企业还有廉价的国家贷款支持。根据“中国制造2025”计划，外国公司将会被排除在人工智能等新兴领域之外。老板们不满地说，总体的结果是美国公司在中国很不起眼，在华销售额只贡献了全球销售额的4%。像亚马逊和高盛这样的行业巨头要么是吃了败仗，要么是基本上被排除在外。只有大概十几家公司每年从中国赚到的利润超过10亿美元，包括通用汽车和少数科技硬件明星企业。

这种抱怨没错，但失之片面。在享受着接近无所不能的中国领导人这种特

权时，大多数老板倒是都很喜欢中国的国有模式。其他一些大国明文设定或隐秘操作的投资门槛简直气死人，比如印度和法国。无论用什么手段，专有技术从富国转移到穷国都是经济发展必不可少的一部分。企业在国外打败仗是常事——它们有什么天赋特权非得成功呢？但少有老板愿意花时间来校正自己的“中国问题”。他们该问问自己，在中国的业务应该发展到多大？或者，怎样才算“公平”？

本专栏使用摩根士丹利和彭博社的数据，从四个方面考察中国是否真的不公平对待企业。首先是中国在美国公司的海外销售中所占的比重。它目前贡献了15%。如果要和中国在全球GDP中的占比一致，那么这个数字应该是20%。这一缺口仅相当于美国公司全球销售额（包括国内和国外）的1%。亚洲其他地区对美国公司海外销售的贡献也有着同样程度的不足，但眼下对韩国或日本的挑战言论却要少得多。

第二项测试是商业关系是否对等。总部位于中国的公司几乎完全通过商品出口来实现对美销售，去年出口额达5060亿美元。美国公司通过出口及其在中国的子公司来对华销售，共实现了4500亿至5000亿美元左右的收入。在这个环节，两者的差距仍然不大。根据所有上市公司的销售情况，美国公司在中国拥有的总市场份额为6%，几乎是中国公司在美市场份额的两倍。

第三个衡量标准是美国公司的业绩是否不如其他跨国公司和本地公司。在某些案例中，在中国的失败并非特例。沃尔玛在中国举步维艰，但在巴西和英国也同样如此。优步把中国的业务卖给了本地竞争对手，在东南亚也一样。美国的消费品和工业蓝筹股在中国的规模通常都与自己最大的竞争对手差不多。波音和空客、耐克和阿迪达斯、通用电气和西门子的销售额基本都不相上下。而在美国有比较优势的领域——科技——它则一马当先。美国公司在中国的销售额有超过一半来自于由苹果、英特尔和高通领头的科技公司。整体而言，美国公司的表现更胜一筹。比对已公开数据的前50名企业，自2012年以来美国企业在华销售额的复合年增长率为12%，高于本地企业（9%）和欧洲企业（5%）。

最后一项标准是美国公司是否被某些行业拒之门外。随着中国经济向服务业转移、智能手机市场这个金矿逐渐成熟饱和，这一点非常重要。答案很明确：“是”。Alphabet、Facebook和Netflix踪影难觅，而华尔街的公司几乎也都被排除在中国大陆之外。然而，中国公司同样可以表达类似的不满。外国公司在硅谷的软件和互联网业务以及华尔街所占的市场份额总共可能不到20%。美国的国家安全法规、错综复杂的监管、游说文化和政治气候，使得中国公司不可能在美国的互联网或金融领域扮演重大的角色。

有远见的老板都知道，他们对中国的立场必须基于一种平衡的评估，而不是对全球化的一种妄想——只要够不上胜利就等于受嘲弄。但他们的声音被淹没了。商业机构对中国的立场转强硬可能给白宫壮了胆，也让财政部和商务部更加斗志昂扬。大多数大公司都对关税见惯不惊，反正它们可以将成本转嫁给客户，而且很少有企业大量出口产品到中国。但中国很快就会没有更多美国进口额可以征收报复性关税了，而在一场以牙还牙的战争中，打击美国公司在中国的子公司将是合乎逻辑的下一步。届时，美国公司的“对华之怒”可能会搬石头砸了自己的脚。 ■



Economic and financial indicators

Economic outlook

The Economist's latest poll of forecasters, July



经济与金融指标

经济前景

《经济学人》7月对各家预测机构的最新调查



The future of tech startups

Into the danger zone

Big, rich and paranoid, today's tech giants are making life complicated for startups

IT IS a classic startup story, but with a twist. Three 20-somethings launched a firm out of a dorm room at the Massachusetts Institute of Technology in 2016, with the goal of using algorithms to predict the reply to an e-mail. In May they were fundraising for their startup, EasyEmail, when Google held its annual conference for software developers and announced a tool similar to EasyEmail's. Filip Twarowski, its boss, sees Google's incursion as "incredible confirmation" they are working on something worthwhile. But he also admits that it came as "a little bit of a shock". The giant has scared off at least one prospective backer of EasyEmail, because venture capitalists try to dodge spaces where the tech giants might step.

The behemoths' annual conferences, held to announce new tools, features, and acquisitions, always "send shock waves of fear through entrepreneurs", says Mike Driscoll, a partner at Data Collective, an investment firm. "Venture capitalists attend to see which of their companies are going to get killed next." But anxiety about the tech giants on the part of startups and their investors goes much deeper than such events. Venture capitalists, such as Albert Wenger of Union Square Ventures, who was an early investor in Twitter, now talk of a "kill-zone" around the giants. Once a young firm enters, it can be extremely difficult to survive. Tech giants try to squash startups by copying them, or they pay to scoop them up early to eliminate a threat.

The idea of a kill-zone may bring to mind Microsoft's long reign in the 1990s, as it embraced a strategy of "embrace, extend and extinguish" and tried to intimidate startups from entering its domain. But entrepreneurs'

and venture capitalists' concerns are striking because for a long while afterwards, startups had free rein. In 2014 *The Economist* likened the proliferation of startups to the Cambrian explosion: software made running a startup cheaper than ever and opportunities seemed abundant.

Today, less so. Anything having to do with the consumer internet is perceived as dangerous, because of the dominance of Amazon, Facebook and Google (owned by Alphabet). Venture capitalists are wary of backing startups in online search, social media, mobile and e-commerce. It has become harder for startups to secure a first financing round. According to Pitchbook, a research company, in 2017 the number of these rounds were down by around 22% from 2012 (see chart).

The wariness comes from seeing what happens to startups when they enter the kill-zone, either deliberately or accidentally. Snap is the most prominent example; after Snap rebuffed Facebook's attempts to buy the firm in 2013, for \$3bn, Facebook cloned many of its successful features and has put a damper on its growth. A less known example is Life on Air, which launched Meerkat, a live video-streaming app, in 2015. It was obliterated when Twitter acquired and promoted a competing app, Periscope. Life on Air shut Meerkat down and launched a different app, called Houseparty, which offered group video chats. This briefly gained prominence, but was then copied by Facebook, seizing users and attention away from the startup.

The kill-zone operates in business software ("enterprise" in the lingo) as well, with the shadows of Microsoft, Amazon and Alphabet looming large. Amazon's cloud service, Amazon Web Services (AWS), has labelled many startups as "partners", only to copy their functionality and offer them as a cheap or free service. A giant pushing into a startup's territory, while controlling the platform that startup depends on for distribution, makes life tricky. For example, Elastic, a data-management firm, lost sales after AWS

launched a competitor, Elasticsearch, in 2015.

Even if giants do not copy startups outright, they can dent their prospects. Last year Amazon bought Whole Foods Market, a grocer, for \$13.7bn. Blue Apron, a meal-delivery startup that was preparing to go public, was suddenly perceived as unappetising, as expectations mounted that Amazon would push into the space. This phenomenon is not limited to young firms: recently Facebook announced it was moving into online dating, causing the share price of Match Group, which went public in 2015, to plummet by 22% that day.

It has never been easy to make it as a startup. Now the army of fearsome technology giants is larger, and operates in a wider range of areas, including online search, social media, digital advertising, virtual reality, messaging and communications, smartphones and home speakers, cloud computing, smart software, e-commerce and more. This makes it challenging for startups to find space to break through and avoid being stamped on. Today's giants are "much more ruthless and introspective. They will eat their own children to live another day," according to Matt Ocko, a venture capitalist with Data Collective. And they are constantly scanning the horizon for incipient threats. Startups used to be able to have several years' head start working on something novel without the giants noticing, says Aaron Levie of Box, a cloud and file-sharing service that has avoided the kill-zone (it has a market value of around \$3.8bn). But today startups can only get a six- to 12-month lead before incumbents quickly catch up, he says.

There are some exceptions. Airbnb, Uber, Slack and other "unicorns" have faced down competition from incumbents. But they are few in number and many startups have learned to set their sights on more achievable aims. Entrepreneurs are "thinking much earlier about which consolidator is going to buy them", says Larry Chu of Goodwin Proctor, a law firm. The tech giants have been avid acquirers: Alphabet, Amazon, Apple, Facebook and Microsoft

spent a combined \$31.6bn on acquisitions in 2017. This has led some startups to be less ambitious. “Ninety per cent of the startups I see are built for sale, not for scale,” says Ajay Royan of Mithril Capital, which invests in tech.

This can be enriching to founders, who can go on to start another firm or provide financing to peers with smart ideas. To the extent that such exits provide more capital to spur innovation, this is no bad thing. The tech giants can help the firms they acquire grow more than they might have been able to do on their own. For example, Facebook’s acquisition of Instagram took out a would-be competitor, but it has thrived under the social-networking giant’s sway by adopting the technical infrastructure, staff and know-how that Facebook had in place.

But plenty of people in the Valley reckon the bad outweighs the good and that early, “shoot-out” acquisitions have sapped innovation. “The dominance of the big platforms has had a meaningful effect on the entrepreneurial culture of Silicon Valley,” says Roger McNamee of Elevation Partners, a private-equity firm, who was an early investor in Facebook. “It’s shifted the incentives from trying to create a large platform to creating a small morsel that’s tasty to be acquired by one of the giants.”

And when startups are bullied into selling, as some are, it is even more worrying. Big tech firms have been known to intimidate startups into agreeing to a sale, saying that they will launch a competing service and put the startup out of business unless they agree to a deal, says one person who was in charge of these negotiations at a big software firm (which uses such tactics).

There are three reasons to think that the kill-zone is likely to stay. First, the giants have tons of data to identify emerging rivals faster than ever before. Google collects signals about how internet users are spending time

and money through its Chrome browser, e-mail service, Android operating system, app store, cloud service and more. Facebook can see which apps people use and where they travel online. It acquired the app Onavo, which helped it recognise that Instagram was gaining steam. It bought the young firm for \$1bn before it could mature into a real threat, and last year it purchased a nascent social-polling firm, tbh, in a similar manner. Amazon can glean reams of data from its e-commerce platform and cloud business.

Another source of market information comes from investing in startups, which helps tech firms gain insights into new markets and possible disrupters. Of all American tech firms, Alphabet has been the most active. Since 2013 it has spent \$12.6bn investing in 308 startups. Startups generally feel excited about gaining expertise from such a successful firm, but some may rue the day they accepted funding, because of conflicts. Uber, for example, took money from one of Alphabet's venture-capital funds, but soon found itself competing against the giant's self-driving car unit, Waymo. Thumbtack, a marketplace for skilled workers, also accepted money from Alphabet, but then watched as the parent company rolled out a competing service, Google Home Services. Amazon and Apple invest less in startups, but they too have clashed with them. Amazon invested in a home intercom system, called Nucleus, and then rolled out a very similar product of its own last year.

Recruiting is a second tool the giants will use to enforce their kill zones. Big tech firms are able to shell out huge sums to keep top performers and even average employees in their fold and make it uneconomical for their workers to consider joining startups. In 2017 Alphabet, Amazon, Apple, Facebook and Microsoft allocated a combined a whopping \$23.7bn to stock-based compensation. Big companies' hoarding of talent stops startups scaling quickly. According to Mike Volpi of Index Ventures, a venture-capital firm, startups in the firm's portfolio are currently 10-20% behind in their hiring goals for the year.

A third reason that startups may struggle to break through is that there is no sign of a new platform emerging which could disrupt the incumbents, even more than a decade after the rise of mobile. For example, the rise of mobile wounded Microsoft, which was dominant on personal computers, and gave power to both Facebook and Google, enabling them to capture more online ad dollars and attention. But there is no big new platform today. And the giants make it extremely expensive to get attention: Facebook, Google and Amazon all charge a hefty toll for new apps and services to get in front of consumers.

Seeing little opportunity to compete with the tech giants on their own turf, investors and startups are going where they can spot an opening. The lack of an incumbent giant is one reason why there is so much investor enthusiasm for crypto-currencies and for synthetic biology today. But the giants are starting to pay more attention. There are rumours Facebook wants to buy Coinbase, a cryptocurrency firm.

Regulators will be watching what the giants try next. Criticism that they have been too lax in approving deals where tech firms buy tiny competitors that could one day challenge them has been mounting. Facebook's acquisition of Instagram and Google's purchase of YouTube, before it was obvious how the pair might have taken on the giants, might well have been blocked today. To fight back against the kill-zone, regulators must closely consider what weapons to wield themselves. ■



科技创业公司前景

进入危险地带

当今科技巨头财雄势大，偏执多疑，让创业公司日子难过

这是一个典型的创业故事，但有一个意外的转折。2016年，三个20来岁的年轻人在麻省理工学院的宿舍里创办了一家公司，目标是运用算法来预测对电子邮件的回复。当年5月，正当他们在为这家公司EasyEmail融资之时，谷歌召开了年度软件开发者大会并发布了一款与EasyEmail类似的工具。EasyEmail的老板菲利普·得瓦洛夫斯基（Filip Twarowski）认为谷歌的闯入“极好地证明了”自己做的事很有价值。但他也承认事情来得“有点冲击”。谷歌已经吓跑了EasyEmail的至少一个潜在投资方，因为风投家们都竭力避开科技巨头可能涉足的领域。

投资公司Data Collective的合伙人迈克·德里斯科尔（Mike Driscoll）表示，巨头们发布新工具、功能和收购信息的年度大会向来“是震慑创业者的冲击波”。“风险资本家参加这些大会，为的是了解自己投资的公司有哪些将被干掉。”但创业公司和投资者对科技巨头的担忧远不止于这些大会。联合广场风险投资公司（Union Square Ventures，推特的早期投资者）的阿尔伯特·温格（Albert Wenger）等风投家现在谈论的是巨头周围的“绞杀地带”。年轻公司一旦进入，可能极难存活。科技巨头会抄袭这些创业公司，然后击垮它们，或者把它们收入囊中，提前扫除威胁。

“绞杀地带”的说法可能会让人想起微软在上世纪90年代长期称霸的那段历史，当时它采取“拥抱、扩展和消灭”的策略，同时力图阻吓创业公司涉足自己的领域。但如今创业者和风投家的忧虑有些让人诧异，因为在微软结束统治后的很长一段时间里，创业公司拥有了充分的自由发展空间。2014年，《经济学人》把创业公司的激增比作寒武纪的生命大爆发，软件降低了运营创业公司的成本，商机似乎层出不穷。

如今则不尽如此。由于亚马逊，Facebook和谷歌（母公司为Alphabet）的

霸主地位，任何与消费互联网有关的业务都被视为危险地带。风投家对网络搜索、社交媒体、移动和电子商务领域的创业公司态度谨慎。创业公司已经更难获得首轮融资了。根据研究公司Pitchbook的数据，2017年首轮融资数量比2012年减少了约22%（见图表）。

这种谨慎是因为他们曾目睹创业公司有意无意进入绞杀地带后的命运。一个最突出的例子是Snap：2013年Snap拒绝了Facebook30亿美元的收购，之后Facebook克隆了Snap的许多热门功能，打压了它的发展。一个不那么为人所知的例子是Life on Air，该公司在2015年推出了视频直播应用Meerkat。之后推特收购了Meerkat的对手Periscope并大加推广，Meerkat就此被挤掉。Life on Air关闭了Meerkat并推出另一款名为Houseparty的应用，提供群组视频聊天功能，风头一时无两，但之后又被Facebook复制，夺走了这家创业公司的用户和关注度。

商业软件（行话叫“企业版”）也是绞杀地带，笼罩在微软、亚马逊和Alphabet的巨大阴影之下。亚马逊的云服务Amazon Web Services（以下简称AWS）把许多创业公司标为“合作伙伴”，但却复制其功能并廉价或免费提供给客户使用。巨头闯入创业公司的领地，同时又控制着这些公司赖以分销业务的平台，令其生存维艰。例如，AWS在2015年推出与数据管理公司Elastic竞争的产品Elasticsearch，导致Elastic销售锐减。

巨头即使不直接模仿创业公司，也会损害这些小公司的发展前景。去年，亚马逊以137亿美元收购了食品杂货商全食超市（Whole Foods Market）。原本准备上市的送餐创业公司蓝围裙（Blue Apron）突然被认为缺乏吸引力，因为市场对亚马逊将进军此领域的预期上升。这种现象不仅限于年轻公司：最近Facebook宣布正在开拓网上约会市场，这导致2015年上市的交友平台Match Group当天股价暴跌22%。

创业公司要成功从来不易。现在，可怕的科技巨头大军规模更大，经营领域也更广，涵盖在线搜索、社交媒体、数字广告、虚拟现实、信息及通信、智能手机和智能家庭音箱、云计算、智能软件、电子商务等等。创业

公司难以寻得突破口并避免被巨头碾压。今天的巨头企业“更无情也更会自省。为多活一天，它们可是虎毒也食子”，Data Collective的风投家麦特·奥科（Matt Ocko）说。同时，它们眼观六路，时刻提防萌芽中的威胁。云计算及文件共享服务商Box成功避开了绞杀地带，目前市值约为38亿美元，其CEO亚伦·列维（Aaron Levie）说，以往创业公司可领先好几年开发新产品而不为巨头注意。但是现在的创业公司只有6到12个月的领先期，随后既有企业便会迅速赶上。

也有一些例外。爱彼迎、优步、Slack和其他“独角兽”都在竞争中击败了既有企业。但这样的例子为数不多，许多创业公司已学会把目光放在更现实的目标上。高赢律师事务所（Goodwin Proctor）的拉里·朱（Larry Chu，音译）表示，现在的创业者“老早就开始考虑哪个整合者会收购自己”。科技巨头一直是狂热的收购者：2017年，Alphabet、亚马逊、苹果、Facebook和微软共计斥资316亿美元收购其他公司。这使得一些创业公司不再那么雄心勃勃。“我见过的创业公司中有90%在成立时都想着将来被收购，而不是发展壮大。”科技投资公司秘银资本（Mithril Capital）的阿贾伊·罗恩（Ajay Royan）说。

创始人可以借此发家，转而创办另一家公司，或者为有好想法的同行提供资金。只要这种退出能带来更多资金刺激创新，就不是坏事。科技巨头可以帮助所收购公司更快成长。举例来说，Facebook收购Instagram的确去除了一个潜在竞争对手，但Instagram通过采用Facebook的技术基础设施、员工和经验，在这个社交网络巨头的控制下取得了蓬勃发展。

但许多硅谷人士认为这弊大于利，早期的“狙击式”收购削弱了创新。“大平台的统治对硅谷的创业文化产生了深远影响。”Facebook的早期投资者、私募股权公司高地风险投资（Elevation Partners）的罗杰·麦克纳米（Roger McNamee）说。“这让动机发生了改变，大家从原来争相打造大平台变成只想创建特色小公司，能够吸引某个巨头收购就好。”

而如果创业公司是被迫出售（有些的确如此），情况就更令人担忧了。众所周知，有些大型科技公司胁迫创业公司同意出售，它们声称，如果对方

拒绝收购，自己将推出同类服务来抢夺市场，把它们挤垮，一位在一家（使用这种策略的）大型软件公司负责这类谈判的人士表示。

绞杀地带可能会一直存在，有三个原因。首先，巨头们拥有大量数据，能以前所未有的速度发现新生对手。谷歌通过其Chrome浏览器、电子邮件服务、安卓操作系统、应用商店、云服务等收集信号，了解互联网用户如何在网上花费时间和金钱。Facebook可以看到人们使用的应用和在网络上的足迹。Facebook先是收购了应用Onavo，这帮助它发现了Instagram的大热势头，随后它以十亿美元的价格收购了Instagram，避免了这家年轻的公司壮大成为真正的威胁。去年Facebook又以类似的方式收购了一家新兴的社交投票公司tbh。亚马逊则可从其电子商务平台和云业务中搜集大量数据。

市场信息的另一个来源是投资创业公司，这有助于科技公司深入了解新市场和潜在颠覆者。在所有美国科技公司中，Alphabet在这方面一直最活跃。自2013年以来，它已向308家创业公司投资了总共126亿美元。创业公司通常乐于从这么成功的企业获取专门知识和技术，但有些公司可能会后悔当初接受了投资，因为出现了利益冲突。例如，优步从Alphabet的一只风险投资基金获得了融资，但随即发现自己面临该巨头旗下的无人驾驶汽车公司Waymo的竞争。专业技工服务交易平台Thumbtack也接受了Alphabet的投资，但随后就眼看着母公司推出了与之竞争的“谷歌家庭服务”（Google Home Services）。亚马逊和苹果较少投资创业公司，但也会和它们发生冲突。亚马逊投资了一个名为Nucleus的家用对讲系统，然后又在去年推出了一款非常相似的产品。

招募人才是巨头们用来巩固绞杀地带的第二种工具。大型科技公司能砸重金留住最优秀的员工乃至普通员工，令跳槽创业公司显得并不合算。2017年，Alphabet、亚马逊、苹果、Facebook和微软对员工的股权激励支出合计高达237亿美元。大公司囤积人才，阻碍了创业公司迅速扩张。据风险投资公司Index Ventures的迈克·沃尔皮（Mike Volpi）称，该公司投资的创业公司目前的招聘进度比今年的预定目标落后10%至20%。

创业公司可能难以突破的第三个原因是，即便移动网络已崛起十多年，仍没迹象表明有能颠覆既有势力的新平台出现。比如说，移动网络的崛起打击了个人电脑领域的霸主微软，而赋予了Facebook和谷歌影响力，使它们得以获取更多在线广告收入及关注。但今天并没有新的大平台。而巨头们令获取关注的成本变得极为高昂：新应用和服务要通过Facebook、谷歌、亚马逊向消费者展示，必须向这些巨头支付巨额费用。

眼见在巨头的地盘上和它们较量的机会渺茫，投资者和创业公司开始转向能发掘机遇的新领域。目前加密货币和合成生物学领域的投资热情如此高涨，原因之一就是这里仍未有巨头称霸。但大公司已开始加大关注。传言Facebook打算收购加密货币公司Coinbase。

监管机构将紧盯巨头们的下一步行动。在科技公司对小型潜在对手的收购案上，认为监管机构的审批过于宽松的批评声音已经不断加大。Facebook和谷歌在威胁明朗化之前就先发制人地分别买下了Instagram和YouTube，换在今天很可能被阻止。要对付绞杀地带，监管机构必须仔细考虑自己该使用什么武器。 ■



Entrepreneurship in Germany

Taking off

Germany's startup system is opening a new chapter in technology innovation

At a rooftop bar in Berlin on May 29th, the glitterati of Germany's startup scene toasted a new arrival. Silicon Valley Bank, a commercial lender which counts as customers half of American startups that went public in 2017, has just opened an office in the country. "They are doing unique, cool things here," gushed Greg Becker, the bank's boss. One of his first German clients is Lilium Aviation, whose electric flying taxis have mastered the tricky combination of a drone-like vertical take-off and forward jet propulsion.

Silicon Valley Bank arrives as a new breed of German startups is gaining altitude. At first e-commerce firms dominated the scene, often by copying ideas from abroad. Rocket Internet, an early success, went further, cloning American e-commerce models in other countries, too. Rocket and Zalando, a fashion e-tailer, did initial public offerings in 2014. After that only two big stockmarket debuts followed, of HelloFresh (which sells meal-kits) and Delivery Hero (a food-delivery firm), both in 2017.

The latest crop have in common an emphasis on science and manufacturing, Germany's historical strengths. These younger startups are developing technologies that address areas such as health care, finance and transport. As would be expected in a decentralised economy, Berlin is gradually ceding ground as the hub of the startup scene. At UnternehmerTUM, an incubator just outside Munich, for example, a hangar-sized workshop is buzzing with 3D printers, welding stations and a gigantic metal-cutting machine. It is attached to the Technical University of Munich (TUM) but owned by Susanne Klatten, heiress to an industrial fortune.

Its boss, Helmut Schönenberger, lists some of the stars born there in the past five years. One is Lilium. Another is NavVis, which makes 3D maps of indoor spaces. Konux, another young firm, makes artificial-intelligence sensors that predict when and where railway-track repairs are due.

Such firms are off most people's radar. "You'll not hear about many of them," says Peter Lennartz of EY, a consultancy. Unlike e-commerce firms, startups that make business-to-business products, such as measurement systems, are bound to be less visible. But they are becoming increasingly popular with investors.

Although e-commerce startups still draw the lion's share of financing, that is largely because they are more mature. The three biggest venture-capital rounds in 2017, all in e-commerce, accounted for almost a quarter of the total amount invested in Germany last year. But the number of funding rounds in e-commerce fell by 34% between 2015 and 2017 (see chart). For startups in health care the figure more than doubled; in mobility it increased fourfold.

This shift reflects the emergence of new firms in industry hubs such as Frankfurt, Germany's financial centre; Hamburg, which has a cluster of logistics firms; and Munich, home to firms such as BMW, Airbus and Siemens. In 2014-16, Hamburg had 253 new business founders per 10,000 working people annually, compared with 238 in Berlin. The capital remains the centre for entrepreneurs in e-commerce and entertainment; but the number of funding rounds for startups in Berlin increased by 14% between 2015 and 2017, compared with 33% for those elsewhere.

Wherever they are based, funding rounds at all stages of a firm's life are becoming bigger and easier. For a young company with a strong product, team and global ambitions, raising money has never been easier, says Julian

Riedlbauer of GP Bullhound, a tech advisory firm in Berlin. In 2017 investors poured €4.3bn (\$4.8bn) into German startups, 53% more than the average in 2015-16. KfW, the federal development bank and one of the biggest startup financiers, is about to launch a subsidiary that will invest €2bn in early-growth firms in the next decade.

Firms have better access to talent as well as to money. Entrepreneurship programmes at technical universities are proliferating. And according to Dietmar Harhoff of the Max Planck Institute for Innovation and Competition, a think-tank, experienced managers are more willing to join startups. Lilium, for example, poached senior staff from Airbus and Tesla when it was a fledgling with just \$10m of backing. For entrepreneurs there seem likely to be further occasions for parties. ■



创业在德国

起飞

德国的创业圈正在开启技术创新的新篇章

德国创业圈的名流5月29日齐聚柏林的一家屋顶酒吧，举杯庆祝一位新成员的到来——硅谷银行（Silicon Valley Bank）。这家商业银行刚刚在德国开设了办事处。2017年上市的美国创业公司中，有一半都是它的客户。老板格雷格·贝克尔（Greg Becker）不吝溢美之词：“这里的人做的事情很酷很独特。”他的第一批德国客户中有百合航空（Lilium Aviation），该公司的电动空中的士已经攻克了一个难题：既能像无人机那样垂直起飞，又能向前喷气推进。

硅谷银行到来之时，正值德国新一类创业公司起飞之际。最初这里的创业公司主要是电子商务公司，它们往往照搬国外的创意。早期的成功企业火箭互联网（Rocket Internet）更进一步，在其他国家也克隆了美国的电子商务模式。该公司和时装电商Zalando在2014年上市。自那以后，只在2017年有两家大规模的创业公司上市，分别是食材配送公司HelloFresh和外卖平台Delivery Hero。

最新一拨创业公司的共通之处是偏重科技和制造，而这两点正是德国的传统优势所在。这些更年轻的创业公司正在开发新技术以解决医疗、金融和交通等领域的问题。柏林正逐渐丧失创业中心的地位，这在一个去中心化的经济体中并不令人意外。例如在慕尼黑近郊就有一个名为UnternehmerTUM的孵化器。它有一个和飞机机库一般大小的车间，3D打印机、焊接站和一台巨大的金属切削机床在其中嗡嗡作响。它隶属于慕尼黑工业大学（TUM），但其所有人是继承了大笔工业财富的苏珊娜·克拉滕（Susanne Klatten）。

老板赫尔穆特·舒恩博格（Helmut Schönenberger）列举了过去五年在这个孵化器里诞生的一些明星企业。一家是百合航空，一家是制作室内空间

3D地图的NavVis。还有一家年轻的企业Konux制造的人工智能传感器能够预测铁轨何时以及在什么位置需要维修。

大多数人都不会注意到这类公司。咨询公司安永的彼得·伦纳茨（Peter Lennartz）说：“其中有许多你都不会听说过。”与电子商务企业不同，生产测量系统等商用产品的创业公司势必不那么引人注目，但它们却越来越受到投资者的青睐。

虽然电子商务类创业公司仍然吸引了大部分投资，但这主要是因为它们处于更成熟的阶段。去年三轮最大规模的风险投资都投向了电子商务，几乎占了当年在德国投资总额的四分之一。但这类公司的融资次数在2015年至2017年间下降了34%（见图表），而医疗类创业公司的融资次数增加了一倍多，出行类创业公司的则翻了两番。

这一转变反映出德国新企业在一些产业中心的崛起，如金融中心法兰克福、物流公司扎堆的汉堡，以及宝马、空客和西门子等大公司云集的慕尼黑。2014年至2016年，汉堡每年每万名工作人口中有253人创建了新企业，在柏林是238人。首都柏林仍然是电子商务和娱乐产业创业者汇聚的中心，但柏林创业公司的融资次数在2015年至2017年期间仅增加了14%，其他城市则增加了33%。

无论企业在何处创办，它们在各个发展阶段的融资都变得愈发容易，规模也更大。柏林一家科技咨询公司GP Bullhound的朱利安·里德鲍尔（Julian Riedlbauer）说，对于拥有强大产品、团队和全球野心的年轻企业来说，融资从未如此简单。2017年，投资者向德国创业公司注资43亿欧元（48亿美元），比2015至2016年的平均水平高出53%。联邦开发银行德国复兴信贷银行（KfW）是最大的创业投资机构之一，它即将开设一家子公司，在未来十年将向早期成长阶段的公司投资20亿欧元。

除了资金，企业在获得人才方面也变得更容易。理工科大学的创业项目在激增。此外，智库马克斯·普朗克创新与竞争研究所（Max Planck Institute for Innovation and Competition）的迪特马尔·哈霍夫（Dietmar

Harhoff) 认为，经验丰富的管理者加入创业公司的意愿变强了。例如，百合航空在羽翼未丰、仅有1000万美元投资的时候就从空客和特斯拉挖走了资深员工。看来，对于企业家来说，未来会有更多机会开派对了。 ■



University admissions

Affirmative dissatisfaction

A lawsuit reveals how peculiar Harvard's definition of merit is

ABBOTT LAWRENCE LOWELL, the president of Harvard from 1909 until 1933, thought the university had too many Jews. In the first year of Lowell's presidency, they made up 10% of the student body. By 1922 their numbers had more than doubled. To address what he called "the Hebrew problem", Lowell proposed an explicit Jewish quota of 15%. When that proved controversial, he set about making "a rule whose motive was less obvious on its face" to deny admission to students suspected of being Jewish. Admission to Harvard, previously granted by meeting a clear academic cut-off, became more nebulous—based more heavily on the "character and fitness" of applicants. The new "holistic" admissions policy worked as intended, successfully suppressing Jewish admissions.

Harvard, like many of America's top universities, retains a holistic admissions process. Unlike elite universities in most other countries, American colleges do not simply select the cleverest pupils—they also take into account extracurricular activities, family wealth and race. To critics, this system still operates as an engine of unfairness, except that the victims have now become Asian-Americans, who outperform their white peers on academic measures but still face stiffer odds when applying to Ivy League colleges. Students for Fair Admissions (SFFA), an organisation founded by Edward Blum, a conservative activist opposed to race-based affirmative action, filed a lawsuit against Harvard alleging discrimination against Asian-American students in 2014. Despite a furious effort to quash the suit, Harvard was forced to turn over 90,000 pages on its tightly guarded admissions process. On June 15th both sides revealed duelling statistical analyses of admissions-decision data in court filings. Harvard's reputation

for fairness and impartiality emerges bruised.

By the admission office's own ratings, Asian-Americans rank higher than white applicants in both their academic prowess and the quality of their extracurricular activities. Yet their admission rates are much lower. For Asian-Americans in the top decile of academic skill, just 13.4% are admitted, compared with 18.5% of whites (see chart). Asians are scored much worse on another measure of applicant quality—the “personal rating”—by admissions officers. Unlike the other two metrics, personality is judged subjectively and is decided by admissions officers who have not met the applicants. The alumni who conduct in-person interviews rate Asian-Americans as highly as white applicants. To SFFA, this constitutes clear proof of discrimination.

Peter Arcidiacono, an economist at Duke University employed by the plaintiffs, built a statistical model of the effect of race on admissions. He estimates that a male, non-poor Asian-American applicant with the qualifications to have a 25% chance of admission to Harvard would have a 36% chance if he were white. If he were Hispanic, that would be 77%; if black, it would rise to 95%. Damningly for the defendants, an internal report by Harvard's research arm, obtained during discovery, reached the same conclusions. Harvard officials claim that the report was incomplete and the analysis oversimplified.

Fighting statistics with statistics, Harvard's lawyers hired David Card, a prominent labour economist at the University of California, Berkeley. His model includes factors like the quality of a candidate's high school, parents' occupations and the disputed personal rating. Under these controls, Mr Card claims that Asian-American applicants are not disadvantaged compared with whites. But given that these factors are themselves

correlated with race, Mr Card's argument is statistically rather like saying that once you correct for racial bias, Harvard is not racially biased.

The duelling economists disagree because they cannot agree on what constitutes fairness. Susan Dynarski, an economist at the University of Michigan, argues that Mr Arcidiacono's model tests for racial bias in an idealised system. Mr Card's model searches for racial bias in the context of how Harvard actually operates.

For those unconvinced by fancy maths, the basic statistics also look worrying. Harvard insists that it has no racial quotas or floors, which would fall foul of Supreme Court rulings and jeopardise the university's federal funding. Yet the share of Asian-Americans it admits has stayed near 20% over the past decade. This is true even as the number of Asian-Americans in high schools has increased. Caltech, a top university without race-based affirmative action, saw its share of Asian-Americans increase dramatically over the same period.

Court filings also reveal how legacy preferences, which give significant advantages to the relatives of alumni, skew Harvard's admissions system. A suppressed internal report shows that the preference is the same size as that given to black applicants. Roughly 34% of legacy applicants are admitted—more than five times the rate of non-legacy applicants. This is tantamount to affirmative action for well-off white students. According to a survey of freshmen conducted by the *Harvard Crimson*, the college newspaper, 88% of legacy students come from families making more than \$125,000 a year. Recruited athletes, which Harvard admits in droves to fill its lacrosse teams and rowing eights, are also disproportionately white. By Mr Arcidiacono's reckoning, 22% of white students are legacies and 16% are recruited athletes.

Even if Harvard does not actually discriminate against Asian-Americans,

its insistence on preserving hereditary preferences undermines its case. Rakesh Khurana, the dean of Harvard College, justified the policy on the grounds that it would bring those with “more experience with Harvard” together with “others who are less familiar with Harvard”. Others say that it is necessary to ensure fundraising. Aside from the moral questions this poses, it is worth noting that nearby MIT, which does not favour legacy applicants, manages to do just fine. ■



大学录取

平权之不平

一场诉讼揭露出哈佛大学对“优秀”的定义有多独特

阿伯特·劳伦斯·洛厄尔（Abbott Lawrence Lowell）在1909年至1933年间担任哈佛大学校长，当时他认为哈佛招收了过多的犹太人。他在任的第一年，犹太人占该校学生总数的10%，到1922年他们的数量增加了一倍多。为了解决他所谓的“希伯来问题”，洛厄尔提议明确将犹太学生的比例限定在15%。此举引起争议后，他开始着手制定“一项动机较不明显的规则”来拒掉疑似是犹太人的学生。以往学生只要满足明确的学业要求就能入读哈佛，现在条件变得模糊了——变得更偏重申请人的“品格和适合度”。这一“全面评估”的招生新政如愿发挥了功效，成功限制了入读哈佛的犹太人数量。

和美国众多顶尖学府一样，哈佛大学保留了“全面评估”这种录取流程。不同于大多数其他国家的精英学府，美国的大学不是直接挑选最聪明的学生，而是要同时考虑课外活动、家庭财富和种族。在批评者看来，这一体系仍然造成了不公，只是现在受害者变成了亚裔美国人——他们的学业成绩优于白人，但在申请常春藤盟校时成功率更低。2014年，由反对基于种族的扶持措施的保守派活动人士爱德华·布鲁姆（Edward Blum）创立的“公平招生组织”（以下简称SFFA）把哈佛大学告上法庭，指控该校歧视亚裔美国学生。尽管哈佛全力争取法官驳回诉讼，它还是被迫就自己守口如瓶的招生过程提交了九万多页资料。6月15日，双方在法庭文件中披露了针对招生决策数据做出的完全对立的统计分析。哈佛大学公平公正的形象受损。

按哈佛招生办自己的评定，亚裔美国学生的学业能力和课外活动质量都高于白人申请者，但其录取率却相对低出许多。学业能力处于前10%的亚裔学生中只有13.4%被录取，而白人为18.5%（见图表）。但在另一个衡量标准——“个性评分”上，哈佛招生人员对亚裔学生的打分则低得多。与前两

项指标不同的是，对个性的判断属主观意见，而且是在招生人员还没见过申请者本人的情况下评断的。而面试申请者的校友给亚裔申请人的评分并不比白人差。SFFA认为这是构成歧视的明显证据。

原告聘请了杜克大学的经济学家彼得·阿西迪亚科诺（Peter Arcidiacono）建立统计模型，显示种族对录取结果的影响。据阿西迪亚科诺的估算，一名达到录取标准的亚裔美籍男性非贫困生有25%的几率被录取，假如换成白人，被录取的机会变为36%，换成西班牙裔，机会为77%，如果换成黑人则上升至95%。对被告极为不利的是，在取证过程中获得的一份哈佛研究部门的内部报告也有同样的结论。哈佛校方则称该报告不完整，分析过于简单。

哈佛大学以牙还牙，其律师请来了加州大学伯克利分校著名的劳动经济学家大卫·卡德（David Card）做统计分析。卡德的模型涵盖的因素包括申请人所在高中的质量、父母的职业，以及有争议的“个性评分”等。卡德声称，在根据这些因素做评定时，学校并没有偏向白人而歧视亚裔美国人。但这些因素本身就与种族相关，因此，从统计学角度来看，卡德的观点等于是说，只要剔除种族因素，哈佛大学就不存在种族偏见。

两边的经济学家意见相左是因为他们对于“公平”的内涵无法达成共识。密歇根大学的经济学家苏珊·戴纳斯基（Susan Dynarski）认为，阿西迪亚科诺的模型是在一个理想化的系统中探测种族歧视，而卡德的模型是在哈佛的实际运作背景中寻找种族歧视。

如果不相信花哨的数学模型，光看基本的统计数据，情况也不容乐观。哈佛坚称自己并没有设定种族方面的招生配额或下限，毕竟这么做有违美国最高法院的裁决，也会影响哈佛从联邦政府获得资助。但哈佛录取的亚裔美国人的比例在过去十年一直保持在20%左右，在亚裔高中生数量增加的情况下仍然如此。加州理工学院是一所没有采取基于种族的扶持措施的顶级大学，在同一时期，其亚裔美国学生的比例是显著上升的。

法庭文件还揭示了“传承性录取”（即对校友子弟优先录取）对哈佛大学录取体系造成的扭曲。一份被禁止披露的内部报告显示，校友子弟的录取规模跟黑人申请者相同。校友子弟申请人中大约34%会被录取，是其他非传承申请人录取率的五倍多。这相当于是造福富裕白人学生的扶持措施。哈佛大学学生报《绯红报》（Harvard Crimson）对大学新生的一项调查显示，88%的校友子弟学生来自年收入超过12.5万美元的家庭。哈佛大学招收的大批体育特长生（用来充实其长曲棍球队和赛艇队）中白人数量也不成比例地高。据阿西迪亚科诺估算，22%的白人学生是校友子弟，16%是体育特长生。

即便哈佛大学没有真的歧视亚裔美国人，坚持保留“传承性录取”的机制也有损其公平主张。哈佛学院院长拉克什·库拉纳（Rakesh Khurana）认为这项政策是合理的，因为它能把“较熟悉哈佛的人”与“不太熟悉哈佛的其他人”联结起来。也有人认为，为确保能筹募到资金，保留此政策是必要的。除了涉及道德问题外，值得留意的是，隔壁的麻省理工学院并没有优先录取校友子弟的政策，但照样蓬勃发展。 ■



Schumpeter

Canaries in the coal mine

As the global trade system fractures, multinational firms are cutting cross-border investment

IF YOU look only at the headline numbers, populism and protectionism seem to be weirdly good for global business. Since 2015 there has been Brexit, the rise of fringe parties in the euro zone, the election of President Donald Trump and a more nationalistic China under Xi Jinping, its president. Yet over this period the profits of the world's biggest 3,000 listed firms have risen by 44% in dollar terms. Share prices have soared. As for tariffs, for now they are little more than an irritant for most bosses. Plenty of Western firms are still keen on exotic thrills far beyond their borders—in May, Walmart bid \$16bn for Flipkart, an Indian e-commerce company. Starbucks is opening a new shop in China every 15 hours.

Look more closely, however, and you will see that the decay of globalisation is accompanied by a steady demoralisation of multinationals. Between the fall of the Berlin Wall in 1989 and the subprime crisis some 20 years later, a few thousand corporate cosmopolitans became ever more powerful, acting as the brains of the global economy, controlling intellectual property as well as international supply chains. During the past decade, however, they got stuck in a rut. And, as a new report from UNCTAD, a multilateral body, underlines, that rut deepened last year.

Consider cross-border investment by firms, which consists of takeovers and greenfield investments such as factories. It fell by 23% in 2017. The sums flowing to Asia and Latin America were stable, but dropped in all other regions. As a share of global GDP, such investment has fallen by half compared with 2007, to 2.4% last year—the lowest ratio since the financial

crisis. And global supply chains have stagnated. One gauge is the share of all exports that comes from cross-border inputs. Having steadily risen from 26% in 1995 to 31% in 2010, it has since dropped to 30%.

Multinationals' malaise has deep causes. Many global firms succumbed to indiscipline and poured money into vanity projects abroad. Plenty relied on arbitrage, basing production in places with cheap labour and booking profits in countries with low taxes. But Chinese wages have risen. European countries and America have made it harder to dodge taxes. In many industries local scale is more important than global reach. Walmart, for instance, is selling control of its business in Britain to J. Sainsbury, a local company, after years of dim performance.

As multinationals' advantages have eroded, so has their claim to supercharged performance. Schumpeter has grouped the biggest 500 companies by market value into local firms and multinationals (firms which make over 30% of their sales outside their home region). Since 2015 the globetrotters' profits have increased by 12%, compared with 30% for the homebodies. Multinationals once had glittering returns on equity; last year they managed only 11%, compared with 12% for local firms. UNCTAD measures the returns of just the foreign operations of multinationals, excluding their domestic businesses (which for American firms can be lucrative). Such returns dropped to 7% last year, from 9% before the financial crisis—probably below their cost of capital.

Faced with soggy profits, bosses are being more cautious, an impulse further amplified by trade tensions. For one thing, regulators are more likely to block deals. Chinese buyers in particular are effectively playing roulette. Even saintly Canada prevented a \$1bn takeover of a construction company, Aecon, by a Chinese firm in May. America's security watchdogs recently kiboshed the takeover of Qualcomm by Broadcom, a rival semiconductor firm then domiciled in Singapore. And who wants to build new cross-border

supply chains while the world's trade regime is in flux?

Perversely, protectionism can sometimes stimulate cross-border investment. After the 1930s, some firms "tariff hopped" by building factories within countries to avoid exporting to them. The White House doubtless hopes this will happen in America, which Mr Trump says is "open for business". There are a few examples—some foreign solar-panel manufacturers made plans for new plants in Uncle Sam's backyard after tariffs were announced in January. But across all industries, inbound investment into America fell by 39% in 2017, according to the Bureau of Economic Analysis. The number of greenfield projects in the United States announced by foreign firms fell by 29% in the first quarter of 2018 compared with the prior year, according to fDi, a data firm.

Perhaps digital flows could provide a new leg for globalisation, a view backed by McKinsey, a consulting firm. Netflix now has more subscribers abroad than at home, for example. But these flows are fragile. They tend not to create lots of jobs, exports or tax revenues for the recipient countries, which is their main motivation for welcoming multinationals. And protectionism has gone digital, too. The control of tech innovation is at the heart of the rows between America and China.

The base case is that cross-border investment will be subdued until Mr Trump leaves office. The weight of multinationals in the pool of global investment (including takeovers) will fade. It has already dropped to 6% last year, compared with a 20-year average of 8% and a peak of 10% in 2007.

But if trade tensions persist beyond the American presidential election in 2020, firms may seek a more radical rethink. One option would be to separate the flow of investment from control. In the 19th century global firms often gave contracts to local managing agents to run their foreign businesses. These could be revived. Or multinationals could seek only

minority stakes in their operations abroad, guaranteeing them local autonomy.

Such structures could muffle political risks but are far less efficient than the model of globally integrated firms that thrived in the 2000s. Consumers and productivity will both suffer, and investors might, too. But after the past few months it is the duty of anyone running a multinational firm to consider how to redesign their business for a pricklier, nastier world. ■



熊彼特

矿井中的金丝雀

随着全球贸易体系破裂，跨国公司正在削减跨境投资

如果只看大体数据，民粹主义和贸易保护主义似乎还对全球商业有益，这有些不可思议。自2015年以来，英国闹脱欧，欧元区边缘政党崛起，特朗普当选总统，习近平领导下的中国也变得更加民族主义。然而在此期间，全球最大的3000家上市公司的利润增长了44%（以美元计）。股价飙升。至于关税，至少到目前为止它们对于大多数老板来说还不是什么了不起的麻烦。许多西方公司仍然热衷于在遥远的异国玩心跳。今年5月，沃尔玛出价160亿美元收购印度电商Flipkart。星巴克每15小时就在中国开张一家新店。

然而细看就会发现，伴随着全球化的衰退，跨国公司的士气也日益消沉。从1989年柏林墙倒塌到大约20年后的次贷危机，其间几千家跨国企业日益壮大，它们充当了全球经济的大脑，不仅控制着国际供应链，还控制着知识产权。但在过去的十年里，它们遇到了瓶颈。并且，正如多边机构联合国贸发会议的一份新报告所强调的，去年这个瓶颈进一步收窄。

举例来说，2017年企业跨境投资（包括收购和建厂之类的创建投资）下降了23%。除了对亚洲和拉丁美洲的投资保持稳定，其余地区无一例外都有所下降。这类投资去年占全球GDP的比例为2.4%，与2007年相比下降了一半，是自金融危机以来的最低值。而全球供应链已经停止扩张。一个衡量指标是进口原料在所有出口中所占比例。这一比例从1995年的26%稳步上升至2010年的31%，之后就下降到现在的30%。

跨国公司的困境有多种深层原因。许多跨国公司缺乏克制，在国外的面子工程上撒钱。很多公司将生产基地设在低廉劳动力地区而把利润记在低税收国家，依靠这样的方式套利。但是中国的工资水平已经上涨，欧洲各国和美国也加大了避税难度。在很多行业，本土化比全球化更重要。例如，

在经历了多年的惨淡业绩后，沃尔玛将自己英国业务的控股权出售给了本土公司英佰瑞（J. Sainsbury）。

随着跨国公司的优势削减，它们曾经强劲的业绩也一路下滑。熊彼特将市值最高的500家公司按本土公司和跨国公司（30%以上的销售额来自本土以外的公司）归类。2015年以来，跨国公司的利润增长了12%，而本土公司增长了30%。跨国公司曾经拥有亮眼的股本回报率，但去年只勉强达到11%，而本土公司为12%。贸发会议只计算了跨国公司的境外业务回报率，不包括国内业务（美国公司的国内利润会比较丰厚）。金融危机前该回报率为9%，去年降至7%，可能低于它们的资本成本。

面对低迷的利润，老板们变得更谨慎，而紧张的贸易局势进一步强化了他们这种直觉反应。比如，监管机构现在更有可能阻止并购交易。尤其是中国的买家，他们根本就是在玩轮盘赌。就连至善至爱的加拿大也在5月阻止了一家中国公司出价10亿美元收购其建筑公司爱康（Aecon）。最近，美国的安全监管机构禁止半导体公司博通（Broadcom）收购竞争对手高通（Qualcomm），前者发起收购时注册地在新加坡。世界贸易体系动荡不定之时，谁还想打造新的跨境供应链？

反常的是，贸易保护主义有时会刺激跨境投资。上世纪30年代后，一些公司通过在国外建厂免去出口来“跳过关稅”。白宫无疑希望美国也能吸引企业来建厂，因为特朗普说美国“向企业开放”。有这么几个例子。今年1月美国宣布加征关税后，一些外国太阳能电池板制造商计划在山姆大叔的后院建造新工厂。但是，美国经济分析局（Bureau of Economic Analysis）的数据显示，从所有行业来看，2017年美国的外来投资下降了39%。数据公司fDi的统计显示，今年第一季度，外国公司宣布在美国首建投资项目的数据同比下降了29%。

或许数字流能为全球化另辟蹊径，咨询公司麦肯锡的统计证实了这一点。例如，目前Netflix的国外用户数已超过了国内用户。但是这类数字流没有实质的影响力——它们往往不会为接受国带来大量工作岗位、出口或者税收，而这些正是接受国欢迎跨国公司的主要原因。而且，贸易保护主义也

已进入数字领域。中美争端的核心正是争夺对科技创新的控制权。

大趋势是，在特朗普卸任前，跨境投资都将受到遏制。跨国公司在全球投资（包括收购）总额中的比重会越来越小。过去20年这一数字的平均值为8%，2007年达到峰值10%，去年已降至6%。

但是，如果贸易紧张局势会持续到2020年美国总统大选之后，那么各家公司可能会谋求较为激进的新思路。办法之一是将投资流与控制脱钩。在19世纪，全球性公司常与本地的经营代理商签订合约，让它们代为管理其国外业务。这种方式可能被重新采用。或者跨国公司可以只持有海外公司的少数股权，以保证它们在本土的自主权。

这样的经营结构可能会降低政治风险，但论效率，它却远不如兴盛于21世纪前十年的全球一体化公司的模式。消费者和生产率都会受损，投资者可能也一样。但是，在经历了过去的几个月之后，每一位跨国公司的掌门人都有责任考虑如何重新谋篇布局，以应对更棘手和险恶的世界。■



Bartleby

Start them up

Business schools can give entrepreneurs vital skills

THE stereotype of a typical MBA graduate is that of a confident, well-dressed person who is destined for a career in management consultancy, finance or climbing the greasy pole at an S&P 500 company. The stereotype of an entrepreneur is a college drop-out. Yet business schools, eager to prove that they are not just factories for manicured professionals, are increasingly keen to teach entrepreneurial skills to their students.

The temptation is to think that the ability and drive needed to start a business cannot be taught. After all, who can engender the combination of opportunism and paranoia usually needed to start a business? But some of those who have taken the path argue that an MBA course has several advantages. Shoshana Stewart, the chief executive of Turquoise Mountain, a crafts business that started in Afghanistan, who studied at the London Business School (LBS), says an MBA gives you three things; a network of people, confidence and exposure, and an array of skills.

The network effect can operate in several ways. Oliver Samwer, who along with his brothers founded the investment group Rocket Internet in 2007, thinks the guest speakers at the WHU-Otto Beisheim School of Management in Germany, provided him with role models. "My view is that it is all about the dream," he says. Every time a leader came to the school, it inspired him to dream of a bigger, more global business. He has undoubtedly achieved lift-off: Rocket Internet was valued at \$8bn when it floated in 2014 and the Samwer brothers have invested in several other successful technology startups.

Sometimes the contacts are more immediate. Vanessa Coleman started a business called FINsix—which built an efficient and compact power converter—at MIT’s Sloan business school with three other graduate students. They combined their studies with their project, getting initial funding in the second year of the course. And some of the advisers that helped the company had connections to MIT. A business school can also organise events where budding entrepreneurs meet potential investors and, in some cases, those backers will be former students.

Self-belief is another quality that students can gain from the classroom. Bilikiss Adebiyi-Abiola came from Nigeria to MIT and took a course run by Bill Aulet, a well-known author, on entrepreneurship; she says that helped her gain confidence in pitching to a room full of investors.

When she went back to Africa she set up a business which collects waste from Nigerian households. The rubbish is sold to recycling plants and the homeowners get points, which can be turned into cash.

Ms Stewart had worked for Turquoise Mountain before taking her MBA at LBS. While doing the course, she realised that the business, which helps artisans with marketing, sales and logistics, could expand into more countries; when she returned, she expanded its operations to Myanmar, Jordan and Saudi Arabia.

The final element is practical skills. Jon Smith set up Pobble, a for-profit education service, with his brother and others, just before taking an MBA at LBS. Previously, he had been a civil engineer and he says that elements of the course were useful. “Management accounting allowed me to read a profit-and-loss account” he says, while another course taught him how to negotiate and bargain.

Mr Smith found that developing the business while simultaneously

studying for the course was also helpful. “We saw lots of case studies about what can go right and wrong,” he says, adding that “doing an MBA gives you the time to think through what you care about.”

Clearly you do not need an MBA to start a successful business. And plenty of people take MBAs and then continue on to mundane corporate jobs. It is one thing to start a business where the technical skills learned in an MBA may go far. It is another thing to build that company into a structure that can last for decades. Ms Coleman, who has now left the business she founded, says that the guidance provided by the school was less helpful in the later stages.

But business schools will certainly need to work harder to prove their relevance; the cost of the qualification has been rising and the number of applicants has been falling. Around 11% fewer people took the GMAT test (which acts as a de facto entrance exam) in 2016 than in 2012. If business schools can improve the skills of those who try to build companies, that has to be good news. We have enough management consultants already. ■



巴托比

筑梦商学院

商学院可以向创业者传授重要技能

在人们的普遍印象中，一个典型的MBA毕业生举止自信、衣着考究，日后不是投身管理咨询、金融等行当，就是在标普500强公司里努力往上爬。而一个典型的创业家是大学念了一半就辍学去开公司的人。不过，如今的商学院很想证明自己并非只是出产模式化专业人士的工厂，它们越来越热衷于向学生传授创业技能。

人们很容易认为，创业所需的能力和冲劲是无法传授的。毕竟，谁能教会人们集创业通常所需的机会主义和偏执于一身？但一些过来人认为，读MBA有几大好处。创立于阿富汗的手工艺品公司绿松石山（Turquoise Mountain）的首席执行官肖莎娜·斯图尔特（Shoshana Stewart）曾就读于伦敦商学院（LBS），她说，MBA给予你三样东西：人脉、自信加眼界，以及多种技能。

人脉的作用体现在几个方面。奥利弗·扎姆韦尔（Oliver Samwer）和他的兄弟在2007年创办了投资集团火箭互联网（Rocket Internet），他认为德国奥托贝森管理学院（WHU-Otto Beisheim School of Management）的演讲嘉宾为他树立了榜样。“关键是梦想。”他表示。每次有领袖级人物来学校，都会激发他构想一家更大、更全球化的公司。毫无疑问他已经“起飞”：火箭互联网2014年上市时估值80亿美元，扎姆韦尔兄弟也已投资了其他好几家成功的科技创业公司。

有时候这些人脉就在身边。瓦妮莎·科尔曼（Vanessa Coleman）在麻省理工的斯隆商学院与其他三名研究生一起创办了一家名为FINsix的公司，制造一种高效、小巧便携的电源转换器。他们把读研与创业项目结合起来，在入学的第二年获得了启动基金。而帮助这家公司的一些顾问也与麻省理工有关系。此外，商学院还可以组织各种活动，新生企业家们可以通过这

些活动与潜在投资者见面，有时候这些资助者就是他们的师兄师姐。

自信是学生们能从课堂上学到的另一种品质。比利克丝·阿迪比伊-阿比奥拉（Bilikiss Adebiyi-Abiola）从尼日利亚来到麻省理工，选修了著名的创业课程作者比尔·奥莱（Bill Aulet）开的课。她说，这门课让自己在向满屋子的投资者推销时满怀信心。

回到非洲后，她在尼日利亚创建了一家收购家庭废品的公司。废品卖给回收工厂，户主们则获得可以兑换现金的积分。

斯图尔特在伦敦商学院读MBA之前曾在绿松石山工作。读MBA时，她意识到这门帮助手艺人营销、销售和物流环节的生意可以扩展到更多国家。回到阿富汗后，她将业务扩展到了缅甸、约旦和沙特阿拉伯。

最后一个元素是实用技能。到伦敦商学院读MBA之前，乔恩·史密斯（Jon Smith）与他的兄弟等人一起创办了盈利性教育服务平台Pobble。原本是一个土木工程师的他认为课堂上教的东西很有用。“管理会计学让我看懂了损益账。”他表示，而另一门课教会了他如何谈判和讨价还价。

史密斯发现，在创业的同时读MBA也很有帮助。“我们学习了很多案例研究，这些案例告诉我们哪些因素事关成败，”他说，“读MBA让你有时间想清楚自己关心的是什么。”

显然，MBA文凭并不是创办成功企业的先决条件。而很多人在读完MBA后还是会继续从事日常的公司工作。从MBA课程中学到的技术性技能可能对创业大有裨益，但要让公司能持续经营数十年又是另外一回事了。科尔曼现在已经离开了她创办的公司，她说商学院提供的指导对公司后期发展的帮助没那么大了。

但是，面对读MBA的成本不断上涨、申请人数持续下降的现状，商学院无疑需要更加努力以证明自己的重要性。2016年参加GMAT考试（事实上的MBA入学考试）的人数比2012年减少了约11%。如果商学院可以提升那些有志创业者的技能，那肯定是一件好事。毕竟，我们的管理咨询人员已经够

多了。 ■



The nuclear industry

The writing on the wall

A panorama of atomic grotesquerie is troubling, surprising—and ruthlessly entertaining

THE Hanford nuclear complex in Washington state contained radioactive alligator carcasses. Nuns used their blood to daub crosses on a missile silo in Colorado. In Cumbria, northern England, 1,500 contaminated birds were killed and buried with some radioactive garden gnomes.

These lurid tales from the nuclear world are all real. But the industry also generates myths that are widely accepted as true. For example, Chernobyl is not a dead zone: its wildlife thrives (see picture), and many returnees have lived into ruddy old age, eating produce from the radioactive soil. The evidence suggests those who die early are the evacuees who, Fred Pearce writes, “languish unhappily in distant towns—free of radiation but often consumed by angst, junk food and fear.” Likewise, no one seems to have died as a direct result of the meltdown at Fukushima. The deaths related to the accident were mainly suicides prompted by the chaotic evacuation and loss of home, jobs and family. “Psychological fallout” can be lethal.

When the truth seems ludicrous, and falsehoods are widely believed, facts can be elusive. In “Fallout” Mr Pearce, a veteran science journalist, travels the world to pin down what he calls “the radioactive legacies of the nuclear age”. He moves between weaponry and energy, cataloguing mistakes, dishonesty and irrational fears. The result is a panorama of atomic grotesquerie that is at once troubling, surprising and ruthlessly entertaining.

His nuclear odyssey yields some hideous examples of the industry’s secrecy,

particularly a visit to the Russian village of Metlino, on the Techa river in the Urals. In the 1950s this was the world's most radioactive river; Mr Pearce reckons it may have been responsible for more sickness than all of the other nuclear incidents in history combined. Upstream sat the Mayak power plant, which "poured into it an average of one Olympic swimming pool's worth of highly radioactive liquids every two hours." Villagers received "staggering" doses of radiation; scientists quietly monitored the rates of illness and death.

Such callous episodes, and better-known calamities such as Chernobyl and Fukushima, dominate the nuclear debate. As Mr Pearce observes, similar attention is rarely given to various studies demonstrating that no link exists between nuclear plants and local cancer rates, nor the painstaking schemes, such as those in Germany, to safely dispose of nuclear waste. His deepest worry is about Britain's Sellafield plant, home to a massive stockpile of plutonium. In 1995 its fence was easily scaled by Greenpeace activists, who sprayed "bollocks" on the walls. A bomb sent across the fence could result in "a terrorist Chernobyl", yet Mr Pearce saw little being done to reinforce the site.

He asks how long the beleaguered nuclear-power industry can survive—hobbled as it is by the association with nuclear weapons ("the Achilles' heel of civil nuclear power"), a litany of disasters and the doomsday hyperbole of anti-nuclear activists. Mr Pearce recognises that "most civilian nuclear activities are safe", but notes that in democracies, at least, the public has the power of veto, however sensibly they wield it. ■



核工业

墙上的凶兆

这幅原子能怪象的全景令人不安、意外，又带有残酷的趣味

在华盛顿州的汉福德（Hanford）核设施里，躺着带放射性的鳄鱼尸体。在科罗拉多州，几名修女用自己的鲜血在一个导弹发射井里涂画十字架。在英国北部的坎布里亚郡（Cumbria），1500只受污染的小鸟被杀死，和一些带放射性的花园小矮人一起埋葬。

这些耸人听闻的故事都在核能世界里真实发生过，但这个行业也带来了广泛的错误认知。例如，切尔诺贝利（Chernobyl）并不是一个死亡地带，那里有大量的野生动物（见图片），许多返乡者吃着放射性土壤出产的农产品，但都健康长寿。有证据表明，早早过世的倒是那些撤离者。在皮尔斯的笔下，他们“在遥远的城镇里痛苦地煎熬，虽未受到辐射，但往往被焦虑、垃圾食品和恐惧所吞噬”。同样，似乎没有一个人的直接死因是福岛反应堆熔毁。与这起事故有关的死亡主要是疏散混乱、流离失所、家破人亡以及失业所导致的自杀。“心理上的核爆余波”可能是致命的。

在真相看似荒谬，而谬误又被广泛接受的情形下，要捕捉事实可能很难。在《辐射》一书中，资深科学记者皮尔斯寻访世界各地，探寻他所说的“核时代的放射性遗产”。他游走于武器与能源之间，记下错误、欺骗和非理性恐惧。结果得出了一幅原子能怪象的全景图，既令人不安、意外，又带有残酷的趣味性。

在探查核能的艰辛历程中，他发现了一些丑恶的行业秘密，尤其是俄罗斯乌拉尔山区捷恰河（Techa river）边的梅特里诺村（Metlino）之行。在20世纪50年代，捷恰河是世界上放射性最强的河流。皮尔斯认为，它导致的疾病可能比历史上其他所有核事故加起来都要多。捷恰河的上游是马亚克（Mayak）核电站，它“平均每两小时向河水注入的高放射性液体可以装满一个奥运标准泳池”。村民们受到的辐射高得“吓人”；科学家们悄悄监

测了发病率和死亡率。

在关于核问题的争论中，这种草菅人命的情形以及像切诺贝利和福岛事件这类更广为人知的灾难占据了主导。正如皮尔斯观察到的那样，论证核电站与当地患癌率之间没有联系的各类研究很少会受到类似的关注，像德国那样煞费苦心地安全处置核废料的方案同样也乏人关注。他最担心的是英国的塞拉菲尔德核电站（Sellafield），那里储存着大量的钚。1995年，绿色和平组织的活动家们轻而易举地爬上了它的围墙，在墙上喷上了“去你的吧”的字样。假如一个炸弹被扔进围墙，就可能导致“恐怖主义的切尔诺贝利事件”，然而皮尔斯并没有看到这座核电站做了什么加固工作。

皮尔斯发问，饱受批评的核工业还能撑多久？由于与核武器（“民用核能的阿喀琉斯之踵”）的联系、一连串的灾难以及反核激进分子夸张的末日论，它已然步履蹒跚。皮尔斯承认，“大多数民用核活动都是安全的”，但他指出，至少在民主国家，无论公众能否明智地行使否决权，他们都拥有这一权力。■



Economic and financial indicators

Metal prices

The gold price rose by 13% in 2017, its best performance in seven years

The gold price rose by 13% in 2017, its best performance in seven years. A stuttering dollar and a boost in demand from lunar new-year celebrations has helped the rally continue. Gold is up by 7% since mid-December and recently hit a near 18-month high. Platinum, used in emissions-reduction technology, has also seen its price rebound from a mid-December slump, benefiting from its strong correlation with gold and China's crackdown on pollution. Base-metal prices have risen even faster. *The Economist's* metal-price index, which excludes precious metals, rose by 23% in 2017. This was largely driven by factory closures in China and the hope that electric vehicles, full of copper, are coming of age. ■



经济与金融指标

金属价格

黄金价格在2017年上涨了13%，为七年来最佳表现

黄金价格在2017年上涨了13%，创七年来最佳表现。美元疲弱以及农历新年对黄金需求的刺激使得这一涨势得以持续。自去年12月中旬以来价格上涨7%，近期达到近18个月新高。在减排技术中使用的铂自去年12月中旬价格骤降后也已回升，既得益于与黄金关联紧密，也得益于中国的治污行动。贱金属价格的增速还要更快。《经济学人》的金属价格指数（不包括贵金属）在2017年上升了23%，主要的推动因素是中国关闭大量工厂，以及人们对于需耗费大量铜的电动汽车逐渐发展成熟的期望。■



Netflixonomics

The television will be revolutionised

The entertainment industry is scrabbling to catch up with a disrupter

IN THE heyday of the talkie, Louis B. Mayer, head of the biggest studio, was Hollywood's lion king. In the 1980s, with the studio system on the wane, “superagent” Michael Ovitz was often described as the most powerful man in town. Now the honour falls to someone who used to run a video store in Phoenix, Arizona.

Ted Sarandos joined Netflix, a DVD-rental firm, in 2000. In 2011, when Netflix was first moving into streaming video, he bought “House of Cards”, a television drama starring Kevin Spacey and Robin Wright and produced by, among others, the film director David Fincher, for \$100m. The nine-figure statement of intent was widely derided as profligate, showing that Netflix might be a source of cash but scarcely offered serious competition. A mail-order video store could hardly be expected to take on networks and studios which took decades to build and were notoriously difficult to run.

Instead it has become an industry in and of itself. Mr Sarandos, Netflix’s chief content officer, and his colleagues will spend \$12bn-13bn this year—more than any studio spends on films, or any television company lays out on stuff that isn’t sport. Their viewers will get 82 feature films in a year when Warner Brothers, the Hollywood studio with the biggest slate, will send cinemas only 23. (Disney, the most profitable studio, is putting out just ten.) Netflix is producing or procuring 700 new or exclusively licensed television shows, including more than 100 scripted dramas and comedies, dozens of documentaries and children’s shows, stand-up comedy specials and unscripted reality and talk shows. And its ambitions go far beyond Hollywood. It is currently making programmes in 21 countries, including

Brazil, Germany, India and South Korea.

Mr Sarandos buys quality as well as quantity with his billions. From Mr Fincher on, he has hired directors both famous and interesting, including Spike Lee, the Wachowski siblings and the Coen brothers. He is building a bench of established television hit-makers: Ryan Murphy (creator of “Glee” and “American Horror Story”) and Shonda Rhimes (creator of “Grey’s Anatomy” and “How to Get Away with Murder”) both recently signed up. David Letterman has come out of retirement to do a talk show. Barack and Michelle Obama have signed a production deal, too. The money helps: Mr Murphy’s deal is reportedly worth \$300m; Mr Letterman is said to be getting \$2m a show. But so does the company’s growing reputation. “They want to be on the channel that they watch,” Mr Sarandos says.

In the first quarter of this year Netflix added 7.4m net new subscribers worldwide. That gave it a total of 125m, 57m of them in America. With an average subscription of \$10 a month, those customers represent some \$14bn in annual revenue which the company will plough straight back into programming, marketing and technology—along with billions more that it will borrow. Goldman Sachs, a bank, thinks that it could be spending an annual \$22.5bn on content by 2022. That would put it within spitting distance of the total currently spent on entertainment by all America’s networks and cable companies.

Enticed by such prospects, the market values Netflix at \$170bn, which is more than Disney. Some analysts see this as outlandish for a company yet to make a profit, which has \$8.5bn in debt and hasn’t even had that many hit programmes. Its competitors, though, see it as a call to arms. It was the prospect of building a similarly integrated producer, purchaser and distributor of content that led AT&T, a wireless giant, to buy Time Warner for \$109bn. If Comcast, America’s largest broadband provider, buys most of 21st Century Fox from the Murdoch family for more than \$70bn, it will be

to a similar end—and if the Fox goes to the mouse house instead, it will be because Disney knows that to compete with the new giant it needs to own even more content than it already does.

Amazon, Apple, Facebook, YouTube and Instagram are all developing programming efforts of their own. “The first thought on everyone’s mind is how do we compete with Netflix?” says Chris Silbermann, managing director of ICM, an agency that represents a number of people who have signed huge deals with Netflix, including Ms Rhimes and the comedians Jerry Seinfeld (another \$100m deal) and Chris Rock (two comedy specials for a reported \$40m). “Apple wouldn’t even be thinking about this business if it wasn’t for Netflix,” says Mr Silbermann. “Neither would Fox be in play.” Rupert Murdoch chose to break up Fox to get out of Netflix’s way. Jeff Bewkes, the former chief of Time Warner, acknowledged after agreeing to sell his company that Netflix’s direct connection to the consumer gave it a huge advantage.

For Mr Bewkes that was quite a reversal. At the beginning of this decade he poured scorn on the idea that Netflix could be a competitor, comparing it to the “Albanian army”. “He did not believe that the internet was going to be material for a very long time,” Reed Hastings, co-founder and chief executive of the Albanian forces, recently told *The Economist* in Amsterdam, Netflix’s European headquarters.

What Mr Bewkes missed, but Mr Hastings did not, was not just that the wireless internet would become a reliable conduit for high-quality video, but that in doing so it would change the rules of television. There would be no time slots and no channels, no waiting until next week to see whom the Lannisters betray or the Good Wife sleeps with. Given big enough pipes—in September 2017 Netflix streams were taking up 20% of the world’s downstream bandwidth, according to Sandvine, a network-equipment firm—a company would be able to offer every one of its customers

something he wanted to watch, whenever and wherever he wanted to watch it, for as long as he wanted to.

That company would need two things: a big, broad, frequently renewed range of programming; and an understanding of its consumers deep enough to serve up to each of them the morsels most likely to appeal. This mixture of breadth and depth, of content and distribution, of the global and the personal, is the heart of Netflixomics—the science of getting people to subscribe to television on the internet.

One of the reasons that Netflix is spending in such haste is that Netflixomics is a winner-takes-most proposition. People can only spend so much time being entertained by television. If you can provide them with entertainment they genuinely enjoy for that length of time, they will have little reason to pay anyone else for further screen-based entertainment—though they may splash out more for sport, and put up with adverts for news, real or fake. Being big early thus constitutes a first-mover advantage. And the dash towards size has the helpful side-effect of driving up rivals' production costs at the same time as it eats into their revenues. Netflix is “intentionally trying to destroy us, the existing ecosystem,” says one Hollywood executive.

Todd Juenger of Sanford Bernstein, a research firm, says Netflix could have 300m subscribers by 2026, with revenues per subscriber of \$15 a month; that suggests \$24bn in earnings before interest, taxes, depreciation and amortisation and an enterprise value of at least \$300bn, Mr Juenger argues. With investors expecting further growth on top of that, its market value would be a lot higher.

One far-reaching effect of Netflixomics is that it has changed the calculus of whether a show or film is worth making. The company has identified

some 2,000 “taste clusters” by watching its watchers. Analysis of how well a programme will reach, draw and retain customers in specific clusters lets Netflix calculate what sort of acquisition costs can be justified for it. It can thus target quite precise niches, rather than the broad demographic groups broadcast television depends on. Decisions about what projects to pursue, and whether to make them, are up to the executives in Hollywood; Mr Sarandos has 20 people working for him who have the coveted power to “green light” a project. But the boffins at headquarters in Los Gatos help set the budgets.

Once a show is ready for delivery, it is up to executives in Los Gatos like Todd Yellin, vice-president of product, to work out how to get it to the appropriate users and check that they are, in the corny parlance of the company, “delighted” by it. Netflix customers will scroll through 40 or 50 titles on their individualised homescreen, he says, before they choose a title. The choice can come down to details like the poster art, which Netflix tweaks algorithmically according to the aspects of a film or show that would appeal most to a given user.

The combination of personalisation and reach makes the Netflix homescreen the most powerful promotional tool in entertainment, according to Matthew Ball, a digital-media analyst. It lets the company get better results for a lesser-quality show than its peers can by showing it only to those who will like it. Most readers of *The Economist* will not have heard of “The Kissing Booth”, a romantic high-school comedy released in May. Critics hated it. But it has been seen by more than 20m households; millions of teenagers targeted by algorithms seem smitten by its leads, Jacob Elordi and Joey King.

Its quantitative understanding, and personalised marketing, of niche projects has seen Netflix revive cancelled shows with loyal fan bases, such as “Gilmore Girls”, and take up shows others turned down, such as “The

Unbreakable Kimmy Schmidt". It has got Emmy nominations for the A-list cast of a show about a pair of elderly women, jilted by their gay husbands, making sex toys ("Grace and Frankie"). Documentaries like "Wild Wild Country" became hot not just by word of mouth, but by being pushed on the homescreen, poster by individualised poster.

Netflix can take risks on such projects because failure costs it less than it does others. It does not shepherd users towards shows their co-clusterers have hated, so few come to distrust the brand because of seeing things they really do not like. Stinkers do not impose the opportunity costs of a poor performer in prime-time; no other shows have to be cancelled because the network could not programme Wednesday nights. The stuff for which there is no market just disappears.

Cheap, personalised, advertising-free, binge-released video is widely seen as having hastened a decline in audiences for broadcast television, thus doing a great deal of damage to television advertising. It has also led millions of American households to dispense with pay-TV. Americans aged 12-24 are watching less than half as much pay-TV as in 2010, according to Nielsen data; those aged 25-34 are watching 40% less. Networks devoted to scripted entertainment or children's programming, as opposed to news and sports, have been hardest hit.

To stay in the game, cable networks and other streaming services have commissioned hundreds of hours of high-quality scripted programming, providing an unprecedented glut of good television drama. This has in turn been bad for cinemas. Ticket sales in America and Canada declined by more than 20% between 2002 and 2017—and by 30% on a per head basis. American studios are now either in the blockbuster business—the five Disney films released so far this year have made over \$4bn worldwide—or devoted to low-budget offerings best enjoyed with a crowd, like horror.

Netflixonomics is also changing the way shows make money. Netflix usually buys up exclusive worldwide rights to the shows it makes and acquires, paying a mark-up over production costs. Creators forgo lucrative licensing of their shows to secondary markets because, in Netflixonomics, there are no secondary markets. That produces handsome upfront deals, but offers much less to the producers if they make something that outperforms expectations. And the bigger Netflix's share of the market, the less generous its upfront deals may need to be.

So producers are delighted to see competitors trying to emulate Netflix's model of integrated production and distribution. Under AT&T, its new owner, HBO is expected to accelerate its move away from its premium-cable base towards direct-to-consumer streaming. It is investing more in shows developed outside America, too, and unwinding partnerships with foreign distributors so that it can stream its own wares worldwide. It will spend over \$2.5bn on content this year—as will Hulu, a US-only streaming service co-owned by four studios and best known for its drama “The Handmaid’s Tale”. Apple has hired Hollywood executives to build out a television offering to which it has committed at least \$1bn so far. YouTube—which is more watched than Netflix, but accounts for less of the internet’s bandwidth because of its lower definition—also has a subscription service alongside its much larger free-to-view business. Disney is pulling its films off Netflix and launching its own streaming service next year, hoping that its roster of Pixar, Marvel and “Star Wars” movies, not to mention copious princesses, gives it a must-have edge.

Amazon seems perhaps the best placed to compete globally. Its video service is already available pretty much everywhere Netflix is. Amazon Studios will spend more than \$4bn this year on content. The company’s boss, Jeff Bezos, has said he wants Amazon to have hits as big and buzzy as HBO’s “Game of Thrones”. To that end the company paid \$250m for the rights to make a “Lord of the Rings” TV show. But for Amazon, video will always be part of a bigger

strategy. For Netflix it is everything.

Netflix's investments beyond America give it an edge over all its competitors that goes beyond sheer size. It has started turning non-English-language shows into hits: "Money Heist", a Spanish crime-caper series, and "Dark", a piece of German science fiction about missing children, have both been watched by millions in the US, Mexico and Brazil. Nine out of ten people who watched "Dark" were from outside Germany. Upcoming releases include "Sacred Games", Netflix's first series in Hindi, and "Protector", a Turkish superhero story. This summer "Jinn", a supernatural teen drama in Arabic, will begin shooting in Amman and Petra. These shows will be dubbed into a range of other languages, as Netflix's English-language shows are—and that range will include English. Americans are not accustomed to dubbing (outside of 1970s Bruce Lee films). But those watching "Dark" and "3%", a dystopian Brazilian thriller, seemed to prefer it to subtitles.

By offering shows more out-of-the-ordinary and expensive than companies looking just at local markets can normally afford, these shows are meant to make Netflix an enticing premium product. They also allow it to sniff out the best writers and directors. In June Baran bo Odar and Jantje Friese, the creators of "Dark", signed up to make more shows for Netflix.

The company's growth in international subscribers—up 48% in 2016 and 42% in 2017—suggests the strategy is working. Goldman Sachs, which is at the bullish end of Netflix assessments, finds that subscriber growth correlates with the rate at which new content is added. But Netflix faces several potential challenges. Its easy-sign-up subscription model is also easy to cancel. Netflix does not discuss its churn rate, but MoffettNathanson, a research firm, estimates it to be about 3.5% a month. That is much higher than pay-TV (around 2%) and wireless providers (closer to 1%). A second problem is its thirst for bandwidth. In markets that lack

net-neutrality protections (such as America), dominant internet providers might decide to give their own streaming services precedence over Netflix. Aware of such risks, the company is increasingly persuading internet and pay-TV distributors like Comcast, T-Mobile and Sky to bundle its service with theirs, an about-face for some of these incumbents.

There are other ways to stumble. Entertainment companies are exposed to public concerns about behaviour at the top. Netflix dropped Mr Spacey from “House of Cards” after allegations of sexual misconduct and recently got rid of a senior executive over his use of a racial slur; there is no way to insure against future scandals. And if the economy were to turn, reducing both consumers’ appetite for paid entertainment and investors’ appetite for junk bonds, a company which is valued entirely on the basis of putative profits after 2022 would be badly hit. Such a setback would slow Netflix’s growth—and give deep-pocketed competitors like Amazon or Apple time to eat into its leads in inventory, tied-up talent and personalisation.

Some think that, even without such a setback, Netflix’s prospects are being exaggerated. In April MoffettNathanson declared that it could not justify Netflix’s share price “under any scenario”. It did not advise selling the stock, though, noting that investors believed in the Netflix story. Shares have risen by 38% since then, as Netflix reported one of its strongest-ever quarters of subscriber growth.

Sitting in Amsterdam, Mr Hastings appears unconcerned about competition. He argues there is room both for competitors to succeed and for Netflix to continue winning more screen time. He is instead looking towards the challenges of success—those that will arise when Netflix becomes a large presence in societies around the world. “What happened when Televisa used to be like 80% of the Mexican television market, what was it like then? What was their relationship with government, with the society?” Mr Hastings asks. Or Globo, a Brazilian media powerhouse. “How

did they get along with their societies when they're so strong? You have to be gentle obviously as you get that big. How did they pull that off?"

The world's first global television giant may yet get to find out. ■



Netflix经济学

电视迎来革命

娱乐产业正奋力追赶一个行业颠覆者的脚步

在有声电影的全盛时期，掌管最大电影制片公司的路易·梅耶（Louis B. Mayer）是好莱坞的狮子王。上世纪80年代，制片厂制度衰落，“超级经纪人”迈克尔·奥维茨（Michael Ovitz）常被指是好莱坞最有权势的人。现在，这个头衔落在了一个曾在亚利桑那州凤凰城经营音像出租店的人身上。

泰德·萨兰多斯（Ted Sarandos）于2000年加入DVD租赁公司Netflix。2011年Netflix开始转向流媒体视频业务，他豪掷一亿美元买下了《纸牌屋》（House of Cards）的版权。这部电视剧由凯文·史派西（Kevin Spacey）和罗宾·怀特（Robin Wright）主演，电影导演大卫·芬奇（David Fincher）等人制作。这份价值九位数的“宣言”被广泛嘲讽为挥霍之举，由此可以看出，Netflix也许能赚钱，但还没有带来过什么真正的竞争。几乎没人会认为一家出租邮寄影碟的公司能与电视网和制片公司一较高下，毕竟后者历经几十年打造，且出了名的不易经营。

结果，Netflix发展成了一个产业的代名词。身为Netflix首席内容官的萨兰多斯和他的同事今年有120亿至130亿美元的预算，超过任何一家电影公司在电影上的投入，或任何电视公司在体育节目以外的花费。Netflix的用户今年一年可欣赏82部故事片，而好莱坞制片量最大的电影公司华纳兄弟将只有23部影片在大屏幕上上映（最赚钱的电影公司迪士尼只有10部）。

Netflix正在制作或购买700部新制作或独家授权的电视节目，其中包括100多部有剧本的剧情片和喜剧、数十部纪录片和儿童节目、单人脱口秀，以及无剧本真人秀和脱口秀。其野心远不局限于好莱坞。目前它正在巴西、德国、印度和韩国等21个国家制作节目。

萨兰多斯的巨额投资兼顾质量与数量。从芬奇开始，他聘请的导演都既知

名又特别，比如斯派克·李（Spike Lee）、沃卓斯基姐妹（Wachowski）和科恩（Coen）兄弟。他正在集结一批成名的热门电视制作人，包括莱恩·墨菲（Ryan Murphy）（《欢乐合唱团》（Glee）和《美国恐怖故事》（American Horror Story）的主创）和珊达·莱梅斯（Shonda Rhimes）（《实习医生格雷》（Grey's Anatomy）和《逍遥法外》（How to Get Away with Murder）的主创），两人都于近期和Netflix签约。大卫·莱特曼（David Letterman）退休后重返脱口秀舞台。前总统奥巴马夫妇也与Netflix签订了内容制作协议。钱多好办事：墨菲的签约据称价值3亿美元；莱特曼每期节目据说能入账200万美元。而公司声誉水涨船高也有帮助。“他们想上自己在看的频道。”萨兰多斯说。

今年一季度，Netflix在全球净增740万订阅用户，总数达到1.25亿，其中5700万在美国。按每人每月平均订购费10美元计算，这些用户带来的年收入将达到140亿美元左右。Netflix会把这些钱连同今年的数十亿美元借债直接重新投入节目制作、市场营销和技术开发上。高盛认为，到2022年该公司每年在内容上的花费可能会高达225亿美元。这和美国所有电视网和有线电视公司目前在娱乐内容上的支出总和相差无几。

如此诱人的前景将Netflix的市值推高到1700亿美元，超过了迪士尼。一些分析师认为，对于一家尚未盈利、负债85亿美元、热门节目也还没那么多的公司来说，这样的市值太夸张了。不过在它的竞争对手看来，这是战斗的号角。无线通讯巨头AT&T正是因为希望建立一个类似的内容制作、购买和分销于一体的企业才斥资1090亿美元收购了时代华纳公司。如果美国最大的宽带运营商康卡斯特（Comcast）能以超过700亿美元的价格从默多克家族（Murdoch）手中买下21世纪福克斯的大部分资产，那也是为了实现类似的目标。而如果福克斯最后加入了米老鼠的大家庭，那将是因为迪士尼明白，若要与新巨头竞争，就需要拥有比现有还要多的内容。

亚马逊、苹果、Facebook、YouTube和Instagram都在发展各自的视频业务。经纪公司ICM的董事总经理克里斯·希尔伯曼（Chris Silbermann）说：“大家首先想到的问题就是，该如何与Netflix竞争？”ICM旗下的众多艺人与Netflix签署了高额合约，其中包括莱梅斯、喜剧演员杰瑞·宋飞

（Jerry Seinfeld，又一个一亿美元合同）和克里斯·洛克（Chris Rock，两档喜剧节目据称总价4000万美元）。“要不是Netflix，苹果甚至都不会考虑这项业务，”希尔伯曼说，“福克斯也不会卷进来。”默多克选择卖掉福克斯，避开与Netflix的竞争。时代华纳前首席执行官杰夫·比克斯（Jeff Bewkes）在同意出售他的公司之后承认，Netflix凭借与消费者的直接联系获得了巨大的优势。

对比克斯来说，形势发生了巨大的逆转。2010年前后，他对Netflix可能成为竞争对手的想法不屑一顾，并将其比作“阿尔巴尼亚军队”。这支军队的联合创始人兼首席执行官里德·黑斯廷斯（Reed Hastings）最近在Netflix位于阿姆斯特丹的欧洲总部对本刊记者说：“比克斯认为互联网在很长一段时间内都不会有多么重大的影响力。”

比克斯看走眼的不止是无线互联网将成为高质量视频的可靠渠道，还有这一转变将会改变电视行业的规则。黑斯廷斯对此却洞若观火。今后不会再有时段和频道的限制，不必等到下周才能看到《权利的游戏》中兰尼斯特家族出卖了谁或者《傲骨贤妻》的女主角和谁上了床。只要带宽足够，一家公司就能为它的每一位用户随时随地提供他想观看的内容，他想看多久就能看多久。网络设备公司Sandvine的数据显示，2017年9月，Netflix的流量占了全球下行带宽的20%。

这样的公司需要做到两点：一是要拥有规模庞大、内容广泛且经常更新的节目；二是要深入了解其消费者，以便为其中的每个人都送上最具吸引力的那份餐点。像这样兼顾广度与深度、内容制作与发行、全体用户与个人用户就是Netflix经济学的核心——一门促使人们在互联网上订阅电视节目的学问。

Netflix这么急于大笔投资，原因之一是Netflix经济学的要义就是赢家拿大头。人们能花在电视娱乐上的时间就那么多，如果你能在这段时间里提供让他们真正乐在其中的娱乐内容，他们就没有理由再花钱到别处观看更多的视频节目——尽管他们可能会为体育节目花更多钱，或为了收看或真或假的新闻而忍受广告。因此早早壮大就能获得先发优势。而且快速扩

大规模还有附带好处——在侵蚀竞争对手收入的同时还提高了它们的制作成本。好莱坞一名高管说，Netflix是“成心要摧毁我们，摧毁现有的生态系统”。

研究公司盛博的陶德·荣格（Todd Juenger）表示，到2026年，Netflix可能将拥有3亿用户，每个用户每月可带来15美元的收入。他认为，Netflix的息税折旧摊销前盈利将高达到240亿美元，企业价值至少3000亿美元。由于投资者预期公司还将在此基础上进一步增长，其市值还将大幅增加。

Netflix经济学的一个深远影响是改变了对一档节目或一部电影是否值得制作的计算方法。通过观察观众，该公司确定了约2000个“口味人群”。

Netflix会分析一档节目对特定用户群体的覆盖、吸引和挽留的情况，从而计算出合理的购买成本。这样它就可以瞄准相当精准的利基市场，而不是广播电视所依赖的广泛人群。在好莱坞，要购买什么内容、是否制作影片由公司高管决定，而萨兰多斯则给予手下20名工作人员令人艳羡的权力，让他们来决定是否给某个项目“开绿灯”。但预算是由位于洛斯加托斯（Los Gatos）总部的研究人员帮助设定的。

一旦节目准备就绪、可以上架，就要由在洛斯加托斯的产品副总裁陶德·耶林（Todd Yellin）这样的高管来决定如何将节目推向合适的用户，并检验节目是否能像该公司的老话说的那样“取悦”他们。耶林表示，Netflix用户在选定一个节目之前，会在其个性化的主屏幕上滚动浏览四五十个节目。吸引用户做出选择的可能会是海报设计这样的细节，Netflix会根据影片或节目中最有吸引力的方面用算法调整这些细节。

数字媒体分析师马修·鲍尔（Matthew Ball）认为，个性化和触及面的结合让Netflix的主屏幕成了娱乐业最强大的推广工具。有了这个工具，Netflix可以把一个质量不算上乘的节目只推送给那些会喜欢它的用户，从而获得比其同行更好的结果。《经济学人》的大部分读者应该都还没看过5月上映的浪漫校园喜剧《亲亲小站》（The Kissing Booth）。影评人的反馈很差。但已有2000多万户家庭收看了该片。算法瞄准的数百万青少年观众

似乎都为主演雅各布·艾洛蒂（Jacob Elordi）和乔伊·金（Joey King）着迷。

凭借对小众节目的量化分析和个性化营销，Netflix为具备忠实粉丝群的《吉尔莫女孩》（Gilmore Girls）等已停播的剧集制作了续集，还买下了被其他公司拒掉的剧集，比如《我本坚强》（The Unbreakable Kimmy Schmidt）。由它推出的《同妻俱乐部》（Grace and Frankie）的明星主演还获得了艾美奖提名。该剧讲述了两个被同性恋丈夫抛弃的老年女性合作经营情趣用品公司的故事。像《异狂国度》（Wild Wild Country）这样的纪录片也收获了高收视率，不仅是因为它们口碑好，还因为Netflix在主屏幕上用个性化海报做了推送。

Netflix可以为这些节目承担风险是因为失败带给它的损失低于对其他公司的影响。它不会引导用户去观看他们所在的口味圈子不爱看的节目，所以很少有人会因为看到自己讨厌的节目而对该品牌失去信任。烂片不会因为浪费黄金时段而造成机会成本：电视台在周三晚上排了烂片后就没法排其他片子了。没有市场的东西会自行消失。

人们普遍认为，低价、个性化、无广告、整季剧集一次性放出的视频加速了电视观众的减少，因此重创了电视广告行业。此外还导致数百万美国家庭放弃了付费电视。根据市场研究公司尼尔森（Nielsen）的数据，12至24岁的美国人收看付费电视的时间比2010年减少了一半多，25至34岁的人减少了40%。相对新闻和体育节目，专门制作有剧本娱乐内容或儿童节目的电视网受到的打击最大。

为了保住市场地位，有线电视网和其他流媒体服务已经委托制作了成百上千小时的高质量有剧本节目，提供了数量前所未有的优秀电视剧。而这又给电影院带来了冲击。2002年至2017年间，美国和加拿大的电影票房下降了超过20%，人均下降了30%。美国的电影公司现在要么在制作大片——今年迄今为止上映的五部迪士尼电影全球票房收入已超过40亿美元，要么专注于制作恐怖片等低成本、适合结伴观看的影片。

Netflix经济学也在改变节目赚钱的方式。Netflix通常会在制作成本的基础上支付溢价，买断其制作和购买节目的全球独播权。节目创作者放弃了在二级市场授权作品的获利机会，因为在Netflix经济学中不存在二级市场。这就产生了一些很大方的预付交易，但如果制作人的节目超出预期，他们原本能得到的好处还要多得多。而Netflix的市场份额越大，它的预付交易可能也就不用再那么慷慨。

所以制作人很高兴看到Netflix的竞争对手试图效仿它整合制作和分销的模式。在新东家AT&T的旗下，HBO预计将加速业务转型，从高价有线电视转向直面消费者的流媒体。它还在海外制作的节目上加大投入，并逐步与国外发行商解除合作关系，以便在全球播放自己的流媒体内容。HBO今年在内容上的投入将超过25亿美元，Hulu也是如此，这家公司由四家电影公司共同拥有，仅在美国提供流媒体服务，以剧集《使女的故事》（The Handmaid's Tale）闻名。苹果已聘请好莱坞的高管来拓展自己的视频业务，迄今已投入至少10亿美元。YouTube的视频观看量比Netflix更多，但由于清晰度较低，互联网带宽占用量也较低。除了免费视频，它也拥有订阅服务，不过规模要小得多。迪士尼正将其电影从Netflix上下架，明年将推出自己的流媒体服务，希望自己的皮克斯、漫威和《星球大战》系列电影——更不必说众多的公主主题影片——能让自己的服务拥有“必看”优势。

也许亚马逊看起来最有资本参与全球竞争。几乎有Netflix的地方就有亚马逊的视频服务。亚马逊影视工作室（Amazon Studios）今年将为内容投入40多亿美元。公司老板杰夫·贝索斯曾表示，他希望亚马逊能够推出像HBO的《权力的游戏》（Game of Thrones）那样的大热作品。为此，亚马逊斥资2.5亿美元买下《指环王》（Lord of the Rings）的电视剧改编版权。但对于亚马逊来说，视频将永远是更大战略的一部分。而对于Netflix来说，视频就是一切。

除了规模巨大之外，Netflix还通过海外投资获得了所有竞争对手都不具备的一项优势。它已经开始将非英语节目变为热门：西班牙犯罪题材连续剧《纸钞屋》（Money Heist）和一部关于失踪儿童的德国科幻剧集《暗

黑》(Dark)在美国、墨西哥和巴西都已有数百万观众。《暗黑》的观众中有九成来自德国以外的国家和地区。即将上线的剧集包括Netflix第一部印地语剧集《神圣的游戏》(Sacred Games)以及土耳其超级英雄故事《保护者》(Protector)。今年夏天，阿拉伯语的超自然青少年剧《精灵》(Jinn)将在安曼和佩特拉开拍。就像Netflix的英语剧集会有其他语言的配音版本一样，这些节目也将用包括英语在内的一系列其他语言配音。美国人不习惯看配音节目(20世纪70年代李小龙的电影除外)，但《暗黑》和巴西反乌托邦惊悚片《3%》的观众似乎更喜欢配音，而不是看字幕。

Netflix提供的节目更为与众不同，成本也非仅关注国内市场的公司能及。这些节目意在让Netflix成为一个具吸引力的高端产品，此外还能让它找到最好的编剧和导演。6月，《暗黑》的主创巴伦·博·欧达尔(Baran bo Odar)和简特耶·弗利泽(Jantje Friese)都再次与Netflix签约制作更多节目。

Netflix的国际订户在2016年增长了48%，2017年增长42%，这样的增速表明其战略正在发挥作用。看涨Netflix的高盛认为，订阅用户增长与新内容的补充速度相关。但Netflix面临着几个潜在的挑战。其易于注册的订阅模式也意味着退订也很容易。Netflix没有谈论其退订率，但研究公司MoffettNathanson估计它的月退订率约为3.5%。这个数字远高于付费电视(约2%)和无线运营商(接近1%)。第二个问题是它对带宽的渴求。在缺乏网络中立保护的市场(如美国)，主流互联网供应商可能会决定将自己的流媒体服务优先于Netflix。该公司也意识到了这样的风险，正加紧说服像康卡斯特、T-Mobile和天空电视台这样的互联网和付费电视分销商将其服务与它们的服务捆绑在一起，这对一些老牌企业来说是一个巨大的转变。

公司也有可能在其他方面出岔子。娱乐公司高层的行为受到公众关注。在史派西被指控性骚扰之后，Netflix把他赶出了《纸牌屋》，最近还开除了一位使用种族歧视字眼的高管。但没有办法保证未来不再出现丑闻。而如

果经济转向、消费者对付费娱乐的兴趣和投资者对垃圾债券的兴趣都减少，那么一家完全依据2022年后的假定利润来估价的公司将受到重创。这样的挫折会拖慢Netflix的发展速度，而亚马逊或苹果这样资金雄厚的竞争对手也就能趁机追赶它在节目资源、签约人才和个性化服务上的领先地位。

有人认为，即使没有这样的挫折，Netflix的前景也被夸大了。4月，MoffettNathanson称它“在任何情况下”都无法证明Netflix的股价是合理的。不过它也指出投资者相信Netflix的故事，因而并不建议出售股票。自那时起，公司股价上涨38%，因为Netflix公布了有史以来最强劲的一次季度用户增长。

坐镇阿姆斯特丹的黑斯廷斯看上去对竞争并不在意。他认为，竞争对手有成功的机会，而Netflix也有机会继续赢得更多的屏幕时间。相反，他正在放眼成功将带来的挑战——当Netflix在世界各地成为社会中的重要力量时，这些挑战就会出现。“当Televisa过去占到墨西哥电视市场的约80%时，发生了什么，它那时是什么样的？与政府和社会的关系如何？”黑斯廷斯问道。还有巴西媒体巨头Globo。“当它们如此强大时，它们与社会相处得怎么样？当你的规模如此之大的时候，你必须显得很温和才行。它们是如何做到的？”

世界上第一家全球电视巨头可能还需要时间来找到答案。 ■



Schumpeter

Think different

Xiaomi's forthcoming IPO in Hong Kong shows how the rules of business are changing

IN 1987, when Lei Jun was a computer-science student in Wuhan, on the banks of the Yangtze River, he read a book about Steve Jobs and vowed to emulate him. If all goes to plan, this summer Mr Lei will take a leap towards that dream with the flotation of his firm, Xiaomi, at a valuation of \$50bn-75bn. It is set to be the world's largest initial public offering (IPO) since Alibaba in 2014.

Xiaomi is probably China's most successful consumer brand, but ever since it started selling smartphones in 2010 it has also been difficult to categorise. Yes, Mr Lei sometimes dresses in black, as Mr Jobs did, but it has never been clear if Xiaomi is China's Apple or if it is more like Samsung, Sony, Nokia, or even Costco, a bulk-discount retailer.

Schumpeter's answer is that Xiaomi does not resemble any rich-world firm. For decades a particular American ideal of the public company has dominated: focused, widely owned and predictable. Xiaomi is a supercharged champion of a new Chinese model that is the opposite: deliberately sprawling, tightly controlled and hyperactive. Edward Tse, of Gao Feng, a consultancy, calls these firms "China's disrupters". Xiaomi's IPO is a test of how valuable investors believe the model is.

Xiaomi is above all a creature of its environment, which in China means rock-star bosses, ambiguous rules, intense competition, proximity to the world's manufacturing hub, and fast-changing consumer behaviour. The firm is what Charles Darwin might call a perfect adaptation. It also seems to live in dog years, packing more into the past seven years than American

firms do in 49. Almost three-quarters of its \$18bn of sales last year came from selling smartphones, where it has a global market share of 7%, but there is lots of sprawl, which is by design.

As well as smartphones, Xiaomi has hundreds of other products, from vacuum cleaners to electric bicycles, and even owns 30% of a small bank. It incubates new hardware suppliers by buying small equity stakes in them. The cost of this ate up a fifth of its free cashflow in 2016-17 and could spiral further. Ferocious competition at home, meanwhile, has meant erratic performance. In 2015 it made an underlying loss and in 2016 sales stagnated after its handset market share in China dropped.

A small but rising number of American firms, including Alphabet and Facebook, have dual voting classes. But Xiaomi takes tight control to a new level. Mr Lei has majority voting control. Like the BAT firms—Baidu, Alibaba and Tencent—Xiaomi has a “variable-interest-entity” structure to get round rules on having foreign shareholders. The firm’s holding company, in the Cayman Islands, has contracts with operating entities in China. The contracts give it control and profits but not ownership, which in several cases remains in the hands of Mr Lei. He is also the personification of the brand, which appeals to younger customers.

Xiaomi’s faults are also its virtues. Tight control means rapid decisions, and intimacy with many suppliers means products can be sourced out of thin air. The firm is quick on its feet. Between 2014 and 2017, while many multinationals would still be searching for Uttar Pradesh on the map, it went from zero to being the biggest smartphone firm in India. Sales of its potpourri of consumer electronics tripled over this period. And a new range of smartphones has led to a comeback. In 2017 sales rose by 68%. Underlying operating profits this year should hit \$1.5bn-2bn.

Does all this justify a high IPO valuation? In frantic fashion, Xiaomi says

that it is in the middle of another reinvention, from a hardware firm into an internet one. It is obvious why: with the exceptions of Apple and Samsung, the industry's profitability is terrible. Xiaomi's handset operating margin is about 1% (its cute pledge to customers that it will never exceed 5% is irrelevant).

Other hardware firms, from Sony in 1999 to Nokia in 2007, have tried similar pitches over the years with dismal results. Now, unlike then, however, the shift to services is tangible. Services are the new engine of Apple, which sells apps, payments and content to its installed base of 1.3bn iPhone, iPad and Mac users. It made sales of \$26 per device in the past year, or \$33bn.

Xiaomi has an installed base of 190m smartphone users, who spend 54 minutes a day using its services, equivalent to 20% of the total time on their phone. It makes \$9 per user per year, from advertisements and commissions on selling apps and games. Margins are high. If Xiaomi can maintain its market share of new smartphone sales—thereby adding new internet users—and if its service revenue per user rises to \$20 over a decade, this business could be worth \$35bn—supporting a chunk of its IPO valuation.

There are glaring risks. Xiaomi's smartphone market share could plummet again, eventually dragging down the number of internet users. It is unclear if its services will travel across borders: sales per user in India are still very low. And the BAT firms are expanding their ecosystems of services and could win a bigger “mindshare” of Xiaomi's device users. To stay in the race Xiaomi will probably reinvest most of the expected \$10bn IPO proceeds.

Xiaomi is therefore an opaque bet on constant reinvention. But it is only the most extreme example of a national trend. There is a second wave of tech firms waiting to IPO, including Didi-Chuxing, which does ride sharing but is diversifying into payments, and Meituan-Dianping, which is expanding from food delivery into ride sharing. Each of the BATs used to have a neat

identity. Alibaba did e-commerce, Tencent did games and Baidu did search. These barriers are collapsing in a giant investment boom.

China's acrobatic, high-stakes, sprawling champions are the antithesis of what investors have been taught to admire. But Xiaomi's IPO may show how no one cares much about that any more, at least for as long as the internet boom rages on. Mr Lei has not created China's Apple. If he succeeds in floating his firm, he will instead have imitated Mr Jobs by breaking all the rules. ■



熊彼特

不同凡想

小米即将在香港上市，显示商业规则正在改变

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Tech firms in emerging markets

Clash of the titans

American and Chinese tech giants are battling head to head in places like India and South-East Asia. Who will prevail?

TWO contests are under way in which titans holding billions in their thrall vie for global domination. One is unfolding on Russian football pitches and features the likes of Neymar and Harry Kane. The other is playing out on the smartphone screens of consumers in India, Indonesia, Brazil and other emerging economies. There, American online superstars such as Google, Facebook and Amazon are pitted against a Chinese dream team led by Alibaba and Tencent.

The geopolitics of business means that the world's biggest tech firms have swelled to combined market capitalisations of over \$4trn without really going head to head. China blocked Google et al with its Great Firewall, preventing American firms (Apple is an obvious exception) from taking on Chinese rivals on the mainland. Chinese giants have stayed out of America; Europe fell under the spell of Silicon Valley before Chinese tech had matured.

Time, and capabilities, have changed. Chinese tech firms once simply mimicked Silicon Valley products, from search engines to e-commerce and social networks. Now the copycats have become pioneers. WeChat, a messaging app run by Tencent with endless bells and whistles, for example, rivals anything from California.

Mainland firms are thus ready to make a strong play for markets which neither they nor American firms can call home. Rising incomes, ballooning smartphone use and improving internet infrastructure in emerging markets make them irresistible terrain for all tech firms. As they vie for the next

billion consumers to come online, Alibaba is taking on Amazon, Google is matched against Baidu and Tencent can prove its mettle against Facebook.

They have very different strategies, however. American firms typically set up outposts from scratch. They fund subsidiaries that offer much the same service to Indians or Mexicans as their domestic users might expect. Amazon's foray into India, for example, involved it pledging over \$5bn to broadly replicate its American offering. It has built a network of warehouses to fulfil e-commerce orders, rolled out its Prime video service (with added Bollywood content), website-hosting services and so on. It rebrands acquisitions. Last year it paid \$650m for Souq.com, an e-commerce website based in Dubai, now clearly marked as "an Amazon company".

Google and Facebook also provide offerings abroad similar to those that consumers get in America; as a result, both are as recognised in Brasilia or Bangalore as they would be in Boston or Berlin. Google customers worldwide use the same Chrome browser, YouTube website or Android phone-operating system—and are served advertisements in much the same way. WhatsApp and Instagram, both owned by Facebook, are popular across the world.

By contrast, few Indonesians or Indians would recognise the name Alibaba. Its strategy in emerging markets has been not to set up shop itself but instead to invest in local players, whether by buying them outright or taking a minority stake. In the past two years or so it has built a constellation of firms focused on shopping, payments and delivery. These include Paytm and BigBasket in India, Tokopedia in Indonesia, Lazada in Singapore, Daraz in Pakistan and, as of July 2nd, Trendyol in Turkey. Most of their customers would have no idea that these apps are backed by a Chinese tech titan.

Tencent has similarly ploughed money into a clutch of Indian firms in areas

as diverse as ride-hailing, online education, music-streaming, health care, IT and e-commerce, as well as Nigerian payments and Indonesian logistics. (Baidu is the least active thus far in building its emerging-market presence, but its heavy investment in artificial intelligence could result in its technology being used globally in self-driving cars, for example.) According to CBInsights, a data firm, Tencent, Alibaba and its Ant Financial affiliate have backed 43% of all Asian “unicorns”, meaning startups worth more than \$1bn. Alibaba’s investment in Lazada, South-East Asia’s largest e-commerce platform, has soaked up \$4bn. Jack Ma, Alibaba’s founder and boss, has pledged \$8bn to India alone.

Their different approaches reflect the way the Western and Chinese firms make money. Google and Facebook earn the bulk of their revenue from advertising against services their users flock to. This requires little localisation, bar a bit of website translation to attract native users.

Chinese firms’ competitive advantage, by contrast, has historically come from being able to process payments and organise distribution of goods in a country where doing such things had previously been tricky. A business based on solving such nuts-and-bolts problems is hard to export. “For that sort of thing, it is difficult to have a one-size-fits-all approach for different countries,” says Tan Yinglan of Insignia Ventures Partners, a tech-investment firm. Being a distribution expert in Singapore (whose former postal monopoly is now 14% owned by Alibaba) brings little insight into distributing packages throughout Indonesia’s 17,500 islands, say. Nor does the ability to process payments in Vietnam smooth transactions in Brazil or in Nigeria, with their vastly different banking and regulatory systems. Such intricacies, in other words, might be better delivered by local entrepreneurs who can be bought out once they have cracked them.

How are these differing strategies panning out on the ground? The most intense Sino-American rivalry thus far is focused on India and South-East

Asia. The scale of investment reflects the stakes: Indian start-ups received \$5.2bn in Chinese tech money last year, according to Tracxn, a data provider, up from \$930m in 2016. Forrester, a market-research group, says that Chinese tech giants (including Didi and JD.com) spent \$6bn on acquisitions in South-East Asia in 2017.

The Chinese firms have several advantages. They have a proven record of chaperoning hundreds of millions of emerging-market consumers onto the internet. A Chinese diaspora in places like Malaysia or Vietnam, paired with plenty of mainland tourists, offers a beachhead into those markets. The Chinese giants also enjoy the tacit support of their country's government, which is keen for them to expand in "Belt and Road" countries near China. Startup founders in Asia are more likely to want to emulate Mr Ma than his American counterparts; they will certainly prefer the Chinese approach if they want to keep running their firms.

Yet to critics, the Chinese approach is akin to what corporate Japan did in the 1980s: overpay for trophy assets in a hopelessly undisciplined way. Chinese firms sometimes end up competing against themselves. Tokopedia and Lazada in Indonesia sell similar stuff and are both backed by Alibaba, for example. Its investment in Paytm came only after it had bet on Snapdeal, a former Indian e-commerce darling whose star has dimmed markedly.

Valuations can be eye-popping. That is partly because there is a lot of capital about. Venture capitalists worried about losing their relevance in the region want to stay invested. SoftBank, a risk-loving Japanese group that is attracted to fashionable startups like a Brazilian to a football trophy, is among those who made a fortune in China (it is Alibaba's biggest shareholder) and is keen to repeat the feat in other rising tech powers.

The Americans' edge lies with their record and their head start. The Silicon Valley giants internationalised operations more or less from the start.

Amazon's British and German arms are about to celebrate their 20th anniversaries. It is easier for English-language firms than for Chinese ones to hire staff or to attract users. Over half of Google's and Facebook's revenues already come from outside America. Alibaba, the most internationalised Chinese firm, is barely at 10%, though it hopes half the value of the stuff sold through it will be transacted overseas by 2025.

Global heft counts for something in local battles. Services such as Amazon's movie-streaming offering can be rolled out from one country to the next, as can its relationships with global suppliers. That has made it cheaper to set up foreign outposts than to acquire them. Amazon has probably spent about \$3.5bn to date building its Indian operation, where it is largely on a par in terms of market share with Flipkart, a local e-commerce site which has raised nearly double that in equity and debt.

The downside of the American approach is that subsidiaries are wedded to a business model that proved itself in completely different circumstances. Like the Chinese, most Asian consumers use only mobile phones to access the internet; the American trio made their first fortunes through PCs. Some think the executives dispatched from head office lack the fizz of the local entrepreneurs they are taking on, and rely overly on lavish cheques from head office.

The two models could yet both be proved right, and start to converge. The advantages of being part of a global outfit might be decisive in delivering some services, such as search or social media. Alibaba is pushing its own branded B2B platform for Indian small businesses, helping them sell their wares abroad and, in this instance, expanding in much the same way that an American rival might have done. In other areas, where local nous matters more, American groups might adopt a more Chinese-style approach of building an "ecosystem" of allied firms. Amazon was said to be interested

in buying Flipkart, in which Walmart is now buying a majority stake (in part from Tencent); Google is still said to be mulling a minority investment. On June 17th Google invested \$550m in JD.com, a Chinese e-commerce firm which has spent lavishly on startups in Indonesia, Thailand and Vietnam.

User numbers for services that are free of charge in emerging markets are inevitably mind-boggling—eight of the ten countries with the largest number of Facebook users are emerging markets, led by India with 270m. Whether that will translate into a commensurate level of revenue and profits is less clear. For all the excitement around Indian e-commerce, say, only about \$27bn-worth of stuff is shifted online in India each year—about what all Chinese e-commerce firms sell in just nine days and American ones in three weeks. South-East Asia is smaller still.

No matter, so far as the tech firms are concerned. Winning the next billion users is seen as an investment worth making at almost any cost. Chinese tech giants must reckon with a dwindling number of new recruits to the internet at home; they also have the confidence, clout and capabilities to expand abroad. America's titans might once have expected to face meek local rivals in emerging markets; now they have a fight on their hands. It is one they could barely have imagined four years ago, when those other titans, of the footballing ilk, were last challenging for global glory. ■



新兴市场上的科技公司

诸神之战

中美科技巨头在印度和东南亚等地展开正面交锋。最后鹿死谁手？

目前正上演着两大竞赛，天文数字身价的巨人们正奋力争夺全球霸主之位。一场在俄罗斯的球场上展开，领衔的是内马尔和哈里·凯恩等球星。另一场则在印度、印尼、巴西等新兴经济体消费者的智能手机屏幕上打响。在那里，谷歌、Facebook和亚马逊等美国互联网超级明星正与阿里巴巴和腾讯率领的中国梦之队对垒。

由于商业中的地缘政治影响，市值总计已超过四万亿美元的全球最大的一批科技公司尚未真正正面交锋过。中国用防火墙把谷歌等公司阻隔在外，阻止美国公司（苹果显然是个例外）在大陆挑战中国竞争对手。中国巨头一直未涉足美国；而在中国科技公司成熟壮大前，欧洲已经被硅谷征服。

时代变了，实力格局也已改变。中国的科技公司以往只是简单地模仿硅谷的产品——从搜索引擎到电子商务和社交网络。现在，复制者已蜕变为行业先锋。例如，腾讯旗下附带无数附加功能的即时通讯应用微信可与加州任何科技产品相媲美。

因此，中国大陆的公司已准备好对中美企业主场以外的市场发起激烈角逐。在新兴市场，人们收入提高，智能手机不断普及，互联网基础设施也在改善，这让它们成为所有科技公司都难以抗拒的热土。为争夺下一个十亿网络消费者，阿里巴巴交锋亚马逊，百度对阵谷歌，腾讯挑战Facebook。

然而，两国公司的策略大相径庭。美国公司通常是从零开始设立“前哨站”。它们资助子公司，为印度人或墨西哥人提供与美国用户的期望大致相同的服务。例如，亚马逊进军印度时承诺投入超过50亿美元，全面复制它在美国的服务。它已在该国建成了一个仓储体系来满足电子商务订单之需，并推出了Prime视频服务（增加了宝莱坞影视节目）和网站托管服务

等。亚马逊还会重塑它收购的品牌。去年，它以6.5亿美元收购总部位于迪拜的电子商务网站Souq.com，该网站现在清楚地标示为“亚马逊旗下公司”。

谷歌和Facebook也在海外提供体验与美国消费者类似的产品，因此，两者在巴西利亚或班加罗尔的认知度与在波士顿或柏林并无二致。全世界的谷歌用户用的都是同样的Chrome浏览器、YouTube网站或安卓手机操作系统，收到推送广告的方式也大致相同。Facebook旗下的WhatsApp和Instagram在全球各地都广受欢迎。

相比之下，很少有印尼人或印度人知晓阿里巴巴的大名。它在新兴市场的战略并非自行建立分店，而是投资当地企业，有完全收购也有少量持股。在过去两年左右的时间里，阿里巴巴已经改造了一系列专门做购物、支付和配送的公司。这些公司中有印度的Paytm和BigBasket、印尼的Tokopedia、新加坡的来赞达（Lazada）、巴基斯坦的Daraz，7月2日又新增了土耳其的Trendyol。这些公司的用户多数都不知道这些应用背后的金主是一个中国科技巨头。

腾讯同样也投资了一些印度公司，涉及众多领域，有网约车、在线教育、音乐流媒体、医疗保健，IT和电子商务，此外还投资了尼日利亚的支付企业和印尼的物流公司。目前来看，百度在抢占新兴市场方面最不活跃，但它大举投资开发人工智能，这可能会令其技术在全球被广泛采用，比如用于无人驾驶汽车。数据公司CBInsights称，腾讯、阿里巴巴及其金融子公司蚂蚁金服已投资了亚洲43%的“独角兽”企业（即估值超过十亿美元的创业公司）。阿里巴巴对东南亚最大的电子商务平台来赞达的投资已达到40亿美元。单单对印度，阿里巴巴的创始人兼董事局主席马云就已承诺投资80亿美元。

中西方企业不同的扩张手法反映出它们不同的盈利之道。谷歌和Facebook的收入主要来自在用户追捧的服务中投放广告。除了要翻译网站以吸引当地用户外，并不需要多少本地化。

对比而言，中国企业的竞争优势是处理支付和组织货物配送，这源自于它们过去在本国解决这类棘手问题所获得的经验。但专攻这类具体细节问题的生意不容易直接输出。“对于这类业务，很难有适合不同国家的通用方案。”科技投资公司Insignia Ventures Partners的陈映岚表示。比如，成为新加坡的配送专家（该市场之前为新加坡邮政垄断，现在阿里巴巴拥有它14%的股份）对于在印尼的17,500个岛屿上开展包裹配送服务几乎没有任何借鉴意义。同样，在越南能顺利处理支付流程，不意味着方案就可以被照搬到巴西或尼日利亚，毕竟各地的银行和监管体系截然不同。换言之，本地企业家或许能更好地应对这类难题，不妨等他们解决问题后再做收购。

这些不同策略的实战效果如何？迄今为止，中美科技巨头之间最激烈的竞争主要集中在印度和东南亚市场。投资规模反映了押注大小：据数据提供商Tracxn的报告，去年印度创业公司获得了中国科技公司共52亿美元的投资，而2016年的数额还是9.3亿美元。市场研究集团弗雷斯特（Forrester）表示，2017年，中国科技巨头（包括滴滴和京东）投入了60亿美元在东南亚展开收购。

中国企业有几个优势。在将新兴市场数以亿计的消费者送入网络时代这件事上，它们拥有成功经验。马来西亚和越南等地的中国侨民及大量大陆游客也为企业挺进这些市场提供了滩头阵地。中国政府也心照不宣地支持本国科技巨头，乐见它们在中国周边的“一带一路”沿线国家扩张。亚洲创业公司的创始人更可能想要效仿马云而不是那些美国大佬：他们如果想要继续经营自己的公司，肯定更喜欢中国那套做法。

然而在批评者眼中，中国公司的扩张方式与上世纪80年代的日本企业类似：毫无节制地为炫耀性资产付出过高的代价。中国企业有时会自己打自己。例如，印尼的Tokopedia和来赞达销售相似的产品，同时获得阿里巴巴投资支持。阿里巴巴在押注印度昔日的电商宠儿、光芒已大不如前的Snapdeal后，又紧接着投资了Paytm。

企业估值高得令人瞠目。部分原因是市场上有充裕的资金。风险资本家担

心在新兴市场错失良机和影响力，因此要持续投资。热衷风险的日本风投集团软银最爱投资热门创业公司，劲头堪比追逐足球奖杯的巴西人。和其他一些投资者一样，软银也在中国赚了大钱（它是阿里巴巴的最大股东），现在渴望通过其他新兴技术公司复制成功。

美国公司的优势在于它们过去的成就和所占的先机。硅谷巨头几乎一开始就是国际化运营。亚马逊的英国和德国业务部门即将迎来创建20周年。工作语言为英语的公司比使用中文的企业更容易招聘人才或吸引用户。谷歌和Facebook的收入已有过半来自美国以外地区。而中国公司中即使是国际化程度最高的阿里巴巴，海外收入也才刚刚达到10%，但该公司希望到2025年其平台的总销售额中有一半来自海外交易。

企业的全球影响力对于它们在地方的争夺战也有助力。亚马逊的电影流媒体这样的服务可以从一国扩展至另一国，亚马逊与全球供应商的关系也一样。这就让它能以比收购更低的成本设立国外业务分支。迄今亚马逊大概花费了约35亿美元在印度开展业务，取得的市场份额已与当地电商网站Flipkart大致相当，而后者的股票和债券融资额是该数字的近两倍。

美国这套方法的缺点是，子公司只能拘泥于一种在完全不同的环境下成功过的商业模式。和中国人一样，亚洲的消费者多数只用手机上网，而美国的三大科技巨头则是在个人电脑上赚到它们的第一桶金。有人认为，这些公司总部派出的高管缺乏与他们竞争的当地企业家身上的那份活力，而且过度依赖总部开出的慷慨支票。

但这两种模式可能都会成功，而且开始趋向一致。身为一家全球性企业的分支在提供某些服务方面可能拥有决定性优势，比如搜索或社交媒体服务。阿里巴巴正向印度的小企业力推自有品牌的B2B平台，帮助它们在国外销售产品，在这个案例中，阿里的扩张方式应该是一个美国竞争对手也会采取的方式。而在更讲求本地智慧的其他领域，美国企业可能会采取更中国化的方式，建立一个由联盟企业构成的“生态系统”。据称亚马逊之前曾有意收购Flipkart，而目前沃尔玛正在收购该公司的多数股权（部分股

份从腾讯购得），而谷歌据说还在考虑投资获得少数股权。6月17日，谷歌向中国电商公司京东投资5.5亿美元，京东此前则大笔投资了印尼、泰国和越南的创业公司。

在新兴市场上，使用免费服务的人数必然是惊人的——Facebook用户数最多的十个国家中有八个是新兴市场，其中印度以2.7亿用户居首。但这是否会转化为相应的收入和利润？答案就没那么明确了。例如，尽管印度的电子商务备受热捧，但印度的网络年销售额只有约270亿美元，大概只相当于中国全体电商九天的总销售额，或者美国电商三周的销售额。东南亚市场就更小了。

对科技公司而言，这并不要紧。赢得下一个十亿用户被视为一种值得付出任何代价的投资。中国科技巨头必须应对国内互联网新用户不断减少的现实，而同时它们还拥有向海外扩张的信心、影响力和能力。美国巨头可能一度以为在新兴市场只会遇到温顺的当地竞争对手，现在它们已经知道自己有一场硬仗要打。四年前，当足坛巨人们拼力争夺上一次世界殊荣之时，科技巨头们还无从想象将有此一战。 ■



Free exchange

The critics it deserves

China's statistics are bad. Many criticisms of them are worse

"Our people crave, more than anything else, to know the extent of the nation," says the narrator in "Do You Love Me?", a short story by Peter Carey set on an imaginary world that lionises cartographers. To satisfy that craving, the country carries out a regular, exhaustive census: a "total inventory of the contents of the nation". Helpful householders even move their possessions—furniture, appliances, utensils, heirlooms—into the street for easier counting.

China, like many countries, is keen to know its own extent. This year it is preparing its latest economic census, a twice-a-decade undertaking. Like the census in Mr Carey's fable, it is a "mammoth task". The most recent one employed 3m people, counted more than 8m enterprises and estimated a GDP of almost 59trn yuan (\$9.5trn at the time). This year's census may find that GDP per person has exceeded \$10,000, enough to form a tidy pile of possessions on the street.

But why, many people will ask, does China bother? Doesn't everyone know that its GDP is "man-made", as Li Keqiang, the country's prime minister, once said? Aren't the data fabricated to support the ruling party's narrative of fast and steady progress? Why pretend that it is an inventory, not an invention?

The critics have plenty of material with which to build their case. China has now reported exactly the same pleasing growth rate (6.8%) for three quarters in a row. The economy grows robustly even when vital correlates of production, such as electricity consumption or rail freight, do not (see

left-hand chart). And China's national GDP figure is laughably out of line with the sum of its provincial GDP figures. The various levels of government cannot keep their statistical stories straight.

In recent weeks, China's data have invited further scorn. The National Bureau of Statistics (NBS) reported that industrial profits in the first five months of the year amounted to more than 2.7trn yuan, 16.5% higher than a year ago. That would be a reassuring result in the midst of a stockmarket slump. The problem is that this time last year the NBS reported that industrial profits were 2.9trn yuan for the same period of 2017. That would imply a 6% decline from then until now (see right-hand chart). Similar discrepancies have appeared in recent retail-sales figures.

In Mr Carey's strange tale, some parts of the country prove increasingly hard to enumerate. Indeed, these "nebulous areas" become hard to discern at all. Unused for agriculture or industry, they "become less and less real". Eventually, they dematerialise.

Something similar may excuse some of the flaws in China's data. China's vast, protean economy is certainly difficult to enumerate. Small firms and self-employed entrepreneurs are hard to track. And the biggest part of GDP is neither agriculture nor industry but "nebulous" services, a growing share of which are provided digitally or purchased implicitly, such as the accommodation that a home can provide to the people who own it.

These measurement difficulties may help explain some of the oddities that harsher critics delight in pointing out. It is true, for example, that China's quarterly GDP figures are implausibly smooth. But so are Indonesia's. That suggests mismeasurement may be as much to blame as manipulation. For the quarterly numbers, points out Carsten Holz of Hong Kong University of Science and Technology, the NBS can draw on the data reported directly

to it by large enterprises (those with annual revenues of over 20m yuan). But it remains largely in the dark about smaller firms. Big enterprises are disproportionately state-owned. They tend to lumber along at a steadier pace than their private rivals, which respond more adroitly to market ups and downs. For the rest, the NBS must make educated guesses, which will err on the side of continuity.

It is also true that China's GDP often grows faster than physical correlates, like tonnes of rail cargo or kilowatt-hours of electricity, two alternative indicators once cited by Mr Li. But this may be because GDP reflects the value of final goods, not simply their volume. An economy that produced 100 phones last year and 103 this year can be growing at more than 3% annually if the phones are not only more numerous, but better. (Besides, electricity and freight are both now expanding faster than China's GDP.)

Many critics who quote Mr Li's scepticism forget that he was talking about Liaoning, the province he once oversaw, not China's national figures. Several provinces have since admitted that their figures have been grossly overstated, presumably to help local leaders win promotion. It should therefore be a source of reassurance, not scorn, that China's national GDP number is not simply the sum of its provincial numbers.

Indeed, the NBS has its own survey teams in many parts of China and requires large enterprises to report data to it directly. That cannot prevent the firms misreporting figures, but it does stop direct meddling by local officials. And next year the NBS will take more centralised control of provincial GDP numbers.

Some of China's recent statistical embarrassments may stem, paradoxically, from its efforts to improve matters. For example, the industrial profits recently reported by large enterprises were lower than those reported last year because some under-sized and double-counted firms were purged

from the sample. Retail-sales figures were also revised in light of a new survey, making them incomparable with those reported last year.

Mr Carey's story ends badly for the statisticians. As the world becomes more nebulous, the census-takers succumb to political pressure, faking information missing from their surveys. Even so, they are blamed for the disappearance of things they cannot measure. Once respected, they become disdained.

China's census-takers should be more open about what they can and cannot measure, inviting outsiders to cross-check their results. In admitting what they do not know, they will gain credibility. Their past opacity has shielded them from searching criticism, but exposed them instead to the laziest disdain. ■



自由交流

应受的批评

中国的统计数据确实糟糕，但很多批评它的声音更糟糕

“我们的人民最渴望的就是了解自己的国家有多大。” 短篇小说《你爱我吗？》（Do You Love Me?）中的叙事者说。小说作者彼得·凯里（Peter Carey）虚构了一个对地图测绘员推崇备至的世界。为了满足人民的这种热望，国家开展定期的全面普查，以期得到一份“国家家底总清单”。积极配合的住户甚至把他们的家当——家具、家电、餐具、传家宝——都搬到街上，以便清点。

和许多国家一样，中国也渴望摸清自己的“家底”。中国每五年开展一次经济普查，今年正在筹备最新的一次。和凯里那则寓言中的普查一样，这是一项“庞大艰巨的任务”。在上一次普查中，300万普查员统计了800多万家企业，估算出GDP接近59万亿元（当时合9.5万亿美元）。今年的普查可能会发现人均GDP已经超过1万美元，足以在街上堆起一大堆财物。

但许多人会问，中国何必如此劳神费力？国家总理李克强之前不是说过，中国的GDP数字是“人造的”吗？这一点难道不是人尽皆知？之所以编造这些数据，不就是为了支撑其执政党对国家发展又快又稳的说法吗？为何还要假装它是清单，而非虚构？

批评者有大量材料为己所用。中国已经连续三个季度公布了完全一样的、令人欣喜的GDP增速（6.8%）。即使在工业用电量和铁路货运量等与生产相关的重要指标没有明显增长之时（见左侧图表），经济仍稳健增长。全国GDP数字与各省GDP之和不一致得离谱。各级政府又没法把这些数字的来历圆了。

最近几周，中国的数据成了更大的笑柄。国家统计局公布，今年前五个月，工业企业利润总额超过2.7万亿元，同比增长16.5%。在股市暴跌之

际，这一数据将提振信心。但问题是，去年这个时候，国家统计局公布的2017年同期工业企业利润总额为2.9万亿元。这样算来应该是同比下降了6%（见右侧图表）。最近公布的零售数据也出现了类似的前后矛盾。

在凯里那则离奇的故事中，那个国家的某些地区越来越难以统计。甚至，这些“模糊不清的区域”变得完全难以识别。这些既非农业也非工业用地的区域“变得越来越不真实”。最终它们丧失了物质实体。

类似情况可能是造成中国某些数据缺陷的原因。中国经济规模庞大且千变万化，必定难以统计。小企业和个体经营者的情况也难以追踪。而且，占GDP比例最大的既非农业也非工业，而是“模糊不清的”服务业，且其中越来越多是以数字化形式提供或者隐形购买的，比如用于自住而非出租的住房就涉及住房服务价值计算的问题。

严苛的批评者很喜欢指出那些奇怪的数字，其中有些可能和测算困难不无关系。比如，中国每季度的GDP数据确实平稳得让人难以置信，但印尼也是如此。这表明除了人为操纵，误算可能同样难辞其咎。香港科技大学的卡斯滕·霍尔茨（Carsten Holz）指出，在季度数据上，国家统计局可以采用大型企业（年收入超过2000万元）直接上报的数据，但对于规模较小的公司，该局在很大程度上一无所知。大企业中又有太多的国有企业，它们往往稳步缓进，而不像私营竞争对手那样更敏捷地应对市场的跌宕起伏。对于其他企业，国家统计局只能靠经验推测，这就造成数据过于平稳连贯。

批评人士常说的另一点也是事实——中国的GDP增速常常高于铁路货运吨数或工业用电度数等相关实物指标的增速（李克强曾经引用的两个指标）。但这可能是因为GDP反映的是最终产品的价值，而不仅仅是数量。如果一个经济体去年生产了100只手机，今年生产了103只，而上升的不仅仅是数量，还有手机的质量，那么该经济体的GDP年增速可能就会超过3%。（此外，目前中国用电和货运的扩张速度都高于GDP增速。）

许多引用李克强那句话的批评者忽略了一个事实：他当时说的是自己曾执

政的辽宁省，而不是全国数据。在那之后，有几个省份承认自己的数据严重夸大——应该是为了帮助当地领导晋升。因此，中国的GDP总量不是各省数字的简单总和，这一点应该令人感到宽慰，而不是引来鄙视。

事实上，国家统计局在很多地方都有自己的统计团队，并要求大型企业直接向其汇报数据。虽然这并不能防止企业谎报数据，但确实阻止了地方官员的直接干预。而且，明年该局将加强对各省GDP数据的集中管控。

矛盾的是，最近一些尴尬的统计数据可能还是由于国家力图改善事态而引发的。例如，最近公布的大型企业工业利润比去年低，是因为从样本中剔除了一些规模不达标和重复计入的企业。零售数据也根据一项新的统计做了修正，因此也不宜与去年公布的数据做比较。

在凯里的故事里，统计员们的结局很糟糕。随着他们生活其中的世界变得越来越模糊不清，普查员屈服于政治压力，对统计中缺失的信息用编造来填补。即便如此，人们还是把一些无法测算的事物的消失怪罪到他们头上。他们曾经备受尊重，后来又遭人鄙视。

无论是力所能“计”还是力所不能“计”的部分，中国的普查人员都应开诚布公，欢迎外界交叉核对普查结果。承认“不知为不知”会让他们赢得公信力。他们过去的讳莫如深让自己免于刨根问底的指责，却也招致了最不假思索的鄙视。 ■



Materials science

Industrial plants

How to make buildings, cars and aircraft from materials based on natural fibres

USING carrots to create concrete, turning wood into plastic, or even compressing it into a “super wood” that is as light and strong as titanium might sound like a series of almost Frankensteinish experiments. Yet all three are among the latest examples of employing natural fibres from plants as eco-friendly additives or alternatives to man-made materials.

Materials-science researchers are finding that plant fibres can add durability and strength to substances already used in the construction of buildings and in goods that range from toys and furniture to cars and aircraft. A big bonus is that, because plants lock up carbon in their structure, using their fibres to make things should mean less carbon dioxide is emitted. The production of concrete alone represents some 5% of man-made global CO₂ emissions, and making 1kg of plastic from oil produces 6kg of the greenhouse gas.

Start with the carrots. These are being investigated by Mohamed Saafi at Lancaster University, in England. Dr Saafi and his colleagues do not use whole carrots, but rather what they call “nanoplatelets” that have been extracted from carrots discarded by supermarkets or as waste from food-processing factories. Sugar-beet peelings are also a useful source of nanoplatelets. The researchers are working with CelluComp, a British firm that produces such platelets for industrial applications, including as an additive that helps toughen the surface of paint as it dries.

Each platelet is only a few millionths of a metre across. It consists of a sheet of stiff cellulose fibres. Although the fibres are minute, they are strong.

By combining platelets with other materials a powerful composite can be produced. Dr Saafi is mixing the platelets into cement, which is made by burning limestone and clay together at high temperature. (The chemical reaction between them releases carbon dioxide from the limestone.) To turn cement into concrete it is mixed with aggregates such as sand, stones and crushed rocks, which act as reinforcement, and with water, which reacts with the chemicals in the cement to form a substance called calcium silicate hydrate. This starts off as a thick gel, but then hardens into a solid matrix that binds the aggregates together.

By adding vegetable platelets to the mix, Dr Saafi and his colleagues can make concrete stronger. This is useful in itself, but it also permits a reduction in the ratio of cement to aggregates that is required to achieve a given level of strength. Reducing the amount of cement in this way consequently reduces CO₂ emissions.

The group is still exploring exactly how strong it can make concrete by adding platelets, but initial studies suggest that the impact could be considerable. Just 500 grams of platelets can reduce the amount of cement needed to make a cubic metre of concrete by about 40kg—a saving of 10%. Dr Saafi and his team have now embarked on a two-year study to investigate the process in more detail and to perfect the best mix for use by the construction industry.

Unlike cement, wood is already a composite material. It is made of cellulose fibres embedded in a matrix of lignin, an organic polymer that serves a number of purposes, including providing woody plants with their rigidity. In May Stora Enso, a Finnish forestry-products company, launched a wood-derived alternative to oil-based plastics. This material, called DuraSense, looks a bit like popcorn. It consists of wood fibres, including lignin, obtained from pulping and other operations. The fibres are mixed with oil-based polymers and other additives, such as colouring agents. The resulting

granules can be melted and moulded in the same way as plastic is in factory processes. Adding wood fibres, the company says, can reduce the amount of plastic needed to make goods with plastic parts by 60%.

Stora Enso has also found a use for pure lignin, which is often a waste product of papermaking, since most paper is made of pulp with the lignin removed. Stora Enso's engineers have worked out how to use lignin as a substitute for the oil-based resins and adhesives employed in the manufacture of engineered timbers, such as plywoods. Nor are they alone in looking for structural applications for lignin. Along with others they are seeking ways to use it to replace oil-based materials in carbon-fibre composites, which are used to make lightweight parts for cars and aircraft.

By contrast, Hu Liangbing and Li Teng of the University of Maryland are trying to make a better material by removing, rather than adding, lignin. Their aim is to create a "super wood" that is stronger than most metals. Their approach is to treat blocks of wood with sodium hydroxide and sodium sulphate in a chemical process similar to that used to remove lignin from papermaking pulp. The difference is that they remove only enough lignin to make the wooden blocks easier to compress. They do that by squeezing the treated wood at around 100°C, which causes most of the pores and tubelike fibres within the wood to collapse. This increases its density threefold and its strength elevenfold.

That puts super wood on a par with some of the lightweight titanium alloys used in high-strength aerospace components. It is also bulletproof. In one test Dr Hu and Dr Li made a laminated sample by placing five sheets of the stuff on top of one another, each sheet having its fibres aligned at right-angles to those of the sheet below. When shot at, this material splintered but was still able to trap a steel projectile that passed effortlessly through a similarly sized sample of natural wood.

The team are now trying to commercialise their process, which Dr Hu thinks will be cheap to scale up. It works on both hardwoods and softwoods, so a range of materials can be created. Dr Hu reckons that, one day, houses, cars, furniture and many other things will be made mainly or partly from densified wood. ■



材料科学

工业植物

如何用基于天然纤维的材料盖房子及造汽车和飞机

用胡萝卜拌制混凝土；把木头变成塑料；把木头压缩成和钛一样又轻又坚固的“超级木材”。这听起来像是科学怪人鼓捣的一连串疯狂实验。实际上，这是研究人员尝试把植物中的天然纤维用作环保添加剂或人造材料的替代品的最近三例。

材料科学研究人员发现，在建筑材料以及玩具、家具、汽车、飞机等各种商品的原材料中添加植物纤维，能让它们更耐久、更结实。而由于植物可将碳封存在其组织内，使用植物纤维应该还会带来一大好处——减少二氧化碳排放。单是混凝土生产就造成了全球大约5%的人为二氧化碳排放，而用石油生产1公斤塑料会产生6千克温室气体。

先来看胡萝卜的妙用。英国兰卡斯特大学的默罕默德·萨菲（Mohamed Saafi）正在探究这种植物的用处。萨菲和同事们用的并不是整根胡萝卜，而是所谓的“纳米薄片”，是从超市丢弃或被食品加工厂当作废料的胡萝卜中提取而来。甜菜皮也是制作纳米薄片的有用材料。研究人员正在和英国公司CelluComp合作。这家公司生产工业用途的纳米薄片，其中有一种可用作添加剂，能让干燥后的油漆表面更牢固。

每个薄片只有一米的几百万分之一宽，由一层硬的纤维素纤维构成。这种纤维虽然非常细小，却很结实。将薄片与其他材料结合，便能得到强大的复合材料。萨菲正在把薄片与水泥混合。水泥由石灰石与粘土高温烧制而成。（二者发生的化学反应会令石灰石释放二氧化碳。）要将水泥变成混凝土，需要将它与骨料和水混合，骨料包括砂石和碎石，起加固的作用；水会与水泥中的化学物质发生反应，形成一种叫作水化硅酸钙的物质。一开始它是一层厚厚的胶状物，但之后会硬化成一种固体基质，将骨料结合在一起。

萨菲及同事将蔬菜纳米薄片加入混合物，让混凝土变得更坚固。这本身就很有益处，但采用这种手段还可以降低水泥与骨料的比例（这两者需要达到一定比例才能使混凝土达到特定强度）。如此减少水泥的用量，也就可以减少二氧化碳的排放。

这个团队仍在探究采用添加纳米薄片的方法究竟能让混凝土达到何种强度，但初步研究已经显示，其效用可能会相当可观。仅500克纳米薄片就可以使生产一立方米混凝土的水泥用量减少约40公斤，相当于节省10%。萨菲和他的团队如今已开始了一项为期两年的研究，准备更加详尽地探究工艺流程，找出最佳配比，以供在建筑行业应用。

和水泥不同，木材已经是一种复合材料了。它是由嵌在木质素基质中的纤维素纤维制成。木质素是一种有多种用途的有机聚合物，其中之一就是赋予木本植物硬度。5月，芬兰林产品公司斯道拉恩索（Stora Enso）发布了一种源自木材的材料，可替代以石油为原料的塑料制品。这种材料名叫DuraSense，看上去有点像爆米花，是由包括木质素在内的木纤维构成，这些纤维是通过制浆等操作方法获取的。该公司将木纤维与基于石油的聚合物以及着色剂等其他添加物混合，所形成的颗粒可以熔化并塑形，就像工厂中为塑料塑形的工艺一样。该公司称，在生产含有塑料配件的商品时如采用这种添加木纤维的做法，可以将塑料的使用量减少60%。

斯道拉恩索还为纯木质素找到了用处。由于大多数纸张都是由去除了木质素的木浆制成，因而这种物质在造纸业中往往是废料。斯道拉恩索的工程师已经研究出方法，既可以将木质素用作石油树脂的替代品，还可以在生产胶合板等工程木料时将它用作黏合剂。为木质素寻找结构性用途的并非只有斯道拉恩索的工程师。其他人也和他们一样，正在探究如何以木质素替代碳纤维复合材料（用来为汽车和飞机制造轻量部件）中的石化材料。

马里兰大学的胡良兵和李腾则是尝试通过去除而非添加木质素的方法来制造一种更好的材料。他们的目标是研制出比大多数金属都要坚固的“超级木材”，方法是用氢氧化钠和硫酸钠对木料加以处理，这一化学过程与从造纸用浆中去除木质素类似。只不过，他们仅去除了木料中的部分木质

素，使木材恰好达到更易压缩的程度。他们将处理过的木料放到大约100℃的温度下做挤压，木头中的大多数管孔和管状纤维就会被破坏。这会使木料的密度提升至原来的三倍，强度提升11倍。

这样一来，超级木材就足以和高强度航空航天部件所采用的某些轻量钛合金相媲美了。这种木材还具备防弹功能。在一次测试中，胡良兵和李腾将五层超级木材叠放，制成一个层压板样品，每一层木板中的纤维都与下一层的呈直角。被射击后这种材料发生碎裂，但仍将钢弹卡在了中间。尺寸相近的天然木材样本则被子弹轻松穿透。

这个团队目前正尝试将这项工艺商业化，胡良兵认为它能以低廉的成本实现规模化。这项工艺在硬木和软木上均适用，因而可以研制出多种材料。胡良兵认为，某一天，房子、汽车、家具以及其他很多东西都会主要或部分由压缩木材制成。 ■



India's rise

The great ghatsby

James Crabtree's book depicts the symbiotic relationship of Indian politics and business

WRITING about India generally falls into one of two categories. There is what you might call the classical view, which emphasises the country's messy democracy, the court intrigue in Delhi, the role of the powerful states, and poverty and religion. And then there is the business-school view, which sees India as a huge potential market that could one day rival China, with a dynamic business scene that is already the world's eighth-largest, ranked by market capitalisation. James Crabtree's new book, "The Billionaire Raj", does the great service of tying these two stories together, showing how India's political system and its firms are symbiotically connected, in an entertaining—and sometimes disturbing—fashion.

Mr Crabtree is a former Mumbai bureau chief of the *Financial Times* and his book is full of sharp snapshots from what he calls India's new gilded age. In the London home of Vijay Mallya, a self-exiled liquor tycoon, Mr Crabtree finds a golden toilet seat and melancholia. He visits the western state of Goa, where mining outfits stripped the earth of iron ore and shipped it to China while tourists frolicked on the beaches. Elsewhere, an Aston Martin is impounded after a mysterious crash.

But Mr Crabtree also makes a muscular argument about the interlinkage of democracy, business and development. The country needs its bosses to marshal capital, build infrastructure and help it industrialise. The bosses need the government for cheap credit and permits. And the politicians—often reluctantly—tap firms for illicit cash, to pay for election campaigns that in total can cost billions of dollars.

Sometimes this arrangement delivers results. In 2004-10 India had the fastest growth spurt in living memory, with GDP rising at close to double-digit rates. A group of tycoons went on an investment binge that expanded the economy's capacity. But as Mr Crabtree documents, eventually the wheels came off, with accusations of corruption and mounting bad debts. The fallout contributed to the election in 2014 of Narendra Modi, India's strongman leader, who pushed an agenda of Hindu nationalism, clean government and development.

To illustrate his case, Mr Crabtree provides profiles of businessmen whose sheer ambition, he argues, is vital. Naveen Jindal, a mid-ranking steel magnate noted for his polo-playing and business debts, is transformed into a sympathetic figure; he is depicted in the remote state of Odisha, surrounded by forests, trying to get a steel and power project up and running.

The analysis really sings when Mr Crabtree finds new ways to capture the collision of profits, politics and public opinion. His account of India's cut-throat network-TV industry, through the eyes of a star presenter, is thrilling. And he explores the paradox of India's "southern belt" of states, most notably Tamil Nadu, which have their share of charismatic politicians and graft, but are also relatively rich. They have developed an efficient kind of populism, he concludes, in contrast to the purely venal politics farther north.

The book's main flaw is that it gives a narrow view of the business world. Like Russia and other parts of Asia, India has its politically connected moguls. But it also has what may be the world's most vibrant tech scene after America and China, a large stock of investment by multinational companies and a cohort of professionally run firms that compete in global markets.

Nonetheless the nexus of business and politics is central to India's future. Mr Crabtree thinks India needs its own progressive era, like America's in the late 19th and early 20th centuries, in which the machinery of the state is reformed in order to make markets work better. But he worries that Mr Modi, despite his formidable image and some solid accomplishments, is too cautious to make that happen. ■



印度的崛起

了不起的印茨比

詹姆斯·克拉布特里的书讲述了印度的政商共生关系

关于印度的叙述通常分为两类。第一类可称为经典视角，强调该国混乱的民主、联邦政府内的勾心斗角、强大的地方势力，以及贫穷和宗教。第二类是商学院视角，认为印度是一个巨大的潜在市场，有朝一日将匹敌中国：它的商业富有活力，按市值计算已位列世界第八。詹姆斯·克拉布特里（James Crabtree）的新书《亿万富翁的天下》（The Billionaire Raj）则难得地把这两个视角结合起来，展示了印度政治体系与企业界的共生关系，读起来趣味横生，有时也令人不安。

克拉布特里曾是《金融时报》孟买分社社长，书中充满了来自他称之为“印度新镀金时代”的一幅幅犀利的“快照”。在自我流放的酒业大亨维贾伊·马尔雅（Vijay Mallya）位于伦敦的宅邸中，他发现了一个黄金马桶座圈，也看到了这位大亨的郁郁寡欢。他去了印度西部的果阿邦（Goa），看到采矿公司从地下大肆开采铁矿运往中国，海滩上游客在嬉戏玩耍。在另一处，一场蹊跷的车祸后，一辆阿斯顿马丁遭到扣押。

但作者也对民主、商业和发展之间的相互关联做了强有力的论证。印度需要企业老板开展投资、建设基础设施、帮助国家走向工业化。老板们需要政府来提供廉价贷款和发放许可。而政客们虽常常不情愿，却还得靠企业提供非法或不正当的资金，以支撑耗资可达数十亿美元的选举活动。

有时这种共生关系能够带来成效。2004至2010年间，印度取得了近百年来最高速的发展，GDP增速接近两位数。一批大亨大肆投资，扩大了经济产能。但正如克拉布特里所记录的，伴随着对腐败的指控和不断增长的坏账，形势最终急转直下。其影响促成了2014年强人领袖莫迪的当选，他主打的是印度教民族主义、清廉政府和发展。

克拉布特里列举了一些商界人士的发展轨迹来阐述自己的观点，指出这些人的十足野心至关重要。位于富豪榜中游的钢铁大亨纳温·金达尔（Naveen Jindal）以爱打马球和巨额商业负债闻名，但他正在转变为一个更讨人喜欢的形象。书中描述到，他在森林环绕的偏远的奥里萨邦（Odisha）尝试启动一个钢铁和发电项目。

当克拉布特里另辟蹊径来捕捉利益、政治和民意之间的冲突时，他的分析着实出彩。他借一位明星主持人之眼对印度竞争惨烈的电视产业所做的一番观察扣人心弦。他还探究了以泰米尔纳德邦（Tamil Nadu）为代表的印度“南方经济带”各邦中存在的吊诡之处——那里也不乏威权政客和贪污，却相对富裕。他总结说，相比北部各邦纯粹的贪腐政治，它们已发展出了一种有效率的民粹主义。

本书的主要瑕疵是对商界的观察失之片面。和俄罗斯以及亚洲其他地区一样，印度也有借助政商关系的企业大亨。但它还拥有也许是除美国和中国之外世界上最具活力的科技产业、来自跨国公司的大量投资，以及一批管理规范、能在全球市场上竞争的企业。

不过，商业和政治错综复杂的连结确实是印度未来的核心。克拉布特里认为，就像19世纪末20世纪初的美国一样，印度也需要它自己的“进步时代”——改革国家机器以令市场能更好地发挥作用。尽管莫迪表现得很强势，也有一些实绩，但作者仍担心他过于谨慎，不能为印度带来这种变革。 ■



Economic and financial indicators

Euro area

The euro area is five years into an economic upswing

The euro area is five years into an economic upswing. Though growth is likely to slow, loose monetary policy and recovery elsewhere in the world mean GDP will increase by 2.2% in 2018 and 2.1% in 2019, according to the OECD, a club of mostly rich countries. Labour markets are improving and support for the common currency is at an all-time high. However, high levels of public debt still burden several countries. The legacy of the financial crisis of 2007-08 remains stark: the Greek economy is 24% smaller than in 2007 and the Italian economy 4% smaller. Aggregate investment in the euro area is not expected to reach pre-crisis levels until 2019. ■



经济与金融指标

欧元区

欧元区经济改善已进入第五个年头

欧元区经济改善已进入第五个年头。根据成员多为富裕国家的经合组织的预测，尽管欧元区的经济增速很有可能会放慢，但由于世界其他地区的货币宽松政策以及经济复苏，2018年该区域的GDP仍会增长2.2%，2019年增长2.1%。劳动力市场正在逐步改善，对共同货币的支持力度前所未有。然而，若干国家仍在承受高额公共债务的重压。2007年到2008年金融危机遗留的创伤依然深重：目前希腊的经济总量较2007年小24%，意大利小4%。2019年之前，欧元区投资总额无望恢复到危机前的水平。■



Urbanisation

A tale of 19 mega-cities

The country tries to reshape itself into a series of conurbations

CHINA'S urbanisation is a marvel. The population of its cities has quintupled over the past 40 years, reaching 813m. By 2030 roughly one in five of the world's city-dwellers will be Chinese. But this mushrooming is not without its flaws. Rules restricting migrants' access to public services mean that some 250m people living in cities are second-class citizens (see chart), who could in theory be sent back to their home districts. That, in turn, has crimped the growth of China's cities, which would otherwise be even bigger.

Restraining pell-mell urbanisation may sound like a good thing, but it worries the government's economists, since bigger cities are associated with higher productivity and faster economic growth. Hence a new plan to remake the country's map. The idea is to foster the rise of mammoth urban clusters, anchored around giant hubs and containing dozens of smaller, but by no means small, nearby cities. The plan calls for 19 clusters in all, which would account for nine-tenths of economic activity (see map). China would, in effect, condense into a country of super-regions. Three are already well on track: the Pearl River Delta, next to Hong Kong; the Yangtze River Delta, which surrounds Shanghai; and Jingjinji, centred on Beijing.

For some urban planners, the strategy is beguiling. They see the clusters as engines for growth that could transform China into a wealthy, innovative powerhouse. But others think it is a trap—a government-driven exercise in development that will lead to gridlock and waste.

Hu Qiuping, a safety manager for a chemicals company, is in the urban vanguard. She lives in Wuxi, a city of 6m about 150km west of Shanghai. A trip between the two used to take a couple of hours. Today the bullet train takes just 29 minutes. Every Monday and Friday she works in Wuxi, inspecting the chemicals factory. From Tuesday to Thursday she travels to the firm's headquarters in Shanghai. She could have based herself in either city, but living costs were much lower in Wuxi. At first she wondered whether her commute was unusual. It was not. "I see familiar faces on the train every day," she says.

For those in bedroom communities near London or Manhattan, Ms Hu's train rides probably sound familiar. But three features make China's super-regions exceptional. The first is scale. The biggest existing city cluster in the world is greater Tokyo, home to some 40m people. When it is fully connected the Yangtze delta, where Ms Hu is based, will be almost four times as big, with 150m people. The average population of the five biggest clusters that China hopes to develop is 110m. Part of the reason is that the physical area of most of the Chinese clusters will also be bigger. The most prosperous, the Pearl delta, is expected to cover 42,000 square kilometres, about the same as the Netherlands.

Given that spread, it might seem nonsensical to talk of the clusters as unified entities. But the second point is the speed of transport links, notably the bullet trains between cities. This expands the viable area of China's clusters. The Jingjinji region around Beijing has five high-speed train lines today. By 2020 there should be 12 more intercity lines, and another nine by 2030. Towns that are woven into the networks can see their fortunes change almost overnight. Plans for a new intercity train to Haining, a smaller city in the Yangtze River Delta, partly explain a doubling of house prices there. "The way that we measure distances has changed from space to time," says Ren Yongsheng of Vantown, a property developer in Haining.

The third difference is the top-down nature of the clusters. China is far from alone in wanting to knot cities together. “Cluster policy” has been in vogue in urban planning for years, with governments trying to devise the right mix of infrastructure and incentives to conjure up the next Silicon Valley, or something like it. But China has intervened more heavily than most. To encourage people to disperse throughout clusters, it has raised the barriers to obtaining a *hukou*, or official residency permit, in the wealthiest cities and lowered them in smaller ones nearby. Whereas Shanghai is picky about granting permits to migrants, Nanjing, to its west, has flung its doors open to university graduates. As construction gets under way in Xiong'an, a new city designed to relieve pressure on Beijing, efforts to push people out of the capital could become more aggressive. The scenes of police forcing thousands of migrant workers to leave Beijing last winter might prove to have been a preview.

The concept of city clusters is grounded in the theory of agglomeration benefits, which holds that the bigger the city, the more productive it is. A large, integrated labour market makes it easier for employers to find the right people for the right jobs. As companies gather together, specialised supply chains can take shape. Knowledge also spreads more easily. In advanced countries, the doubling of a city’s population can increase productivity by 2-5%, according to the Organisation for Economic Co-operation and Development, a club mostly of rich countries. Studies have found that the potential gains in China are even bigger, perhaps because of its cities’ surprising lack of density. Take Guangzhou, one of China’s more crowded cities. If it had the same density as Seoul, it could house an additional 4.2m people on its existing land, according to the World Bank.

But China’s government has long resisted the emergence of true megacities. It aims to prevent the population of its two biggest cities, Beijing and Shanghai, from exceeding 23m and 25m, respectively, in 2035—little bigger than they are today. City clusters are a workaround. In the jargon of urban

planners, they represent “borrowed size”: cities can, in principle, have the benefits of agglomeration with fewer of the downsides such as congestion. Alain Bertaud of New York University says that, if integrated well, China’s city clusters could, thanks to their size, achieve levels of productivity never seen in other countries. He says it would be comparable to the differences between England and the rest of the world during the Industrial Revolution.

This vision of hyper-productive Chinese clusters is a pipe dream for now. The government first mentioned city clusters as a development strategy in 2006. It was not until 2016 that it elaborated the concept. Of its 19 identified clusters, just a few have published detailed plans so far. The gap between talk and policy remains vast. Officials have called for more region-wide governance, a welcome change from the municipal turf battles that have bedevilled China. In January the Yangtze River Delta area established an office for regional co-ordination, the first of its kind. But it is a bureaucratic minnow, with little more than a dozen employees. Stefan Rau of the Asian Development Bank says it is essential that regional offices have power over budgets if they are to play a useful role.

Evidence about economic gains from clustering in China is promising, if limited. Counties enjoy a 6% boost in productivity from being tied into the Yangtze super-region, according to an article published last year in the *Journal of the Asia Pacific Economy*. But the researchers found few such gains in other regions. That might be because they looked at old data. A more recent study, published in April by the National Bureau of Economic Research in America, supported the idea of big knowledge spillovers in super-regions. When cities were connected by high-speed rail, the quantity and quality of academic papers by local researchers increased by nearly a third, according to the authors.

Sceptics, however, note that the most successful clusters tend not to be creations of the government. As China’s economy has modernised, the

tendency towards concentration has been irresistible, especially in coastal areas. Some towns have specialised in electronics, others in the clothing industry and so on. There has also been much more migration to the coast than to other regions. It is the clusters that have coalesced naturally, especially the deltas of the Pearl and Yangtze rivers, that have the brightest prospects.

Beyond these coastal conurbations, the outlook is dimmer. Several of the 19 designated clusters seem fanciful. An economic zone linking Nanning, a poor provincial capital, to Haikou, a port on Hainan island, some 500km and a ferry crossing away, is unlikely to amount to much. The proposed cluster in the middle reaches of the Yangtze, a territory larger than Poland, is too expansive to make sense. Even within promising areas, government plans can be counter-productive. Beijing could benefit from shifting some of its universities and businesses to other cities in the Jingjinji region. But Xi Jinping, the president, has decided that an entirely new city, Xiong'an, should be created, some 100km away. A similar development closer to Beijing would have a better shot at success.

The main concern for those trying to lead productive lives across the vast super-regions is more mundane: how easy it is to get from A to B. The government classifies clusters as “one-hour economic zones” or “two-hour economic zones”, depending on the time it takes to cross the cluster by high-speed rail. But it often takes longer to get to train stations within cities than to travel by train between cities. Ding Shu works in Shanghai and lives in Kunshan, a satellite town linked to Shanghai by a subway. Factoring in her bus ride to the subway, security checks to enter the station, walking time and waiting time, she spends about four hours a day commuting. She says she is thinking about looking for a job closer to home. New rail lines to Shanghai might eventually help. But for now, Ms Ding sees herself as a victim of urban sprawl, not the denizen of a seamless city cluster. ■



城市化

十九巨城记

中国试图重塑自己，打造一系列大都市圈

中国的城市化进程是个奇迹。过去40年间，中国城市人口增长了四倍，达到8.13亿。到2030年，全球约五分之一的城市居民将会是中国人。但这种激增并非没有弊端。一些规定让外来人员无法充分享受公共服务，大约2.5亿居住在城市的人因此沦为二等公民（见图表），这些人理论上可以被遣送回乡。而这进而又限制了中国的城市发展，否则这些城市的规模还会更大。

对无序的城市化加以控制听上去似乎是件好事，政府的经济学家们却为此感到担忧，因为城市扩大能带来更高的生产率和更快的经济增长。一项重绘国家地图的新计划应运而生，意图促进特大城市群崛起。这些城市群以巨大的中心城市为依托，辐射周边几十个相对较小（其实本身并不小）的城市。计划打造的城市群总数为19个，将占中国经济活动总量的90%（见地图）。如此一来，中国实际上将浓缩为多个超级区域的集合体。其中三个已经基本成形，分别是毗邻香港的珠三角、上海周边的长三角，以及以北京为中心的京津冀。

在一些城市规划者眼里，这一战略相当诱人。他们将城市群视为令中国发展成富裕创新强国的增长引擎。但另一些人认为这是作茧自缚：这种政府主导下的发展实验将导致僵局和浪费。

胡秋萍（音译）是一家化工企业的安全经理，也是双城生活的先行者。她居住在上海以西约150公里、人口600万的无锡。从前往来两地需要两三个小时，现在乘高铁只需29分钟。周一、周五她在无锡工作，在化工厂巡视，周二到周四前往公司位于上海的总部。她本可以住在这两个城市中的任意一个，但是无锡的生活成本要低得多。一开始她还想着自己这种通勤

方式是不是很少见。并不。“我每天都在火车上看到熟面孔。”她说。

对于那些居住在伦敦或者曼哈顿郊区的人来说，胡秋萍的火车通勤听起来可能并不陌生。但是中国的超级区域因三个特征而与众不同。首先是规模。目前世界上最大的城市群是大东京地区，约有4千万人口。而胡秋萍所在的长三角如果完全实现一体化，人口将达到1.5亿，差不多是大东京地区的四倍。中国希望打造的五个最大城市群的平均人口是1.1亿。这在一定程度上是因为大多数中国城市群的地理面积也会更大。最繁荣的珠三角预计占地4.2万平方公里，和整个荷兰差不多大。

中国城市群范围如此之大，将它们说成是统一的整体似乎有些荒谬。但是第二个特征，即以城际高铁为突出代表的高速交通系统，拓展了中国城市群的有效覆盖范围。目前以北京为中心的京津冀地区有5条高铁线路。到2020年应该会增加12条城际线路，到2030年再增加9条。那些纳入高铁网络的城镇的命运几乎一夜之间就被改写。长三角地区的小城市海宁房价翻番，原因之一就是一条新规划的城际高铁途经这里。“我们衡量距离的方式已经从空间变成了时间。”海宁房地产开发商万通的任永胜（音译）表示。

第三个差异是中国城市群“自上而下”的特性。想把多个城市联结在一起的国家远不止中国一个。多年来，城市规划中一直盛行“集群政策”，各国政府试图想出兼顾基础设施和激励机制的良策，再造一个硅谷或类似的集群。但是中国的干预力度超过大多数国家。为了鼓励人口向周边城市分流，中国提高了获得最富裕城市的户口的难度，同时降低了周边小城市的落户门槛。上海对外来人员的落户审批很挑剔，但它西边的南京却向大学毕业生敞开了大门。雄安新区是为缓解北京的压力而建的一座新城。随着其建设的推进，政府可能会加大力度让人们迁出首都。去年冬天，警察强迫成千上万农民工离开北京或许就是一次预演。

“集聚效益”是城市群概念的理论基础。该理论认为，城市越大其生产率就越高。雇主在一体化的庞大劳动力市场中更容易找到合适的人做合适的事。随着企业集聚，专业化供应链得以形成。知识也更容易传播。成员主

要为富裕国家的经合组织（OECD）的数据显示，在发达国家，城市人口每翻一番，生产率就可以提高2%到5%。而研究发现，中国的潜在收益甚至更高，原因或许是这里的城市人口密度出人意料地偏低。以中国人口较为密集的广州为例，根据世界银行的数据，如果广州的人口密度达到首尔的水平，那么它现有的土地上还可以再容纳420万人。

但是中国政府长期以来一直在遏制真正的超大城市出现。它力争将北京和上海两个最大城市的人口在2035年分别控制在2300万和2500万以内，与现在相差无几。城市集群是一种变通方案。用城市规划者的行话来说就是“借用规模”，即原则上城市可以享有集聚带来的好处，而减少拥堵等不利因素。纽约大学的阿兰·贝尔托（Alain Bertaud）指出，中国的城市群规模庞大，如果融合得好，生产率可能会达到其他国家前所未有的水平。他表示，这将堪比工业革命期间英国和世界其他国家间的差距。

目前来看，希望中国城市群带来超高生产率的愿景还只是空想。政府在2006年首次提出打造城市群的发展战略，但直到2016年才详尽阐述了这一概念。在确定的19个城市群中，至今只有少数几个公布了具体规划。从讨论到政策出台仍相去甚远。官员们呼吁更加区域化的治理，这对于地方长期上演势力范围之争的中国来说是个可喜的变化。1月，长三角地区成立了首个区域合作办公室，但却是个微不足道、只有十几名工作人员的行政机构。亚洲开发银行的斯特凡·劳（Stefan Rau）指出，如果区域办公室要切实发挥作用，就必须有财务预算权。

关于中国城市群带来的经济收益，证据虽有限，却显露出乐观的前景。

《亚太经济杂志》（Journal of the Asia Pacific Economy）去年发表的一篇文章指出，划入长三角超级区域的各县生产率提高了6%。但研究人员几乎没有发现其他地区有如此收益。也许他们参看的是旧数据。美国国家经济研究局（National Bureau of Economic Research）4月发布的一项更新的研究成果支持了超级区域知识大溢出的观点。根据作者的说法，城市之间通过高铁相连之后，区内研究人员学术论文的数量和质量都提升了近三分之一。

然而质疑者指出，最成功的城市群往往不是政府规划的产物。随着中国经济的现代化，集聚已势不可挡，特别是在沿海地区。有些城镇专门制造电子产品，有些侧重制衣业，等等。向沿海地区的人口流入也远远高于其他地区。自然形成的城市群，特别是珠三角和长三角，前景最为光明。

除了那些沿海都市圈，其余的前景就没那么乐观了。19个划定的城市群中有几个似乎是异想天开。比如连接南宁与海口的经济圈就不大可能成什么气候。前者是一个贫穷的省会城市，后者是海南岛的港口，两地相隔约500公里，依靠渡轮往来。而位于长江中游区域的城市群面积比波兰还大，要在这么广大的区域内打造集群并不合理。即使是在前景不错的地区，政府规划也可能适得其反。将北京的部分高校和企业迁到京津冀地区的其他城市可能会让北京受益。但是国家主席习近平却决定要在距北京大约100公里的地方建造一个全新的城市雄安。如果是在离北京更近的地方建这么一个类似的开发区，成功的几率可能会更大些。

对于那些想在广阔超级区域有所作为的人来说，他们最关心一个更现实的问题：从甲地到乙地有多便捷。根据乘坐高铁横穿城市群所花的时间，政府将城市群分为“一小时经济圈”或“两小时经济圈”。但是赶往一个城市的火车站常常比乘火车去到另一个城市花费的时间还要多。丁舒（音译）在上海工作，住在与上海有地铁相连的卫星城昆山。如果把乘巴士去地铁站、进站安检、步行和等车这些时间都算进去，她每天的通勤时间大约为4小时。她说自己正在考虑找一份离家更近些的工作。通往上海的新铁路线可能最终会改善这种状况。但就目前而言，丁舒认为自己是城市扩张的受害者，而不是无缝连接的城市群的居民。 ■



Free exchange

Who's tit and who's tat?

In international trade and investment, Donald Trump insists on reciprocity. But what kind?

IN THE sixth episode of “The Apprentice”, a reality-television show first broadcast in 2004, Donald Trump, as always, fired a contestant vying for a job in his company. She was, he said, the worst negotiator. And she had failed to fight back when belittled by her teammate. The episode was entitled “Tit For Tat”.

That same principle of reciprocity guides Mr Trump’s trade policy as president. And it is animating his tariff war with China. On July 6th America imposed 25% duties on Chinese imports worth about \$34bn. (Another \$16bn-worth will be hit in due course.) China responded by slapping tariffs on a similar amount of American goods (including a cargo of soyabeans aboard the *Peak Pegasus* that arrived at the port of Dalian mere hours later).

The two sides disagree, however, about which is tit and which tat. China believes it is responding dollar-for-dollar to American aggression. But America too believes it is retaliating: punishing China for trade and investment transgressions, including the theft of American technology. In Mr Trump’s view, China’s new tariffs are not a reprisal, but a fresh affront, to which he must respond. On July 10th America gave notice of its intention to place 10% tariffs on another \$200bn-worth of Chinese goods, including swordfish, magnifying glasses, vacuum cleaners and red dye.

Mr Trump’s view of trade reciprocity is simple. If America imposes a 2.5% tariff on China’s cars, China should levy something similar on America’s. If China has been charging 25%, America’s trade representatives must have been poor negotiators who, presumably, would not have survived past

episode six of his show.

Trade negotiators take a broader view of reciprocity. Yes, countries must give and take. But what is given and taken is political gain and pain. A government will not expose a politically sensitive industry to fiercer foreign competition unless the deal provides commensurate political rewards. And so a reciprocal deal may leave all sides sheltering equally sensitive, but entirely different, sectors. America, for example, charges tariffs of 27.3% or more on a variety of textiles, including polyester suits and T-shirts.

Sometimes the pain or gain does not work out as expected. Developing countries did not have to reciprocate the cuts in manufacturing tariffs that America and the European powers negotiated with each other in successive rounds of post-war trade talks. At the time, it was not thought that poor countries would gain much from the rich world's liberalisation and were not required (or prepared) to offer much in return.

But China did not join the World Trade Organisation until 2001. By then, its manufacturing potential was easier to foresee. It was forced to forswear many of the perks that similar developing countries enjoyed. It agreed, for example, not to raise its tariffs above a ceiling of 10% on average. The equivalent ceiling for Brazil, a founding member of the system, is 31.4%; for India, 48.5%.

In the opening scenes of "The Apprentice" Mr Trump explained the quid pro quo at the heart of the show. After enduring a season's worth of trials, the successful contestant would be rewarded with a job in Mr Trump's company and, more important, the chance to "learn enough so that maybe they too can become a billionaire someday". "As the master," Mr Trump said, "I want to pass on my knowledge to somebody else."

This kind of bargain is common to all apprenticeships. Aspirants toil

eagerly, and often cheaply, in return for the know-how they will acquire on the job. An analogous kind of reciprocity has also been at work in China's economic relationship with America. Its aspiring firms have learned a great deal from serving American customers and working with American firms. One attempt to quantify how much they have learned was recently published by Kun Jiang of Nottingham University and her co-authors, who looked at the performance of international joint ventures from 1998 to 2007. These ventures, which were often created at government insistence, were 30% more productive than otherwise similar Chinese companies.

What did China give in return for this knowledge? Some American commentators seem to think: nothing at all. They believe American industry passed on knowledge entirely under duress and without recompense. But that misses the other side of the grand bargain that America implicitly struck with China. Like an apprentice, China provided cheap, but dedicated, labour. The benefits accrued to American companies and consumers (though some of the workers who voted for Mr Trump lost out). Thanks to China's entry into the WTO, the price of manufactured goods in America fell by 7.6% in 2000-06, according to Mary Amiti of the Federal Reserve Bank of New York and her co-authors.

When China joined the WTO it promised to stop making American firms pass on their knowledge as a condition for doing business in the country. Americans complain, with some justice, that it has breached the spirit of that agreement and sometimes the letter. They also point out that the WTO is ill-equipped to adjudicate complaints about unofficial and implicit obstacles to investment. But foreign investors, unlike exporters, have a straightforward remedy of their own. If the conditions China imposes on foreign multinationals are too onerous, they can refuse to invest.

Apprentices have always dreamed of surpassing their master. In the 1780s, for example, Samuel Slater served as an apprentice in Derbyshire at one of

the first water-powered cotton mills. He memorised the factory's designs and procedures, decamped to America and helped set up rival mills in New England. After this devastating misappropriation of cutting-edge technology, his compatriots called him "Slater the traitor". The Americans, however, celebrated him as the father of their Industrial Revolution. None of the contestants on Mr Trump's show achieved the glory he described in the programme. China may do better. Sometimes the future plays tit for tat with the past. ■



自由交流

谁先动的手，谁是在报复？

在国际贸易和投资方面，特朗普坚持互惠。但什么样的互惠呢？

在2004年首次播出的真人秀节目《学徒》（The Apprentice）第六集中，特朗普一如既往地解雇了一名争夺他公司职位的选手。他说她是最糟糕的谈判者，而且她在被队友贬低时未能反击。这集的标题是“以牙还牙”（Tit For Tat）。

等到特朗普做了总统，同样的相互性原则也指导着他的贸易政策，并且让他与中国的关税战愈演愈烈。7月6日，美国对从中国进口的价值约340亿美元的产品开征25%的关税。（另外价值160亿美元的产品将于稍后开征。）中国的回应是对类似数量的美国商品征收关税（包括仅在数小时后抵达大连港的“飞马峰号”上的一批大豆）。

然而，中美双方对于是谁先动的手、谁是在报复各执一词。中国认为自己是在一比一地回应美国的进攻。但美国也认为自己是在报复：惩罚中国的贸易和投资违规行为，包括窃取美方技术。在特朗普看来，中国的新关税不是报复，而是新一轮冒犯，他必须对此做出回应。7月10日，美国发出通知，打算对另外价值2000亿美元的中国商品征收10%的关税，包括箭鱼、放大镜、吸尘器和红色染料等。

特朗普对贸易互惠的看法很简单。如果美国对中国的汽车征收2.5%的关税，中国对美国汽车征收的税额也应该类似。而如果中国一直收取25%，那么美国的贸易代表一定是糟糕的谈判者，他们肯定不会在他的第六集节目里幸存下来。

贸易谈判代表对互惠的看法更宏观。确实，各国必须平等交换，但平等交换的是政治上的利益和牺牲。除非一项协议能带来相应的政治回报，否则政府不会让政治上敏感的行业面临更加激烈的外国竞争。因此，一项互惠协议可能会使各方保护同样敏感但完全不同的行业。例如，美国对包括涤

纶西装和T恤在内的各种纺织品征收27.3%或更高的关税。

有时损失或获利和人们原本预期的不一样。美国和欧洲大国在战后连续展开若干轮贸易谈判，相互削减了制造业关税，而发展中国家对此不必做出回馈。当时，人们认为贫穷国家不会从富裕国家的自由化中获得太多收益，并不要求它们（或者它们自身也未准备）给予多少回报。

但中国直到2001年才加入世贸组织。当时它的制造业潜力已经比较容易预见了。它被迫放弃了与它类似的发展中国家享有的许多优惠。例如，它同意不让自己征收的平均关税超出10%的上限。该体系的创始成员巴西的这一上限是31.4%，印度是48.5%。

在《学徒》的开场镜头中，特朗普解释了这档节目的核心：交换。在经历了一个季度的考验之后，获胜选手将获得特朗普公司的工作，更重要的是，有机会“学到足够的东西，这样有朝一日也能成为亿万富翁”。“作为师傅，”特朗普说，“我想把自己的知识传授给另一个人。”

这种交换对所有学徒都很普遍。有抱负的学徒热切地（并且常常是廉价地）辛苦劳作，以换取在工作中获得专业知识。类似的互惠在中国与美国的经济关系中也起到了作用。有抱负的中国公司在服务美国客户以及与美国公司合作的过程中学到了很多东西。诺丁汉大学的姜坤与合著者最近发表了一篇论文，试图量化中国公司到底学到了多少。他们研究了1998年至2007年间国际合资企业的表现，这些企业通常是在政府的坚持下创建的，其生产率比在其他方面都类似的中国企业高出30%。

中国为了这些知识给出了什么回报？一些美国评论家似乎在想：什么都没有。他们认为美国工业完全在胁迫下传授知识而没有获得任何报偿。但这忽视了美国与中国达成的宏大交易中隐含的另一面。像学徒那样，中国提供了廉价却敬业的劳动力，而美国公司和消费者则慢慢获得了好处（虽然投票给特朗普的一些工人确实遭受了损失）。纽约联邦储备银行的玛丽·阿米提（Mary Amiti）及合著者表示，由于中国加入WTO，美国制成品的价格在2000年至2006年间下降了7.6%。

当中国加入WTO时，它承诺不再把让美国公司传授知识作为它们在中国开展业务的条件。美国人抱怨中国违反了该协议的精神，有时甚至违反了协议的条文，这不无道理。他们还指出，世贸组织没有能力就关于非正式和隐含的投资障碍的投诉做出裁定。但是，与出口商不同，外国投资者自有简单直接的应对方式。如果中国对外国跨国公司施加的条件过于繁重，他们不投资便是了。

徒弟们总是梦想着超越师傅。例如，在18世纪80年代，塞缪尔·斯莱特（Samuel Slater）在德比郡（Derbyshire）最早建成的其中一家水力棉纺厂当学徒。他记住了工厂的设计和流程，偷偷溜到了美国，在新英格兰帮助建立了与之竞争的工厂。在尖端技术遭到毁灭性盗用之后，他的同胞称他为“叛国者斯莱特”。然而美国人却尊崇他为美国工业革命之父。特朗普的节目中没有一位参赛者获得了他在节目中描述的那种荣耀。中国可能会做得更好。有时候真可谓天道好轮回。 ■



Burgernomics

Watch your BMI

Investors are gorging themselves on American assets

ECONOMISTS think prices, like spilt ketchup, are sticky. They move only slowly as firms digest economic conditions. Financial markets are an exception. Computerised trading by thousands of participants means prices, especially of currencies, can move in a McFlurry.

Since *The Economist* last updated the Big Mac index (BMI), our lighthearted guide to currency valuation, burger prices have remained constant in 19 of 44 countries. But every currency has shifted in value (see chart 1). Our index uses a nugget of economic wisdom called purchasing-power parity: currencies should adjust until goods cost the same everywhere. If, once converted into dollars, Big Mac prices vary, one or other currency looks dear. Big movements in exchange rates, without similarly supersized shifts in burger prices, can send a currency up or down the index.

That explains why the Argentine peso has been the biggest mover since January. Then, it looked 25% undervalued compared with the dollar; today, that has swelled to 51%. The peso tumbled on fears of a debt crisis and inflation. For similar reasons, two other emerging-market currencies, the Turkish lira and Brazilian real, are also big movers. Only the valuation of Norway's krone has moved much on account of purchasing power. A 14% fall in the dollar price of a Norwegian Big Mac has taken the krone from looking 18% overvalued in January to 5% undervalued now. This shift should be taken with a pinch of salt, however; burgers may be getting cheaper, but overall Norwegian inflation is a bland 2.6%.

Sometimes, currency traders foresee long-term changes that have yet to

move domestic prices. That may be true in Britain, where the pound has been particularly cheap since the Brexit vote in 2016 (see chart 2). It now looks 23% undervalued. At other times, currencies deviate from fundamentals because of temporary disparities in risks and short-term interest rates. America's economy is sizzling and the Federal Reserve is raising rates, but growth has flattened off elsewhere. That has made the dollar as strong as a bull. Almost every currency in the index has weakened relative to the greenback since January. Only two, the Swiss franc and the Swedish krona, now look overvalued against it.

One beef with the BMI is that burgers cannot easily be traded across borders. Neither can some inputs to production, such as land and labour. To take account of this, we also produce another version of the index, which adjusts Big Mac prices for GDP per person. You can binge on both at economist.com/bigmac. ■



汉堡包经济学

留心你的体重

投资者正在“狼吞虎咽”美国资产

经济学家认为，价格就跟溅出的番茄酱一样黏黏糊糊。因为企业需要时间来领会和适应经济形势，所以商品的价格只会缓慢地变化。金融市场却是个例外。成千上万的参与者开展计算机化的交易，价格因而可能会像卷入“麦旋风”一般激烈波动，尤其是货币的价格。

自《经济学人》上一次更新“巨无霸指数”（BMI，本刊关于货币估值的一项简易指南）以来，44个国家中有19个国家的汉堡包价格保持不变。但是各国货币的价值均有变化（见图表1）。我们的指数运用了名为“购买力平价”的经济学理论：货币汇率会不断调整，直至商品在各地的价格一致。假如转换成美元后各地的巨无霸价格各不相同，那么某些货币就显得偏贵了。如果汇率大幅变动，而巨无霸价格没有类似的剧烈变化，那么货币的“巨无霸指数”就可能上升或下跌。

这是为什么自1月以来阿根廷比索的该指数变化最大。1月，比索兑美元汇率被低估25%；今天，低估幅度已扩大至51%。对债务危机和通货膨胀的恐慌导致比索大跌。出于类似的原因，另外两个新兴市场货币土耳其里拉和巴西雷亚尔的指数波动也很大。只有挪威克朗的估值大体上是按购买力变化的。挪威的巨无霸美元价格下跌了14%，克朗兑美元汇率也就从1月的被高估18%变成现在的被低估5%。然而，这也不能尽信。汉堡包也许是变便宜了，但挪威的整体通胀率只有2.6%。

有时，货币交易商预见到可能在未来改变国内商品价格的长远变化。英国的情况可能就是这样：自2016年英国脱欧公投以来，英镑汇率一直相当低（见图表2）。目前英镑被低估23%。另外一些时候，由于风险和短期利率的一时差异，货币汇率会偏离基本面。目前，美国经济势头火热，美联储也正在加息，但在其他地区经济增长趋于平缓。这使得美元牛气十足。

自1月以来，指数中几乎所有货币兑美元汇率都在走弱。现在，只有瑞士法郎和瑞典克朗被高估。

“巨无霸指数”的一个问题是，汉堡包无法轻易跨境交易。土地和劳动力等一些生产性投入也是如此。考虑到这一点，我们还制作了另一个版本的“巨无霸指数”，按人均GDP调整了巨无霸的价格。我们在economist.com/bigmac上提供了两版指数，供您尽情享用。 ■



World trade

A plan to save the WTO

Global trade is in grave danger. But there is still a chance of a rescue

THE headquarters of the World Trade Organisation (WTO), on the banks of Lake Geneva, once belonged to the League of Nations. That ill-fated body was crippled by American isolationism. The building's occupant today is also at the mercy of decisions taken in Washington.

President Donald Trump has circumvented the WTO to impose tariffs on steel and aluminium imports, including those from America's allies. Complaining of unfair treatment, the administration is blocking nominations to seats on the WTO's appellate body, which could leave it unable to hear cases after 2019. Most ominously, America is embroiled in a trade war with China. Both sides have imposed tariffs on goods worth tens of billions of dollars and are threatening worse.

The WTO was supposed to contain trade disputes and prevent retaliatory pile-ups. Today it appears to be a horrified bystander as the system it oversees crumbles. Free-traders are right to be deeply worried, but not yet right to despair. For the outlines of a plan to save the system are discernible.

That might seem fanciful, given Mr Trump's belligerence, but for two things. The first is that the president is not the only person forging American trade policy. The European Union and Japan have been talking to Robert Lighthizer, his low-profile chief trade negotiator, about WTO reform. Mr Trump's tirades make headlines, but Mr Lighthizer wants to remake the WTO, not abandon it entirely. He could use the president's threats as leverage to make deals. Think of it as a good cop/bad cop routine, albeit one in which the bad cop has only a faint grasp that he has been allotted the role.

The second thing to understand is that the focus of much of America's ire, China, arouses deep suspicion elsewhere, too (see Briefing). Since joining the WTO in 2001, China has not turned towards markets, as the West expected. Instead, it has distorted trade on a scale that is far bigger than the dumping and other causes of disputes between market economies that the WTO was designed to handle.

The EU and Japan share America's desire to constrain Chinese mercantilism. China's state-owned firms and its vast and opaque subsidies have distorted markets and caused gluts in supply for commodities such as steel. Foreign firms operating in China struggle against heavy-handed regulation, and are required to hand over their intellectual property as a condition of market access.

But holding China to account is hard with the existing rule book. The reforms being talked about by the EU, Japan and America could plug many of the gaps. They would set out how to judge the scale of government distortions to the market, make it easier to gather information on wrongdoing and set the boundaries for proportionate retaliation. They would also define what exactly counts as an arm of the government, and broaden the scope of banned subsidies. And they would lower the burden of proof for complainants, which, given the opacity of the Chinese system, is too high.

Even the sunniest optimist will be able to identify the obstacles to this plan. Most obviously, why would China ever accept a reform that jeopardises its state-run economic model? Put plainly, because America could wreak havoc otherwise. It is in China's interests to preserve the global trading order because, if China is isolated, the Communist Party cannot achieve the prosperity that cements its legitimacy. The benefits to China of its WTO membership have come not from lower tariffs in America—they were already low—but from the certainty of stable trading relationships. Its

“Made in China 2025” plan to boost vital industries sounds threatening, but if China were obliged to produce everything at home, its time frame would be delayed by decades. Sure enough, China and the EU agreed on July 16th to co-operate on WTO reform (see China section).

Reaching a global agreement that covered every one of the WTO’s 164 members would also be extremely difficult. The last big round of global trade talks stalled over demands by developing economies such as India for more leeway to protect farmers. New negotiations may be held hostage to these old disputes. Luckily, negotiators can skip around them if necessary, by securing a “plurilateral” agreement between a group of big economies. The WTO would still enforce the terms, though they would not apply to its other members.

Last comes the greatest block to a grand bargain, Mr Trump himself. The president is a fierce critic of the WTO and a believer that bilateral deals suit American interests better. Last week he called the EU a “foe” on trade. If he thinks Mr Lighthizer is manipulating him, he will strike back.

A better idea than the Trump administration’s wrecking strategy would have been to unite most of the world around a set of rules in America’s interest, forming blocs so large that China would have had to choose between compliance and isolation. That was the idea behind both the Trans-Pacific Partnership (TPP), a pact from which Mr Trump withdrew within days of taking office, and also a stalled trade deal with Europe.

Wrecking strategies do not always fail, however. Sometimes they pay off handsomely. A WTO fit to handle complaints about unfair competition would be a gift to the world. The genius of the rules-based system is that it has torn down barriers by persuading producers that the prize of access to foreign markets is worth the accompanying global competition. When that competition is deemed lawless, political support for free trade withers. A

world in which China is pursued by its critics through the WTO, and faces proportionate retaliation when necessary, is far preferable to one in which a tit-for-tat trade war can escalate without limit.

Mr Trump is hard to predict. He may yet abandon the WTO. If he does, other powers will probably go on building links and writing rules—witness the trade deal that the EU and Japan signed last week. But if Mr Lighthizer is able to present Mr Trump with an agreement that the president likes, the world trading system may yet be saved. It might even be improved. ■



世界贸易

世贸组织拯救计划

全球贸易深陷危机，但仍有拯救机会

位于日内瓦湖畔的世界贸易组织（以下简称WTO）总部曾经是国际联盟的所在地。当年，这个命运多舛的机构因美国的孤立主义而难以发挥作用。这幢大楼如今的住户同样难逃华盛顿决策的左右。

美国总统特朗普已经绕过WTO对进口钢铁和铝材征收关税，包括来自美国盟国的进口。特朗普政府埋怨WTO对美国不公，因而阻挠WTO上诉机构任命新法官，这可能导致该机构在2019年之后无法审理案件。最不妙的是，美国正与中国大打贸易战，双方都已对价值数百亿美元的商品征收了关税，并威胁狠招还在后头。

WTO本应遏制贸易争端并防止冤冤相报。但如今WTO就像一个旁观者，惊恐地看着自己监管下的体系分崩瓦解。主张自由贸易的人士有理由深感忧虑，但还无需绝望。因为挽救该体系的计划还是大体可见。

以特朗普的好斗，说WTO有救似乎是异想天开，但要注意两件事。首先，总统不是美国贸易政策的唯一决策者。欧盟和日本一直在与特朗普低调的首席贸易谈判代表罗伯特·莱特希泽（Robert Lighthizer）就WTO的改革展开磋商。虽然特朗普的各种激烈言论占据了新闻头条，但莱特希泽还是希望重塑WTO，而不是完全放弃。他可以将特朗普的威胁用作谈判的筹码。这就等于一个唱红脸一个唱白脸，只不过唱白脸的那位没怎么意识到自己拿到了这个角色。

第二个要明白的是，美国的怨怒大多指向中国，而中国在其他地区也引发了深深的质疑。自2001年加入WTO以来，中国并没像西方预期的那样转向市场机制。相反，中国扭曲了贸易，程度远超过倾销和引起市场经济体之间争端的其他缘由，而WTO本是用来处理这些争端的。

与美国一样，欧盟和日本也想限制中国的重商主义。中国的国企以及中国政府庞大而不透明的补贴机制扭曲了市场，导致钢铁等大宗商品供过于求。在华外国企业在严苛的监管下求存，还要交出知识产权以求进入市场。

但按WTO现有的规则，很难让中国承担责任。欧盟、日本和美国讨论的改革也许可以填补其中许多漏洞。这些改革将明确如何判断政府对市场的扭曲程度，方便收集有关违规行为的信息，并对相应报复行动设限。改革还将对“政府所属机构”做出明确界定，并扩大禁止补贴的范围。另外，改革还将减轻申诉人的举证责任——鉴于中国制度的不透明性，目前申诉人的举证责任太大。

即使是最积极的乐观主义者也能看出这项计划面临的阻碍。最明显的就是，中国为什么要接受一项危及其国营经济模式的改革？说白了，那是因为中国不这么做，美国就会大肆破坏。维护全球贸易秩序符合中国的利益，如果中国被孤立，共产党就无法实现国家的繁荣发展，也就难以巩固其执政地位。中国加入WTO的好处不在于出口美国的低关税（之前就已经很低了），而在于确保建立稳定的贸易关系。意在推动关键行业发展的“中国制造2025”计划听起来咄咄逼人，但如果中国被迫要在国内生产一切产品，那么实现目标的时间将要推后数十年。不出所料，中国和欧盟已于本月16日就联手改革WTO达成一致。

要达成涵盖WTO全部164个成员国的全球性协议也极为困难。上一轮全球贸易谈判陷入僵局，原因是印度等发展中经济体要求更大的自由度以保护农民。新谈判可能会遭到这些旧争议的绑架。幸好，必要时谈判代表可以在一些大型经济体之间谈妥“诸边”协议，从而绕过旧问题。WTO仍将执行这些条款，不过不会将它们应用于其他成员国。

最后，达成重大协议的最大障碍是特朗普本人。这位总统狠批WTO，深信双边协议更符合美国利益。上周他称欧盟是贸易的“敌人”。如果感到自己在受莱特希泽摆布，他势必会反击。

相比特朗普政府现在的破坏性策略，原本更好的一种做法是拉拢世界大多数地区建立一套符合美国利益的规则，形成庞大的阵营，迫使中国在妥协与孤立之间做选择。这本是《跨太平洋伙伴关系协定》（TPP）及美欧之间另一贸易协议背后的思路，但特朗普上任几天后就退出了TPP，后者的进程也陷于停滞。

但破坏性策略也不总是失败。有时它收获巨大。WTO如果能够胜任处理有关不公平竞争的投诉，全世界都将受惠。这个基于规则的体系的高明之处在于，它说服了生产者相信进入外国市场的好处抵得过随之而来的全球竞争，从而拆除了全球贸易壁垒。当竞争被认为变得无法无天时，自由贸易获得的政治支持就会消失。如果批评者可通过WTO向中国追责，必要时实施适当的报复，将远比那种可能无限升级的报复性贸易战更为可取。

特朗普其人难以预测。他也许还是会放弃WTO。若真如此，其他大国可能会继续打造贸易关系并制定规则，上周欧盟和日本就签署了新的贸易协议。但如果莱特希泽能为特朗普奉上一份令他称心的协定，那么WTO这一世界贸易体系也许仍然有救，说不定还会得到改进。 ■



Chipmaking

Hyenas and cheetahs

Artificial intelligence has revived the semiconductor industry's animal spirits

SUPERCOMPUTERS usually fill entire rooms. But the one on the fifth floor of an office building in the centre of Bristol fits in an average-sized drawer. Its 16 processors punch more than 1,600 teraflops, a measure of computer performance. This puts the machine among the world's 100 fastest, at least when solving certain artificial-intelligence (AI) applications, such as recognising speech and images.

The computer's processors, developed by Graphcore, a startup, are tangible proof that AI has made chipmaking exciting again. After decades of big firms such as America's Intel and Britain's ARM ruling the semiconductor industry, the insatiable demand for computing generated by AI has created an opening for newcomers. And it may even be big enough to allow some startups to establish themselves as big, independent firms.

New Street, a research firm, estimates that the market for AI chips could reach \$30bn by 2022. That would exceed the \$22bn of revenue that Intel is expected to earn this year from selling processors for server computers. It could swell further, argue the authors of a recent report by UBS, an investment bank. AI processors, they believe, will create their own demand; they allow firms to develop cleverer services and devices, which will collect even more data, generating a need for even brainier chips.

To understand what is going on it helps to make a short detour into zoology. Broadly speaking, the world of processors is populated with two kinds of animal, explains Andrew Feldman, chief executive of Cerebras, an American competitor to Graphcore. One sort of chip resembles hyenas: they are

generalists designed to tackle all kinds of computing problems, much as the hyenas eat all kinds of prey. The other type is like cheetahs: they are specialists which do one thing very well, such as hunting a certain kind of gazelle.

For much of computing history, hyenas named “central processing units” (CPUs) have dominated the chip savannah. Becoming ever more powerful according to Moore’s law, the rule that the performance of processors doubles every 18 months, they were able to gobble up computing tasks, or “workloads”, in the jargon. This is largely why Intel, for instance, in the early 1990s became the world’s biggest chipmaker and stayed that way for decades.

But in recent years the world of number-crunching has changed radically. Moore’s law has started to peter out because making ever-denser chips has hit physical limits. More importantly, cloud computing has made it extremely cheap to amass huge amounts of data. Now more and more firms want to turn this asset into money with the help of AI, meaning distilling data to create offerings such as recognising faces, translating speech or predicting when machinery will break down.

Such trends have altered the chip-design habitat. First to benefit were “graphics processing units” (GPUs), a kind of hyena which are mainly made by Nvidia. Originally developed to speed up the graphics in video games, they are also good at digesting reams of data, which is a similar computational problem. But because they are insufficiently specialised, GPUs have been hitting the buffers, too. The demand for “compute”, as geeks call processing power, for the largest AI projects has been doubling every 3.5 months since 2012, according to OpenAI, a non-profit research organisation (see chart). “Hardware has become the bottleneck,” says Nigel Toon, the chief executive of Graphcore.

The response from various firms has been to design processors from the ground up with AI in mind. The result of Graphcore's efforts is called an intelligent processing unit (IPU). This name is not just marketing: on GPUs, memory (the staging area for data) and brain (where they are processed) are kept separate—meaning that data constantly have to be ferried back and forth between the two areas, creating a bottleneck with data-heavy AI applications. To do away with it, Graphcore's chips do not just have hundreds of mini-brains, but the memory is placed right next to it, minimising data traffic.

Graphcore's chip can also hold entire neural networks, computational models inspired by structures in biological brains, which are used in many AI applications. Having such models, which can be immensely complex with billions of parameters, sit in the chip allows them to be “trained” more quickly—the act of feeding them with lots of data (pictures of cats, say), so they learn to recognise them. The set-up also simplifies what is known as “inference”, when the model applies what it has learned (spotting cats, for instance).

Cerebras is going further still. It is not only designing a new processor, which is similar to Graphcore's, but a specialised AI computer as well. Putting a new chip on a circuit board, as Graphcore does, that is added into an existing system limits specialisation and optimisation because of constraints in power, cooling and communication, says Mr Feldman. But this means that he has a steeper hill to climb: while Graphcore has already delivered a first batch to customers, Cerebras has yet to announce when its product will be available.

Although Graphcore and Cerebras were early to see the need for specialised AI chips, they are by no means alone. Dozens of startups are creating what are known as “application-specific integrated circuits” (ASICs). These are meant to do inference in all kinds of connected devices, from smartphones

to sensors, known as the “edge”. The processors come with trained AI models baked in, for instance to let a video camera recognise faces without having to upload the entire footage.

Big cloud-computing providers have also joined the fray, deeming AI chips important enough to develop their own. In May Google launched the third generation of its Tensor Processing Units (TPUs), the previous versions of which already power many of its services, including search and Street View. Amazon, Facebook and Microsoft, too, are developing processors. Apple, for its part, ships its iPhone X with an AI chip that helps the device recognise the owner and read his facial expressions.

Firms that ruled the world of hyenas, notably Intel, are now acquiring designers of cheetahs. It has spent billions in recent years buying AI-related startups, including Nervana Systems and Mobileye. The idea, says Gadi Singer, in charge of the firm’s AI products, is to have an entire portfolio of processors, each with its own specialisation—for neural networks, for self-driving cars and for inference at the edge.

If the history of other semiconductor markets, such as networking processors, is any guide, the new field of AI chips could consolidate before too long, perhaps with one or two processor architectures winning the day. There is already talk that big cloud-computing firms, such as Amazon, are interested in buying startups, including Cerebras and Graphcore. And incumbents are trying to catch up. Intel has developed a program that ties together all its AI chips; Nvidia has tweaked the architecture of its processors, which is said to now match the performance of Google’s TPUs.

But there are forces that push toward fragmentation. Specialisation in AI chips can go very far, just as with animals (cheetahs are the only large cats whose claws do not retract, so they are ready to accelerate and catch a gazelle at all times). Pierre Ferragu of New Street says that ever more demanding

AI workloads needing special treatment, fast-evolving algorithms, and tech giants designing their custom chips all may lead to a world in which lots of processor architectures thrive.

China, too, is likely to inject more diversity. The government has plans to spend tens of billions to create a national semiconductor industry in an effort to be less dependent on Western imports. According to some estimates, hundreds of firms are developing ASICs. Alibaba has announced that it is working on its own AI chip, called Ali-NPU (which stands for neural processing unit). Cambricon, a startup based in Shanghai, recently unveiled a chip that is similar to Graphcore's and Cerebras's. The chip kingdom is unlikely to become a dull monoculture again anytime soon. ■



芯片制造

鬣狗和猎豹

人工智能唤醒了半导体行业的动物精神

超级计算机一般要占满一整个房间，但在英国布里斯托尔（Bristol）市中心一栋办公楼的五楼，有一部超级计算机所需的空间只有一个普通抽屉大小。它的16个处理器的浮点运算速度（衡量计算机性能的一个指标）超过每秒1600万亿次。至少在解决语音和图像识别等某些人工智能（AI）的应用上，它是世界上运算速度最快的100台计算机之一。

由创业公司Graphcore开发的这台计算机的处理器切实证明了AI已经让芯片制造再次蓬勃发展起来。在美国英特尔和英国ARM等大公司统领半导体产业几十年后，AI带来了对计算能力的无尽需求，也就为行业后来者创造了机会。一些创业公司甚至可能趁此机会发展成为大型独立公司。

研究公司新街（New Street）估计，到2022年AI芯片市场的规模可能会达到300亿美元，这将超过英特尔今年预期220亿美元的服务器计算机销售收入。在投资银行瑞银（UBS）最近的一份报告中，作者认为这个市场可能还会进一步膨胀。他们相信AI处理器会创造对自己的需求：企业可利用它们开发出更智能的服务和设备，再收集更多的数据，进而产生对更智能的芯片的需求。

用动物做一个简单比喻有助我们理解当前的发展状况。Graphcore的美国竞争对手Cerebras公司的首席执行官安德鲁·费尔德曼（Andrew Feldman）解释说，一般而言，处理器的世界由两种动物构成。一种芯片类似鬣狗：它们是解决各种计算问题的多面手，就像鬣狗一样什么猎物都吃。另一种芯片就像猎豹：它们是具有某项专长的专家，像猎豹捕猎某种瞪羚。

在运算演进史的大部分时间里，名为“中央处理器”（CPU）的鬣狗类芯片一直是芯片大草原上的霸主。根据处理器性能每18个月翻一番的摩尔定

律，它们变得越来越强大，能够吞食各种计算任务——行话叫“运算负荷”。这也是大型芯片制造商在过去称霸市场的主要原因。比如英特尔，它在上世纪90年代初期成为世界上最大的芯片制造商，且领先地位几十年未变。

但近年来，数字运算的世界发生了根本性的变化。芯片密度越来越大，已经达到物理极限，摩尔定律开始逐渐失效。更重要的是，云计算让收集大量数据的成本变得极低。现在越来越多的公司希望能在AI的帮助下将这项资产转化为收入，也就是通过提炼数据来创建各种产品，例如人脸识别、语音翻译，或预测机器何时会发生故障。

这种趋势改变了芯片设计的生态环境。首先受益的是“图形处理器”（GPU），这是一种主要由英伟达（Nvidia）制造的类狗类芯片。GPU最初是为加快电子游戏中的图形处理速度而开发的，不过也擅长处理大量数据——一个类似的运算问题。但由于不是完全的专用芯片，GPU同样已接近性能的极限。据非营利性研究机构OpenAI称，自2012年以来，一些规模最大的AI项目对于“运算”（极客对处理能力的叫法）的需求每3.5个月就翻一番（见图表）。Graphcore的首席执行官奈杰尔·图恩（Nigel Toon）说：“硬件已经成为瓶颈。”

各家公司的应对方式是针对AI重新设计处理器。Graphcore经过努力研发出了名为“智能处理器”（IPU）的芯片。取这个名字不仅是为了营销效果。在GPU上，内存（数据的暂存区域）和大脑（处理数据的地方）是分开的，因此数据就得不断在两个区域之间来回传送，这样一来就对数据量极大的AI应用程序造成了瓶颈。为了消除这个瓶颈，Graphcore的芯片不仅拥有数百个迷你大脑，而且内存紧挨大脑，最大限度地减少了数据传送量。

Graphcore的芯片还可以容纳整个“神经网络”，也就是受生物大脑结构启发而构建的计算模型，它们被运用于许多AI应用中。这些模型可能非常复杂，参数可达数十亿个。将这样的模型置入芯片中可以让它们更快速地得

到“训练”，即向它们输入大量数据（例如猫的图片），让它们学会识别。这样的设置也简化了“推理”，即模型应用自己学到的知识（例如识别猫的图片）。

Cerebras走得更远。它不仅设计了一个和Graphcore的芯片类似的新处理器，还设计了专门的AI计算机。费尔德曼表示，由于电源、冷却和通信方面的制约，像Graphcore那样把新的芯片放到电路板上添加到现有系统中会限制专门化和性能优化。但这意味着费尔德曼要爬的坡更陡：Graphcore已经向客户交付了第一批产品，而Cerebras尚未公布其产品面世的时间。

尽管Graphcore和Cerebras很早就看到了专用AI芯片的需求，但朝着这个方向努力的决非只有它们。数十家创业公司都在开发被称为“专用集成电路”（ASIC）的产品，它们将在从智能手机到传感器的各种各样被称为“边缘”的联网设备中展开推理。这些处理器内置了经过训练的AI模型，例如可以让摄像机识别人脸，而无需上传所有视频记录。

大型云计算供应商也纷纷加入角逐，它们认为AI芯片很重要，有必要开发自己的产品。5月，谷歌推出了第三代“张量处理器”（TPU）。之前的版本已经为其许多服务提供了支持，包括谷歌搜索和街景。亚马逊、Facebook和微软也都在各自开发处理器。苹果在iPhone X里加入了AI芯片，帮助设备识别所有者并读取其面部表情。

鬣狗类芯片世界的统治者正在收购猎豹类芯片设计公司，特别是英特尔。近些年它斥资数十亿美元收购与AI相关的创业公司，包括Nervana Systems和Mobileye。负责英特尔AI产品的加迪·辛格（Gadi Singer）说，公司的目标是拥有一整套各有专长的处理器，分别用于神经网络、无人驾驶汽车，以及边缘设备上的推理。

如果其他半导体市场（如网络处理器）的历史可以作为参考的话，那么AI芯片的新领域可能过不了多久就会整合，最终可能会有一两个处理器架构胜出。业界已有传言称亚马逊等大型云计算公司有意收购包括Cerebras和

Graphcore在内的创业公司。老企业正努力赶上新趋势。英特尔开发了一个连接它全部AI芯片的项目；英伟达调整了其处理器的架构，据说现在性能堪比谷歌的TPU。

但存在推动市场分散化的力量。AI芯片的分门别类可以走得很远，就像动物一样（猎豹是唯一爪子不会收缩的大型猫科动物，因此可以随时加速并捕获瞪羚）。新街的皮埃尔·费拉古（Pierre Ferragu）表示，AI工作量的不断增加需要专门处理，再加上算法快速演变、科技巨头各自设计定制芯片，所有这些都可能导致未来众多处理器架构共同蓬勃发展。

中国也可能为行业注入更多的多样性。中国政府计划投入数百亿美元建立国家半导体产业，以减少对西方进口的依赖。据估计，那里有数百家公司正在开发ASIC。阿里巴巴已经宣布正在自行开发名为Ali-NPU（“神经处理单元”的缩写）的AI芯片。总部位于上海的创业公司寒武纪科技最近推出了一款与Graphcore和Cerebras的芯片类似的产品。芯片王国在短期内不大可能再次成为一家独大的世界。 ■



Reforming the welfare state

Back to basic liberalism

Liberals created the welfare state. They must reclaim and overhaul it

IN THE mythologies of both left and right, the welfare state is a work of socialism. Yet the intellectual tradition it owes most to is liberalism. The architect of its British version, William Beveridge, did not want to use the power of the state for its own sake. The point was to give people the security to pursue the lives they chose. And liberal reformers believed that by insuring people against some risks of creative destruction, welfare states would bolster democratic support for free markets.

In the decades since Beveridge published his seminal report in 1942, welfare states have spread, grown larger, more complex and, often, less popular (see International section). This shift has many causes. But one is that welfare states have often diverged from the liberal principles that underpinned them. It is these principles that must be reaffirmed.

As countries become richer they tend to spend higher shares of national income on public services and benefits. Spending on “social protection”, such as pensions, unemployment insurance and assistance for the hard-up, has risen from an average of about 5% of GDP in rich countries in 1960 to 20% today. Include spending on health and education and those shares roughly double. For some, the sheer scale of these welfare states is reason enough for reform.

But what the welfare state does is perhaps more important than its size. It should seek to allow individuals to make their own choices, whether through support for parents to return to work as in Scandinavia, personal budgets for disabled people to select their own provision as in England, or

Singapore-style learning accounts so that the jobless can acquire new skills.

Everyone needs enough to live on. Many of those who drop out of the job market, or who work in the gig economy, struggle to get by. And too often, help for the poor comes in ways that are cruel, inefficient, paternalistic or complex. In some rich countries, the unemployed face marginal tax rates of over 80% when they begin a job, because of the loss of benefits.

Any welfare reform entails trade-offs between the cost of a scheme and its effects on poverty and incentives to work. No scheme is perfect. But a good basis is the negative income tax, which subsidises workers below an earnings threshold, while taxing those above it. Negative income tax can be combined with a minimum income for everyone. It is a relatively simple, efficient way of targeting poverty while maintaining incentives to work, so long as the tax rate is not too high.

Reform, however, also requires taking on two challenges that did not cause Beveridge much concern. The first is ageing. The ratio of working-age people to the retired in rich countries is projected to fall from about four to one in 2015 to two to one by 2050. And as countries grey, welfare spending becomes more biased towards the elderly. To mitigate rising intergenerational inequality, it would make sense to cut the cushiest benefits for the elderly and steadily raise retirement ages.

The second challenge is immigration. Across Europe, “welfare chauvinism” is on the rise. This supports a generous welfare state for poorer, native-born people—but not immigrants. Populists argue that, if migrants from poor countries immigrate freely to rich ones, they will bankrupt the welfare state. Others argue that liberal migration policies depend on curbing access to it: build a wall around the welfare state, not the country. Polls suggest that few native-born Europeans want to deprive new arrivals of instant access to health care and schools for their children. But some restrictions on cash

benefits, like those already in place in America and Denmark, may be necessary.

As liberals such as Beveridge realised, the best way to secure support for free markets is to give more people a stake in them. The welfare state must be seen as more than providing shoes and soup for the poor, and security in old age. In a democratic society it is also crucial to the case for capitalism. ■



改革福利国家

回归基本自由主义

自由派创造了福利国家。他们必须重申并改造它

无论按左翼还是右翼的说法，福利国家都是社会主义的产物。不过在思想传承上，它主要源于自由主义。缔造了这一理论英国版的威廉·贝弗里奇（William Beveridge）并不想用国家的力量为国家自身牟利。关键是要为人们提供保障，让他们能够追求自己所选择的生活。自由派改革家们相信，通过确保人们规避一些创造性破坏所带来的风险，福利国家将会增强民主社会对自由市场的支持。

贝弗里奇于1942年发表了他影响深远的报告，之后的几十年里，福利国家理念不断蔓延，变得更庞大、更复杂，而且往往变得不那么受欢迎。这种转变有诸多原因。但其中之一是福利国家经常偏离支撑它们的自由原则。现在必须重申这些原则了。

随着国家变得越来越富有，它们往往会将更高比例的国民收入用于公共服务和福利。富裕国家在社会保障方面的支出，如养老金、失业保险和对贫困人口的援助，已经从1960年平均占GDP的5%上升到现在的20%。如果再算上在医疗和教育上的支出，这一比例接近翻番。对一些人来说，这些福利国家的庞大規模就足以成为改革的理由。

但是，福利国家的举措也许比它的规模更重要。它应该寻求让个人能够做出自己的选择，无论是像斯堪的纳维亚半岛国家那样支持有子女的劳动者重返职场，还是像英国那样向残疾人提供有不同使用方式可选的个人补贴，或者像新加坡一样开设学习账户，让失业者能够获得新的技能。

每个人都要维持生计。许多失业或是打零工的人都生活艰难。而援助穷人的方式往往残酷、低效、专断或复杂。在一些富裕国家，因为没有了救济金，失业者在重新开始工作时面临着80%以上的边际税率。

任何福利改革都需要在方案成本、对贫困的影响以及对就业的激励之间做权衡。没有完美的方案。但负所得税是一个好的基础方案，它为低于某个收入阈值的就业者提供补贴，而对高于它的就业者征税。负所得税可以和为所有人提供最低收入相结合。这是一种相对简单高效的方法，既能解决贫困问题，又能保持就业积极性——只要税率不太高。

不过，改革还需要应对两项并没有引起贝弗里奇太多关注的挑战。首先是老龄化。富裕国家的劳动年龄人口与退休人口之比预计将从2015年的4比1降至2050年的2比1。而随着国家日益老龄化，福利支出越来越偏向老年人。为了缓解日益加剧的代际不平等，削减对老年人最轻松易得的福利、逐步延迟退休年龄是合理的。

第二个挑战是移民。在整个欧洲，“福利沙文主义”正在抬头。它支持向本土出生的穷人提供慷慨的福利，但不支持对移民的福利。民粹主义者声称，如果贫穷国家的人自由移民到富裕国家，会让福利国家破产。另一些人主张，自由移民政策有赖于限制移民获得福利：要在福利国家制度而非国家的周围筑起围墙。民意调查显示，很少有本土出生的欧洲人想要剥夺新移民快速获得医疗保健和子女入学的权利。但对现金福利的一些限制，比如已经在美国和丹麦实施的那些，可能是必要的。

正如贝弗里奇等自由派人士所意识到的那样，要确保自由市场获得支持，最佳途径是让更多人参与其中。福利国家不能仅仅被视为向穷人派发衣食和为老年人提供保障。在一个民主社会里，这对推行资本主义也至关重要。 ■



Economic and financial indicators

Coal

The world's coal market experienced an unexpected revival in 2017

The world's coal market experienced an unexpected revival in 2017, according to an annual energy round-up from BP, an oil firm. The uptick was driven partly by a resurgence of demand for coal in China, which increased by 0.5% year on year, after falling for three consecutive years. Although China is attempting to diversify away from the dirtiest fuels, it used more coal to satisfy its growing electricity demand. The global power sector still remains heavily dependent on coal, too. Despite growth in the use of renewables in recent years, and efforts to shift power generation away from coal, it accounts for around two-fifths of the total, the same share as two decades ago. ■



经济与金融指标

煤炭

2017年全球煤炭市场意外复苏

根据英国石油公司（BP）发布的年度能源产业综述，2017年全球煤炭市场意外复苏。这在一定程度上是因为中国煤炭需求回升：在连续三年下降后，去年中国煤炭需求同比增长了0.5%。虽然中国正尝试摆脱对这种污染最严重的燃料的依赖，但为了满足持续增加的电力需求，还是消耗了更多的煤。全球电力行业也仍旧严重依赖煤炭。尽管近年来对可再生能源的利用增长，各国也力图摆脱燃煤发电，但煤炭在电力行业的占比仍在五分之二左右，与20年前相比并无变化。■



Football transfers

Winning moves

Talent scouts are paying less attention to the World Cup

CHEERS erupted from Calais to Cannes when Kylian Mbappé, a 19-year-old striker, thumped in France's fourth goal in the World Cup final on July 15th. Among the smuggest onlookers were the accountants at Paris Saint-Germain, Mr Mbappé's club. He was already a prized asset before the tournament, having broken the record for goals scored by a teenager in the Champions League, Europe's premier-club competition. CIES Football Observatory, a research organisation, reckoned then that his club could charge €190m (\$223m) for him. But an electrifying World Cup, with four goals, has surely increased his value.

That, at least, is how the transfer market usually responds to international tournaments. According to 21st Club, a consultancy, each time a player found the net in the World Cup and European Championship tournaments in 2004-16, his price went up by, on average, 13%. After the 2014 World Cup James Rodríguez, whose six goals for Colombia made him the top scorer, earned a reported €80m move to Real Madrid. That was twice what 21st Club estimated he was worth from his career record.

The club soon realised it had overpaid. Mr Rodríguez struggled, and ended up loaned to Bayern Munich. Indeed 21st Club has found that though a footballer's goals for his club in the previous season predict his future impact, those at an international tournament do not. That should not be surprising. A World Cup lasts five weeks and features plenty of mismatched teams; a domestic season is eight months of tough games. Mr Mbappé's four World Cup goals are a less useful indicator than the 47 he scored in his two most recent club seasons.

Could Mr Mbappé net a spectacular transfer? He says he is not thinking of moving and earlier this month Real Madrid denied rumours that it had made a bid. Even so, speculation continues. Bookmakers give the club about a one-in-four chance of luring Mr Mbappé from Paris. Otherwise, the transfer market seems flat. Russia's Aleksandr Golovin is the only surprise World Cup star close to moving—and his rumoured transfer to Chelsea may owe more to the patriotism of Roman Abramovich, the club's Russian owner, than to its scouting department.

For most of football's history, scouts relied on hearsay for foreign transfers. In 1996 Southampton, an English team, signed someone claiming to be the cousin of George Weah, Africa's biggest star. After his dreadful debut, the club discovered he had barely played professionally. An international tournament at least offered a chance to see potential imports play.

Today's scouts, however, have access to footage and statistics from every league in the world. Raffaele Poli, the head of CIES Football Observatory, says an influx of staff from financial firms has led to greater interest in big data. In 2012 Arsenal purchased StatDNA, an American analytics firm. Both Bayern Munich and Manchester City have worked with SAP, a software company that provided insights for Germany's World Cup winners in 2014.

The result, says Mr Poli, is an increasingly rational market. A full 80% of the differences between transfer fees for players can be accounted for by variables that CIES uses in its model, with only a few prices raising eyebrows. It reckoned Cristiano Ronaldo, sold earlier this month by Real Madrid to Juventus for €112m, was worth €103m. Real Madrid could easily bid three times that for Mr Mbappé. But it would probably be overpaying. ■



足球转会

转会胜着

球探们对世界杯的关注降低了

在7月15日举行的世界杯决赛上，当19岁的前锋基利安·姆巴佩为法国队踢进第四个进球时，从加来到戛纳都欢声雷动。最得意的观众里有巴黎圣日耳曼的会计师，姆巴佩正是效力于这家俱乐部。世界杯开赛前，他已经打破了20岁以下球员在欧洲顶级俱乐部赛事欧洲冠军联赛上的进球纪录，成为俱乐部的宝贵资产。调研机构CIES Football Observatory当时估计俱乐部可能会为他标价1.9亿欧元（2.23亿美元）。但在令人激动的世界杯上打入四粒进球无疑又增加了他的价值。

至少这是转会市场对国际赛事通常的反应。根据咨询公司21st Club的数据，在2004年至2016年的世界杯和欧洲杯上，每打进一球，球员的身价平均会上涨13%。2014年世界杯上哈梅斯·罗德里格斯为哥伦比亚打入六粒进球，成为最佳射手，这一成绩令他以据称8000万欧元转会加盟皇家马德里。这个数额是21st Club根据他的履历对他估价的两倍。

皇马很快就意识到自己出价过高。J罗状态不佳，最终被租借到拜仁慕尼黑。实际上，21st Club发现，尽管球员在上赛季为自己俱乐部取得的进球预示着他未来的作为，但他在国际赛事上的进球并不能说明什么。这并不让人意外。一届世界杯持续五周，其中有许多场实力悬殊的比赛；而国内联赛的一个赛季是八个月艰难的比赛。与在最近两个俱乐部赛季的47粒进球相比，姆巴佩的四粒世界杯进球并不是那么有用的指标。

姆巴佩能赢得一场炫目的转会吗？他说自己没有考虑转会，而本月早些时候皇马也否认了传言，称并未提出报价。即便如此，猜测并未平息。博彩公司认为皇马有四分之一的几率吸引姆巴佩出走巴黎。除此之外，转会市场看起来很平淡。俄罗斯的亚历山大·戈洛文（Aleksandr Golovin）是唯一一个接近转会的世界杯新星。而他转会切尔西的传闻可能更多是出于俱

乐部的俄罗斯老板罗曼·阿布拉莫维奇（Roman Abramovich）的爱国情怀，而不是切尔西球探部门的意思。

足球史上大部分的时间里，球探都靠道听途说物色国外球员。1996年，英格兰球队南安普敦签下了一个自称是非洲巨星乔治·维阿（George Weah）表弟的人。在他糟糕的处子秀之后，俱乐部发现他几乎没参加过职业比赛。国际赛事至少提供了一个机会，可以看到潜在购买目标在赛场上的表现。

而如今，球探们可以获得世界上每个联赛的视频和数据。CIES Football Observatory的负责人拉菲尔·波利（Raffaele Poli）说，从金融公司涌入足球界的大批员工让人们对大数据产生了更大的兴趣。2012年，阿森纳收购了美国分析公司StatDNA。拜仁慕尼黑和曼城都与软件公司SAP合作过，SAP曾为2014年世界杯的冠军球队德国队提供洞见。

波利说，结果就是市场越来越理性。球员转会费之间的差异有80%可以用CIES在模型中使用的变量来解释，只有很少的价格会让人大跌眼镜。本月早些时候，C罗被皇马以1.12亿欧元卖给尤文图斯，而CIES对其估值为1.03亿欧元。皇马很可能会给出三倍于此的价格买姆巴佩。但这有可能是花冤枉钱。■



Solar energy

On the solarcoaster

After a clampdown in China, could the global photovoltaic industry survive without subsidies?

A LITTLE over a decade ago, when JinkoSolar, a Shanghai-based company, entered the solar business, it was such a novice that when it visited international trade fairs, all it had was a bare table and a board with its name scribbled on it. But it also had luck, a technological edge and lots of public money on its side.

The industry globally was riding high on subsidies. Generous feed-in-tariffs (FITs), financial incentives for installing solar, made Germany the world's largest solar market by around 2010. Germans turned to China for cheap sources of crystalline silicon solar panels, not least because subsidised land and loans enabled China's fledgling manufacturers to undercut European and American competitors.

When European solar subsidies slumped during the euro crisis, the Chinese government once again stepped in to support its renewable-energy champions. It offered FITs to slather the remote west of China with solar farms. By 2013 China had eclipsed Germany as the world's largest solar-panel market; last year it installed 53 gigawatts (GW), almost five times as much as in America, now the next-biggest market. Jinko became the world's largest provider of solar panels in 2016, shipping almost 10GW globally last year. Six of the top ten producers are Chinese.

These ups and downs are known globally as the “solarcoaster”: just as subsidies can quickly build the market up, their withdrawal can tear it down. On June 1st this happened with a particularly heart-stopping lurch when Chinese authorities, with almost no notice, strictly limited new solar

installations that qualified for FITs, blitzing the shares of Jinko and some of its peers in China, as well as of First Solar, one of America's biggest solar suppliers.

Analysts reckon that at least 20GW of solar projects expected to be built in China this year will now be scrapped (see chart). As demand wilts, they predict, Chinese panel prices will fall by at least a third. Benjamin Attia of Wood Mackenzie, an energy consultancy, says that, depending on how quickly the price falls encourage an uptake of solar in new markets, this could be the first year since 2000 that the global solar industry stalls. "In the short term, the policy change will rack the China market with angst," says an industry insider there.

The clampdown comes at a time when the solar industry globally is increasingly able to compete toe-to-toe on price with more conventional sources of power generation, such as coal, natural gas and nuclear. Countries in Europe, including Britain and Spain, and elsewhere too, have drastically slashed FITs. It all raises an important and tricky question: is this the end of the line for solar subsidies?

China provides an illustration of the likely answer, which is that FITs may be disappearing but other subsidy-lite alternatives are taking their place. Analysts say China's decision to scrap FITs follows a rise to about \$15bn last year in the deficit in the subsidy fund earmarked for developers; plugging the gap would have strained public finances. As a result of this shortfall, solar developers were not getting the subsidies they were owed. As one industry insider puts it, everyone loves subsidies—but only when they get paid.

Paolo Frankl of the International Energy Agency, a global forecaster, notes that China had recently begun to experiment, via a programme called "Top

runner", with an alternative to FITs that is gaining popularity internationally. This is a reverse auction in which solar developers that offer to build and run projects most cheaply win. The price they bid is what they will charge in long-term power-purchase agreements (PPAs) for the electricity they generate. Such reverse-auction PPAs have produced startlingly low bids in sunny places from Arizona and Nevada to Mexico, Abu Dhabi and India. In China recent PPAs sharply undercut the FITs, he says. One even beat coal-fired power. Hence China's aim to encourage more of such auctions to make solar, on the face of it, subsidy-free. The benefits could be significant in China. Lower prices of panels as a result of a temporary glut will encourage more aggressive bids, saving the government money and making solar more competitive against coal.

Yet though few doubt that PPAs are better than FITs, there is still fierce debate about whether they are also a sort of market-distorting subsidy. For instance, utilities may be forced to offer renewable PPAs, rather than fossil-fuel alternatives, because governments hold them to renewable-energy targets. The very existence of long-term contracts may make it cheaper for solar developers to get funding than they would otherwise. That said, it is hard these days, in China or elsewhere, to build any power plant without some public support. And purists say that any fossil-fuel project that goes ahead without taxing the carbon it produces is also enjoying an implicit subsidy.

China's move—though it will stall new solar installations for a while—may nonetheless make the global industry healthier over time. The shift may hasten consolidation in the industry in China, bringing the four main manufacturing components, polysilicon, wafer, cell and panels, under one roof, as they are at Jinko.

Bloomberg New Energy Finance, a consultancy, says that by 2019 more markets may embrace solar, given the fall in panel costs. The cheaper solar

gets, the more appealing it becomes, especially in poor countries struggling to satisfy rising energy demand. Mr Attia of Wood Mackenzie notes that pre-qualified bidders for a solar tender in Kuwait, announced after June 1st, involved Chinese property, mining and defence firms, which are not usually associated with photovoltaics (PVs). They may opportunistically be attempting to shift a surfeit of Chinese PV abroad.

The price cuts may also give Chinese solar manufacturers, stung by 30% tariffs imposed by the Trump administration in January, an opportunity to regain competitiveness in America (which maintains subsidies of its own via tax credits). The tariffs kept their silicon PV products out of the American market, bolstering sales of First Solar. But a fall of 30% or more in PV prices should make the tariffs less of a hindrance. Analysts say that is why First Solar's shares have fallen by a fifth since June 1st.

Solar experts expect the solarcoaster to rattle out of its current trough. But the ride still has a long way to go. Though solar was the world's biggest source of new power-generating capacity last year, it still generates a paltry 2% of global electricity. Technological improvements to make it better at turning sunlight into energy are slowing down. Here again, China offers a lesson. Its "Top runner" programme rewards those companies experimenting with the latest PV technologies, in a bid to make solar more competitive. Jinko says no other country offers such a scheme. The shame is that it is only open to Chinese firms. ■



太阳能

坐上“太阳能过山车”

中国收紧政策之后，全球光伏产业能否在无补贴下生存？

十多年前，总部位于上海的晶科能源刚进入太阳能行业，参加国际展会时只有一张光秃秃的桌子和一块潦草写着公司名字的纸板，是不折不扣的新手。但那时的晶科还拥有运气、技术优势和充裕的政府资金支持。

全球太阳能产业曾倚赖政府补贴而春风得意。慷慨的上网电价补贴（以下简称FIT）以及对安装太阳能设施的财政激励使德国在2010年前后成为世界第一大太阳能市场。德国人从中国买进廉价的晶体硅太阳能电池板，这主要是因为中国政府给该行业的新兴制造商提供土地和贷款补贴，让它们能够以低于欧美竞争对手的价格销售产品。

欧元危机期间，欧洲的太阳能补贴减少，这时中国政府再次出手扶持国内可再生能源领军企业，并提供FIT在偏远的西部地区大举建设太阳能电站。到2013年，中国已超越德国成为全球最大的太阳能电池板市场；去年中国的新增太阳能装机容量达53GW，几乎是美国（如今是全球第二大市场）的五倍。晶科能源于2016年成为全球最大的太阳能电池板供应商，去年的全球出货量接近10GW。目前世界前十大生产商中有六家是中国企业。

这些起起落落在全球被喻为“太阳能过山车”：正如补贴可以迅速壮大市场，撤回补贴也可能令市场倾覆。6月1日，一场令人惊心的打击猝然而至——中国有关部门几乎毫无预警地推出了新规，大大提高了新增光伏发电项目申请FIT的门槛，重挫晶科能源、其部分中国同行以及美国最大的太阳能供应商之一First Solar的股价。

分析师估计，中国今年拟建的太阳能发电项目中至少有20GW将被放弃（见图表）。他们预测，随着需求萎缩，中国产太阳能电池板的价格将下跌至少三分之一。能源咨询公司伍德麦肯兹（Wood Mackenzie）的本杰

明·阿提亚（Benjamin Attia）表示，今年有可能会是自2000年以来全球太阳能行业首次出现停滞的一年，待视价格下跌能以多快的速度促使新市场吸纳这些产能。“短期看来，这次政策变化会让中国市场倍感焦虑。”中国一位业内人士表示。

在价格方面，全球太阳能产业已日渐能与煤炭、天然气和核能等传统发电能源正面竞争，而补贴政策就在此时收紧了。英国、西班牙等欧洲国家及其他地区的国家都已大幅削减FIT。这就引出了一个重大而难解的问题：对太阳能产业的补贴就此到头了吗？

中国演示了一种可能的答案：FIT可能正在消失，但可代之以其他“轻补贴”措施。分析师称，中国的太阳能开发商专用补贴基金去年的赤字扩大到约150亿美元，政府就是在这之后决定取消FIT的。填补这一赤字会给公共财政带来压力。而资金缺口也使得太阳能开发商拿不到政府最初承诺的补贴。正如一位业内人士所说的，谁都喜欢补贴，但也要能兑现才有用。

全球预测机构国际能源署的保罗·弗兰克尔（Paolo Frankl）指出，中国最近开始通过一项名为“领跑者”的计划试验一种在国际上日渐流行的FIT替代手段。这是一种反向竞标，以最低成本建造和运营发电项目的太阳能开发商中标。他们的竞标价就是将被写入长期购电协议（以下简称PPA）的对自己出产电力的售价。在亚利桑那州、内华达州、墨西哥、阿布扎比、印度等阳光充裕的地区，这种反向竞标PPA产生了低得惊人的中标价。他说，在中国，最近一些PPA的价格大大低于上网电价。其中个项目甚至比火力发电的电价还低。因此，中国的目标是鼓励更多此类竞标，使太阳能产业表面上不再依赖政府补贴。这在中国可能带来显著效益。暂时的过剩导致了光伏电池板价格下跌，这将激发更激进的投标，进而为政府节省资金，也会令太阳能发电比火力发电更具竞争力。

然而，尽管无人否认PPA好过FIT，但PPA是否也是一种扭曲市场的补贴呢？对此仍存在激烈的争论。例如，电力公司可能被迫提供可再生能源PPA项目，而非化石燃料发电项目，因为政府要求它们完成可再生能源目

标。而由于坐拥长期合同，太阳能开发商获取资金的成本可能较低。但话说回来，今时今日，无论在中国还是其他地方，建设任何发电厂都难免需要公共支持。而纯粹主义者说，任何不交碳税的化石燃料发电项目实质上也是在享受隐形补贴。

中国的新政策尽管会暂时阻碍太阳能项目的增长，但长远来看也许会让全球太阳能产业变得更健康。这一转变也许会加速该行业在中国的整合，令多晶硅、硅片、电池和面板这四大主要部件的制造整合起来，就像在晶科能源那样。

咨询公司彭博新能源财经表示，鉴于电池板成本下降，到2019年可能会有更多市场接受太阳能。太阳能的价格越便宜，它的吸引力就越大，在那些难以满足日益增长的能源需求的贫穷国家尤其如此。伍德麦肯兹的阿提亚指出，6月1日之后，科威特某太阳能项目公布了通过资格预审的投标人，其中包括中国的房地产、矿业和国防公司。这些公司通常与光伏产业没什么关联，它们可能是看准时机，想将中国过剩的光伏产能转移到国外来赚钱。

今年1月特朗普政府对中国太阳能产品征收30%的关税，造成冲击，而降价也许会让中国的太阳能制造商有机会在美国市场重拾竞争力（美国本身仍在通过税收抵免补贴本国太阳能产业）。关税把中国的硅光伏产品挡在美国市场之外，推动了美国First Solar的销售。但只要中国的光伏产品降价30%或更多，关税就应该不是什么大问题。分析师表示，这就是为何First Solar的股价自6月1日以来下跌了五分之一。

行内专家预计，“太阳能过山车”终将爬出目前的低谷。但是这趟过山车还有很长的路要走。虽然去年全球新增发电装机容量中太阳能占比最大，但太阳能发电目前仅占全球发电量的2%。提升光电转化效率的技术进步正在放缓。在这方面，中国再次提供了经验。它的“领跑者”计划奖励试验最新光伏技术的公司，希望以此提升太阳能的竞争力。晶科能源表示没有其他国家提供这样的计划。可惜，该计划只面向中国公司。■



Patient safety

Physician, heal thy systems

As they strive to reduce the alarming incidence of medical errors, hospitals are using ideas from industry and behavioural science

AFTER a brain aneurysm in 2004, Mary McClinton was admitted to Virginia Mason Medical Centre in Seattle. Preparing for an x-ray, the 69-year-old was injected not, as she should have been, with a dye that highlights blood vessels, but with chlorhexidine, an antiseptic. Both are colourless liquids. The dye is harmless; the antiseptic proved lethal. After kidney failure, a stroke and two cardiac arrests McClinton died 19 days later.

In response, Virginia Mason committed itself to improving safety. It used an unlikely model: the Toyota Production System (TPS), the Japanese carmaker's "lean" manufacturing techniques. Nearly every part of the hospital, from radiology to recruitment, was analysed and standardised. Staff were trained to raise safety concerns. Today Virginia Mason prides itself on its safety record—and sells its take on Toyota to hospitals across the world.

Among its recent customers are five in England's National Health Service (NHS), including University Hospitals Coventry & Warwickshire. On a recent Thursday morning the hospital's patient-safety team began its daily meeting by reviewing errors reported overnight. In one case, a surgeon had perforated a patient's bowel during a laparoscopy. In another, a patient's chest drain, a tube used to remove air, fluid or pus from the thorax, was dislodged.

Since the team was set up a year ago, reporting of such incidents has increased from 35 incidents per 1,000 bed-days in October 2015 to 57 per 1,000 in April 2018. After the meeting, the safety team apologises to the

patients involved. It also debriefs the relevant staff, and sometimes, as in the case of the botched chest drain, recommends changes to procedures.

“To Err Is Human”, a study published in 2000 by America’s National Academies of Sciences, Engineering and Medicine, estimated that medical errors were to blame for up to 98,000 deaths a year in American hospitals, or twice as many as deaths in road accidents. A study published in 2016 by researchers from Johns Hopkins medical school in Baltimore puts the number much higher, at 250,000 deaths per year.

That is probably an exaggeration. But a study in 2017 by the OECD estimated that 10% of patients are harmed at some point during their stay in hospital. It also found that unintended or unnecessary harm in a medical setting is the 14th leading cause of ill health globally—a burden akin to malaria. At the annual meeting in May of the World Health Organisation (WHO), the UN’s public-health body, delegates discussed “global action” on patient safety.

So policymakers are trying many ways to improve safety. Much is standard fare— tweaks to regulations, changes to training and new kit less prone to cause infection. But Virginia Mason is not alone in looking outside medicine—not just to industry, but, for example, to behavioural science. There is a growing sense that, to make patients safer, hospitals need to simplify the ever more complex world of health care.

Efforts to reduce the harm medics do have a long history. In the 20th century, doctors began systematically to compare how patients are treated in different settings. Take James Alison Glover, a doctor, who noted that, by 1938, 83% of new boys at Eton, England’s poshest public school, had no tonsils (perhaps so the silver spoons could fit). Yet just 2% of Basque refugee children fleeing the Spanish civil war then raging had their tonsils out, and were no worse off for it. So Glover urged an end to widespread tonsillectomies, which, given the rate of surgical infections at the time,

spared English teenagers a lot of suffering.

Even so, until the 1990s, notes Ashish Jha of Harvard University, harm done to patients was often blamed on doctors, not defective health-care systems. “To Err Is Human” changed that by showing that most cases of harm resulted from dysfunctional ways of working. A lack of good historical data makes it impossible to know if medical errors have become more common. But Dr Jha suspects that the increasing complexity of health care means they are more prevalent than in the 1960s. Back then, a paediatrician, say, would need to know at most a few dozen different drugs. Today it is over a thousand.

Evidence from developing countries supports the idea that errors are the side-effects of better, if more complex, health care. A study in 2010 for the WHO found that rates of hospital infections were higher in poor countries. But, since fewer drugs were doled out, less harm was done by incorrect prescriptions and side-effects.

To improve their hospitals, rich countries have borrowed heavily from two industries: manufacturing and aviation. “Lean” is one of the popular industrial-management theories taken from manufacturing. It suggests that hospitals should study a patient’s “flow” through the building much as a car is monitored through the production line. That way bottlenecks and other inefficiencies can be spotted. In addition, Virginia Mason, for example, uses a policy of “stop the line”—ie, any member of staff is encouraged to halt a procedure deemed unsafe. It also has *genchi genbutsu*, or “go and see for yourself”, a standardised way for executives to visit wards and speak to staff about safety risks.

Virginia Mason claims that since 2001 it has become more profitable as it has reduced liability claims. Yet there is little evidence that introducing manufacturing-based management to other hospitals has made much

difference. A literature review published in 2016 found that just 19 of 207 articles on the effects of “lean” methodologies were peer-reviewed and had quantifiable results. These found no link between lean methods and health outcomes. Mary Dixon-Woods of Cambridge University notes that evangelists for the use of manufacturing methods can be loth to submit to rigorous, randomised studies.

As for aviation, over the past decade the use of checklists like those used by pilots has become commonplace. Before cutting a patient open, surgeons, anaesthetists and nurses go through a simple exercise to ensure they have the right equipment (and the right patient), know the operation to be performed and understand the risks.

In 2009 another study for the WHO suggested that a simple checklist in eight hospitals in cities in eight countries cut the rate of death during surgery from 1.5% to 0.8%, and that of complications from 11% to 7%. Since then checklists have become ubiquitous in Danish, French, Irish, Dutch and British hospitals, and used about half of the time in developing countries.

But, again, there are very few randomised studies to bear this out. And, often, medics know procedures are under evaluation, which may change behaviour. Some of the more rigorous studies are disappointing. One published in 2014, of 200,000 surgical procedures in 101 hospitals using checklists in Ontario, Canada, found no link to improved outcomes. A recent study of the use of checklists in obstetric care in India again found no firm link between their introduction and reduced deaths of infants or new mothers. The reasons for these disappointing results “are primarily social and cultural”, suggested an article in the *Lancet* medical journal co-authored by Charles Bosk, a medical sociologist. He argues that many surgeons feel that using a checklist infantilises them and undermines their expertise.

So, more promising may be approaches that do not ask much of doctors

themselves. Over the past few years behavioural scientists have begun to try to nudge doctors to make better decisions by studying and acting upon their inherent biases. “Default bias”, the tendency to accept the status quo, is powerful in clinical settings. Most doctors, for example, follow the prescription dosages suggested by electronic medical-record (EMR) software. The same is true of the default settings on medical kit. Research in ICUs has shown that, on their standard settings, artificial ventilators can put huge pressure on the lungs, tearing tissue and provoking inflammation. Tweaking ventilators so that they have a “low tidal volume” setting is often better, but many doctors do not have the time to make the necessary calculations. In a study published in 2016, doctors at the University of Bristol showed that, just by switching the default settings on the machine, patients received safer ventilation.

Established in 2016, the Penn Medicine Nudge Unit, based at the University of Pennsylvania, is the first dedicated behavioural-science unit to be set up within a health system anywhere. It has shown how courses of action can be safer when doctors have to opt out of typically better practices, rather than opt in. For example, just 15% of patients with heart attacks were being referred on to cardiac rehabilitation, because doctors had to opt in to the service and fill out a lengthy form. By making referral to rehab the default setting, and providing pre-filled forms, rates rose to 85%.

Opioids offer another example. Many EMR systems are set by default to prescribe 30 pills to patients requiring pain relief, when ten may be sufficient. The consequences can be severe. The more pills in the first opioid prescription, the greater the chance of becoming addicted. By changing the default setting of their EMR, the Penn team doubled the number of patients on the ten-pill doses.

Other researchers are exploring the power of design to improve safety. The

Helix team based at St Mary's hospital in London is a joint project of Imperial College London and the Royal College of Art. One of its projects involved prescription forms. The team noticed that when doctors had to write out the units of the drug to be prescribed they often made mistakes—milligrams instead of micrograms, for example. The Helix team redrew the form so that doctors just had to circle a pre-written unit.

Perhaps the greatest potential for reducing medical errors, however, lies in new technology. Streams, an app developed by DeepMind, an artificial-intelligence company owned by Google's parent, is on trial at the Royal Free hospital in London. It is currently being used to alert doctors and nurses more quickly to patients at risk of acute kidney injury, a potentially fatal condition often first detected by blood tests rather than by a patient's feeling unwell. Instead of having to receive a pager message and then log on to a computer, the medics get an alert to the Streams app on their mobile phone, along with all the data needed to make a quick clinical decision.

In future, Streams may use machine learning to improve how it crunches data. But for now the researchers have focused on how to make the app useful for clinicians. One concern it is trying to tackle, for example, is "alarm fatigue". A study of ICU wards found an average of 350 alerts per bed per day; one averaged 771 alerts. Other research has found that nurses are interrupted every five to six minutes. Little wonder, perhaps, that staff can ignore alerts, with sometimes fatal consequences.

Medical technology is saving ever more lives. But by expanding the range of what medicine can do, progress also brings with it new routes for harm. It is surely right that to tackle these medicine studies the advances other fields have made in dealing with complexity. But the profession has too often been oddly slapdash in implementing these advances. They too need to be subject to the scientific rigour—and exhaustive testing—that has served medicine so well. It might also help to remember that, for all health care's

dazzling progress, doctors are mere humans.

Award: On June 20th, at the Medical Journalists' Association annual awards for health-care journalism, John McDermott, our global public-policy editor, and Natasha Loder, our health-care correspondent, both won prizes—for writing about trauma medicine and cancer, respectively. ■



病患安全

医生，先治好你的系统

医院借鉴工业界和行为科学的理念，力争降低惊人的医疗差错发生率

二〇〇四年，玛丽·麦克林顿（Mary McClinton）因脑动脉瘤住进了西雅图的弗吉尼亚·梅森医疗中心（Virginia Mason Medical Centre，以下简称“梅森医院”）。69岁的她本该在做X光检查前注射突显血管的造影剂，却被注射了一种叫作洗必泰的消毒剂。两者都是无色液体。造影剂对人体无害，而注射消毒剂的结果却是致命的。之后麦克林顿便出现肾衰竭、一次中风和两次心脏骤停，于19天后去世。

梅森医院以此为戒，致力于提高医疗安全。医院采用了一种匪夷所思的模式：日本汽车制造商丰田的“精益”制造技术——丰田生产体系（TPS）。医院对从放射到招聘的几乎所有环节加以分析并实行标准化管理，培训员工以提高他们的安全意识。如今，梅森医院不仅以其医疗安全记录为荣，还将其“丰田之道”出售给世界各地的医院。

梅森医院近期的客户中有五家从属于英国全民医疗服务体系（NHS），包括考文垂和沃里克郡大学医院（University Hospitals Coventry & Warwickshire）。最近一个周四的上午，该医院的病患安全小组召开每日例会，审查头天晚上报告的医疗差错。其中一起是外科医生在腹腔镜检查中造成患者肠穿孔。另一起是医生拔除了患者用来排出胸腔中空气、液体或脓液的胸腔引流管。

自该小组成立一年以来，针对此类事故的报告已从2015年10月的每1000个住院日35起增加到2018年4月的57起。会后，安全小组会向相关患者道歉，并详细询问涉事工作人员，有时还会建议整改流程，比如在上述胸腔引流管事故中。

美国国家科学院、工程院及医学院在2000年发表的名为《人非圣贤》（To Err Is Human）的研究报告估计，美国医院每年因医疗差错导致

的死亡人数多达9.8万人，是交通事故死亡人数的两倍。而巴尔的摩的约翰·霍普金斯医学院（Johns Hopkins medical school）的研究人员在2016年发表的研究报告估计出的数字还要高出许多，为每年25万人。

这可能有些夸大。但经合组织（OECD）2017年的一项研究估计，10%的患者在住院期间曾遭受过医疗损害。该研究还发现，在全球危害健康的主要原因中，医疗环境中的意外或不该出现的损害位列第14，危害程度和疟疾不相上下。在联合国的公共卫生机构世卫组织（WHO）5月召开的年会上，代表们讨论了有关病患安全的“全球行动”。

因此政策制定者正在尝试多种方法来提高医疗安全。其中不少很常见，比如微调监管法规、修改培训计划，以及启用更不易导致感染的新设备等。但并非只有梅森医院一家把目光投向了医学以外的领域——不只是工业界，还有行为科学等。越来越多的人认识到，要提高医疗安全，医院需要简化愈发复杂的医疗体系。

尽力减少医源性损伤由来已久。上世纪，医生开始系统地比较患者在不同的环境中得到的医治情况。例如，詹姆斯·艾利森·格洛弗（James Alison Glover）医生指出，到1938年，英国顶级私立寄宿男校伊顿公学（Eton）83%的新生没有扁桃体（可能这样更方便含着银汤匙）。然而，从当时激烈的西班牙内战中逃亡的巴斯克难民儿童只有2%切除了扁桃体，而保留了扁桃体并没让他们健康状况更糟。于是格洛弗呼吁停止盛行的扁桃体切除术。此举让英国青少年免受很多痛苦，因为当时手术感染率较高。

哈佛大学的阿希什·杰哈（Ashish Jha）指出，即便如此，直到上世纪90年代，人们还是常将患者所受的伤害归咎于医生，而不是医疗系统的缺陷。

《人非圣贤》纠正了这一观念，该报告表明大多数伤害事件的起因是工作方式紊乱。由于缺乏充分的历史数据，人们无法知道医疗差错是否变得更加常见。但杰哈猜测，与上世纪60年代相比，医疗的日益复杂使得医疗差错更加普遍。比方说，当时儿科医生最多需要了解几十种不同的药物，而现在他们需要了解一千多种。

伴随更先进但也更复杂的医疗而来的是更多差错——这种观点在发展中国家得到了印证。2010年一项为世卫组织所做的研究发现，贫困国家的医源性感染比率更高，但由于发放的药物更少，错误处方及药物副作用造成的损害也更小。

为改善医院的医疗水平，富国大量借鉴了两个行业的经验：制造和航空。“精益”就是一种源自制造业的流行的工业管理理论。根据该理论，医院应该研究患者在医院的“流动”情况，很像全程监控生产线上的汽车。这样就可以发现瓶颈和其他低效现象。此外，梅森医院采用了“停线”制度，所有员工都可叫停他们认为不安全的步骤；医院还借鉴了丰田“亲临现场”（*genchi genbutsu*）的原则，要求主管们前往病房、向员工提示安全风险，作为一种标准化操作。

梅森医院声称，自2001年以来，由于责任索赔事件减少，自己的利润增加了。然而，几乎没有证据表明，引入源于制造业的管理方式给其他医院带来了重大改变。2016年发表的一篇文献综述发现，在207篇有关“精益”方法对医疗影响的文章中，只有19篇经过同行评审并且有可量化的结果。这些文章没有发现精益方法和医疗结果之间存在关联。剑桥大学的玛丽·狄克逊-伍兹（Mary Dixon-Woods）指出，鼓吹采用制造业方法的人可能不愿意开展严谨、随机的研究。

至于对航空业的借鉴，在过去的十年里，像飞行员一样采用核查清单的做法已经司空见惯。在为患者实施手术前，外科医生、麻醉师和护士要通过一个简单的演练以确保设备无误（还有患者无误），明确要做的手术并了解其风险。

2009年另一项为世卫组织开展的研究表明，在八个国家的八家城市医院中，一份简单的核查清单将手术死亡率从1.5%降到了0.8%，并发症发生率从11%降到了7%。从那时起，丹麦、法国、爱尔兰、荷兰和英国的各个医院开始普遍使用核查清单，而发展中国家大概有一半的时候会用到它。

但是，同样很少有随机研究来证实这一点。而且，很多时候，医护人员知

道手术过程在接受评估，因而可能会改变自己的行为。一些较为严谨的研究得出的结果令人失望。2014年发表的一份报告考察了加拿大安大略省101家使用核查清单的医院所做的20万次外科手术，并未发现核查清单与手术结果改善有关联。最近一项对印度产科护理中使用核查清单情况的研究同样发现，使用它们与母婴死亡率下降之间没有确切的关联。这些令人失望的结果背后的原因“主要是社会和文化上的”，医学社会学家查尔斯·博斯克（Charles Bosk）在医学杂志《柳叶刀》（Lancet）上一篇与他人合著的文章中这样指出。他认为，许多外科医生觉得使用核查清单这种东西是拿他们当小娃娃，会损害他们的专业能力。

因此，更有效的办法可能是那些不会对医生本人提出太多要求的。数年来，通过研究医生的固有偏见并对此做出干预，行为科学家们已经开始尝试助推医生更好地做决策。在临床环境中，倾向于接受现状的“默认偏见”影响力相当大。例如，大多数医生直接就采用电子病历（EMR）软件建议的处方剂量。医疗设备的默认设置也有同样的影响。对重症监护病房的研究表明，如果采用标准设置，人工呼吸机可能对肺部造成巨大的压力，撕裂组织并引发炎症。微调呼吸机、将其设置为“低潮气量”通常会更好，但很多医生没有时间进行必要的潮气量计算。在2016年发表的一项研究中，布里斯托大学（University of Bristol）的医生们的操作显示，只需调整下呼吸机上的默认设置，患者的换气呼吸就会更加安全。

成立于2016年的宾夕法尼亚大学医学助推小组（Penn Medicine Nudge Unit）是世界上首个专门在医疗系统内部设置的行为科学团队。该小组证实，当默认操作是通常更好的做法时可能会带来更安全的处理。例如，因为医生必须要主动选择另外采取心脏康复治疗这种不同于默认选择的做法，并要为此填写一份冗长的表格，所以只有15%的心脏病患者被转诊到心脏康复治疗。而如果把转诊到康复治疗作为默认设置，并向医生提供事先填好的表格，这一比率就上升到了85%。

阿片类药物的使用也能说明问题。需要镇痛的患者可能开10粒药就足够了，但许多EMR系统设置的默认值却是30粒。后果可能很严重。第一次阿

片类处方开的剂量越大，患者上瘾的几率就越大。通过改变EMR的默认设置，宾大助推小组让剂量为10粒药的患者人数增加了一倍。

其他研究人员正在探索通过设计的力量来提高医疗安全。位于伦敦圣玛丽医院（St Mary's hospital）的Helix团队是伦敦帝国学院（Imperial College London）和皇家艺术学院（Royal College of Art）的合作项目。它的其中一个课题和处方笺有关。该团队注意到，医生经常会在书写处方药的单位时犯错，比如将微克写成毫克。团队重新设计了处方笺，这样医生只需在事先写好的单位上画个圈就行了。

不过，最有可能减少医疗差错的办法或许还是运用新科技。伦敦的皇家自由医院（Royal Free hospital）正在试用谷歌母公司旗下人工智能公司DeepMind开发的Streams应用。目前这款应用被用于更快速地向医生和护士发送患者有急性肾损伤危险的警报。急性肾损伤可能致命，通常最先是从血液检测而不是患者的不适被发现。现在，医护人员不再是收到呼叫信息再登录电脑，而是通过他们手机上的Streams应用接到警报和全部数据，可以迅速做出临床决策。

未来，Streams也许会使用机器学习来改进对数据的处理。但是目前，研究人员关注的是怎样能让这款应用帮到临床医生。例如，它试图解决的一个问题是“警报疲劳”。一项针对重症监护室的研究发现，每天每个床位平均发出350次警报，每个重症监护室平均发出771次警报。其他研究发现，护士每五到六分钟就会被打断一次。难怪工作人员会忽略警报，而这有时会带来致命的后果。

医疗技术正在挽救越来越多的生命。但是，随着医疗进步扩展了医疗的作用范围，损害也在以新的形式出现。借鉴其他领域在对付复杂性上取得的成果来解决这些问题无疑是正确的，但医学界在实施这些方法时往往草率得令人吃惊。科学上的严谨和全面详尽的测试一直令医学受益良多，在应用这些成果时同样需要如此。记住这一点可能也有好处：尽管医疗取得了耀眼的进步，医生终究只是凡夫俗子。

获奖：6月20日，《经济学人》的全球公共政策编辑约翰·麦克德莫特（John McDermott）和医疗卫生记者娜塔莎·洛德（Natasha Loder）分别因撰写创伤医学和癌症方面的文章，双双斩获医学记者协会（Medical Journalists' Association）的医疗新闻年度奖。 ■



Central Europe's Goldilocks economies

Never had it so good

The region is enjoying a boom. But long-term success requires more skilled workers and more innovative companies

THEY evoke metal gorillas in a cavernous, floodlit hall: 640 robots with riveting guns and arms for handling parts. They will spring into action this autumn at the opening of a new plant for Jaguar Land Rover (JLR), built at a cost of €1.4bn (\$1.6bn) on former farmland in Nitra, in western Slovakia. Cars under construction will travel along 3.9km of elevated maglev track, taking just two days from start to completion. The robots, together with 2,800 human workers, will assemble a Land Rover Discovery every two minutes.

JLR is just the latest carmaker to come to Slovakia. VW arrived 27 years ago, followed by Kia and PSA. The firms together churn out over 1m cars annually, more per head of population than any other country. JLR considered 30 or 40 locations, says Alexander Wörberg, who oversees operations at Nitra. Mexico has cheaper workers and (for now, at least) favourable access to the American market. But Nitra is close to a new motorway and Slovakia has an impressive supply chain, with more than 300 factories making car parts.

The new JLR factory gives a fair picture of Slovakia's, and more broadly central Europe's, model of development. First, it was built with foreign capital and largely by foreign contractors. Signs for Bouygues, from France, and Takenaka, from Japan, hugely outnumber those for Dynamik, a local building firm. Membership of the EU has facilitated the flow of capital from the bloc's western members to its eastern ones. Second, it depends on customers in economies to the west slurping up goods made relatively

cheaply in the hinterland.

And third, government support was essential. Last year the European Commission said it was checking if the €125m JLR received broke the bloc's state-aid rules. Such subsidies are common in central Europe. Investors flock to special economic zones across the region, lured by tax giveaways. EU funds boost investment in infrastructure that appeals to foreign investors, like roads and rail. Even in Poland, the region's biggest and most diversified economy, this money matters. It will be nearly 3.5% of GDP and 10% of public spending each year until 2022, reckons Paweł Borys, head of Poland's development fund. In Hungary it added spending worth an average of 5% of GDP over the five years to 2015.

This foreign-led development model has had much success. Countries from the Baltic states in the north to littoral Black Sea states have become considerably richer over the past two decades (see map). GDP per person in the Czech Republic is now close to that in Spain. Bulgaria and Romania are much poorer, but managing to win investment and grow, too.

The European Commission tracks the progress of five EU members immediately east of Germany and Austria (the Czech Republic, Hungary, Poland, Slovenia and Slovakia) compared with a group of four wealthy "frontier" EU countries (Austria, Denmark, the Netherlands and Sweden). In 1995 average GDP per person (at purchasing-power parity) was around 55% lower in the five central European countries than in the frontier countries. By 2016 the difference had shrunk to 39%. Average incomes in the five countries are now equal to those in Portugal and far above those in Greece. Slovakia saw the most dramatic gains.

But the challenge for these countries—as for any hinterland reliant on supplying labour to produce goods for richer neighbours,

maquiladora-style—is to keep closing the income gap. The next stage of development is bound to be harder, requiring more productive firms, more private capital and more skilled labour. It is not clear that central Europe is ready.

For now, the good times roll. The region is growing strongly once again. The IMF expects these countries to expand by an average of some 4% this year, nearly twice as fast as western Europe. This expansion looks more sustainable than the last one, which ended with the 2007-08 financial crisis. Back then, cheap foreign loans, including Swiss-franc mortgages taken out by individual households, had boosted consumption but quickly became hard to pay off. Today banks are in better shape, investment plays a bigger part in growth and consumption is supported less by debt and more by rising incomes.

The region's increasingly nasty politics have taken some of the shine off the EU's eastward expansion. But so far foreign companies seem unruffled. Though Viktor Orban, Hungary's prime minister, is an illiberal authoritarian, Mercedes Benz announced an investment of €1bn in the country two years ago and plans to make 330,000 cars yearly by 2020. Though Poland's nativist government is hostile towards immigrants and, on occasion, the rule of law, foreign capital keeps coming and annual GDP growth has touched 5%. Anti-corruption protests toppled Slovakia's prime minister in March. Even so, "corruption or political instability doesn't deter investors when other conditions are good," says a consultant at Vienneast, a business-risk analyst.

Building firms are doing particularly well. Construction activity in the region has typically grown twice as fast as GDP in recent years, says Thomas Birtel, the boss of Strabag, Austria's largest building company. Central Europe accounts for a fifth of its business; bright prospects there help explain why its share price has risen by two-thirds in the past three years.

Business in Poland has gone so well that Strabag is branching out from EU-funded infrastructure into hotels, shopping centres and office blocks.

Weinberger, a building-materials supplier, has 64 plants across eastern Europe (if you include Austria and Turkey). A spokeswoman for the firm says 30% of homes in the region are not connected to a sewerage system, compared with just 5% in western Europe. Hungary has been headiest of late, as Mr Orban scrambled ahead of an election to build roads, tunnels and bridges. Subsidies for better housing have meant a boom in brick sales.

Services are playing a bigger part in this expansion than in the pre-crisis boom. Cornelius Walter of McKinsey, a consultancy, says white-collar work is doing well. Western banks are moving back-office jobs east to pleasant, affordable spots such as Krakow. JPMorgan Chase is putting 2,500 jobs in Warsaw; Goldman Sachs is recruiting there. McKinsey itself has 1,000 analysts in Poznan in central Poland, serving clients globally. Brexit will probably mean some mid-level finance jobs move from London. Poland's Association of Business Service Leaders already counts 750 firms, most foreign-owned, in business services, employing 265,000 people.

Fritz Mostbock of Erste, an Austrian bank with 16m customers in Poland, the Czech Republic, Slovakia, Croatia, Serbia, Romania and Turkey, says it expects banking in central and eastern Europe to grow faster than in western Europe for years to come. Central Europe has transformed Vienna Insurance Group, a 194-year-old institution, says a spokesman. Its 21 companies across central and eastern Europe now provide half of all VIG's premiums and profits. "As incomes rise, spending on insurance goes up," he says.

It seems, then, that central Europe's Goldilocks economies are well set for sustainable growth. But there are three reasons to worry: a lack of innovation in local firms, a coming demographic squeeze and an over-

dependence on foreigners, especially German ones, to drive development.

The first concern is illustrated by how few locally owned, non-state firms can compete with foreign ones. Sazka Group is one, but it is small. A Czech operator of lottery companies at home and in Greece, Italy, Cyprus and Austria, it has shown rare foreign ambitions. Last year it generated some €500m in revenues and employed 5,600 staff. Robert Chvatal, its boss, talks of plans to list in London, to raise capital for further expansion.

Cord Prinzhorn, the boss of Prinzhorn Holding, an Austrian packaging and recycling firm that has invested €650m in central and eastern Europe in a decade, says rivals do pop up, notably in Poland. But not many, and none has grown big. The few big domestic firms are state-owned behemoths left over from pre-capitalist days, such as PKN Orlen, a Polish oil refiner with a market capitalisation of over €8bn.

The region is in large part a back office and workshop for western Europe, says Richard Grievson of WIIW, a think-tank in Vienna, and is reliant on companies created and based elsewhere. He worries that, though open capital accounts and lashings of foreign direct investment have helped it to grow up till now, they are not a strong basis for further development.

More needs to be done to encourage innovation, says Marcin Piatkowski of the World Bank. He thinks universities and governments could help by promoting better management. Officials should be quicker, he reckons, to choose startups that get grants for research and development or help in scaling up.

Jadwiga Emilewicz, an economy minister in Poland, claims that the country's firms are being prodded to move up value chains. Spending on research and development reached 1% of GDP last year, up from 0.5% in 2016. The goal is 2.7% by 2021, in line with America, Germany and Sweden,

the world leaders. An “innovation act” will give tax benefits to firms that commercialise research, among other pro-business measures. Other countries in the region have similar goals.

A more immediate difficulty is finding skilled, competitively priced labour. A building boom has soaked up workers. Mr Wortberg of JLR has just hired his 1,000th employee. Most are Slovaks, but he foresees having to import staff, though bureaucrats make that difficult. The squeeze is only going to get worse. Ageing populations, continued emigration and widespread hostility to migrants mean workforces are soon going to shrink. Old-age dependency ratios across the region are already rising fast, and in the coming two decades will soar (see chart).

Labour markets are rigid. People in rural areas are reluctant to move for a job, which helps keep participation rates low. Older people, who are more likely to live in villages than youngsters, are the least likely to work: according to Eurostat, less than half of Polish 55- to 64-year-olds have jobs. At the plant in Nitra, Mr Wortberg thinks that the difficulty of finding housing means that workers do not move.

Populist policies compound the problem. Last year Poland lowered the retirement age, immediately limiting the labour force. The number of employed Poles rose by a mere 135,000 in 2017, a pitifully small gain in a country with an 18m-strong workforce experiencing an economic boom. Poland has 152,000 vacancies, with construction, IT and transport firms most in need. In the Czech Republic there are around five vacancies per 100 people employed, the highest rate in the EU. “Companies’ main problem is a lack of workforce, especially skilled workers,” says Adam Czerniak of Polityka Insight, a think-tank in Warsaw.

If central Europe succeeds in moving up the value chain, the coming

demographic crunch will matter less, as more productive workers will find it easier to support a growing dependent population. But making that happen will require doing more to create a skilled workforce. Apprenticeship schemes and vocational education of the sort common in Germany, Switzerland, Singapore and the Nordic countries, are rare in central Europe.

All the while, tight labour markets mean fast-rising wages, at least in cities. In Poland salaries are rising by an average of 7% yearly, far above inflation, says Mr Borys. Wages in Prague are close to those in Austria, notes an official at the Austrian central bank. Mr Birtel at Strabag, the building firm, says he expects wage growth to push up costs of materials and subcontracting work, and thus to eat into profits. Higher wages spread economic benefits, especially as many salaries used to be desperately low. But unless workers also become more productive, rising wages will make the region less appealing to investors. Mr Grievson predicts that central Europe's demography will limit growth from the 2020s on.

Even before then, the region's close links with western Europe leave it exposed to any change in policies or financial conditions there. Its reliance on exports means that any softening of demand to the west would be felt quickly. If President Donald Trump's threats to put higher tariffs on American imports of European-made cars become reality, its car and auto-parts manufacturers would soon suffer. It could also be hit as monetary policy tightens in the euro zone, since rates are set to suit larger, richer countries rather than those to their east.

What is more, the next round of EU cohesion-policy funds, to run from 2021 to 2027, will be much less generous to central and eastern Europe than the current one, which started in 2014 and runs until 2020. Proposals published by the European Commission in May would give Poland, for example, €64bn, down from €84bn in 2014-20. That is partly because central Europe

is comparatively richer than it used to be. It is also because Brexit will cut the EU budget and because western Europeans are peeved at populists to the east refusing to help share the burden of refugees. Central Europe has benefited greatly from integration with countries to the west. But its dependence on exports and EU funds is also a source of vulnerability. It needs to plan for what might replace them. ■



中欧的金发女孩经济体

最好的时代

该地区正在蓬勃发展。但持久的成功需要更多的技术熟练工人和更多的创新企业

在一个泛光灯照明的巨型大厅里，它们好像一群金属大猩猩——640个配备了铆钉枪和机械臂来装配零件的机器人。它们会在今年秋天一家捷豹路虎的新工厂开工时动起来。这家工厂投资14亿欧元（16亿美元），建在斯洛伐克西部的尼特拉市（Nitra）一片曾是农田的土地上。生产中的汽车将沿着一条3.9公里长的架空磁悬浮轨道装配线行进，从上轨到下线只要两天。机器人将和2800名工人一起工作，每两分钟组装一辆路虎发现。

捷豹路虎只是最新进入斯洛伐克的汽车制造商。大众在27年前就来了，之后是起亚和标致雪铁龙，这几家公司每年在这里生产超过一百万辆汽车，令斯洛伐克的人均汽车产量世界居首。负责尼特拉工厂运营的吴斌（Alexander Wortberg）说，捷豹路虎在选址时考虑了三四十个地方。墨西哥有更廉价的劳动力和进入美国市场的有利条件（至少现在还有）。但尼特拉靠近一条新建成的高速公路，而斯洛伐克由300多家汽车零部件厂家构成的供应链也令人印象深刻。

捷豹路虎的新工厂清楚地展示了斯洛伐克乃至整个中欧的发展模式。首先，它依赖外国资本，且主要由外国承包商建造。法国布依格（Bouygues）和日本竹中土木（Takenaka）的标志远多过当地建筑公司Dynamik的标志。欧盟成员国的身份促进了资本从西欧国家向中东欧国家的流动。其次，这种模式依赖西欧经济体的消费者大把消费在欧洲腹地制造出来的相对廉价的商品。

第三，政府支持至关重要。去年，欧盟委员会表示，它正在调查捷豹路虎工厂获得的1.25亿欧元的资金是否违反了欧盟的国家援助法规。这种补贴在中欧很常见。在税收优惠的诱惑下，投资者大批涌向该地区的各个经济特区。欧盟的资金促进了对公路和铁路等基础设施的投资，这个领域非常

吸引外国投资者。即使在波兰这个该地区最大和最多元化的经济体，这样的资金也很重要。波兰发展基金会主席波维尔·鲍里斯（Pawel Borys）估计，在2022年前，欧盟资金每年将占波兰GDP的近3.5%和公共支出的10%。在匈牙利，从2010年到2015年的五年里，因这些资金而增加的支出平均相当于GDP的5%。

这种靠外国拉动的发展模式已经取得了很大的成功。过去20年来，从北部的波罗的海国家到黑海沿岸国家，各国富裕程度大幅提高（见地图）。捷克的人均GDP现在接近西班牙。保加利亚和罗马尼亚要穷得多，但也在赢得投资，实现增长。

欧盟委员会跟踪了紧挨在德国和奥地利东边的五个欧盟成员国（捷克、匈牙利、波兰、斯洛文尼亚和斯洛伐克）的发展情况，并与四个稍后发达起来的富裕欧盟国家（奥地利、丹麦、荷兰和瑞典）做比较。1995年，五个中欧国家的平均人均GDP（按购买力平价计算）比前沿国家低约55%。到2016年，差距已缩小至39%。现在，这五国的平均收入与葡萄牙相当，远高于希腊。斯洛伐克收入增长的幅度最大。

但这些国家面临的挑战是继续缩小收入差距——任何依赖提供劳动力为富裕邻国生产商品这种出口代工模式的内陆国家都是如此。下一阶段的发展需要更多富有生产力的企业、更多私人资本和更多熟练劳动力，发展难度必然会更大。很难说中欧是否已准备就绪。

就目前而言，好时光还在继续。该地区正再次强劲增长。国际货币基金组织预计，今年这些国家经济的平均增速约为4%，接近西欧的两倍。相比上一轮随2007至2008年金融危机而终结的增长，本轮增长看起来更可持续。在上一轮增长中，包括个体家庭获得的瑞士法郎抵押贷款在内的廉价外国贷款提振了消费，但很快就变得难以偿还。如今，银行状况改善，投资在增长中发挥了更大的作用，消费对债务的依赖减少，更多是依靠收入的增加。

该地区日益恶劣的政治局面让欧盟东扩的成就略显失色。但到目前为止，

外国公司似乎不为所扰。尽管匈牙利总理维克托·欧尔班（Viktor Orban）是一个非自由主义的威权领导人，梅赛德斯-奔驰两年前仍宣布在该国投资10亿欧元，并计划到2020年每年生产33万辆汽车。尽管波兰的本土主义政府对移民、甚至有时对法治都持敌视态度，外资仍不断涌入，且年均GDP增幅达到5%。3月，反腐败抗议活动把斯洛伐克总理赶下了台。即便如此，“当其他条件良好时，腐败或政局不稳并不会阻止投资者。”商业风险咨询公司Vienneast的一名顾问表示。

建筑公司的发展势头尤其好。奥地利最大的建筑公司Strabag的老板托马斯·博特尔（Thomas Birtel）表示，该地区的建筑业近年的增速通常是GDP的两倍。中欧市场占了Strabag业务的五分之一；一定程度上，正是这里光明的前景令Strabag的股价在过去三年中上涨了三分之二。Strabag在波兰的生意非常火红，正在从欧盟资助的基础设施扩展到酒店、购物中心和办公大楼。

建筑材料供应商Weinberger在东欧拥有64家工厂（如果算上奥地利和土耳其的话）。公司发言人表示，该地区30%的房屋没有连接污水处理系统，在西欧这个比例仅为5%。由于欧尔班要在选举前加紧修建道路、隧道和桥梁，近来匈牙利的建筑业发展最为迅猛。住房改善补贴让建筑用砖的销量大涨。

与危机前的繁荣相比，服务业在这轮经济扩张中发挥了更大的作用。咨询公司麦肯锡的科尼利厄斯·沃尔特（Cornelius Walter）称，白领工作形势良好。西欧的银行正将后台工作向东转移到波兰的克拉科夫（Krakow）等宜居且成本合理的地方。摩根大通（JPMorgan Chase）正把2500个工作岗位放到华沙；高盛也在那里招聘人才。麦肯锡自己在波兰中部的波兹南（Poznan）有1000名为全球客户服务的分析师。英国退欧可能导致一些金融业中级岗位从伦敦迁出。波兰的商业服务领导者协会（Association of Business Service Leaders）已有750家商业服务业会员，其中大多数是外资企业，雇有26.5万名员工。

奥地利第一储蓄银行（Erste）在波兰、捷克、斯洛伐克、克罗地亚、塞

尔维亚、罗马尼亚和土耳其拥有1600万客户。该银行的弗利茨·莫斯伯克（Fritz Mostbock）说，该行预计未来多年里中东欧的银行业增速将超过西欧。创建194年的维也纳保险集团（VIG）的发言人说，中欧已经彻底改变了集团的面貌。它在中东欧的21家公司现在贡献了集团所有保费和利润的一半。这位发言人说：“收入增加了，人们在保险上花的钱也水涨船高。”

这样看来，中欧的金发女孩经济体似乎完全具备了可持续增长的条件。但有三个方面需要担心：本土公司缺乏创新、劳动力人口将要缩减，以及过度依赖外国企业尤其是德国公司来驱动发展。

第一个问题从鲜有本土非国有企业能与外国企业竞争就看得出来。Sazka集团算得上一个，但它规模很小。这家博彩运营商在捷克本国以及希腊、意大利、塞浦路斯、奥地利等地开展业务，显示出了罕见的海外发展野心。去年，它创造了约5亿欧元的收入，雇用员工5600名。公司老板罗伯特·希瓦塔尔（Robert Chvatal）表示有意在伦敦上市，为进一步扩张筹集资金。

奥地利包装和回收公司Prinzhorn Holding过去十年里已在中东欧地区投资6.5亿欧元。公司老板科尔德·普林佐恩（Cord Prinzhorn）表示，竞争对手确实时有出现，特别是在波兰，但数量不多，也都没能发展壮大。那里的少数几家国内大企业还是前资本主义时代遗留下来的国有巨头，例如市值超过80亿欧元的炼油商波兰国营石油公司（PKN Orlen）。

维也纳智库WIIW的理查德·格里弗森（Richard Grievson）说，该地区在很大程度上是西欧企业的后台和车间，依赖那些在其他地方创建和设立总部的公司。他担心，虽然到目前为止，开放的资本账户和大量外国直接投资一直在帮助中东欧增长，但它们并不能充当进一步发展的坚实基础。

世界银行的马尔辛·皮亚考斯基（Marcin Piatkowski）表示，该地区还需要做更多的工作来鼓励创新。他认为高校和政府可以通过促进更好的管理来出一份力。此外，官员应增加行动力，更快选出一批创业公司，向它们

划拨研发资金或帮助它们扩大规模。

波兰一位主管部分经济事务的部长亚德维加·艾米莱维奇（Jadwiga Emilewicz）称，该国正在推动企业向价值链上游移动。去年波兰的研发支出占到GDP的1%，高于2016年的0.5%。目标是到2021年提升至2.7%，与世界领先的美国、德国和瑞典相当。一项“创新法案”将向把研究成果产业化的企业提供税收优惠，此外还有其他商业促进措施。该地区的其他国家也有类似的目标。

一个更紧迫的难题是找到具有价格竞争力的熟练工人。建筑热潮吸走了大批工人。捷豹路虎的吴斌刚刚聘用了他的第1000名员工。他的员工大多数都是斯洛伐克人，但他预计未来必须要引入外国劳动力——尽管官僚会百般阻挠。劳动力紧缩只会变得更严重。人口老龄化、持续的移民出境，以及对外国移民的普遍敌意意味着劳动人口很快将萎缩。该地区的老年抚养比已经在快速上升，未来20年还将飙升（见图表）。

当地劳动力市场僵化。农村地区的人们不愿意外出务工，这让劳动力参与率一直保持在低位。老年人比年轻人更有可能生活在农村，他们工作的可能性也最小。根据欧盟统计局（Eurostat）的数据，波兰55至64岁的人口中只有不到一半的人在工作。在尼特拉的工厂，吴斌认为，难以找到住房意味着工人不会离开本地。

民粹主义政策让问题变得愈发严重。去年波兰降低了退休年龄，劳动力供应随即受限。2017年波兰就业人数仅增加了13.5万，这样的增幅对于一个拥有1800万劳动力、经济正繁荣发展的国家而言小得可怜。波兰有15.2万个职位空缺，其中建筑、信息技术和运输企业缺口最大。在捷克，每100名就业人员约对应五个岗位空缺，比率为欧盟最高。华沙智库“政治洞察”（Polityka Insight）的亚当·泽涅克（Adam Czerniak）说：“企业的主要问题是劳动力不足，特别是技术熟练工人。”

如果中欧成功向价值链上游移动，那么即将到来的人口减少的影响就会小一些，因为产值更高的工人将更容易供养不断增长的老龄人口。但要让这

成为现实，需要做更多工作来培养技术熟练劳动力。在德国、瑞士、新加坡和北欧国家常见的学徒计划和职业教育在中欧还很少见。

与此同时，劳动力市场吃紧使得工资快速上涨，至少在城市是这样。鲍里斯表示，波兰的工资水平正以年均7%的速度上涨，远高于通货膨胀率。奥地利中央银行的一位官员指出，布拉格的工资水平已与奥地利相近。建筑公司Strabag的博特尔说，他预计工资增长将推高材料和分包工作的成本，进而蚕食利润。更高的工资让经济发展之利惠及人民，尤其是过去许多岗位的工资非常低。但除非工人的产值也能提高，否则工资上涨将降低该地区对投资者的吸引力。格里弗森预计中欧的人口结构变化在2020年代之后将限制经济增长。

甚至在这之前，与西欧的紧密联系就会让该地区容易受到任何西欧政策或金融形势变化的影响。由于高度依赖出口，西欧的需求稍有疲软就会快速冲击该地区。如果特朗普对欧洲制造的进口汽车提高关税的威胁变为现实，那么该地区的汽车和汽车零部件制造商很快就会受损。欧元区收紧货币政策也可能令该地区受到打击，因为利率水平会利于更大、更富裕的西欧国家而不是中东欧国家。

此外，欧盟凝聚政策基金的下一个预算期（2021到2027年）对中东欧的拨款将远不如当下的预算期（2014到2020年）那么慷慨。举例来看，根据欧盟委员会5月份公布的提案，拨给波兰的资金将为640亿欧元，低于本个预算期的840亿欧元。其中一个原因是中欧比从前更富裕了。此外，英国脱欧将会削减欧盟预算，并且西欧对拒绝分担难民负担的中东欧民粹主义者十分不满。中欧从与西欧国家的融合中获益匪浅。但它对出口和欧盟资金的依赖也是一个弱点。中欧需要就如何替代这种依赖做出谋划。■



Military aviation

Welcome to the wingbot

Tomorrow's squadron leaders will be accompanied by drones

JULY 16th saw the opening of the Farnborough air show. Plane spotters attending the show, which by *entente cordiale* alternates annually with that in Paris, hoped for an appearance by one of the F-35 Lightning fighters delivered recently to Britain's air force and navy. The F-35 represented the best that the present has to offer in aerial military technology. The minds of visitors from the aerospace industry and the armed forces, though, were mostly on the future—and in particular what sort of aircraft would follow the F-35. All around the show were drones of almost every shape and size. This raises the question: would future combat aircraft need pilots?

At least part of the answer can be found 400km north of Farnborough, near Preston, Lancashire. Warton Aerodrome is the site of Britain's nearest equivalent to Lockheed Martin's celebrated Skunk Works—a research and development facility run by BAE Systems, the country's largest aerospace and defence contractor. Inside a high-security building called 31 Hanger sits *Taranis*, an aircraft named after the Celtic god of thunder.

Taranis looks like something out of "Star Wars". It is about the size of a small jet fighter, but is shaped like a flying wing. It is an unmanned, stealthy combat drone. Like most military drones it can be operated, via a secure data link, by a pilot sitting in a control centre on the ground. *Taranis*, however, can also be let off its digital leash and allowed to think for itself using artificially intelligent automated systems. Left to its own devices, *Taranis* can take off, find its way to a combat zone, select a target, attack said target with missiles and then find its way home and land. A ground pilot would be needed only to keep an eye on events and take control if there was a

problem.

Removing the pilot, together with the systems required for a human being to fly a fighter aircraft and remain alive during the gut-wrenching manoeuvres this involves, has many advantages—not least of them, cost. A manned version of *Taranis*, were one to be built, would be twice the size and twice the price. The current prototype is thought to have set BAE back by around £185m (\$244m). That is cheap for what is a one-off experimental prototype. The F-35, a ten-country effort led by Lockheed Martin, is reckoned to be the most expensive military weapons system in history. Some \$50bn was spent developing the aircraft, which cost around \$100m each.

At present, *Taranis* is not scheduled for production. It was built to explore what such a drone is capable of achieving. After a series of successful test flights in Australia (pictured), BAE's engineers are ready to apply the lessons they have learned to their designs of combat aircraft that might take to the sky a decade or so hence.

The good news for pilots is that even in drone-heavy air forces they will still have a job—though not necessarily in the air. Many will be employed supervising drones from the ground. Others, though, will indeed remain flying for, as Michael Christie, BAE's head of air strategy, observes, in the future pilotless and piloted fighter aircraft will operate together.

A human being who can make decisions will always be needed somewhere in the system, Mr Christie reckons. And in some cases it would be best if that person was in the aerial thick of things. Just as fighter pilots now fly with wingmen alongside them, a single pilot could fly with a number of combat drones, similar to *Taranis*, as his “wingbots”. The drones would operate autonomously but respond to a pilot's command. They might be used to reconnoitre an area or attack it, permitting the manned aircraft to hold back.

The idea of people flying in formation with drones is being explored in several other countries, too. Last year Lockheed Martin's research engineers converted an F-16 fighter into an unmanned drone, complete with various anti-collision systems, and flew it alongside a manned fighter to carry out ground attacks on a test range. Japan is also looking at using drone squadrons to accompany piloted aircraft. Japanese officials say the drones could undertake defensive twists and turns at g-forces so high that a human being could not withstand them, and thus be used to divert incoming missiles away from a manned fighter. China is also developing a combat drone known as *Dark Sword*, which might similarly be used in conjunction with manned fighter jets.

This vision of a team of full-sized drones with a single human mind in charge gives the term "squadron leader" a whole new meaning. It also requires new technology, some of which is prefigured in the F-35. This aircraft is a massive information system, in which the amount of data generated by its sensors is beyond anything a human being could take in, so the aircraft's computers dish up only what a pilot needs to know, when he needs to know it. Information relevant to the flight at any particular time is presented on touchscreens in the cockpit and as images projected within the pilot's helmet. His vision is improved further by cameras embedded in the aircraft's skin, allowing him to "see" through its structure. That way he can spot anything which might otherwise be obscured—even things directly below.

This information feed also extends to other manned aircraft, to reconnaissance drones and to ground forces. Instead of attacking a heavily defended position himself, an F-35 pilot could, for example, summon a missile strike from a ship. Eventually, this information feed will extend to his receiving data from, and issuing orders to, accompanying combat drones.

All these extra data mean military aviators of the future are likely to be even more reliant than today's are on their helmets. BAE has an experimental system in which almost all the physical instruments and controls in a cockpit have been replaced by virtual ones projected into the pilot's helmet. The pilot can reach out to touch or operate these controls as if they were in physical form, with sensors recognising from his movements what he is trying to do. This could mean that when an aircraft's flight systems need updating, it is the pilot's helmet rather than the aircraft itself that is revised.

Such possibilities raise the question of just how far automated operations could spread to civil aviation. Digital fly-by-wire systems, in which computers make the high-speed decisions needed to execute manoeuvres signalled by movements of a pilot's joystick, have already migrated from military jets to the cockpits of civilian airliners. America, Russia and other countries are now exploring the possibility of using unmanned military planes to carry cargo and as refuelling tankers. Civilian freighters could be automated too. Airline bosses tend to think, however, that passengers would not be comfortable boarding a plane that has no pilots.

Yet there is a halfway house for airliners. The radio operator, navigator and flight engineer have already been made redundant by technological advances. Drone technology could see the co-pilot relieved of duty, too. Airbus, for one, is known to be looking at single-pilot operation in some circumstances. Such a system would allow a ground-based pilot to take control of an aircraft in the event of a problem. A team of seasoned pilots based in a control centre would be able to monitor a fleet of jets. Whether that would be enough to reassure the nervous traveller, even if it results in lower fares, remains to be seen. ■



军事航空

欢迎“无人僚机”登场

未来，飞行中队长会由无人机伴飞

范堡罗航展于7月16日开幕。根据英法间的友好协议，该航展与巴黎航展每年交替举行。飞行爱好者们期盼近期交付英国空军及海军的F-35闪电战斗机之一会在此次航展中亮相。F-35战斗机代表着当今军事航空技术的最高水平。不过，来自航空业和军队的观展者更多还是放眼未来——他们尤其关注继F-35之后将出现怎样的飞机。本次航展上，各种形状和大小的无人机让人应接不暇。由此引出了一个问题：今后的战斗机还需要飞行员吗？

要寻觅答案，可到范堡罗以北400公里、临近兰开夏郡普雷斯顿（Preston）的某地略探究竟。那里有个沃顿工厂（Warton Aerodrome），是英国最大的航空航天及防务承包商英国宇航系统公司（BAE System）旗下一个研发机构的所在地。在英国，该机构是与洛克希德·马丁著名的臭鼬工厂（Skunk Works）最具可比性的一个。在一栋戒备森严、名叫31 Hanger的建筑内，安放着一架根据凯尔特神话中的雷电之神Taranis命名的雷神无人机。

雷神看起来就像是从《星球大战》里走出来的东西，它的大小与小型喷气式战斗机相近，但外形像一对飞翼。这是一款隐形作战无人机。和大多数军用无人机一样，雷神也可由位于地面控制中心的飞行员通过隐蔽数据传输线来操控。不过也可以解开这条数字“栓绳”，让雷神运用人工智能自动化系统来独立思考。它可以自行起飞，寻觅路径前往作战区，选择目标并以导弹攻击，然后返航并着陆。地面上的飞行员只需留意事态发展，在出现问题时重新控制局面。

移除了飞行员，飞机上也就不用再配备人类驾驶战斗机和在惊心动魄的飞行中保命所需的系统。这就带来了许多好处，最突出的一个就是降低成

本。如果要制造出一个有人驾驶版的雷神，尺寸及造价得是现在的两倍。据信，BAE为目前这款原型机花费了1.85亿英镑（2.44亿美元），这对一架一次性试验用原型机来说并不算贵。由洛克希德·马丁牵头设计和生产、汇集十国力量的F-35被认为是史上最昂贵的军事武器系统，其研发已耗费约500亿美元，平均每架耗费约一亿美元。

目前雷神并没有投产计划。打造它是为了探究这样的无人机可能拥有怎样的本领。在澳大利亚完成了一系列成功的试飞后（见图），BAE的工程师已准备好将获得的经验运用到可能在约十年后升空的战斗机的设计上。

对飞行员来说，好消息就是即使空军大量部署无人机，他们仍有用武之地，尽管不一定是在空中。空军仍会用大量飞行员在地面监督无人机。不过在BAE的航空战略总监迈克尔·克里斯蒂（Michael Christie）看来，其他一些飞行员还是会继续飞，因为在未来，无人战斗机和有人战斗机将会并肩作战。

克里斯蒂认为，系统中总会有某个环节需要能做决策的人类，而且在某些情况下，最好还是深谙航空门道的人士。如今的战斗机飞行员会有僚机一道飞行，同理，单个飞行员可由若干类似雷神的战斗无人机伴飞，充当其“无人僚机”。这些无人机会自主操作，但也会回应飞行员的指令。它们或许可用来侦查或打击某个区域，让有人驾驶的长机退居后方。

其他几个国家也在探索人类飞行员和无人机编队飞行这种想法。去年洛克希德·马丁的研发工程师将一架F-16战斗机改装成无人机并配备了多种防撞系统，让它同一架有人战斗机共同飞行，在训练场上实施地面攻击。日本也在研究部署无人机中队配合有人驾驶飞机作战。日本官员称，无人机可以做出防御性的扭转和转弯动作——所产生的重力加速度人类根本无法承受——因而可发挥为有人战斗机引开来袭导弹的作用。中国也在研发一款名叫“暗剑”的作战无人机，可能同样会与有人战斗机配套使用。

这种由一个飞行员做主脑、一队全尺寸无人机伴飞的构想赋予了“飞行中队长”一词全新的含义。要实现这种设想还需要新技术，其中的某些已为

F-35所用。这款飞机是一个庞大的信息系统，机上传感器生成的数据量之大，人类飞行员无法悉数领会。因此，机上的电脑仅将飞行员需要知晓的信息提炼出来，在他需要知道的时候奉上。航程中任一时刻的相关信息会显示在驾驶舱中的触摸屏上，并以图像形式投射到飞行员的头盔中。飞机蒙皮上安装的摄像头进一步增强了飞行员的视物能力，让他能够“看”穿飞机的结构。这样一来，原本有可能被遮盖住的事物也逃不过他的眼睛——即使它们位于飞机的正下方。

飞机上的数据流也会被传输给其他有人驾驶飞机、侦查无人机和地面部队。F-35的飞行员不用自己去攻击一个重兵把守的阵地，而是可以假手“他人”，比如说让一艘舰艇来发动导弹攻击。最终，飞行员将会利用这种信息传输接收来自伴飞作战无人机的数据，以及向它们发布命令。

这样一来就会增加大量数据，因此未来的军事飞行员可能会比现在更依赖他们的头盔。BAE有一个实验系统，驾驶舱内几乎所有的实体仪表和操纵装置都被投射到飞行员头盔中的虚拟版本取代。传感器可以从飞行员的动作中识别出他的意图，因此他可以像面对实物那样，伸手触摸或操控这些虚拟装置。这也许意味着如果飞机的飞行系统需要升级，那么要加以调整的是飞行员的头盔，而不是飞机本身。

这些可能性促使人们思考自动化操作会在多大的程度上应用于民用航空。线传飞控系统已从军用飞机走入民用客机的驾驶舱：飞行员对操纵杆的操作会转化为电信号，计算机会在处理这些信号后迅速做出决策，执行这些操作。美国和俄罗斯等国家如今正在研究是否有可能将无人军用飞机用作货机和燃料补给飞机。民用货机也可实现自动化。但航空公司的老板们往往认为，没有飞行员的飞机会让乘客心里不踏实。

不过民航业也可以采取一种折中方案。电报员、领航员和随机工程师已经因技术进步而退出历史舞台，无人机技术或许还会卸下副驾驶身上的担子。据了解，空客就在考虑在某些情况下仅安排一名飞行员来操控飞机。采用这样的系统，留守地面的飞行员就可在发生问题时接管飞机。让一组经验丰富的飞行员在控制中心坐镇，就可监督一个机队的状况。至于这是

否会让不安的旅客打消疑虑（虽说这能让机票更便宜），还需拭目以待。





If companies had no employees

Run, TaskRabbit, run: July 2030

Driven by technological and legal changes, how far can the “gig economy” go?

THE E-MAIL THAT landed in Eva Smith’s mailbox at 7pm on Friday October 13th 2028 had the ominous subject line “Changes”. Ms Smith, a director at a private-equity firm in New York, opened it with trepidation. “Dear team,” it began, “You have probably heard rumours that we are shaking up the way we work at Innovation Investment Management. We will be transitioning to a new model.”

All jobs below C-suite level are to be reclassified. All those impacted will no longer be employees of IIM. Instead you will work for IIM on a contract basis. This change sounds scarier than it really is. It holds great benefits both for you and for IIM. The company will be able to respond more nimbly to a rapidly changing marketplace. We hope that you will continue to perform services for IIM on a contract basis, but you will also have the opportunity to work and earn elsewhere. If you have any questions, please ask Irma, our human-resources chatbot.

To begin with, Ms Smith did not notice much difference in her relationship with IIM. She was already working on a deal, and while doing so she moved seamlessly from her full-time, permanent position to a fixed-term contract. (Her hourly rate went up by 20%, but she became responsible for her own pension and health insurance.) Ms Smith had hoped to be involved in the next deal. But she then learned that someone with a PhD in engineering from Harvard had got the contract for that gig, not her. “It’s not personal; they have the perfect skill-set for this deal,” said IIM’s boss.

Ms Smith’s experience is increasingly typical. During the 2020s companies

across the rich world began to rely more heavily than ever on outsourced, temporary workers assigned via digital platforms. TimeToCare, a platform known as the “Uber for social care”, organises 90% of the in-home elderly-care visits in America. Workers from autonomous-taxi mechanics to retail assistants to flight attendants have jobs assigned on a daily or weekly basis through online exchanges that match firms with contractors.

McDonald’s, a fast-food company, has taken things the furthest, outsourcing 100% of its restaurant jobs. Servers, cooks and cleaners at McDonald’s are no longer employees of the firm or its franchisees, but bid for positions at the till on an hourly basis through TaskRabbit, an online labour platform. “The First *Fortune* 500 Company With No Employees,” trumpeted *Fortune*, a business-news service, in its profile of the firm published in 2029.

It is all a stark contrast to the way work was organised in the second half of the 20th century. Back then, businesses were fairly self-contained operations. Most functions were completed in-house by permanent, full-time employees. Many people worked for only one or two companies during their careers. That arrangement had a business logic. As Ronald Coase, an economist, argued in the 1930s, it was usually cheaper for firms to have someone there at all times, and to direct them by fiat, than to negotiate and enforce separate contracts in the open market for every task.

In the 1980s, however, the Coasean model began to be challenged by a new way of working. As shareholders encouraged companies to focus on their core competencies, firms outsourced certain roles—cleaning, accountancy, branding—to specialist providers. During the 1990s outsourcing fever swept through the business world. Charles Handy, a management guru, spoke of the “shamrock organisation”, which he defined as a “core of essential executives and workers supported by outside contractors and part-time help.”

For years, however, the shamrocks struggled to flower. Outsourcing ran up against technological limitations. Firms could not know for sure that they would be able to find the right sort of labour in the open market as quickly as it was needed. Companies were thereby forced to hold on to many employees who were not really central to their business. That arrangement suited many workers, who preferred the stability of permanent employment to the alternative of flitting between short-term contracts, which they would also find difficult to organise.

But that all changed around 2010, with the rise of gig-economy platforms such as TaskRabbit, PeoplePerHour and Expert360, capable of quickly and seamlessly matching workers with employers. Ratings given by previous clients provided a way to assess quality. This enabled further chunks of firms' activities to be outsourced. The gig economy started small, but within a decade it was growing rapidly; its poster-child was Uber, a ride-hailing service. In 2018 roughly 1% of workers were listed on at least one labour platform; by 2028 that figure had risen to 30%. More and more companies are starting to look like IIM.

Two factors explain the boom in gigging. The first is changes to the law. For years the gig economy struggled against repeated legal challenges. In many cases, courts found, gig-economy workers were being classified as self-employed when they were really employees. (This meant workers were being denied things like minimum-wage protection and sick pay.) In 2020 FindMeChef, a platform linking cooks with restaurants, lost a ruling before an employment tribunal in Seattle, brought by a worker who had worked on a “temporary” basis for a client for an entire year. FindMeChef had to pay millions of dollars in back-pay and other benefits to its chefs. And Uber lost case after case in employment tribunals around the world, which forced it to stop classifying its workers as independent contractors in some countries.

Amid such setbacks, gig-economy companies argued that governments ought to be on their side. They pointed out that gig work could be an important route into the labour market for the unemployed, and should therefore be encouraged, not regulated out of existence. In America the platforms lobbied furiously for the creation of a new category of employment, somewhere between self-employment and employment. Known as “dependent contractor” status, the third category would give workers the flexibility of self-employment but with entitlement to some workers’ rights, such as sick pay.

President Donald Trump heeded the call. In 2020 he introduced a package of labour-market reforms which provided for the introduction of “dependent contractor” employment status. The package was backed by Republicans as a way to free companies from red tape, and by some Democrats as a way guarantee some basic rights to gig-economy workers. On the day the reform was announced, the share prices of the big online-labour platforms jumped. Other countries soon followed suit. High-unemployment countries in Europe saw deregulation as a way to boost jobs. Others hoped it would attract foreign investment.

The second big driver behind the gig-economy boom has been technology. Progress in artificial intelligence (AI) has made finding the right worker for a discrete task quicker and easier than ever, because modern AI systems can look past crude ratings systems and use a range of signals to determine whether a candidate is a good fit. Since 2026 LinkedIn, a professional-networking service, has offered a guarantee that it can find a suitable worker for any task within six hours—and, thanks to a deal with Uber, can ensure that they are on-site within one working day.

All this has given outsourcing a new lease of life. The latest wave of functions being contracted out includes administrative work, marketing and training. And some firms, like IIM, are going even further, shedding

employees who perform core operations and rehiring them as short-term contractors to do specific tasks. True, outsourcing has not always gone well. In December 2028 an attempt by a group of American hospitals to use on-demand doctors led to a shortage of staff over Christmas, when many decided not to work even though “surge pricing” had bumped up their hourly rate. Some companies report that morale among contracted workers is low, because they do not feel part of a team. Others worry that some of the “tacit knowledge” that employees gain through working at a business full-time—the culture of a firm, say, or how to approach a particular boss—is lost.

But companies that embraced the shift away from having employees have reaped big gains. They no longer need to pay people to be in the office when demand is slack. They can find the worker with the perfect skills for a task, not just someone willing to have a go. Because individual workers’ output is finely measured, and their proficiency at completing a task becomes part of their online profiles, no one can be lazy and get away with it. Productivity growth, which had stagnated in the rich world after the financial crisis of 2008-09, has accelerated since the mid-2020s.

Many workers have also benefited. For those with sought-after skills, it can be far more lucrative to flit from contract to contract than to work for a single firm. After a bumpy start, Ms Smith now earns more than she did as an employee. She checks Expert360 and LinkedIn three times a day, playing off rival bidders for her labour against each other. Alongside on-and-off work for IIM, she consults for other investment firms, writes articles and offers lifestyle coaching.

Workers without such valuable skills, however, are not doing nearly as well. The biggest problem stemmed from the 2020 labour reform. Dependent contractors working through online platforms, unlike employees, are not entitled to a minimum wage. It is difficult for trade unions to organise

workers who are highly dispersed. Automation is also reducing the overall demand for low-skill labour. Having a pool of workers always available makes the gig economy operate efficiently, but limits workers' bargaining power.

In real terms, wages at the bottom of the income distribution have now stagnated for two decades. Such workers cannot afford to contribute to pension pots; health-care coverage has also fallen. Concern over the potential long-term hit to the public finances has led to calls for more regulation of the gig economy. In America, the Democrats want to undo the 2020 reform and extend minimum-wage legislation to more people. But the gig economy has a powerful logic. In 1937, Coase famously asked "why do firms exist"? Nearly a century later, as technology makes it ever easier for them to disassemble their enterprises, more and more managers are asking the same question. ■



如果公司没有员工

跑腿兔快跑：2030年7月

在技术和法律变革的推动下，“零工经济”能走多远？

一封邮件在2028年10月13日星期五晚上7点进入了伊娃·史密斯（Eva Smith）的邮箱，标题是“改变”，让人感到不祥。史密斯是纽约一家私募股权公司的部门总监，她惶恐不安地打开了它。“亲爱的团队，”邮件开头写道，“你可能已经听说了‘创新投资管理’（IIM）公司正在调整它的工作方式。我们将转为新模式。”

“所有低于首席官级别的工作都将被重新分类。所有受影响的人将不再是IIM的员工。相反，您将作为合同工为IIM工作。这种变化实际上并没有听起来那么可怕。它对您和IIM都有很大的好处。公司将能够更灵活地应对快速变化的市场。我们希望您将继续作为合同工为IIM提供服务，但您也有机会在其他地方工作和赚取收入。如果您有任何疑问，请咨询我们的人力资源聊天机器人Irma。”

一开始，史密斯并未发现自己与IIM的关系有太大变化。她当时已经在忙活公司的一笔交易，过程中她的永久性全职职位无缝转换成了一份定期合同。（她的小时工资上涨了20%，但她要自己交退休金和医疗保险。）史密斯曾希望参与下一笔交易。但她随后得知，哈佛大学的一位工程博士获得了那份工作合同，而不是她。“这不是针对你。他们拥有完美适配这项交易的技能。”IIM的老板说。

史密斯的经历越来越典型。在21世纪20年代，富裕国家的公司开始比以往更加依赖通过数字平台安排的外包临时工。TimeToCare是一个被称为“社会关怀优步”的平台，它在美国组织了90%的登门护理居家老人服务。从无人驾驶出租车的机械修理工，到售货员和空乘人员，工人每天或每周通过在线交易所获得工作任务，这些交易所把公司与合同工匹配起来。

快餐公司麦当劳把这一点做到了极致，将它的餐厅工作百分之百外包。麦

当劳的服务员、厨师和清洁工不再是这家公司或其特许经营商的雇员，而是通过在线劳工平台跑腿兔（TaskRabbit）每小时竞标一次。“第一家没有员工的《财富》500强公司。”商业新闻服务公司《财富》在2029出版的麦当劳公司简介中宣传道。

这与20世纪下半叶工作的组织方式形成了鲜明的对比。那时企业都相当自成体系。大多数职能由永久性全职员工在内部完成。很多人在他们的整个职业生涯中只为一两家公司工作。这种安排自有其商业逻辑。正如经济学家罗纳德·科斯（Ronald Coase）在20世纪30年代提出的那样，一般来说，企业拥有常备人员并对他们发号施令，要比到公开市场上为每项任务都议定并执行单独的合同更便宜。

然而，到了20世纪80年代，这种“科斯模型”开始受到新工作方式的挑战。由于股东鼓励公司专注于它们的核心竞争力，公司将某些职务，比如清洁、会计、品牌营销，外包给专业供应商。到了90年代，外包热潮席卷了整个商业世界。管理大师查尔斯·汉迪（Charles Handy）谈到了“三叶草组织”，将它定义为“由外部承包商和兼职帮手支持的核心高管和员工”。

然而，多年来三叶草一直未能开花结果。外包遇到了技术上的限制。企业无法确保自己能够在有需要之时马上就在公开市场找到合适的劳动力。因此，它们不得不留任许多并非从事核心业务的员工。这种安排对许多工人来说很合适，他们更喜欢长期就业的稳定性，而不是辗转在短期合同之间。工人要把各种短期工作安排好也并非易事。

但随着跑腿兔、PeoplePerHour和Expert360等零工经济平台的兴起，这一切都在2010年前后发生了变化。这些平台能够快速无缝地将工人与雇主进行匹配。先前的客户给出的评分提供了一种评估质量的方法。这使得企业能将更多活动外包。零工经济一开始还很小，但它在十年内迅速增长；它的一个明星范例就是叫车服务优步。2018年，大约1%的工人被列入至少一个劳工平台；到2028年，这一数字已上升至30%。越来越多的公司开始看起来像IIM了。

两个因素推动了零工经济的繁荣。首先是法律的变化。多年来，零工经济一直在艰难应对各种法律挑战。法院发现，在许多情况下，零工工人实际上是雇员，却被归为自由职业者。这意味着工人被剥夺了最低工资保障和病假工资等待遇。2020年，连接厨师和餐馆的平台FindMeChef在西雅图的一个劳资纠纷仲裁法庭上输了官司，原告是一名“临时”为客户工作了一整年的工人。FindMeChef不得不向其平台上的厨师们支付了数百万美元的补偿款和其他福利。而优步在世界各地的劳资仲裁庭上输掉了一场又一场官司，迫使其停止在一些国家将员工归为独立合同工。

在这些挫折中，零工经济公司声称政府应该站在它们这一边。它们指出，零工工作可能是失业人员进入劳动力市场的重要途径，因此应予以鼓励，而不该被严苛的监管驱逐。在美国，这些平台疯狂地展开游说以创造一种新的就业类别，它介于自由职业和就业之间。这第三类状态被称为“从属合同工”（dependent contractor），将赋予工人自由职业的灵活性，但又让他们享有一些员工权利，例如病假工资。

特朗普总统听到了这个呼声。2020年，他推出了一揽子劳动力市场改革，为“从属合同工”这种就业方式铺平了道路。这个方案得到了共和党人的支持，因为它让企业免于繁文缛节。它也获得了一些民主党人的支持，因为它保障了零工工人的一些基本权利。在宣布改革的当天，大型在线劳工平台的股价大涨。其他国家很快效仿。欧洲高失业率国家将放松管制视为提高就业的一种方式。其他国家则希望它会吸引外国投资。

零工经济繁荣背后的第二大推动力是技术。人工智能（AI）的进步使得为零星任务找到合适的人选变得前所未有的便捷，因为现代人工智能系统不止步于原始的评分系统，而是使用一系列信号来确定候选人是否适合。自2026年以来，专业社交服务领英保证可以在六小时内为任何任务找到合适的人员——并且，由于与优步达成协议，可以确保他们在个工作日内到达现场。

所有这些都给外包带来了新的生机。最近一波被外包的职能包括行政、营销和培训。而像IIM这样的公司走得更远，裁掉了执行核心业务的员工，

将他们重新雇用为短期合同工来完成特定任务。诚然，外包并不总是一帆风顺。2028年12月，一批美国医院试图使用“按需请医生”，导致圣诞节期间员工短缺，因为许多人决定不在这段时间工作，哪怕“高峰定价”提高了他们的小时费率。一些公司报告说，合同工人的士气低落，因为他们不觉得自己是团队的一员。其他人担心，员工通过全职工作获得的一些“隐性知识”会丢失，比如企业文化，或者如何与某个老板打交道。

但那些拥抱转变而不再拥有员工的公司已经获得了巨大的收益。当需求疲软时，它们无需付钱让人们坐在办公室。它们可以找到具有完美适配技能的工人，而不仅仅是愿意去试试看的人。由于个体工人的产出得到了精确的衡量，并且他们完成任务的熟练程度成为其在线档案的一部分，没有人能偷懒而不被察觉。在2008至2009年金融危机之后就停滞不前的富裕国家生产率自21世纪20年代中期以来加速增长。

许多工人也从中受益。对于那些拥有广受欢迎的技能的人来说，辗转在一个个合同之间可能会比为同一家公司工作更有利可图得多。在最初的不顺过去后，史密斯现在的收入超过了她做员工时的收入。她每天要查看Expert360和领英三次，让投标者加码争夺她的劳动。除了IIM不时提供的工作外，她还为其他投资公司提供咨询，撰写文章，并提供生活方式辅导。

然而，没有这样宝贵技能的工人日子就不大好过了。最大的问题源于2020年的劳动力改革。与员工不同，通过在线平台工作的从属合同工无权享受最低工资。工会很难组织高度分散的工人。自动化也降低了对低技能劳动力的总体需求。总是有一批工人在待命使得零工经济能高效地运作，但也限制了工人的议价能力。

按照实际价值计算，处于收入分配最底部的工人工资到现在已经停滞了20年。这些工人无力为退休金账户缴费；医疗保险的覆盖面也在缩小。一些人担心长期而言这会给公共财政造成冲击，因而呼吁对零工经济加强监管。在美国，民主党希望废除2020年的改革，让最低工资立法惠及更多人。但是，零工经济有一个强大的逻辑。1937年，科斯提出了一个著名的

问题：“公司为什么存在？”近一个世纪之后，随着技术让企业变得更容易被拆解开来运作，越来越多的管理者提出了同样的问题。■



If people were paid for their data

Data workers of the world, unite

What would happen if personal data were treated as a form of labour that tech giants had to pay to use?

“DATA SLAVERY.” Jennifer Lyn Morone, an American artist, thinks this is the state in which most people now live. To get free online services, she laments, they hand over intimate information to technology firms. “Personal data are much more valuable than you think,” she says. To highlight this sorry state of affairs, Ms Morone has resorted to what she calls “extreme capitalism”: she registered herself as a company in Delaware in an effort to exploit her personal data for financial gain. She created dossiers containing different subsets of data, which she displayed in a London gallery in 2016 and offered for sale, starting at £100 (\$135). The entire collection, including her health data and social-security number, can be had for £7,000.

Only a few buyers have taken her up on this offer and she finds “the whole thing really absurd”. Yet if the job of the artist is to anticipate the Zeitgeist, Ms Morone was dead on: this year the world has discovered that something is rotten in the data economy. Since it emerged in March that Cambridge Analytica, a political consultancy, had acquired data on 87m Facebook users in underhand ways, voices calling for a rethink of the handling of online personal data have only grown louder. Even Angela Merkel, Germany’s chancellor, recently called for a price to be put on personal data, asking researchers to come up with solutions.

Given the current state of digital affairs, in which the collection and exploitation of personal data is dominated by big tech firms, Ms Morone’s approach, in which individuals offer their data for sale, seems unlikely to

catch on. But what if people really controlled their data—and the tech giants were required to pay for access? What would such a data economy look like?

It would not be the first time that an important economic resource had gone from simply being used to being owned and traded; the same has already happened with land and water, for example. But digital information seems an unlikely candidate to be allocated by markets. Unlike physical resources, personal data are an example of what economists call “non-rival” goods, meaning they can be used more than once. In fact, the more they are used, the better for society. And frequent leaks show how difficult it can be to control data. But another historical precedent might provide a model—and also chimes with contemporary concerns about “technofeudalism”, argue Jaron Lanier, a virtual-reality pioneer, and Glen Weyl, an economist at Yale University, who both work for Microsoft Research.

Labour, like data, is a resource that is hard to pin down. Workers were not properly compensated for labour for most of human history. Even once people were free to sell their labour, it took decades for wages to reach liveable levels on average. History won’t repeat itself, but chances are that it will rhyme, Mr Weyl predicts in “*Radical Markets*”, a provocative new book he has co-written with Eric Posner of the University of Chicago. He argues that in the age of artificial intelligence, it makes sense to treat data as a form of labour.

To understand why, it helps to keep in mind that “artificial intelligence” is something of a misnomer. Messrs Weyl and Posner call it “collective intelligence”: most AI algorithms need to be trained using reams of human-generated examples, in a process called machine learning. Unless they know what the right answers (provided by humans) are meant to be, algorithms cannot translate languages, understand speech or recognise objects in images. Data provided by humans can thus be seen as a form of labour which powers AI. As the data economy grows up, such data work will

take many forms. Much of it will be passive, as people engage in all kinds of activities—liking social-media posts, listening to music, recommending restaurants—that generate the data needed to power new services. But some people's data work will be more active, as they make decisions (such as labelling images or steering a car through a busy city) that can be used as the basis for training AI systems.

Yet whether such data are generated actively or passively, few people will have the time or inclination to keep track of all the information they generate, or estimate its value. Even those who do will lack the bargaining power to get a good deal from AI firms. But the history of labour offers a hint about how things could evolve: because historically, if wages rose to acceptable levels, it was mostly due to unions. Similarly, Mr Weyl expects to see the rise of what he calls “data-labour unions”, organisations that serve as gatekeepers of people's data. Like their predecessors, they will negotiate rates, monitor members' data work and ensure the quality of their digital output, for instance by keeping reputation scores. Unions could funnel specialist data work to their members and even organise strikes, for instance by blocking access to exert influence on a company employing its members' data. Similarly, data unions could be conduits channelling members' data contributions, all while tracking them and billing AI firms that benefit from them.

All this may sound like science fiction. Why should Google and Facebook, for instance, ever give up their current business model of using free data to sell targeted online advertising? In 2017 they raked in a combined \$135bn in ad dollars. If they had to compensate people for their data, they would be much less profitable. Meanwhile, startups such as CitizenMe and Datacoup, which can be seen as early forms of data unions, have so far failed to make much headway. Yet in other corners of the industry, tech giants already pay for data, although they are careful not to talk too much about it. Mostly through outsourcing firms, they employ armies of raters and moderators to

check the quality of their algorithms and take down content that is illegal or offensive. Other firms use crowd-working platforms, such as Amazon's Mechanical Turk, to farm out data work such as tagging pictures. Mighty AI, a startup based in Seattle, pays thousands of online workers to label images of the street scenes that are used to train the algorithms that power self-driving cars.

What is more, if AI lives up to the hype, it will lead to demand for more and better data. As AI services get more sophisticated, algorithms will need to be fed a higher-quality diet of digital information, which people may only provide if they get paid. Once one big tech firm starts paying for data, others may have to follow.

Treating data as labour means tech giants' profit margins are likely to get squeezed, but their overall business may get bigger. And workers will, at least partially, be in the driving seat. Their mornings might start with checking a dashboard provided by their data-labour union, showing a personalised list of available jobs: from watching advertising (the computer's camera collects facial reactions) to translating a text into a rare language, to exploring a virtual building to see how easy it is to navigate. The dashboard might also list past earnings, show ratings and suggest new skills.

But much still needs to happen for personal data to be widely considered as labour, and paid for as such. For one thing, the right legal framework will be needed to encourage the emergence of a new data economy. The European Union's new General Data Protection Regulation, which came into effect in May, already gives people extensive rights to check, download and even delete personal data held by companies. Second, the technology to keep track of data flows needs to become much more capable. Research to calculate the value of particular data to an AI service is in its infancy.

Third, and most important, people will have to develop a “class consciousness” as data workers. Most people say they want their personal information to be protected, but then trade it away for nearly nothing, something known as the “privacy paradox”. Yet things may be changing: more than 90% of Americans think being in control of who can get data on them is important, according to the Pew Research Centre, a think-tank.

Even if people got money for their data, sceptics say, they wouldn’t get much. If Facebook shared out its profits across all its monthly users, for instance, each would get just \$9 a year. But such calculations fail to recognise that the data age has only just begun. AI is often likened to electricity, and when electrification began in the late 19th century, entire cities used only as much power as a single household does today.

Wouldn’t this data economy be hugely unequal? Some people’s data will surely be worth much more than others’. But Mr Weyl argues that the skills needed to generate valuable data may be more widely spread than you might think, so data work could disrupt the standard hierarchy of human capital. One way or another, societies will have to find a mechanism to distribute the wealth created by AI. As things stand, most of it accrues to the big data distilleries. Unless this changes, social inequality could revert to medieval levels, Mr Weyl warns. If that happens, it is not unreasonable to assume that one day, the data workers of the world will unite. ■



如果人们的数据能获得报酬

全世界数据工作者联合起来

如果将个人数据被视为技术巨头必须付费才能使用的一种劳动，会怎么样？

“数据奴隶。”美国艺术家詹妮弗·林恩·莫伦（Jennifer Lyn Morone）认为这就是大多数人现在的生活状态。她哀叹道，为了获得免费的在线服务，人们把私密信息拱手交给科技公司。“个人数据比你想象的有价值得多。”她说。为了强调这种糟糕的现状，莫伦诉诸于她所谓的“极端资本主义”：她在特拉华州把自己注册成了一家公司，以利用她的个人数据获取经济利益。她制作了包含不同数据子集的档案，并于2016年在伦敦的一家画廊展出并出售，起价为100英镑（135美元）。包括她的健康数据和社会安全号码在内的整套档案可花7000英镑买下。

只有几位买家接受了这个出价，她发现“整件事真的很荒谬”。然而，如果艺术家的工作是预测时代的精神，那么莫伦可谓是一语中的：今年，这个世界发现数据经济有些地方腐坏了。自从今年3月份政治咨询公司剑桥分析（Cambridge Analytica）被发现暗中获取了8700万Facebook用户的数据以来，倡议反思在线个人数据处理方式的呼声越来越大。就连德国总理默克尔最近也在呼吁为个人数据标价，并要求研究人员提出解决方案。

目前个人数据的收集和利用被大型科技公司主宰，在这种情况下，莫伦提倡的个人出售自己数据的做法似乎不太可能流行开来。但是，如果人们真的控制了自己的数据，而技术巨头需要付费才能访问它们呢？这样的数据经济会是什么样子？

重要的经济资源从简单地被使用转为被拥有和交易已经不是第一次了，比如这在土地和水上就已发生过。但数字信息似乎不太可能被市场分配。与实体资源不同，个人数据是经济学家所谓“非竞争”商品的一个例子——意思是它们可以被使用不止一次。事实上，它们被使用得越多，对社会就越好。而从频繁的泄露事件中可以看出要控制数据的使用有多困难。但是，

微软研究院的两位研究者——虚拟现实先驱贾伦·拉尼尔（Jaron Lanier）和耶鲁大学经济学家格伦·韦尔（Glen Weyl）——指出，另一个历史先例或许可以提供一个模型，而且它能回应当前对“技术割据”的担忧。

像数据一样，人工是一种难以界定的资源。在人类历史上大部分时间里，工人没有得到适当的劳动补偿。即使到了人们可以自由地出售劳动力之后，工资也花了几十年才普遍达到生活所需的水平。在韦尔与芝加哥大学的埃里克·波斯纳（Eric Posner）合著的引发争议的新书《激进市场》（Radical Markets）中，他预测道，历史不会重演，但可能会相似。他认为，在人工智能时代，将数据视为一种劳动形式是说得通的。

要理解他的理由，有必要记住“人工智能”在某种程度上是一种误称。韦尔和波斯纳将这种技术称为“集体智慧”：大多数人工智能算法都需要在一个称为机器学习的过程中使用大量人为生成的例子进行训练。除非知道正确答案（由人类提供）应该是什么样的，否则算法无法翻译语言、理解语音或识别图像中的物体。因此，人类提供的数据可被视为一种驱动人工智能的劳动形式。随着数据经济的增长，这种数据工作将拥有多种形式。其中大部分都是被动的，因为人们在参与各种活动时——在社交媒体上为喜欢的帖子点赞、听音乐、推荐餐馆——产生了驱动新服务所需的数据。但是，有些人的数据工作将更加活跃，因为他们会做出决策（例如标记图像或驾车通过繁忙的城市），这些决策可以作为训练人工智能系统的基础。

然而，无论这些数据是主动还是被动生成，很少有人有时间或乐于跟踪自己生成的所有信息或估计其价值。哪怕是这样做过的人，也缺乏议价能力来从人工智能公司那里拿到好价钱。但劳动史提供了一种可能的演变方式：从历史上看，如果工资上升到可接受的水平，那主要是工会的功劳。同样地，韦尔希望看到他所谓的“数据劳工工会”的崛起，这些组织将充当人们的数据守门人。与先前的工会一样，它们将协商费率，监控成员的数据工作，并确保数字输出的质量——例如持续给成员打出“声誉评分”。工会可以向其成员提供数据专员工作，甚至组织罢工，例如封锁使用其成员数据的公司的访问权，以此施加影响。同样，数据工会可以成为输送成员数据贡献的渠道，同时跟踪它们，并对从中受益的人工智能公司计费。

这一切听起来可能像科幻小说。比如，谷歌和Facebook为什么要放弃目前使用免费数据来销售定向在线广告的商业模式？2017年，它们共计获得了1350亿美元的广告收入。如果它们不得不为人们的数据付钱，利润将会低得多。与此同时，像CitizenMe和Datacoup这类公司可被视为数据工会的早期形式，但它们迄今未能取得多大进展。然而，在科技行业的其他角落，巨头们已经在为数据付费，不过它们小心翼翼地避免过多地谈论它。它们通常利用外包公司来雇用大批评估员和内容管理员来检查自己算法的质量，并删除非法或冒犯性的内容。其他公司使用众包工作平台，例如亚马逊的Mechanical Turk，来外包标记图片等数据工作。总部位于西雅图的创业公司Mighty AI向成千上万的在线工作人员付费来标记街景图片，用于训练驱动无人驾驶汽车的算法。

更重要的是，如果人工智能真能达到人们大肆宣传的预期，它将带来对更多、更好的数据的需求。随着人工智能服务日益成熟，就需要给算法输入更高质量的数字信息，而人们只有在获得报酬时才会提供这样的数据。一旦一家大型科技公司开始为数据付费，其他人可能不得不跟进。

将数据视为劳动，意味着科技巨头的利润率可能会受到挤压，但它们的整体业务可能会进一步扩张。而工人们将至少拥有部分控制权。每天一早，他们可能会查看自己的数据工会提供的仪表板，上面显示了个性化的工作选项列表：从观看广告（计算机的摄像头会收集面部反应）到将文本翻译成罕见语言，再到探索虚拟建筑物来看看布局是否方便。仪表板还可能列出过去的收入，显示评级，并建议新技能。

但是，如果要让个人数据被普遍视为劳动并因此获得报酬，还有许多工作要做。首先，需要合适的法律框架来鼓励一种新型数据经济的出现。欧盟新的《通用数据保护条例》已于5月生效，它已经赋予人们查看、下载甚至删除公司所持个人数据的广泛权利。其次，跟踪数据流的技术需要变得更加强大。有关如何计算特定数据对人工智能服务的价值的研究尚处于起步阶段。

第三，也是最重要的一点，人们将必须培养自己身为数据工作者的“阶级

意识”。大多数人都说希望保护自己的个人信息，但随后就几乎无偿地给出这些信息，这就是所谓的“隐私悖论”。然而情况可能正在起变化：智库皮尤研究中心表示，超过90%的美国人认为掌控谁可以拿到自己的数据非常重要。

怀疑论者说，即使人们能从他们的数据中赚到钱，也赚不了太多。例如，如果Facebook把利润平分给其所有月度用户，那么每个用户每年也仅能得到9美元。但是这样的计算未能认识到数据时代才刚刚揭幕。人工智能常被比作电力，而19世纪后期电气化刚开始时，整个城市的用电量只相当于今天一个家庭的用电量。

这种数据经济难道不会非常不平等吗？有些人的数据肯定比其他人的价值更高。但韦尔认为，生成有价值的数据所需的技能可能比你想象的传播更广泛，因此数据工作可能会颠覆人力资本的标准层级结构。无论如何，社会必须找到一种机制来分配人工智能创造的财富。照今天看来，这种财富的大头都流向那些大数据精炼厂了。韦尔警告说，除非情况发生变化，否则社会的不平等程度可能会恢复到中世纪水平。如果真是这样，那么我们可以合理想象，某一天，全世界的数据工作者将联合起来。■



If there was no Moon

Empty sky, empty Earth?

Whether complex life would still have arisen on Earth in the absence of the Moon is the subject of much debate

WAXING AND WANING from invisible new to full-beam full and back, month in and month out, the Moon is famously inconstant. But appearances deceive. Its aspect in the sky may change; the brute fact of there being 73 quintillion tonnes of rock orbiting at a distance of some 380,000km does not. All humans with eyes to see have seen it. It has raised tides in the Earth's oceans ever since the oceans first formed.

So the Moon is ancient. But it is not necessary. Look at the Sun's other rocky planets. Venus, the one which is closest in size to the Earth, does not have a moon. Nor does little Mercury. Mars has a couple, but they are titchy. The Moon boasts more than 1% of the Earth's mass; Mars outweighs Deimos, the larger of its moons, by more than 10m to one.

That the Earth has an exceptionally big moon is, scientists believe, an accident of history—the result of a chance, and incredibly violent, collision between the Earth and another young planet, perhaps about the size of Mars, soon after the formation of the solar system. And some think it may have been a happy accident: perhaps, in a rather literal sense, a vital one.

Scientists have long wondered what aspects of the Earth made it a suitable cradle for life and, 4bn-odd years later, intelligence. It is a question that influences the way they think about the rest of the cosmos. If there is nothing much special about the Earth, then it seems a reasonable bet that life, and perhaps even civilisations, are fairly common elsewhere in the universe. But if the Earth is a space oddity, life may be rare—even, perhaps, a one-off.

The case for thinking the Earth unusual was made with influential vigour by Donald Brownlee, an astronomer, and Peter Ward, a palaeontologist, in “Rare Earth”, a book published in 2000. They argued that, while microbial life might develop quite easily on all sorts of planets, the evolution of complex life had depended on various aspects of the Earth and the solar system being just so. One of these aspects was the unlikely existence of a large moon.

The idea that the Moon might have a relevance to life beyond providing nocturnal illumination was not new. Some have argued that, without the Moon, the Earth would have a stiflingly thick atmosphere like that of Venus. Fortunately, this theory suggests, the impact that formed the Moon helpfully drove off the volatile chemicals that formed the Earth’s original, Venus-like atmosphere, allowing a much thinner blanket of gases to form in its place. Others have suggested that lunar tides—which were much more pronounced on the early Earth, because the Moon was then much nearer—were a prerequisite for the origin of life. By episodically sloshing seawater into tidal pools, from which it would then evaporate, they would have provided a way of concentrating the chemicals from which life developed. This is not an idea many people take seriously at the moment: the smart money on life’s origin these days puts it in deep ocean hydrothermal vents, not tidal pools. But ideas on the subject have changed before, and may change again. Hypotheses, like tidal pools, come and go.

All these are intriguing ideas, but hardly compelling ones. Dr Brownlee and Dr Ward plumped instead for another lunar effect: a damping down of the Earth’s wobbling. Planets do not sit up straight in their orbits: they lean over. The Earth’s axis of rotation is currently at an angle of 23.4° to the vertical, as measured with respect to the plane in which the planet orbits. The planet is slowly sitting up straighter; but once it reaches about 22.1° , in a bit more than 10,000 years or so, it will start to lean over again. Its obliquity nods up and down this way between 22.1° and 24.5° regularly every 41,000 years. The

effect of this nodding on the planet's seasons is one of the things which sets the rhythm of the ice ages.

On moonless Mars, things are very different; the obliquity shifts around both more, and more chaotically. Sometimes Mars sits bolt upright, with no seasons to mention. Over the aeons its obliquity can get as high as 60° —a situation in which inhabitants, if there were any, would experience the midnight sun far into the tropics, producing intolerably hot hyper-seasons. Its obliquity changes over a 100,000-year cycle.

In the 1990s Jacques Laskar, one of the astronomers who first discovered the role that chaos plays in the seemingly stable solar system, showed that the difference between the Earth's gentle nodding and Mars's wild oscillations could be accounted for by the Moon. A constant lunar tug on the Earth's equatorial bulge—a paunchy distortion of the planet's sphericity caused by its spin—keeps things in order. Take the Moon away, and the Earth's obliquity becomes even less stable than Mars's, swinging as high as 85° . Such poles-pointing-at-the-Sun episodes would make continents at currently temperate latitudes uninhabitable. In “Rare Earth” Dr Ward and Dr Brownlee argued that the double whammy of obliquities that were sometimes very high and could also shift dramatically would mean that a moonless Earth would have such a chaotic and catastrophe-prone climate that complex life would find it difficult to flourish.

Subsequently, though, the story has been shown to be a bit more complex. How chaotic a planet's obliquity is depends on how fast it rotates. The Earth and Mars happen to have days of very similar lengths, which is why, if it were not for the Moon, the Earth's axis would jerk back and forth as Mars's does. But while Mars may have had something pretty like a 24-hour day for almost all of its history, the Earth has not—because of the Moon. Straight after the collision that created the Moon, the Earth rotated much faster than

it does today. Since then it has been continually slowing down—thanks, again, to the Moon. The tides it raises in the oceans act as a gentle brake on the Earth's rotation.

So yes, without the Moon, an Earth with 24-hour days would suffer radical chaotic shifts in its obliquity. Yet no one has the faintest idea what the Earth's rotation period would be if it had not been whacked hard enough to form the Moon in the first place. Nor is there any way of finding out.

But there are other ways to make a case that complex life is a lot more likely on a planet with a big moon. David Waltham, a British geophysicist, suggests in his book “Lucky Planet”, published in 2014, that complex life needs both a pretty stable obliquity and a fairly long day. On planets with significantly shorter days, he argues, the transfer of heat from equator to poles would be less efficient. The winds and currents responsible for that transfer are diverted from the direct equator-to-pole trajectory that you might expect by the Coriolis effect, which swings them to the east. The faster a planet spins, the stronger that effect would be, and the harder it would be to warm the poles. Dr Waltham argues that the Moon is just the right size to allow the Earth both a stable obliquity and poles warm enough to keep any ice ages relatively minor. It is a cunning argument, but not a compelling one.

It may be that making significant progress on the question of the Moon's importance for life will have to wait until planets inhabited by complex life forms are discovered round other stars. If there are a lot of otherwise earthlike planets boasting neither complex life nor big moons, the idea may be taken to have some merit, as it would if those searching for signals from alien intelligence found such signals coming from big-mooned planets.

While the world waits for such discoveries—a wait likely to be measured in decades, if not centuries—it is worth bearing in mind an intriguing

argument made by Isaac Asimov, a science-fiction writer, in “The Tragedy of the Moon”, an essay published in 1972. It argues that rather than being crucial to the development of complex life, and thus humans, the Moon might be a factor in their downfall.

Asimov’s claim was that if humans had evolved on a moonless planet, they might never have come up with the idea that their home was the centre of the universe. The fact that the Moon really does revolve around the Earth, and can be shown to do so, made it natural to assume that all the other things in the sky do, too. Even true appearances deceive when they lead to false generalisations. But the easiest way to explain the different motions of the different planets is that the Earth and everything else orbit the Sun. If there had been no misleadingly Earth-orbiting Moon, Asimov argued, that sun-centred idea would have been much easier to accept. Thus a heliocentric solar system might well have been a constant of astronomical thought from Babylon and classical Greece onwards.

This would not merely have meant that the world would have been better explained sooner (though to Asimov, ever the pedagogue, that was indeed a good in and of itself). Civilisations for which the Earth was not the centre of the universe might, he suggested with a sort of atheist piety, have been less likely to develop the sort of monotheisms that see humans as the centre of the universe and the apex of creation. Such broader perspectives, he went on in an eco-gloomy, 1970s sort of way, might have led to civilisations less careless of their environments, and less likely to think that their way of seeing the world was worth preserving even if it led them to nuclear war. Such civilisations, he imagined, might last for longer than his own.

Hardly a knockdown argument. But it does sound a useful note of caution against those arguments that seek to make the Moon evolutionarily important by underlining how thoroughly humans tend to think of themselves, and their planet, as special—and how wrong they often are.

And it also suggests a new prediction. If humans do make contact with aliens who evolved under a moon of their own, they too will tell all sorts of wonderful stories about its significance. Whether they will be true or not, who knows? ■



如果没有月亮

空荡荡的夜空，空荡荡的地球？

假如没有月球，地球上还会孕育出复杂的生命吗？对这个问题存在诸多争论

从朦胧的新月变成光辉的满月，再渐渐回到残月，月复一月的盈亏消长，月亮的善变世人皆知。然而月不可貌相。尽管它在天空中的样子可能改变，有一个基本事实是恒定不变的：一团7.3千亿吨重的岩石在距地球约38万公里的地方绕着它转。所有眼睛看得见的人类都见过它。自地球上的海洋最初形成以来，月亮就引发了海洋中的潮汐。

所以月亮很古老。但它并非必然的存在。看看太阳系中的其他岩质行星。金星的大小与地球最接近，但它并没有自己的“月亮”。小小的水星也没有。火星倒有一对卫星，但体积非常小。月球的质量是地球质量的1%多一些，而火星的质量是它较大的卫星火卫二（Deimos）的一千多万倍。

科学家们认为，地球之所以会有一个特别大的月球绕着它转，是因为一个偶然的历史事件。在太阳系形成后不久，地球与另一颗年轻的行星（大小可能与火星相当）发生了一次偶然但极为猛烈的冲撞，结果生成了月球。一些人认为这可能是一个幸运的意外，因为它或许名副其实地“攸关生死”。

长久以来，科学家们一直在思索，地球的哪些特点让它成为了适于生命生长的摇篮——而且在40多亿年后还出现了智慧。这个问题影响到他们对宇宙其余部分的看法。如果地球并无特别之处，那么就可以合理地推断，生命、甚至文明，在宇宙的其他地方也相当普遍。但如果地球是太空中的一个异类，那么生命可能就很罕见，甚至绝无仅有。

天文学家唐纳德·布朗利（Donald Brownlee）和古生物学家彼得·沃德（Peter Ward）在2000年出版的《特异星球》（Rare Earth）一书中提出了“地球不寻常”的理论，他们热情洋溢的论述产生的很大的影响力。他们认为，虽然微生物生命可能很容易在各种各样的行星上发展，但复杂生命

的演进却依赖地球和太阳系独有的很多特点，其中之一就是大月亮这一罕见的存在。

认为月球除了在夜间提供光亮之外可能还与生命有关的想法并不新鲜。过去已有人提出，如果没有月球，地球上的空气会像金星上的那样厚重得令人窒息。这套理论称，幸运的是，太空中形成月球的那股力量帮助驱逐了地球上最初形成的、和金星类似的大气层中的挥发性化学物质，让一层稀薄得多的气体取而代之。其他人则提出，月亮引发的潮汐是生命发端的先决条件。这种潮汐在地球初期要明显得多，因为那时月球远比现在更靠近地球。潮汐不时地将海水推到潮汐池中，海水在那里蒸发，促进了化学物质浓缩汇聚，继而发展出生命。当下许多人并不把这种理论当回事，研究生命起源的资金都被投到了深海热液喷口这一块，而不是潮汐池。但是，关于这个研究课题的理念以前就发生过变化，今后可能会再次转向。和潮汐池一样，科学假设也会“循环往复”。

所有这些猜想都很有趣，但都难以令人信服。布朗利和沃德博士则专注于月亮的另一种影响力：减少地球的摇摆。行星在它们各自的轨道上并非“正襟危坐”，而是歪着身子。目前地球的自转轴与垂直方向(即与地球绕行太阳的轨道平面呈90度的方向)的夹角为 23.4° 。地球正在慢慢地坐直身子，但一旦这个夹角缩小到约 22.1° ——这将发生在一万多年以后——它又会开始慢慢倾倒。每4.1万年，地球这样“点一次头”，在 22.1° 和 24.5° 夹角之间完成一个来回。这种变化对地球上季节的影响是决定冰河期发生频率的因素之一。

在没有月亮的火星上，情形截然不同：火星倾角的变化更多也更混乱。有时火星坐得笔直，那就全无季节可言。在宇宙漫长的历史中，火星的倾角最大可达到 60° 。这时，如果火星上有居民的话，他们在热带地区都会经历午夜太阳，这造成了热到无法忍受的“超级季节”。火星的倾角变化以10万年为周期。

上世纪90年代，雅克·拉斯卡尔（Jacques Laskar）论证了地球的温和“点头”和火星的疯狂振荡之间的差异可以用月球来解释。他是首先发现了混

沌在看似稳定的太阳系中发挥的作用的天文学家之一。月球对地球的赤道隆起部分（由地球自转导致的球体变形向外鼓出的部分）的强劲拉拽力使得地球保持相对稳定的状态。如果将月球撤走，地球的倾角会变得比火星的还要不稳定，摆动幅度将达到 85° 。这种地球极点指向太阳的时期会令目前温带地区的大陆不适宜居住。在《特异星球》中，沃德和布朗利认为，倾角有时非常大、有时又剧烈变化的双重打击，意味着在没有了月球的地球上气候会非常混乱且灾难频发，复杂的生命难以蓬勃发展。

不过，接下来这个故事变得有点复杂。行星的倾角有多动荡不定要取决于它旋转的速度。地球和火星一天的长度碰巧非常相似，这就是为什么如果没有月亮，地球的自转轴会像火星的那样剧烈地来回晃动。但是，虽然火星基本上自其诞生以来每天差不多都是24小时长，地球却并非如此——因为月亮的缘故。在形成了月球的那次撞击之后，地球的自转速度要比现在快得多，自那以后它不断放慢转速，而这又是月亮的功劳。月亮在海洋中引发的潮汐对地球的自转起到了温和的制动作用。

所以，是的，如果没有月亮，一个一天24小时长的地球的倾角将发生激烈、混乱的变化。但是，谁都不知道，假如地球没有被撞得足够生成月球，那么它的旋转周期会是多长。也没有任何办法可以找到答案。

但还有其他方法来论证拥有大月亮的行星更可能孕育复杂的生命。英国地球物理学家大卫·沃尔瑟姆（David Waltham）在2014年出版的《幸运星球》（Lucky Planet）一书中提出，复杂生命的发端既需要一个比较稳定的倾角，也需要相当漫长的一天。他指出，在一天明显更短的行星上，热量从赤道传输到极地的效率更低。负责传输热量的风和洋流会偏离从赤道到极地的直线路径，因为科里奥利效应（Coriolis effect）而向东摆动。行星旋转得越快，这种效应就越强，向极地传输热量的难度就越大。沃尔瑟姆认为，月球的大小正好让地球既有稳定的倾角，又有足够温暖的极地而让任何冰河期都相对较短。这是一个巧妙的论点，但不具有足够的说服力。

若要在月亮对生命的重要性这个问题上取得重大进展，可能将不得不等到我们在围绕其他恒星的行星上发现复杂的生命形态。如果有许多行星既不拥有复杂的生命也没有大月亮，除此之外都与地球相似，那么这种观点可能会更站得住脚些。又或者，如果那些搜寻外星人信号的人在拥有大月亮的行星上发现了这种信号，那么也会有同样的作用。

当世界等待这样的发现时——这很可能耗时数十年甚至数百年——我们值得记取科幻作家艾萨克·阿西莫夫（Isaac Asimov）在1972年发表的论文《月球的悲剧》（The Tragedy of the Moon）中提出的一个有趣的观点：月亮可能并非复杂生命亦即人类发展的关键，却反而是他们衰亡的一个原因。

阿西莫夫声称，如果人类是在一个没有月球的星球上进化而来，他们可能永远不会认为自己的家园是宇宙的中心。月球绕着地球转这个已被证明的事实使得人类想当然地以为太空中所有其他物体亦是如此。即便“眼见为实”，也可能因为导向错误的结论而具有欺骗性。而解释不同行星不同运动方式的最简单方法，是地球和其他一切都是绕着太阳转。阿西莫夫认为，如果没有月球绕地球转这一事实所带有的误导性，太阳是太阳系中心的观点会更易被人接受得多。这样，太阳系日心说很可能会是自巴比伦和古希腊以来固有的天文学理论。

这不仅仅意味着人类会更早找到对世界更好的解释（尽管这对做了一辈子教育工作者的阿西莫夫来说本身就是一件好事）。带着一种虔诚的无神论者的姿态，作者指出，不以地球为宇宙中心而生成的文明可能不大会发展出那种视人类为宇宙中心和造物顶点的一神论。他继而以一种上世纪70年代常见的生态悲观论说到，这种更广阔的视角可能会让人类不那么忽视环境，也不大会在引发了核战争之后仍然认为自己看世界的方式值得维护。他想象，这样的文明或许会比人类的文明更持久。

这可算不上是个强有力的论证。但在人们努力讲述月球对于进化的重要性之时，它确实是一个有用的警告。它强调了人类总是如何不遗余力地把自己和地球视作特殊的存在——而他们常常大错特错。从中还可以得出一个

新的预言。如果人类真的联系上了在他们自己的月亮下进化的外星人，他们一样会讲述各种有关这颗月亮如何重要的精彩故事。是真是假又有谁知道呢？ ■



Free exchange

Barely managing

User-rating systems are cut-rate substitutes for a skilful manager

IT OFTEN arrives as you stroll from the kerb to your front door. An e-mail with a question: how many stars do you want to give your Uber driver? Rating systems like the ride-hailing firm's are essential infrastructure in the world of digital commerce. Just about anything you might seek to buy online comes with a crowdsourced rating, from a subscription to this newspaper to a broken iPhone on eBay to, increasingly, people providing services. But people are not objects. As ratings are applied to workers it is worth considering the consequences—for rater and rated.

User-rating systems were developed in the 1990s. The web held promise as a grand bazaar, where anyone could buy from or sell to anyone else. But e-commerce platforms had to create trust. Buyers and sellers needed to believe that payment would be forthcoming, and that the product would be as described. E-tailers like Amazon and eBay adopted reputation systems, in which sellers and buyers gave feedback about transactions. Reputation scores appended to products, vendors and buyers gave users confidence that they were not about to be scammed.

Such systems then spread to labour markets. Workers for gig-economy firms like Uber and Upwork come with user-provided ratings. Conventional employers are jumping on the bandwagon. A phone call to your bank, or the delivery of a meal ordered online, is now likely to be followed by a notification prompting you to rate the person who has just served you.

Superficially, such ratings also seem intended to build trust. For users of Uber, say, who will be picked up by drivers they do not know, ratings look

like a way to reassure them that their ride will not end in abduction. Yet if that was once necessary, it is no longer. Uber is a global firm worth tens of billions of dollars and with millions of repeat customers. Its customers know by now that the app records drivers' identities and tracks their route. It is Uber's brand that creates trust; for most riders, waiting for a driver with a rating of 4.8 rather than 4.5 is not worth the trouble.

Rather, ratings increasingly function to make management cheaper by shifting the burden of monitoring workers to users. Though Uber regards its drivers as independent contractors, in many ways they resemble employees. The firm seeks to provide users with a reasonably uniform experience from ride to ride. And because drivers are randomly assigned to customers, it is the platform that cares whether rides lead to repeat business and which therefore bears the cost of poor behaviour by drivers. Ordinarily a firm in such a position would need to invest heavily in monitoring its workers—hiring staff to carry out quality assurance by taking Uber rides incognito, for instance. A rating system, however, reduces the need for monitoring by aligning the firm's interests with those of workers. (Drivers with low ratings risk having their profile deactivated.)

Outsourcing management like this appeals to cost-conscious firms of all sorts; hence the proliferation of technological nudges to rate one service worker or another. To work as intended, however, ratings must provide an accurate indication of how well workers conform to the behaviour that firms desire. Frequently, they do not. Raters may have no incentive to do their job well. They may ignore the prompt to rate a worker, or automatically assign the highest score. They may adhere to social norms that discourage leaving a poor rating, just as diners often leave the standard tip, however unexceptional the service. Uber's customers often award drivers five stars rather than feel bad about themselves for damaging a stranger's work prospects. And even when users are accurate, their ratings may reflect factors beyond a service provider's control, such as unexpected traffic.

Systems that allow users to leave more detailed feedback (as Uber's has begun to) could address this, but at the cost of soaking up more time, which could mean fewer reviews.

When the quality of a match between a worker and a task is particularly important, the problem of sorting the signal from the noise in rating systems grows. Skilled managers can tell when a worker struggling in one role might thrive in another; rating systems can capture only expressions of customer dissatisfaction. Such difficulties also affect gig-economy platforms. Poor ratings on a job-placement site could reflect an inappropriate pairing between a worker with one set of skills and a firm that needs another, rather than the worker's failure of effort or ability.

Platforms can reduce the potential for such errors by including more information about tasks and the workers who might tackle them. Yet they may discover to their chagrin that more information also provides users with more opportunities to discriminate. An analysis of Upwork, for example, found that employers of Indian descent disproportionately sought Indian nationals for their tasks. True, this particular sort of information could be concealed—and conventional management permits plenty of discrimination. But firms typically have a legal obligation not to discriminate, and to train managers accordingly.

Management is underappreciated as a contributor to success. Recent work by Nicholas Bloom, John Van Reenen and Erik Brynjolfsson suggests that good management matters more than the adoption of technology for a company's performance. Even so, the use of ratings seems sure to grow. They are, as "Left Outside", a pseudonymous blogger, puts it, a genuine disruptive technology: cheap enough to be adopted widely even if inferior to established practice. Further advances could improve such systems, as is common with disruptive technology. Artificial-intelligence programs may one day know how much people enjoyed a taxi ride better than they do

themselves. In the meantime, management risks being left to the wrong sort of stars.

Sources for this story can be found at Economist.com/ratings2018 ■



自由交流

不用管

用户评分系统只能算优秀管理人才的二流替代品

你从马路边慢慢向家门口走去。通常在这个时候，你会收到一封电子邮件，问：为你的优步司机打几颗星？在电子商务的世界中，像这家网约车公司所用的评分系统是必不可少的基础设施。几乎所有你可能从网上购买的东西都带有大众评分，从订阅本刊到eBay上的一部破iPhone莫不如此，给提供服务的人打分的情况也越来越多。但人不是物品。当评分系统被用到员工身上时，就有必要思考其后果，包括对评分者和被评分者的后果。

用户评分系统是上世纪90年代被开发出来的。当时的互联网似乎将成为一个大巴扎，人人都可以在上面买卖东西。但电子商务平台必须建立起信任。卖家得相信自己会收到付款，买家得相信商品不会货不对版。亚马逊和eBay这样的电子零售商采用了信誉系统，供卖家和买家就交易给出反馈。提供了关于产品、卖家和买家的信誉评分，就可以让用户定下心来，相信自己不会受欺诈。

这类系统随后也被运用到劳动力市场中。零工经济公司优步和Upwork的员工要接受用户的评分。传统雇主也开始跟风。如今不管是给银行打个电话还是接收网上订餐，都有可能事后收到一条推送，请你给刚刚为你提供过服务的人打分。

表面上看，设置这类评分似乎同样是为了建立信任。举例来说，对于并不认识将要前来接送自己的司机的优步用户来说，评分看似是一个让他们放心自己不会不慎上了贼车遭到绑架的方法。不过，假如说这在以前还有必要，如今已不再是这样。优步是一家价值数百亿美元、拥有几百万回头客的全球公司。它的客户如今已经知道应用会记录司机的身份信息并追踪他们的行程。建立起信任的是优步这个品牌。对大多数乘客来说，并不值得费工夫去等待一个评分为4.8的司机而无视一个4.5分的司机。

实际上，由于评分系统将监督员工的重负转移到了用户的身上，它正在越来越多地发挥降低管理成本的作用。虽然优步将旗下司机视作独立合同工，但他们在很多方面都与正式员工相似。优步力图让用户每次乘车都能获得大体上一致的服务质量。而由于司机是随机分配给客户的，需要担心每次服务能否带来回头客的就是平台而非司机，司机的不良行为产生的代价因而也是由平台来承担。一般来说，处于这样一种状况的企业需要在监督员工方面有大笔投入，例如雇用评分人员隐瞒身份乘车，从而把控服务品质。然而，评分系统将企业和员工的利益绑在了一起，监督员工的必要性也就降低了。（若评分太低，司机就面临账号被封的风险。）

这种将管理外包出去的做法吸引了各类有意控制成本的公司，所以人们的手机上开始收到各种敦促，要你给这位或那位服务人员评分。然而评分若要发挥预期的功效，必须能精确反映员工在多大程度上遵守了公司的行为准则。但现实中常常不是这样。评分者也许并没有动力好好打分。他们也许会忽略为一位员工打分的提示，或者想也不想就打出最高分。他们可能会受制于社会规范，不便给人打出偏低的分数，就像食客们不管餐厅的服务多一般，往往还是会按常规标准给小费一样。优步乘客不愿意因为破坏一个陌生人的工作前景而有心理负担，因而常常会给司机五星好评。而就算用户给出了恰如其分的评分，所反映的也可能是超出服务提供者控制的因素，例如意想不到的交通拥堵。那些鼓励用户给出更详细反馈的系统（优步已经开始使用）或许能解决这个问题，但代价是占用用户更多时间，因此他们给出的点评可能会减少。

员工与任务之间的匹配度特别重要，因而难以从评分系统中找到准确信息的问题也在增加。有经验的管理人员能够看得出，一个难以胜任某个角色的员工也许能从容应对另外一个。而评分系统只能捕捉到客户的不满之声。这类难题对零工经济平台也有影响。如果就业安置网站上的评分不高，与其说反映出员工努力不够或能力欠缺，倒有可能显示平台匹配不当：员工具备某种技能，而企业需要的是另外一种。

平台可以通过一个办法来减少这类差错：提供更多关于工作任务以及有可能接手这些任务的员工的信息。然而它们也许会懊恼地发现，提供了更多

信息，用户也就有了更多差别对待的机会。例如，对Upwork的一项分析发现，印度裔雇主聘请印度人为自己做事的比例奇高。当然，平台可以将特定信息隐藏起来，而且传统管理下也可能会发生很多歧视现象。但企业通常有反歧视以及对管理人员提供相关培训的法律责任。

管理对于成功的促进作用被低估了。尼古拉斯·布鲁姆（Nicholas Bloom）、约翰·范雷南（John Van Reenen）和埃里克·布林约尔夫松（Erik Brynjolfsson）最近的研究显示，良好的管理对企业业绩的影响更甚于采用新技术。尽管如此，评分机制的应用看起来肯定会增长。用匿名博主“Left Outside”的话说，评分系统是一种真正的颠覆性技术：就算它们比不上常规管理手段，但胜在足够便宜，可以广泛应用。就像许多颠覆性技术一样，技术进步可能会令评分系统得到改善。也许某一天，人工智能会比出租车乘客更清楚他们的乘坐体验如何。而与此同时，管理可能将不再需要企业明星，人们手机上的星星就可代劳。

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If new foodstuffs became popular

Insects, algae or artificial meat?

Explore possible scenarios for the future of food, right on your kitchen table, using augmented reality

THE WORLD WILL need to rethink its approach to food as the population grows towards an expected 9.7bn people in 2050, particularly if more of them adopt Western-style diets. Several options are on the menu, including artificial meat made from vegetable protein, or grown in vats; wider adoption of insects such as crickets and mealworms as a source of protein; using spirulina and other forms of algae as a food supplement, or a foodstuff in its own right; and futuristic protein shakes that provide a nutritionally complete meal in a glass—handy for the busy astronaut who needs to get back to exploring Mars. Or perhaps we'll use food robots that download recipes and 3D-print our meals from cartridges of ingredients, opening up all kinds of new shapes and textures for the cooks of the future to explore.

These different approaches each have pros and cons. Artificial meat is getting cheaper and more realistic, and could slash greenhouse-gas emissions associated with livestock farming. But what about the 1.3bn people who depend on livestock farming for employment and food security? Insects are already widely consumed in much of the world, but will Western consumers ever overcome the “yuk” factor? Growing spirulina in tanks yields 20 times more protein per unit area than soybeans, and more than 200 times more than beef, but other forms of algae can be toxic, so ensuring purity is vital. Meal-replacement shakes are quick to prepare and consume, but they are an expensive and unsatisfying form of food, and the implications of long-term consumption are unclear. And 3D food printers are still in their infancy, and can only handle foodstuffs that can be squeezed through nozzles. The food replicator in “Star Trek” is still a long

way off.

But amid this plethora of choice, one thing is clear: consumer preferences will play a big part in determining the outcome. So which of these futuristic foods would you want to see on your table?

Thanks to the magic of augmented reality (AR), which projects virtual objects into the real world, you can take a close look at some of the options in the comfort of your own kitchen. For *The Economist*'s first foray into AR, we have teamed up with Kabaq, a startup based in New York that specialises in applying the technology to food. All you need is a smartphone with the Snapchat app. Scan the Snapcode for each food (ask a teenager for help if necessary) to add it as a temporary "lens" that lasts 24 hours. You can see one Snapcode, for edible insects, on this page; the full menu can be found online at economist.com/arfood

You can then place the food on your table, zoom or rotate it, and decide whether you'd want to eat it. (Alas, AR technology does not yet capture taste or smell.) Tap the plate to see an infographic explaining the implications of each food choice; there's also a brief audio summary. We invite you to share an image with the hashtag #econfood once you've decided which of these options for the future of food you find most appetising. Tuck in! ■



如果新型食物流行

昆虫、藻类，还是人造肉？

用增强现实技术尝试一下未来的食物吧，就在你自家餐桌上

到2050年地球人口预期将增至97亿，这就迫使人类重新思考食物来源，特别是如果更多人将采用西式饮食的话。我们的菜单上有这样几个选项：用植物蛋白制成的或在大桶中种植的人造肉；更广泛地采用蟋蟀和面包虫等昆虫作为蛋白质来源；使用螺旋藻和其他形式的藻类作为食物补充剂或食物本身；在一个玻璃瓶里提供营养全面的一餐的未来派蛋白饮料——这对忙着探索火星的宇航员来说尤其方便。又或者，我们将请食物机器人为我们下载食谱并用各种“食材墨盒”3D打印出一顿饭，这将让食物拥有各种各样的新形状和质地，供未来的厨师们大展拳脚。

这些不同的方法各有利弊。人造肉越来越便宜，也越来越逼真，还可以大幅减少与畜牧业相关的温室气体排放。但依赖畜牧业提供就业和食品保障的13亿人要怎么办？世界上很多地方的人们已经在吃昆虫，但西方消费者能否克服“恶心”的感观和心理？在桶里培育的螺旋藻每单位面积产生的蛋白质比大豆多20倍，比牛肉多200多倍，但其他形式的藻类可能有毒，因此确保纯度至关重要。饮料代餐制备和食用都很快捷，但这是一种昂贵又难以满足食欲的食物形式，而且长期食用的影响尚不清楚。3D食物打印机仍处于起步阶段，只能处理那些可以从管口里挤出来的食材。《星际迷航》中的“食物复制机”还遥遥无期。

但在这众多选择中，有一点是明确的：消费者的偏好将在很大程度上决定结果。那么，你想在你的餐桌上看到哪种未来派食物？

感谢增强现实技术（AR，它将虚拟物体投射到现实世界中）的魔力，你可以在自家厨房里舒舒服服地仔细查看其中一些选项。本刊首次涉足AR就是与纽约的创业公司Kabaq合作，这家公司专门研究将AR技术应用于食品领域。你只需要一部智能手机和Snapchat应用。打开Snapchat扫描每种

食物的Snapcode（如有必要，可求助身边的青少年），将它们添加为可保留24小时的临时“滤镜”。在现在这个页面上，你可以看到一个可食用昆虫的Snapcode；登录economist.com/arfood，你可以获得完整的菜单。

然后你就可以把这种食物放到你的餐桌上，放大、缩小，或旋转它，决定你想不想吃它。（可惜AR技术还没法捕捉味道和气味。）点击盘子，你会看到一张信息图，上面解释了每种食物选项对你意味着什么，还配有一个简短的音频概要。我们邀请你分享带有#econfood话题标签的照片，告诉大家这些未来食物中哪种最合你的胃口。尽情试吃吧！ ■



Bartleby

Taking minutes, wasting hours

How to make meetings work better

MOST workers view the prospect of a two-hour meeting with the same enthusiasm as Prometheus awaited the daily arrival of the eagle, sent by the gods to peck at his liver. Meetings have been a form of torture for office staff for as long as they have pushed pencils and bashed keyboards.

One eternal problem has been their inefficiency. In 1957, C. Northcote Parkinson, an academic and legendary writer on management, came up with the law of triviality, that “the time spent on any item of the agenda will be in inverse proportion to the sum [of money] involved.” In that same spirit, this columnist would like to propose an even broader principle, applying to gatherings of ten people or more, and immodestly called Bartleby’s Law: “80% of the time of 80% of the people in meetings is wasted.”

Various corollaries to this law follow. After at least 80% of meetings, any decisions taken will be in line with the HIPPO, or “highest-paid person’s opinion”. In short, those who backed a different outcome will have wasted their breath. Perhaps because they are aware of the futility of their input, fewer than half of the people in a large meeting will bother to speak and at least half of the attendees will at some point check their phones.

Part of the problem lies in the paradox that, although workers hate attending meetings, they loathe being excluded even more. Nothing is so likely to induce paranoia than a department meeting to which you are not invited. To avoid this fear, managers are tempted to invite as many people as might be interested.

Clearly there are occasions when everyone should be involved: when a

significant event occurs such as a change of leadership or strategy, or the announcement of job losses. If workers are organised into small teams, there is much to be said for the “morning huddle” in which members update each other on their progress; the whole thing can take 15 minutes.

But most meetings drag on for much longer. Maurice Schweitzer, professor of management at the Wharton School of the University of Pennsylvania, says they work best when preparation is done. Informing people of the agenda in advance keeps them from being caught off guard—surprise often leads to a negative reaction to plans. Sadly, he adds, preparation is not a sexy part of management so seldom gets done.

One prerequisite is to establish if the meeting is designed to persuade the staff to go along with a management decision or to learn about the workers’ ideas and problems. If the former, then allies of whoever is in the chair should speak first, and drive the agenda. But such meetings ought to be rare in a well-run firm.

If a meeting’s object is to learn what people think, a new approach is required. Low-status employees should be encouraged to speak, says Mr Schweitzer, and there should be a “no interruption rule” so they cannot be intimidated. Another option would be to let people submit views anonymously in advance.

The danger of a “no interruption” rule is that garrulous colleagues might make such meetings extremely lengthy. At one point, every worker will have lost patience with “Tommy Tangents” (those who drone on at length about an issue that is irrelevant to the agenda) and “Hearsay Harrys” (those who cannot tell the difference between a personal anecdote and scientific evidence). So Bartleby would favour limiting all interventions to a maximum of 2-3 minutes.

The best way to avoid Parkinson's law of triviality is to get the agenda right. Jay Bevington of Deloitte, a consultancy, says there is a temptation to leave the most important—and therefore the most contentious—items until the end of the meeting. Instead they should be tackled at the start.

Furthermore, there is no point in holding a meeting unless everyone knows what has been decided afterwards. Mr Bevington says that many would be surprised how many board directors leave a meeting without being sure of what has been agreed upon.

But perhaps the best solution to tedious gatherings is to have far fewer of them. GE's new boss, John Flannery, has called for "little or no meetings where possible". Thanks to the miracle of modern technology, messaging groups allow management and employees to keep in touch. Information can be imparted in succinct form and those who are not involved can ignore the messages and get on with their work. Next time a manager is tempted to call colleagues together, they must have a good answer to the question: "Is this meeting absolutely necessary?" ■



巴托比

做做记录，耗费半日

怎么让开会更有效

大多数上班族等待两小时会议的感受，就跟普罗米修斯每天等天神派那只鹰来啄食他的肝脏一样。自打办公室员工们开始写写记记、猛敲键盘，开会对他们来说就是一种折磨。

会议的低效是一个永恒的问题。1957年，管理学学者兼传奇作家C·诺思科特·帕金森（C. Northcote Parkinson）提出了“芝麻绿豆定律”，即“在议程表的每个项目上花费的时间与其涉及的金额成反比”。本着同样的精神，本专栏作者想提出一个更广泛、适用于10人或以上会议的法则，并毫不谦虚地将它命名为“巴托比定律”：“在会议中，80%的人浪费了他们80%的时间。”

这条定律又可引申出各种各样的推论。至少80%的会议做出的任何决定都与最高薪者的意见一致。简言之，那些支持了其他意见的人都是白费口舌。也许是因为意识到了自己的付出总是徒劳，在大型会议上只有不到一半的人会发言，而且至少一半与会者会在某个时刻看手机。

问题部分源自一个悖论：尽管员工讨厌参加会议，但更讨厌被排除在外。没有什么事比没请你参加部门会议更容易让人疑神疑鬼的了。为了避免引起这种担忧，经理们会尽可能多地邀请可能对会议感兴趣的人。

显然，某些情况下每个人都应当出席，比如说发生了领导层变动、战略改变，或是宣布裁员之类的重大事件。如果员工们被分成一个个小团队，那么在成员间互相知会工作进度的“晨会”上也会有不少东西要说，整个过程可能需要15分钟。

但大多数会议都拖沓得多。宾夕法尼亚大学沃顿商学院的管理学教授莫里斯·施维泽（Maurice Schweitzer）表示，准备工作到位时，开会效果最

好。提前告诉人们会议的日程安排，他们就不至于措手不及——突如其来的会议常常会招致与会者对工作计划的消极反应。遗憾的是，他补充道，准备工作并不是管理中最酷的部分，所以人们很少做到位。

一个必要的前提是确定开会的目的：是要说服员工同意某个管理决策，还是要了解员工的想法和存在的问题。如果是前者，那么无论是谁主持会议，他的盟友都应该首先发言，并推动议程。但是这样的会议在一个运营良好的公司里应该很少见。

如果会议的目的是了解人们的想法，那么就需要一种新的模式。施维泽认为，应该鼓励低级别的员工发言，并且实行“不许打断原则”，这样他们就不会怯场。另一种做法是让人们提前匿名提交观点。

“不许打断原则”的危险在于，那些喋喋不休的同事可能会让这样的会议变得极其冗长。到了某个时刻，每位员工都会对“唠叨老王”（絮絮叨叨地谈论和议题无关的事）和“八卦老李”（分不清小道消息和科学证据的差别）失去耐心。所以巴托比专栏赞成将所有发言时间限制在2到3分钟以内。

要避免帕金森的“芝麻绿豆定律”，最佳方法是安排好议程。咨询公司德勤的杰伊·贝文顿（Jay Bevington）表示，人们倾向于将最重要、因而也是最具争议的部分放到会议的最后阶段来讨论。其实应该在一开始就来处理这些部分。

此外，除非每个人在会后都知道达成了什么决议，否则开会没有意义。贝文顿表示，要是知道有多少董事离会时都不确定达成了什么共识，许多人都会大吃一惊。

但是，对于单调乏味的会议，最好的解决办法也许是少开一些。通用电气的新老板约翰·弗兰纳里（John Flannery）呼吁“尽可能少开会或不开会”。多亏了神奇的现代科技，管理层和员工可以通过讯息群组保持联系。信息可以简明地传达，不相干的人可以忽略它们，继续干自己的活。下次如果一名经理想要召集同事时，他们必须好好回答这个问题：“这个会真是非开不可吗？”■



Military communications

Jaw-jaw and war-war

A new type of battlefield network is in development

MOBILE armies need mobile communications. Those communications, though, must be secure—and not just from eavesdropping. They also need to be uninterrupted. And that is a problem. Many mobile networks (think Wi-Fi routers or mobile-phone towers) operate via hubs. Destroy the hub and you destroy the network. Even a peer-to-peer system in which messages travel in a series of hops between nodes (in the form of the devices that comprise the system) rather than via a hub, can be degraded by a loss of nodes. Existing versions of such systems, which are usually static, rather than mobile, require each node to be set up individually, in advance, to talk to particular other nodes. Mobility brings a need for constant reconfiguration.

In theory such a system is possible. It is called MANET, an approximate acronym for mobile ad-hoc network. In practice, though, a workable MANET has proved impossible to design—until now.

The main problem is mathematical. To avoid the pre-programming required by existing systems, a MANET must maintain routing tables that keep track of the shortest routes between nodes. Updating these tables takes geometrically increasing amounts of processing power as the number of nodes increases. A second, related problem is that to maintain the routing tables each node has to send regular “hello” messages to all the others within range. As the number of nodes increases, these messages rapidly multiply and crowd out other traffic. The upshot is that a MANET with more than about 30 nodes starts to experience problems, and one with more than about 50 will grind to a halt.

Faced with that, America's Defence Advanced Research Projects Agency, DARPA, decided in 2013 to launch a challenge to build a MANET with more than 50 nodes, with the carrot of a juicy contract for the winner. The challenge worked. Earlier this year the American army tested a MANET with 320 nodes at its urban-training facility at Fort Bragg, North Carolina. This system can support the equivalent of a brigade-sized expeditionary unit, with voice, text and data traffic at up to 30m bits per second (bps). Each node is a hand-held unit like a chunky smartphone. During the test, users were distributed across dozens of buildings. To make things extra tricky, some of them were in basements.

The new MANET was able to perform so well because it overcame both the routing-table problem and the hello-message problem. Engineers at Persistent Systems, a firm in New York that designed it, simplified the routing task by employing tricks such as remembering the route taken to reach another node and reusing it, rather than working out the best path every time a message is sent. Another trick they perfected is "overhearing". This occurs when a node happens to pick up a message it was not intended to receive, and can provide a shorter path than the planned one.

To deal with the hello-message problem, the packets that carry those messages are simplified. Louis Sutherland, Persistent Systems' head of business development, likens the process to saying "hi" rather than "hello, how are you?"

Persistent Systems is not the only company trying to develop better MANETs. Thales, a European defence giant, has one it claims can support 150 nodes at speeds of up to 6m bps. TrellisWare, of San Diego, claims 8m bps over more than 200 nodes. Nor need MANETs be restricted to communications between people. They could enable robots, whether on the ground or in the air, to work in co-operative groups. Persistent Systems already has a contract to supply communications for the American army's

PackBot ground robots.

MANETs will also appeal to some groups of civilians. Rescue workers in places hit by natural disasters, where existing communications have been destroyed, will benefit. So may miners. A MANET can easily stretch from above ground into underground areas. Industrial sites where there is too much interference for conventional communications may be suitable for MANETs as well. Altogether, then, these particular MANETs may soon paint a picture of communications perfection. ■



军事通信

动手也动口

一种新型的战地网络正在开发中

机动部队需要移动通信。不过，这些通信必须能确保安全，而不仅仅是不被窃听。它们还不能间断，而这是个问题。许多移动网络（如Wi-Fi路由器或移动电话基站）通过集线器运行。破坏了集线器就破坏了网络。即使是一个对等系统，其中的信息在节点（即构成系统的各种设备）之间跳来跳去而不是通过集线器传递，也会因节点的丢失而减弱。目前已有的这类系统通常是静态而非移动的，需要预先单独设置每个节点，以便与特定的其他节点通信。要有移动通信则需要不断重新配置。

理论上有存在这类系统的可能。它被称为MANET，是移动自组网（mobile ad-hoc network）的近似缩写。不过，实际上人们一直以来都没法设计出切实可行的MANET，直到现在。

主要问题出在计算。为了避免现有系统所需的预编程，MANET必须维护路由表，以追踪记录节点之间的最短路径。随着节点数量的增加，更新这些表所需的处理能力呈几何级数增长。第二个相关的问题是，要维护路由表，每个节点必须向范围内的所有其他节点定时发送心跳包。随着节点数量的增加，这些消息会迅速增加并挤掉其他流量。结果是节点超过30个的MANET就开始出问题，而节点超过50个左右的MANET会逐渐瘫痪。

面对这种困境，美国国防高级研究计划局（DARPA）在2013年决定发起一项竞赛，来建造一个有50个以上节点的MANET，并为获胜者提供一份诱人的合同。这一挑战有了效果。今年早些时候，美国陆军在北卡罗来纳州布拉格堡（Fort Bragg）的城市训练基地测试了一个有320个节点的MANET。该系统可以支持一个旅大小的远征部队，以最高每秒30Mb的速度传输语音、文本和数据。每个节点都是一个手持设备，外型仿佛一部大块头的智能手机。在测试期间，用户分布在几十栋建筑物中。为了让情境

更加复杂，有些用户还待在地下室里。

新的MANET之所以能够表现得如此出色，是因为它克服了路由表和心跳包的问题。设计它的纽约公司Persistent Systems的工程师运用了一些妙招来简化路由任务，比如记住到达另一个节点的路径并重复使用，而不是每次发送消息时找出最佳路径。他们完善的另一个妙招是“串音”。这是指一个节点碰巧接收到一个本来不该由它接收的消息，由此提供的路径比计划的更短。

为了处理心跳包的问题，工程师简化了携带这些消息的数据包。路易斯·萨瑟兰（Louis Sutherland）是Persistent Systems的业务开发负责人，他打比方说，这就好像打招呼时只要说“嗨”，无需说“你好，你怎么样？”

Persistent Systems并不是唯一一家想要开发更好的MANET的公司。欧洲防务巨头泰雷兹（Thales）也建立了一个MANET，据称可支持150个节点，速度最高可达每秒6Mb。圣地亚哥的TrellisWare公司称自己拥有超过200个节点的MANET，速度达每秒8Mb。MANET也不限于人与人之间的通信。它们可以让机器人联合作业，无论是在地面还是在空中。Persistent Systems已经与美国陆军签订合同，为其PackBot地面机器人提供通信支持。

MANET对一些普通民众也会有吸引力。在遭受自然灾害的地区，当已有通讯系统被破坏时，救援人员能从中受益。矿工也一样。MANET可以很轻易地从地面延伸到地下。在传统通信受到太多干扰的工业场所，MANET也可能有用武之地。总之，这些特殊的MANET可能很快就会描绘出一幅完美的沟通画面。 ■



Foreign direct investment

Security screening

America and the EU are both toughening up on foreign capital

“DEAR Donald, let’s remember our common history,” wrote Jean-Claude Juncker, the president of the European Commission, on a picture of a military cemetery in Europe that he presented to President Donald Trump during talks on July 25th. The reminder of shared values and sacrifices may have helped nudge the two men towards a truce in the incipient transatlantic trade war (see United States section). That truce will help America and Europe to co-operate on another front.

Both suspect that investment from China is a ploy to gain access to advanced technology and undermine domestic security. European officials are thrashing out the details of an EU-wide investment-screening mechanism, proposed by Mr Juncker in 2017. A government white paper on national security and investment published on July 24th suggests that post-Brexit Britain will be no soft touch, either: it was widely seen as intended to increase scrutiny of Chinese buyers. But it is the Trump administration that is moving fastest.

Mr Trump had considered raising barriers to Chinese inward investment in sectors targeted by the “Made in China 2025” development policy. But he decided instead to support a plan to strengthen an existing investment-screening mechanism, the Committee on Foreign Investment in the United States (CFIUS). With votes in both houses of Congress expected shortly, and bipartisan support, he could soon be signing it into law.

CFIUS is already powerful. If it thinks a deal threatens national security, it can propose remedies or recommend that the president blocks the

transaction. But security threats have evolved since it was set up in 1975, says Heath Tarbert, assistant secretary of the Treasury. The line between commercial and defence technologies has blurred, and the explosion in personal data has created new vulnerabilities. CFIUS's workload has more than doubled in a decade. Lawyers complain that even uncontroversial deals are being held up.

The Foreign Investment Risk Review Modernisation Act would give CFIUS greater authority to examine deals where foreign investors gain control of critical infrastructure or technology, or of personal data. Minority investments would be covered if they give investors access to sensitive information. It allows for CFIUS's budget to be increased. And it tightens export-control rules, which prevent sensitive technology being transferred abroad.

Early drafts were seen by businesses and former CFIUS officials as too draconian. Lawmakers have been surprisingly willing to listen to critics, and unusually bipartisan, says Kevin Wolf, a former assistant secretary to the commerce department under Barack Obama. The latest version should, he reckons, give businesses more clarity on the kinds of technology that will come under CFIUS review.

Other aspects are hazier. Without further regulations, businesses that store personal data may not always know if their deals need review. CFIUS's remit will expand to include more small firms receiving early-stage investment. Reviews are costly, since would-be buyers and sellers usually hire lawyers and CFIUS is to be allowed to start charging fees. Some fret that the costs could put startups off foreign investment.

Although the new rules set out the kinds of deals that should be scrutinised, CFIUS alone decides if a deal poses a security risk. Among its members are officials from both security-oriented defence and justice agencies, and

business-facing departments such as commerce and treasury. That split used to allow CFIUS both to protect national security and to promote foreign investment, says Clay Lowery, a former assistant secretary of the Treasury. Under Mr Trump, though, the economic protectionists now line up alongside the security hawks.

Investment from China has already fallen (see chart). That partly reflects capital controls and crackdowns on dealmaking back home. CFIUS blocked several high-profile deals in the past year, and Mr Trump's threats on trade and investment will not have helped.

Flows of capital to Europe have held up a bit better. But it too is becoming less welcoming to Chinese investment. Mr Juncker's proposals, which officials are hoping to finalise by the end of the year, would allow EU countries to share information on the national-security impact of foreign deals. With the tough guys in charge in America and Europe, Chinese investors may have to look elsewhere. ■



外国直接投资

安检

美国和欧盟都在加强对外资的审查

“亲爱的唐纳德，让我们铭记我们共同的历史。”7月25日，欧盟委员会主席让-克洛德·容克（Jean-Claude Juncker）在与美国总统特朗普会谈时，给他递上了一张欧洲一处美军公墓的照片，在上面写下了这样的文字。重提共同的价值观和牺牲也许帮助推动了两人叫停大西洋两岸刚打响的贸易战。休战将帮助美国和欧洲在另一条战线上展开合作。

双方都怀疑中国以投资为手段来获取先进技术和破坏本地安全。容克去年提出了一个覆盖整个欧盟的投资筛查机制，欧盟官员目前正在仔细商讨细节。英国在7月24日发布了一份关于国家安全与投资的政府白皮书，表明脱欧后的英国也不容易对付——人们普遍认为这份白皮书意在加强对中国买家在英投资的审查。但还是特朗普政府行动最为迅速。

特朗普曾考虑在“中国制造2025”发展政策提出的关键行业中提高中国对美投资的限制。但后来他转而支持另一项计划，决定加强一个现有的投资筛查机制——美国外国投资委员会（以下简称CFIUS）。国会两院即将就相关法案投票，再加上两党对它的支持，它可能很快就会获特朗普签署成为法律。

CFIUS本就已大权在握。如果它认为某项交易威胁国家安全，它可以提出补救措施或建议总统阻止交易。但美国财政部助理部长希思·塔伯特

（Heath Tarbert）表示，自1975年CFIUS成立以来，安全威胁已经发生变化。商业和国防技术之间的界限已变得模糊，个人数据的爆炸式增长也导致新漏洞出现。CFIUS的工作量在十年内增加了一倍多。律师们抱怨就连无可争议的交易也被拖延。

《外国投资风险评估现代化法案》（以下简称FIRRMA）将赋予CFIUS更大的权力，审查那些会令外国投资者获得对关键基础设施或技术的控制、

或者获得对个人数据的控制的交易。如果交易令投资者可获取敏感信息，那么即便是少数股权投资，也会被审查。该法案允许CFIUS增加预算，此外还收紧了出口管制法规，防止敏感技术转移到国外。

FIRRMA早期的草案被一些企业和CFIUS前任官员认为太过严苛。前奥巴马政府商务部助理部长凯文·沃尔夫（Kevin Wolf）表示，立法者出人意料地愿意倾听批评的声音，两党也异乎寻常地联合支持该法案。他认为，最新的法案版本应该能让企业更清楚地了解哪些技术会受到CFIUS的审查。

其他方面则相对模糊。如果没有进一步规定，存储个人数据的企业未必总能知道自己的交易是否需要审查。CFIUS的职权范围将扩大到覆盖更多接受早期投资的小公司。审查的花费不菲，因为潜在买家和卖家通常需要雇用律师，而且CFIUS将获准开始收取费用。有人担心这些成本可能导致创业公司对外国投资失去兴趣。

尽管新法规列出了应该仔细审查的交易类型，但一宗交易是否存在安全风险完全由CFIUS说了算。CFIUS的成员包括专注国家安全的国防和司法机构官员，以及面向商界的商务部和财政部等部门的官员。美国财政部前助理部长克莱·罗威（Clay Lowery）表示，以往，这样的制衡使得CFIUS既能保护国家安全又能促进外国投资。然而，在特朗普治下，现在是经济保护主义者与鹰派安全官员并肩作战。

来自中国的投资已见减退（见图表）。这在一定程度上反映了中国国内的资本管制和严查并购交易的行动。CFIUS在过去一年里阻止了几项备受瞩目的交易，而特朗普就贸易和投资所作的威胁言论加剧了整体趋势。

投资欧洲的情况相对好一点。但欧洲对中国的投资也不再那么欢迎。容克的提案（官员们希望在年底前定稿）将允许欧盟国家分享有关外国交易对国家安全影响的信息。鉴于强硬派在美国和欧洲掌权，中国投资者也许不得不放眼别处了。 ■



Red Sea scramble

Ports in the Horn

Shipping gives the United Arab Emirates (UAE) a foothold in east Africa. But it also draws rivals, from Qatar to China

IT SEEMED an irrational decision 20 years ago. DP World is one of the world's largest maritime firms. From a squat office overlooking Dubai's bustling Jebel Ali port, it directs operations in 40 countries. Most are in busy shipping hubs such as London and Rotterdam. But in the 1990s it started making surprisingly big investments in the Horn of Africa. It built a large port in Djibouti, and is now working on another in Somaliland (see map). The combined GDP of the two African entities is smaller than that of Moldova. Yet the firm sees the region as a land of opportunity.

So do the rulers of United Arab Emirates (UAE), one of whose components, Dubai, owns a majority stake in DP World. It is one of several Gulf states trying to gain a strategic foothold in east Africa through ports. Controlling these offers commercial and military advantages but risks exacerbating tensions in the region.

Executives at DP World argue that Africa needs many more ports—especially in the Horn, where conflict has stifled trade. Ethiopia, populous and fast-growing, lost its coastline when Eritrea broke away in 1991. Its 105m people rely on Djibouti for 95% of their trade. Farther inland, countries such as South Sudan, Uganda and Rwanda struggle to reach markets. DP World thinks the region from Sudan to Somalia needs 10-12 ports. It has just half that. “The whole Horn of Africa is short of ports. It’s stifling,” says one executive.

The firm's first foray was on Djibouti's coast. When DP World won its first

concessions there in the 1990s, the Emiratis were among the few investors interested in the small and poor former French colony. DP World built and operated a new container terminal, Doraleh, and helped finance roads and other infrastructure. Doraleh is now the country's largest employer and the government's biggest source of revenue. It runs at nearly full capacity, handling 800,000 containers a year. Much of its cargo travels along a Chinese-built railway from Addis Ababa, Ethiopia's capital.

Djibouti's profile rose further after the terrorist attacks on America of September 11th, 2001, when America opened a military base there. France and China also have bases; other navies patrol off its coast to deter Somali pirates. But when the Emiratis wanted to open their own naval base they were rebuffed, partly because of their close ties to Djibouti's rival, Eritrea (the two states had a bloody border dispute in 2008). In 2015 the UAE started building a naval base in Assab, in southern Eritrea. The base has been used in the Saudi-led war against Houthi rebels in Yemen. It would be the jumping-off point for a mooted amphibious assault on Hodeida, Yemen's main port, now the focus of heavy fighting. The UAE also helped mediate Eritrea's peace deal with Ethiopia signed on July 9th, ending decades of hot and cold war. If it holds, the truce could end UN sanctions and open Eritrea to investment. Assab and another port, Massawa, could be expanded.

In 2016 DP World won a 30-year concession to operate the port of Berbera in Somaliland, which declared independence in 1991 (though no foreign government recognises it). Critics said the deal would hasten the break-up of Somalia. Djibouti was upset for different reasons. With a planned capacity of 1.25m containers, Berbera would erode Djibouti's monopoly on Ethiopian cargo. Indeed, Ethiopia acquired a 19% stake in the port earlier this year. All this could cost Djibouti hundreds of millions in annual transit fees.

It would also cement the UAE's place in a strategic region. Uniquely among

Arab states, it tries to project military power far beyond its borders. The Horn ports all sit near the Bab al-Mandab strait, a vital choke-point at the mouth of the Red Sea: 4.8m barrels of oil passed through it every day in 2016. Competition is getting fierce, though. Qatar and its ally, Turkey, are building ports in Sudan. Saudi Arabia is in talks to set up a naval base in Djibouti. All three Gulf states are trying to snap up farmland in east Africa, part of a broader effort to secure food supplies for their arid countries. Emirati-built ports could one day export crops from Emirati-owned farms.

As the Gulf states move in, however, they bring their own conflicts to a troubled region. Qatar helped to end the clashes between Djibouti and Eritrea and kept peacekeepers there for almost a decade. Then came the bust-up of 2017, when four Arab states, including the UAE, imposed an embargo on Qatar. Both Djibouti and Eritrea sided with the blockading states. Qatar pulled out its troops, and Eritrea soon seized the disputed territory from Djibouti.

Gulf states could also find themselves in competition with China. The UAE hopes to be part of China's Belt and Road Initiative, a scheme to invest hundreds of billions of dollars in infrastructure such as roads and ports. Jebel Ali is the busiest port outside Asia, and already acts as a hub for trade with Africa. But China may want to cut out the middleman. In 2014 Djibouti tried to toss out DP World. It accused the firm of paying bribes to secure its Doraleh concession. Arbitrators in London found the claim meritless.

In February Djibouti dropped the legal niceties: it simply seized the port. The government says DP World failed to expand the port as quickly as promised. Shippers believe it took Doraleh as a sop to China, to which it is heavily indebted (see next article). In July Djibouti opened the first phase of a new \$3.5bn free-trade zone, set to be the largest in Africa when it is finished. Built mostly by state-owned Chinese firms, it sits next to Doraleh. DP World says the project violates the terms of its concession and is

threatening to sue. The UAE helped to put Djibouti on the map. Now, ironically, it may find itself frozen out. ■



红海争夺战 非洲之角的港口

阿联酋靠航运业在东非站稳脚跟。但也引来了卡塔尔、中国等竞争对手

这在20年前似乎是个不可理喻的决策。迪拜环球港务集团（以下称DP World）是全球最大的港口公司之一。公司大楼是一座低矮的建筑，位于迪拜繁忙的杰贝阿里港（Jebel Ali port），这里管理着公司在40个国家的业务，其中大部分是在伦敦、鹿特丹这样繁忙的航运枢纽。但在上世纪90年代，这家公司开始在非洲之角展开惊人的巨额投资。它在吉布提建造了一个大港口，目前又在索马里兰兴建另一个（见地图）。这两个非洲实体的GDP加起来还不及摩尔多瓦。但DP World却将这里视为机遇之地。

阿联酋的统治者们也这么认为。阿联酋酋长国之一的迪拜拥有DP World的多数股权。阿联酋是试图通过港口在东非获得战略据点的几个海湾国家之一。控制这些港口带来了商业和军事上的优势，但也可能加剧该地区的紧张局势。

DP World的高管们认为非洲需要更多的港口，特别是在非洲之角，那里的地区冲突抑制了贸易发展。埃塞俄比亚人口众多且发展迅速，却在1991年厄立特里亚分离出去时失去了海岸线。该国的1.05亿人口要依赖吉布提完成95%的贸易。在更远的内陆，像南苏丹、乌干达和卢旺达这样的国家很难接入外部市场。DP World认为，从苏丹到索马里的这一地区需要10到12个港口，而目前只有一半。“整个非洲之角缺少港口，抑制了发展。”一位高管表示。

DP World首先进军的是吉布提的海岸。上世纪90年代，吉布提还是个又小又穷的前法国殖民地，对它感兴趣的投资者寥寥无几，阿联酋便是其中一员。DP World于那时在吉布提获得了它的首个特许权，建成并经营一个新的集装箱码头多哈雷（Doraleh），并帮助筹资建设道路和其他基础设施。如今，多哈雷码头是吉布提最大的雇主，也是政府最大的收入来源。

它每年处理80万个集装箱，几乎满负荷运营。多哈雷的很多货物是从埃塞俄比亚首都亚的斯亚贝巴沿着中国人建造的铁路运过来的。

在2001年“9·11”恐怖袭击事件发生后，美国在吉布提设立了军事基地，吉布提的地位进一步提升。法国和中国也在此设有军事基地。另一些国家的海军沿这里的海岸巡逻以震慑索马里海盗。但是阿联酋人在此建立海军基地的想法却遭到吉布提的断然拒绝，部分原因是阿联酋与吉布提的对头厄立特里亚关系密切（两国曾在2008年发生边界流血冲突）。2015年，阿联酋开始在厄立特里亚南部的阿萨布（Assab）建立海军基地。该基地已经在沙特领导的打击也门胡赛叛军的战斗中派上了用场。在商议中的对荷台达（Hodeida）的两栖进攻计划中，这里将是进攻的起点。荷台达是也门的主要港口，也是当前激战的中心。阿联酋还在厄立特里亚与埃塞俄比亚之间帮助斡旋，促成两国于7月9日签署和平协议，结束了数十年的热战和冷战。如果停火协议被切实履行，联合国将解除对厄立特里亚的制裁并开放对其投资。阿萨布和另一个港口马萨瓦（Massawa）有望得到扩建。

DP World于2016年获得了索马里兰柏培拉（Berbera）港口30年的特许经营权。索马里兰于1991年宣布独立（尽管没有外国政府承认它）。批评人士称该特许协议会加速索马里的解体。吉布提则是为别的原因烦恼。柏培拉的计划吞吐量为125万个集装箱，它将会削弱吉布提在埃塞俄比亚货物运输上的垄断地位。实际上，埃塞俄比亚在今年稍早时获得了柏培拉港19%的股份。所有这些可能让吉布提每年损失数亿美元的转运费。

DP World对柏培拉的特许经营权还将巩固阿联酋在一大战略要冲的地位。在所有阿拉伯国家中，只有阿联酋试图将自己的军事力量投射到国界以外很远的地方。非洲之角的港口全部坐落在曼德海峡（Bab al-Mandab strait）附近，这里是红海入海口的咽喉要道，2016年每天有480万桶原油和成品油运经这里。然而竞争正在加剧。卡塔尔及其盟友土耳其正在苏丹修建港口。沙特也在谈判建立吉布提海军基地。三个干旱的海湾国家都在设法抢购东非的农田，以此作为确保自身粮食供应的行动的一部分。阿联酋修建的港口有朝一日可以出口阿联酋自有农场的农作物。

然而，随着海湾国家的进入，它们也将彼此之间的冲突带到了一个是非之地。卡塔尔帮助结束了吉布提和厄立特里亚之间的冲突，并在该地区驻扎维和部队将近十年。2017年，包括阿联酋在内的四个阿拉伯国家与卡塔尔断交，并对卡塔尔实施禁运。吉布提和厄立特里亚都站在封锁国一边。卡塔尔因而撤军，厄立特里亚很快从吉布提那里夺取了有争议的领土。

海湾国家可能发现中国也是自己的竞争对手。阿联酋希望加入中国的“一带一路”倡议，该计划将向道路、港口等基础设施投资数千亿美元。杰贝阿里是亚洲以外最繁忙的港口，已成为与非洲贸易的枢纽。但是中国可能想要撇开中间人。2014年，吉布提试图让DP World出局。它指控该公司通过贿赂获得了多哈雷的特许经营权。伦敦仲裁法院认为吉布提的指控缺乏法律依据。

今年2月，吉布提放弃了繁琐的法律途径，直接收回了多哈雷。吉布提政府表示，DP World未能按承诺的速度扩建该港口。航运商们认为，多哈雷是吉布提政府给中国的甜头，因为它欠下中国巨额债务。7月，吉布提总投资35亿美元的新自贸区的一期建成开园。该自贸区毗邻多哈雷，主要由中国国企承建，预期建成后将成为非洲最大的自贸区。DP World表示该项目违反了特许经营权条款，威胁提起诉讼。阿联酋曾帮助吉布提扬名世界，如今，讽刺的是，它却可能发现自己被排挤出局。■



The Belt and Road Initiative

Planet China

China’s “project of the century” inspires admiration and anxiety. There are good reasons for both

SHUNNING all false modesty, China’s leader, Xi Jinping, calls his idea the “project of the century”. The country’s fawning media hail it as a gift of “Chinese wisdom” to the world’s development. As for the real meaning of the clumsy metaphor to describe it—the Belt and Road Initiative (BRI)—debate rages.

The term itself is confusing. The “road” refers mostly to a sea route; the “belt” is on land. Countries eager for China’s financing welcome it as a source of investment in infrastructure between China and Europe via the Middle East and Africa. Those who fear China see it instead as a sinister project to create a new world order in which China is the pre-eminent power.

One cause of confusion is that the BRI is not a single plan at all. A visitor to its website would click in vain to find a detailed explanation of its aims. There is no blueprint of the kind that China’s leaders love: so many billions of dollars to be spent, so many kilometres of track to be laid or so much new port capacity to be built by such-and-such a date.

Chinese maps show the belt and road as lines that trace the routes of ancient “silk roads” that traversed Eurasia and the seas between China and Africa (see Briefing). That was the original conceit, but these days China talks about BRI as if it were a global project. The rhetoric has expanded to include a “Pacific Silk Road”, a “Silk Road on Ice” that crosses the Arctic Ocean and a “Digital Silk Road” through cyberspace.

To the extent that this is all about building infrastructure, the idea is welcome. Trillions of dollars' worth of roads, railways, ports and power stations are needed in countries across Asia, Africa and Europe. China's money and expertise could be a big help in spreading wealth and prosperity.

China says anyone can join in. Countries such as Azerbaijan and Georgia, which stand to benefit immensely from better connections to the world, are wildly enthusiastic. One of China's motives is to strengthen security on its western flank by helping Central Asian countries prosper—thereby, it hopes, preventing them from becoming hotbeds of Islamist terrorism. Everyone would benefit from that, too.

But there are worries. The BRI is bound up with the growing cult around Mr Xi. State media call it “the path of Xi Jinping”. It has become shorthand for China's overseas aid, state-led investment abroad and for Mr Xi's much-ballyhooed “great-power diplomacy with Chinese characteristics”. China urges other countries to praise the BRI, so that their words can be relayed back home as propaganda. Few Chinese dare offer open criticism; that makes mistakes more likely.

The citizens of countries hosting BRI projects may come to regret their governments' enthusiasm. Like all Chinese cash, the BRI billions come without pesky questions about human rights or corruption. Indeed, the terms are often shrouded in secrecy, raising fears that local politicians may benefit more than their people. Projects tend to require the use of lots of Chinese labour. BRI countries risk piling up dangerous amounts of debt, which some fear is designed to give China a strategic hold over them. Pakistan, one of the most important BRI countries, has just held an election in which candidates vied to take credit for Chinese investment; yet the debts are so large that, before long, Pakistan is likely to need an IMF bail-out.

Then there are possible security risks. In his metaphorical flights, Mr Xi

sometimes speaks of his belt and road as a single thoroughfare, a “road of peace”. But what if the Chinese navy were to take advantage of ports such as Hambantota? This was repossessed by a Chinese state-owned firm after the Sri Lankan government struggled to repay the debts it had amassed to build it. Military planners worry that China could develop a string of such berths that its ships could use to extend their reach far beyond China’s shores.

Analysts in Asia and the West believe that China wants to displace America as the Asian hegemon. The BRI could end up furthering that plan, even if it is not its focus. China’s crude maps show the belt and road running through disputed territory, including the bitterly contested waters of the South China Sea where China has been busy building fortresses on reefs.

Some Asian countries, including India and Vietnam, are wary and most Western countries share their unease. Last year America’s defence secretary, James Mattis, said that: “No one nation should put itself into a position of dictating [BRI]”. In January France’s president, Emmanuel Macron, warned that the BRI “cannot be the roads of a new hegemony that will make the countries they traverse into vassal states.” He added: “The ancient silk roads were never purely Chinese...These roads are to be shared and they cannot be one-way.”

What should the world do about the BRI? For a start, it needs to keep some perspective. Even if China does hope to use it as a political tool to beat back Western influence, Beijing is bound to face difficulties, as projects go awry, debts go bad and people grow hostile to China’s presence. History suggests that simply doling out money will not, on its own, usher in a *Pax Sinica*.

The world can also use its influence to make the BRI more beneficial. Even China’s billions cannot finance everything on offer. Money coming from the West, from the European Union and from institutions such as the World Bank and the IMF should be lent according to international

standards—including on such things as transparency, environmental safeguards, public procurement and debt sustainability. So long as they are good projects, let China include them in the BRI if it wants to.

Last is security. The way to assuage fears about the BRI's threat to the balance of power is not by trying to frustrate China's efforts, let alone by starting a trade war or by pulling America's armed forces out of Asia, as President Donald Trump sometimes seems to contemplate. On the contrary, the balance of risks and benefits of the BRI is related to America's commitment to Asia. If the United States is engaged, the world can mitigate the dangers of BRI and reap its rewards. If not, the risks will outweigh the benefits. The BRI is yet one more argument for America to stay in Asia. ■



“一带一路”倡议

行星中国

中国的“世纪工程”赢得了赞美也引发了不安。两种反应都有很好的理由

中国领导人习近平丝毫不故作谦虚，称自己的构想为“世纪工程”。中国国内阿谀奉承的媒体盛赞它是“中国智慧”赠与世界发展的礼物。“一带一路”用了一个蹩脚的比喻来命名，而有关其真正含义的争议持续发酵。

这个名字本身就有些混乱。“路”指的主要是一条海路，而“带”是指陆路。那些渴望获得中国投资的国家欢迎这项倡议，视其为从中国经中东和非洲到欧洲沿线基础设施投资的来源。而那些戒备中国的人却认为它用心险恶，意在创造由中国统领的世界新秩序。

造成困惑的一个原因是“一带一路”根本不是一个单一的计划。要在它的官网上找到对其目标的详细解释只会一无所获。网站上没有中国领导人喜欢的那种蓝图：某年某月之前投资多少亿美元、铺设多少公里铁路，或者新增多少港口吞吐量。

在中国展示的地图上，“一带一路”追溯了穿越欧亚大陆和中国与非洲之间海域的古代“丝绸之路”的路线。这是一开始费心构思的比喻。但现在，中国说起“一带一路”来就好像它是一个全球工程。有关它的宣传辞令已扩展到包含“太平洋丝绸之路”、穿越北冰洋的“冰上丝绸之路”和贯穿网络空间的“数字丝绸之路”。

如果说这一工程只限于建设基础设施，那么它会受到欢迎。亚洲、非洲和欧洲各国需要数万亿美元的投资来修建公路、铁路、港口和发电站。中国的资金和专长能在传播财富和繁荣方面起到很大的作用。

中国表示各国都可以加入。阿塞拜疆和格鲁吉亚等国热情高涨：如果能与世界建立起更完善的联系，它们势必受益匪浅。中国提出“一带一路”倡议的动机之一是帮助中亚国家实现繁荣，希望以此防止这些国家成为伊斯兰

恐怖主义的温床，从而加强中国领土西翼的安全。这一点也能让各方受益。

但也存在担忧。“一带一路”与对习近平不断升温的个人崇拜密切相关。官方媒体称之为“习近平之道”。它已成为中国海外援助、国家主导的海外投资以及习近平大力宣传的“中国特色大国外交”的代名词。中国竭力鼓动其他国家颂扬“一带一路”倡议，好将它们的言论传达回国内以作宣传。中国国内鲜有人敢公开批评这一倡议，而这就使得错误更容易发生。

开展“一带一路”项目的国家的人民日后可能会因本国政府的热情而遗憾。与所有中国投资一样，“一带一路”动辄数十亿美元的投资和贷款并不过问棘手的人权或腐败问题。事实上，这些资金的条款往往秘而不宣，让人担忧受益更多的可能是各国的政客而非人民。相关项目往往需要使用大量中国劳工。“一带一路”沿线国家面临着堆积过高债务的风险，有人担心这些债务旨在让中国对这些国家形成战略控制。最重要的沿线国家之一巴基斯坦刚刚举行了选举，候选人争相为引入中国投资邀功，然而借债规模如此之大，该国可能用不了多久就需要国际货币基金组织为其纾困。

此外还有潜在的安全风险。在习近平天马行空的诸多修辞中，他有时会把他的“一带一路”比作一条大道——“和平之路”。但如果中国海军借机利用汉班托塔（Hambantota）这样的港口呢？斯里兰卡政府为修建该港口累积了巨额债务，而后无力偿还，将其控制权移交给了一家中国国企。军事规划人员担心中国会开发一系列这样的停靠港，让其舰船的活动范围能远远超出中国领海。

亚洲和西方的分析人士认为，中国希望取代美国成为亚洲霸主。“一带一路”最终可能会推进该计划，即使这不是这一倡议的重点。中国粗略的地图上显示，“一带一路”途经有争议的领土，包括引发激烈争议的南中国海水域。中国一直在该海域的岛礁上积极修建防御工事。

包括印度和越南在内的一些亚洲国家对“一带一路”持谨慎态度，大多数西方国家也感到不安。去年美国国防部长詹姆斯·马蒂斯（James Mattis）表

示：“任何一个国家都不应把自己放到强制决定（‘一带一路’）的位置上。”今年1月，法国总统马克龙警告说，“一带一路”“不能变成令沿线国家沦为附庸国的新霸权之路。”他又补充说：“古老的丝绸之路从来都不只是中国的……这些通道应该共享，而不能是单行道。”

全世界应该怎样对待“一带一路”呢？首先，它需要放宽视野。即使中国确实希望将它用作政治手段来抗击西方影响力，然而随着项目出现问题、债务状况恶化、人们对中国的力量产生敌意，中国政府必将面临困境。历史表明，仅凭撒钱并不能带来“中华治世”。

世界也可以利用自身影响力让“一带一路”产生更多益处。就算是中国的大笔资金也不能够满足所有的待建项目。西方、欧盟以及世行和国际货币基金组织等机构应根据国际标准提供贷款，这些标准包括透明度、环境保障措施、公共采购和债务可持续性等。只要是好项目，如果中国愿意，那就随它纳入“一带一路”中。

最后是安全问题。要缓和对“一带一路”威胁权力平衡的担忧，方法不是试着去挫败中国的努力，更不是发动贸易战，或者像特朗普总统有时似乎在盘算的那样让美军撤出亚洲。相反，“一带一路”的风险和收益各有几何要看美国对亚洲的投入。如果美国参与其中，世界就可以减轻“一带一路”的危险并从中收获回报。否则，风险将大过收益。“一带一路”是美国应该留在亚洲的又一论据。 ■



Economic and financial indicators

Official development assistance

Official development assistance to “fragile” countries increased by 26% between 2009 and 2016

Official development assistance (ODA) to “fragile” countries increased by 26% between 2009 and 2016. The OECD, a think-tank, defines fragile states as those that fail to provide basic services to their poor. Most of the growth in ODA to these countries is accounted for by humanitarian assistance, which increased by 144% in 2009-16, reaching a record \$18.3bn. Aid tends to be concentrated in a small number of countries. Between 2003 and 2012 Afghanistan and Iraq together accounted for 22% of all ODA to countries then defined as fragile. Syria was the largest recipient of aid in absolute terms in 2016; the Palestinian Territories received the most per person. ■



经济与金融指标

官方发展援助

自2009年到2016年，面向“脆弱”国家的官方发展援助增长了26%

自2009年到2016年，面向“脆弱”国家的官方发展援助（以下简称ODA）增长了26%。按智库经合组织的定义，脆弱国家是指那些无法向本国贫困人口提供基本服务的国家。ODA的增长主要源自人道援助，这类援助同期增长了144%，达到创纪录的183亿美元。援助往往集中在少数国家上。2003年到2012年间，在提供给当时被界定为脆弱国家的ODA中，阿富汗和伊朗获得了其中的22%。从绝对值来看，2016年当年最大的援助接收国是叙利亚。人均获援助金额最高的是巴勒斯坦领土。 ■



Climate change

The long hot summer

Greece is burning, Japan is in a state of emergency. Heat is causing problems across the world and, worryingly, such weather events may become more common

SODANKYLA, a town in Finnish Lapland just north of the Arctic Circle, boasts an average annual temperature a little below freezing. Residents eagerly await the brief spell in July when the region enjoys something akin to summer. This year they may have wished for a bit less of it. On July 18th thermometers showed 32.1°C (89.8°F), which is 12°C warmer than typical for the month and the highest since records began in 1908. But Sodankyla is not the only place that is sizzling.

Wildfires have killed at least 80 people near Athens. Sweden has suffered a rash of forest fires, sparked by unusually hot and dry weather. Britain and the Netherlands look more parched than they did in 1976, one of the driest summers on record. Some 80,000 hectares of forest are burning in Siberia. Japan has declared its heatwave to be a natural disaster. On the night of July 7th, the temperature in downtown Los Angeles did not drop below 26.1°C. That seems positively nippy compared with Quriyat in Oman, which recorded a 24-hour minimum temperature of 42.6°C a few days earlier.

Heatwaves bring problems, especially in the developing world. Crops are ravaged, food spoils and workers become less productive. Studies have linked rising temperatures to violent crime and civil strife. And heat can kill on its own. In 2003 more than 70,000 Europeans may have died as a direct result of an infernal summer.

That was seen as a once-a-millennium heatwave at the time. By comparison, notes Geert Jan van Oldenborgh of the Royal Netherlands Meteorological Institute, outside of northern Europe the summer of 2018 looks

unremarkable, so far, in terms of temperature. The Netherlands, for instance, can expect scorchers every couple of years. Except, he adds, a century ago that might have been once every 20 years. A few years back, a team led by Peter Stott of Britain's Met Office calculated that, by 2012, summers like the one in 2003 would be expected to occur not every 1,000 years but every 127.

No consequence of global warming is as self-evident as higher temperatures. Earth is roughly 1°C hotter today than it was before humanity started belching greenhouse gases into the atmosphere during the Industrial Revolution. If this so-called thermodynamic effect were all there was to it, temperatures now considered unusually hot would become more typical and those regarded as uncommonly cold, uncommoner still. But climate being a complicated thing, there is more to it.

Weather patterns can change because the colder poles warm faster than balmier lower latitudes. As the thermal difference between the two diminishes, so does the velocity of the jet stream, a westerly wind which blows at an altitude of around 10km. That means the weather it carries can stay in place for longer. Sometimes, it offsets the thermodynamic effects, leading to cooler temperatures than might be expected. Often, it amplifies them.

When and by how much is a matter of hot debate among climate scientists. It is hard to pin any particular heatwave, drought or flood on the effects of man-made pollution. Freak events happen; the highest temperature ever recorded on Earth was 56.7°C in Death Valley, California, but that was on July 10th 1913, when concentrations of carbon dioxide in the atmosphere were much lower.

By using clever statistics to compare the climate's actual behaviour with computer simulations of how it might have behaved in the absence of

human activity, researchers can calculate how mankind has made a particular weather event more likely. The first such study, co-authored by Dr Stott in 2004, found that the likelihood of the 2003 European summer had doubled as a result of human activity. Since then similar “event attribution” research has burgeoned. A year ago Carbon Brief, a web portal, identified a total of 138 peer-reviewed papers in the field, covering 144 weather events. Of 48 heatwaves, 41 contained humankind’s imprint in the data.

More studies have appeared since then. World Weather Attribution, a website run by Dr van Oldenborgh and Friederike Otto of Oxford University, posts a new one practically every month. Besides scrutinising past weather, many of the studies look ahead—in particular at how the likelihood of future extreme events changes depending on how seriously countries take their commitment in Paris in 2015 to limit global warming to “well below” 2°C relative to pre-industrial levels (and better yet, to no more than 1.5°C).

The picture that emerges is bleak. One study, published in June by Andrew King of the University of Melbourne and his colleagues, found that the number of Europeans who can expect to witness a temperature above the current record, wherever they happen to live, would double from 45m today to 90m if the planet warmed by another 0.5°C or so on top of the 1°C since the 1880s. If, instead of 0.5°C, it warmed by 1°C, the figure would rise to 163m.

This looks even more alarming if you factor in humidity. Human beings can tolerate heat with sweat, which evaporates and cools the skin. That is why a dry 50°C can feel less stifling than a muggy 30°C. If the wet-bulb temperature (equivalent to that recorded by a thermometer wrapped in a moist towel) exceeds 35°C, even a fit, healthy youngster lounging naked in the shade next to a fan could die in six hours.

At present, wet-bulb temperatures seldom exceed 31°C. In 2016 Jeremy Pal of Loyola Marymount University and Elfatih Eltahir of the Massachusetts Institute for Technology found that if carbon emissions continue unabated, several cities in the Persian Gulf, including Abu Dhabi and Dubai, could exceed wet-bulb levels of 35°C by the end of the century. A follow-up study reckoned that, by 2100, parts of South Asia, which is much more populous than the sheikhdoms and a lot poorer, could suffer a wet-bulb level of 34.2°C every 25 years.

The effects could be devastating. The World Bank has warned that rising temperatures and changing monsoons could cost India 2.8% of GDP per person by 2050 and affect the living standards of 600m Indians in areas identified as hot spots. The global cost of productivity lost to heat has been estimated at \$2trn by 2030.

The toll on human lives is hard to imagine. But at least people can learn from past mistakes. Thanks to better government responses, particularly in care for the elderly, in 2012 Europe survived a summer hotter still than 2003 with fewer casualties. As Indians get richer more will be able to afford air-conditioning; even those in shantytowns can paint their corrugated-iron roofs white to reflect sunlight. If only the world could take in a similar lesson about the importance of stopping climate change in the first place. ■



气候变化

漫长的炎夏

希腊山火肆虐，日本进入紧急状态。高温席卷全球，引发各种问题。令人担忧的是，这样的天气事件也许会变得更常见。

芬兰的拉普兰有个叫索丹居拉（Sodankyla）的小镇，位于北极圈往北一点点，年平均温度略低于冰点。每年7月，当地居民热切期盼一段近似夏天的短暂时光如约而至。然而今年他们可能会希望这段时光更短一些。7月18日该地气温达到 32.1°C ，比7月里通常出现的温度高 12°C ，也是自1908年有记录以来的最高温度。但索丹居拉并不是唯一遭遇炎夏的地方。

雅典周边至少已有80人因野火丧生。在瑞典，罕见的高温干燥天气引发多起森林火灾。英国和荷兰在1976年经历了有记录以来最干燥的夏季之一，眼下两国似乎比那时还要干热。在西伯利亚，约八万公顷的森林被烈火吞噬。日本已宣布将今年这种高温天气归为自然灾害。7月7日晚间，洛杉矶市区内的最低温度保持在 26.1°C 。这跟阿曼的古利亚（Quriyat）相比简直算得上凉飕飕——此前几天，古利亚的24小时最低气温达到了创纪录的 42.6°C 。

高温引发了种种问题，特别是在发展中国家。农作物受损，食物腐坏，劳动效率降低。有研究显示，气温升高与暴力犯罪和内乱之间存在关联。而高温本身就能夺人性命。2003年，酷暑也许直接导致了超过七万名欧洲人死亡。

那次席卷欧洲的热浪在当时被认为是千年一遇。相比之下，荷兰皇家气象研究所的吉尔特·扬·范奥尔登伯格（Geert Jan van Oldenborgh）指出，今年夏天至目前来看，除北欧以外气温似乎并无不寻常之处。例如，荷兰可能每隔两三年会经历一次夏季高温。只不过，他补充道，一个世纪以前这个间隔期大概是20年。几年前，英国气象局的彼得·斯托特（Peter Stott）带领的一个团队估算，到2012年，像2003年那样的夏天预计不再是千年一遇，而是每127年就要遇一次。

全球变暖最不言而喻的后果就是气温升高。工业革命期间人们开始向大气中排放大量温室气体，到今天地球的温度大约上升了 1°C 。如果这种所谓的热力效应的表现仅此而已，那么如今被认为异常炎热的气温将会变得更常见，而被认为冷得不同寻常的天气会更少见。但气候是一个很复杂的事物，它的表现形式没那么简单。

天气模式可能会发生变化，原因是更寒冷的两极升温的速度要快过气候更宜人的纬度较低地区。随着两者温差缩小，喷射气流（大约一万米高空气中的西风）的速度也会降低。这样一来，它带来的天气就会在沿途各地停留更久。有时这会抵消热力效应，导致气温比预期的要低，但通常还是会放大这种效应。

至于会在何时以及在多大程度上放大这种效应，气候学家展开了激烈的争论。很难将哪次高温、干旱或洪水归咎于人为污染的影响。反常的天气事件时有发生：地球自有记录以来的最高气温是 56.7°C ，出现在加州的“死亡谷”。但那天是1913年7月10日，当时大气中的二氧化碳浓度比现在低得多。

研究人员用电脑模拟没有人类活动的情况下气候的表现形式，并运用巧妙的统计方法将之与气候的实际表现形式作对比，从而估算出人类让某个天气事件发生的可能性增加了几何。2004年，斯托特等人开展了首个这类研究，发现2003年欧洲炎夏发生的可能性因人类活动增加了一倍。自那之后，类似的“事件归因”研究快速增长。一年前，门户网站“碳简报”（Carbon Brief）统计出该领域共有138篇同行评议论文，涵盖144个天气事件。48个高温事件中，有41个在数据中体现出了人类的影响。

自那以后又涌现出了更多的研究。范奥尔登伯格和牛津大学的弗雷德里克·奥托（Friederike Otto）运营的网站“世界天气归因”（World Weather Attribution）几乎每个月都会上传一项新研究。除了细查过去的天气外，很多研究还放眼未来——特别是要探究未来极端天气事件发生的可能性在多大程度上取决于各国贯彻2015年《巴黎协定》的力度。根据该协定，全球平均气温的升高幅度较之工业化前的水平要“远低于” 2°C （最好是不超

出 1.5°C ）。

眼下来看局势不容乐观。墨尔本大学的安德鲁·金（Andrew King）及其同事在6月发表的一项研究发现，如果地球温度继19世纪80年代以来上升 1°C 之后再上升 0.5°C ，那么在欧洲，有可能亲历气温超过当前记录的人（不管他们身居何处）的数目将翻番，从如今的4500万人上升至9000万人。如果升温幅度不是 0.5°C 而是 1°C ，这个数字会升至1.63亿。

如果再把湿度考虑进去，情况就更堪忧了。人类可以通过排汗忍耐高温，因为汗水蒸发后会降低皮肤温度。这就是为什么 50°C 的干热天气可能不像 30°C 的湿热天气那么让人感觉透不过气。如果湿球温度（相当于温度计裹上湿毛巾后测出的温度）超过了 35°C ，即使一个身强体壮的年轻人光着身子懒洋洋地躺在阴凉处，还吹着电扇，也可能在六小时内死亡。

目前湿球温度很少超过 31°C 。2016年，洛约拉马利蒙特大学（Loyola Marymount University）的杰里米·帕尔（Jeremy Pal）和麻省理工学院的埃尔法蒂赫·埃尔塔希尔（Elfatih Eltahir）发现，如果碳排放量持续不减，到本世纪末，包括阿布扎比和迪拜在内的几个波斯湾周边城市的湿球温度可能会超过 35°C 。一项后续研究估计，到2100年，南亚部分地区（比那些酋长国人口稠密得多，也贫穷得多）每隔25年就会遭遇一次 34.2°C 的湿球温度。

这可能会带来毁灭性的影响。世界银行已警告称，到2050年，气温上升和季风生变可能会令印度损失2.8%的人均GDP，并影响该国被划定为火灾易发区内的六亿人的生活水平。据估算，到2030年，全球因高温造成生产率下降而遭受的损失将达到两万亿美元。

对性命的影响难以想象，但人们至少可以从过去的错误中汲取教训。由于政府改善了应对措施，尤其是加强了对老年人的照护，2012年欧洲挺过了比2003年还要炙热的一个夏天，伤亡人数也比那年更少。随着印度人富裕起来，会有更多人买得起空调，就算是住在棚户区的人也可以把瓦楞铁皮的屋顶刷成白色来反射阳光。如果在遏制气候变化这个源头问题上世界也

能同样地汲取教训就好了。 ■



Global warming

In the line of fire

The world is losing the war against climate change

EARTH is smouldering. From Seattle to Siberia this summer, flames have consumed swathes of the northern hemisphere. One of 18 wildfires sweeping through California, among the worst in the state's history, is generating such heat that it created its own weather. Fires that raged through a coastal area near Athens in late July killed 91 (see Science section). Elsewhere people are suffocating in the heat. Roughly 125 have died in Japan as the result of a heatwave that pushed temperatures in Tokyo above 40°C for the first time.

Such calamities, once considered freakish, are now commonplace. Scientists have long cautioned that, as the planet warms—it is roughly 1°C hotter today than before the industrial age's first furnaces were lit—weather patterns will go berserk. An early analysis has found that this sweltering European summer would have been less than half as likely were it not for human-induced global warming.

Yet as the impact of climate change becomes more evident, so too does the scale of the challenge ahead. Three years after countries vowed in Paris to keep warming “well below” 2°C relative to pre-industrial levels, greenhouse-gas emissions are up again. So are investments in oil and gas. In 2017, for the first time in four years, demand for coal rose. Subsidies for renewables, such as wind and solar power, are dwindling in many places and investment has stalled; climate-friendly nuclear power is expensive and unpopular. It is tempting to think these are temporary setbacks and that mankind, with its instinct for self-preservation, will muddle through to a victory over global warming. In fact, it is losing the war.

Insufficient progress is not to say no progress at all. As solar panels, wind turbines and other low-carbon technologies become cheaper and more efficient, their use has surged. Last year the number of electric cars sold around the world passed 1m. In some sunny and blustery places renewable power now costs less than coal.

Public concern is picking up. A poll last year of 38 countries found that 61% of people see climate change as a big threat; only the terrorists of Islamic State inspired more fear. In the West campaigning investors talk of divesting from companies that make their living from coal and oil. Despite President Donald Trump's decision to yank America out of the Paris deal, many American cities and states have reaffirmed their commitment to it. Even some of the sceptic-in-chief's fellow Republicans appear less averse to tackling the problem (see United States section). In smog-shrouded China and India, citizens choking on fumes are prompting governments to rethink plans to rely heavily on coal to electrify their countries.

Optimists say that decarbonisation is within reach. Yet, even allowing for the familiar complexities of agreeing on and enforcing global targets, it is proving extraordinarily difficult.

One reason is soaring energy demand, especially in developing Asia. In 2006-16, as Asia's emerging economies forged ahead, their energy consumption rose by 40%. The use of coal, easily the dirtiest fossil fuel, grew at an annual rate of 3.1%. Use of cleaner natural gas grew by 5.2% and of oil by 2.9%. Fossil fuels are easier to hook up to today's grids than renewables that depend on the sun shining and the wind blowing. Even as green fund managers threaten to pull back from oil companies, state-owned behemoths in the Middle East and Russia see Asian demand as a compelling reason to invest.

The second reason is economic and political inertia. The more fossil fuels a

country consumes, the harder it is to wean itself off them. Powerful lobbies, and the voters who back them, entrench coal in the energy mix. Reshaping existing ways of doing things can take years. In 2017 Britain enjoyed its first coal-free day since igniting the Industrial Revolution in the 1800s. Coal generates not merely 80% of India's electricity, but also underpins the economies of some of its poorest states (see Briefing). Panjandrums in Delhi are not keen to countenance the end of coal, lest that cripple the banking system, which lent it too much money, and the railways, which depend on it.

Last is the technical challenge of stripping carbon out of industries beyond power generation. Steel, cement, farming, transport and other forms of economic activity account for over half of global carbon emissions. They are technically harder to clean up than power generation and are protected by vested industrial interests. Successes can turn out to be illusory. Because China's 1m-plus electric cars draw their oomph from an electricity grid that draws two-thirds of its power from coal, they produce more carbon dioxide than some fuel-efficient petrol-driven models. Meanwhile, scrubbing CO₂ from the atmosphere, which climate models imply is needed on a vast scale to meet the Paris target, attracts even less attention.

The world is not short of ideas to realise the Paris goal. Around 70 countries or regions, responsible for one-fifth of all emissions, now price carbon. Technologists beaver away on sturdier grids, zero-carbon steel, even carbon-negative cement, whose production absorbs more CO₂ than it releases. All these efforts and more—including research into “solar geoengineering” to reflect sunlight back into space—should be redoubled.

Yet none of these fixes will come to much unless climate listlessness is tackled head on. Western countries grew wealthy on a carbon-heavy diet of industrial development. They must honour their commitment in the Paris agreement to help poorer places both adapt to a warmer Earth and also abate

future emissions without sacrificing the growth needed to leave poverty behind.

Averting climate change will come at a short-term financial cost—although the shift from carbon may eventually enrich the economy, as the move to carbon-burning cars, lorries and electricity did in the 20th century. Politicians have an essential role to play in making the case for reform and in ensuring that the most vulnerable do not bear the brunt of the change. Perhaps global warming will help them fire up the collective will. Sadly, the world looks poised to get a lot hotter first. ■



全球变暖

火线狙击

世界正在输掉对抗气候变化之战

地球在闷烧。今年夏天，从西雅图到西伯利亚，北半球的大片土地被火焰吞噬。18场山火席卷加州，其中一场堪称当地历史上最严重的山火之一，释放的热量甚至形成了局部天气系统。7月底，在雅典附近的沿海地区肆虐的火灾造成91人死亡。在其他地方，人们正因酷热天气而备受煎熬。日本遭受热浪袭击，东京的气温史无前例地升至40°C以上，全国已有约125人丧生。

这类以往被视为反常的灾害事件如今已屡见不鲜。科学家早就警告说，随着地球变暖（相比工业时代第一批熔炉点火以前，全球气温已上升了约1°C），天气模式将变得更狂暴。早前一项分析发现，若非人为因素导致全球变暖，今年欧洲闷热的夏季本来多半不会出现。

然而，随着气候变化的冲击变得愈加明显，未来挑战之大也更清晰可见。三年前，各国在巴黎立誓要将全球平均气温相对工业化前水平的升幅控制在“远低于”2°C，如今温室气体排放量却再次上升。对石油和天然气的投资也在增加。2017年，煤炭需求四年来首次出现增长。许多地方逐渐减少了对风能和太阳能等可再生能源的补贴，这方面的投资也陷入停滞；有利于气候的核电造价昂贵又不受欢迎。人们往往会觉得这些只是一时的挫折，人类凭借自己维持生存的本能，总归可以应付过去，战胜全球变暖。但事实上，人类正在输掉这场战役。

我们说进展不足，并不是说毫无进展。随着太阳能电池板、风力发电机及其他低碳技术变得更便宜高效，其应用已经激增。去年全球售出超过100万辆电动汽车。在一些阳光或风力充沛的地方，可再生能源发电的成本已低于煤炭。

公众的关注度也在提升。去年在38个国家开展的一项民意调查发现，61%

的人认为气候变化是仅次于“伊斯兰国”恐怖分子的重大威胁。在西方，维权投资者称有意从煤炭及石油公司撤资。尽管特朗普决定让美国退出《巴黎协定》，但许多美国城市和州都重申将继续坚守该协定。甚至特朗普这位“气候变化怀疑论总司令”的一些共和党同僚似乎也不怎么反对处理气候议题。在雾霾笼罩的中国和印度，呼吸困难的市民正促请政府反思国内重度依赖煤炭发电的规划。

乐观主义者说脱碳已经指日可待。然而，即便要达成并实施全球性目标通常都很复杂，脱碳这件事仍显现出非比寻常的难度。

其中一个原因是能源需求飙升，特别是在亚洲发展中国家。2006年至2016年，亚洲新兴经济体蓬勃发展，能源消耗随之增长40%。煤炭（无疑是污染最严重的化石燃料）的使用量以每年3.1%的速度上升。较清洁的天然气的使用量增速为5.2%，石油为2.9%。相比依赖阳光和风的可再生能源，化石燃料更容易接入现有电网。尽管绿色基金经理威胁从石油公司撤资，但亚洲的能源需求也足以促使中东和俄罗斯的国有能源巨头继续投资。

第二个原因是经济和政治惯性。一个国家消费的化石燃料越多，就越难摆脱对它的依赖。强大的游说团体及支持他们的选民巩固了煤炭在能源结构中的地位。要重塑现有行事方式可能要耗时多年。自19世纪工业革命之火点燃以来，英国到2017年才迎来首个无煤日。在印度，煤炭不仅是80%电力的来源，还是一些最贫穷的邦的经济支柱。德里的官老爷们并不希望看到煤炭走向终结，唯恐会拖垮银行系统和铁路行业——银行向煤炭业提供了大量贷款，而铁路业则依赖煤炭。

最后，要在电力以外的其他行业实现脱碳存在技术上的挑战。钢铁、水泥、农耕、运输和其他经济活动占全球碳排放量的一半以上。从技术上说，这些活动要实现脱碳比实现清洁发电的难度更大，而且受既得工业利益集团的保护。成功可能只是臆想。中国100多万辆电动汽车的电力来自电网，而电网中三分之二的电力来自煤炭，因此这些电动汽车造成的二氧化碳排放实际上比一些高能效的燃油汽车还要多。另外，气候研究模型显示，需要大规模清除大气中的二氧化碳才能达成《巴黎协定》的目标，但

人们对这方面的关注度就更低了。

为实现《巴黎协定》的目标，世界并不缺乏创意。碳排放占总量五分之一的约70个国家或地区推行了碳定价。技术人员竭力打造更强固的电网、零碳钢材，甚至负碳水泥（生产过程中吸收的二氧化碳比释放的要多）。这些及其他尝试（包括将阳光反射回太空的“太阳地球工程”研究）应加倍发展。

然而，如果不能从正面纠正人们面对气候问题的怠惰态度，这些补救措施将难以发挥很大的作用。西方国家通过高碳排放的工业发展富裕起来。它们必须履行在《巴黎协定》中的承诺，既要帮助贫困地区应对地球变暖，又要帮助它们减少未来的碳排放，同时又不会牺牲摆脱贫困所需的发展。

遏止气候变化将需要付出短期的经济代价，虽然脱碳最终可能会造福经济，就像20世纪人们转用高碳的汽车、卡车和电力那样。在提倡改革并确保最弱势群体不会承受改革最大的冲击方面，政客们发挥着至关重要的作用。也许全球变暖将帮助他们点燃人们的共同意愿。遗憾的是，整个世界似乎免不了要先变得酷热许多。 ■



Buttonwood

A trunkful of bolívares

How Venezuelans preserve their savings from hyperinflation—and the lessons for everyone else

ASK the chief investment officer of a fund-management firm how to spread your investments and you will be told to put so much in stocks, so much in bonds and something in hedge funds or private equity. Chances are that white-elephant buildings, eggs and long-life milk will not feature. But in Venezuela, where the inflation rate is in the tens of thousands, things that people elsewhere would shun for fear they will lose value have become stores of real wealth.

That is why you can see scaffolding and other signs of a building boom dotted around Caracas, the capital of a country that has endured an economic collapse. Businesses need to park their earnings where they will not be wiped out by inflation. A smaller-scale response to galloping prices is the emerging “egg economy”. Eggs hold their value better than cash, for a while at least. They make for a convenient currency, too. It is easier to carry around a half-dozen eggs than a trunkful of banknotes. And many tradespeople would be happier to receive the eggs.

There are plenty of lessons from Venezuela’s calamity, including for ordinary savers. An often-overlooked one concerns personal finances. In stable countries, the penalty for a careless approach to saving can hit you a long way in the future. It might be the drawn-out misery of a meagre income in retirement, say. In Venezuela bad decisions lead to ruin—and rather quickly. Keeping your head above water takes great care. A sure way to go under is to keep money in bolívares for any longer than it takes to buy essentials.

Episodes of hyperinflation are quite rare. Steve Hanke of Johns Hopkins University lists 57 cases, starting with France in the 1790s. It takes something extraordinary—war, revolution or epic incompetence—to mess things up on such a scale. The root cause is usually a chronic weakness in public finances. This might be because of looting by officials, lavish welfare spending or reliance on a single source of tax revenue. The government resorts to printing money to pay its bills. That feeds inflation. A vicious cycle ensures that it rises quickly. Because taxes are paid some time after the activity they relate to, rapid inflation erodes the value of tax receipts. More money is created to fill the gap in revenue. Inflation accelerates. The cycle turns.

Venezuela fits this template, more or less. Its people were not completely unprepared. High inflation in the 1980s and 1990s taught the middle classes to keep a chunk of their savings offshore in dollar accounts. The financially astute switch between accounts in Miami and Caracas. But capital controls make it tricky to transfer large sums. Other inflation hedges are needed.

One is property. When protests against Nicolás Maduro, the autocratic president, were at their height last year, some foreigners hoped to snap up homes at fire-sale prices. But there were no bargains. Property was too valuable as an inflation hedge. For a while, a car was as much a savings vehicle as a way to get from A to B. It was once possible to sell one for more than the purchase price in dollars. But cars have become less of a sellers' market as people leave Venezuela and sell their belongings. Property prices, too, have stabilised in dollar terms. A shrewd minority are using the stockmarket as a sort of inflation-linked bank, buying shares to deposit cash and selling them to withdraw it. A favoured stock is Banco Mercantil, which has businesses outside Venezuela.

It is impossible to guard against extreme inflation with precision. For many it is hard to guard against it at all. The poor have few ways to do so. In this

regard, what happens in Venezuela tallies with what happens elsewhere. A newish strain in academic finance examines how ordinary people manage their money. A survey of the literature* by Cristian Badarinza, John Campbell and Tarun Ramadorai sums up what has been learned so far. A key finding is that the wealthy and educated make fewer mistakes with their money. They invest in a broader range of assets, pay lower fees and are quicker to refinance their debts when interest rates change. The penalty the poor pay for their comparative lack of financial acumen is real, if not always visible.

The costs are more obvious in Venezuela. It thus provides a vivid lesson in why ordinary folk should pay closer attention to how they manage their money. Even quite small changes can make a big difference to long-term returns. To Venezuelans such wisdom is essential, because when you are coping with hyperinflation, the long term is next week.

* “International Comparative Household Finance”, NBER Working Paper 22066, March 2016 ■



梧桐

一箱子玻利瓦尔

委内瑞拉人如何在恶性通货膨胀中保住积蓄——以及所有人都可汲取的教训

如果向基金管理公司的首席投资官咨询该如何分散投资，得到的回答通常是在股票、债券、对冲基金或私募股权基金上分别投入一定的比例。华而不实的建筑项目、鸡蛋和常温奶都不太可能被列为投资对象。然而在通货膨胀率已接近六位数的委内瑞拉，其他地方的人担心会贬值的物品却成了真实财富的存储工具。

因此，在这个经济业已崩溃的国家的首都加拉加斯（Caracas），脚手架等建筑业蓬勃发展的迹象随处可见。企业需要将收入暂存在不会被通货膨胀抹杀掉的地方。另一种规模较小的应对物价飞涨的方法是新兴的“鸡蛋经济”。鸡蛋比现金更能保值，至少在一段时间内是这样。鸡蛋还是一种方便的货币。带六个鸡蛋可比带一箱钞票容易多了。而且许多商贩也更乐意接受鸡蛋。

从委内瑞拉的灾难中可以得到诸多教训，包括对普通的储蓄者。一个经常被忽视的教训涉及个人财务。在稳定的国家，一个人储蓄不善的不良后果可能要在未来很久后才会显现，比如在退休后收入微薄，长期困顿。而在委内瑞拉，决策不当会带来灭顶之灾——而且是很快。要小心翼翼地谋划才能维持生计。如果你手里攥着玻利瓦尔而没有立刻去买必需品，一定会陷入困境。

恶性通胀颇罕见。约翰·霍普金斯大学的史蒂夫·汉克（Steve Hanke）从18世纪90年代的法国开始，共列举出了57个案例。要发生非同寻常的事件才会导致如此规模的乱局，比如战争、革命，或统治者极其无能。恶性通胀的根本原因通常都是公共财政长期疲软。这可能是因为官员大肆贪污、福利支出过度，或依赖单一税收来源造成的。政府依靠印钞票来支付账单，这引发了通胀。恶性循环会让通胀迅速上升。由于税金是在相关经济活动

发生一段时间后才缴纳的，因此快速通胀会侵蚀税收的价值。政府继而又印发更多钞票来填补收入缺口。这又让通胀加速，形成恶性循环。

委内瑞拉差不多就是这种情况。该国人民并非毫无防备。上世纪八九十年代的高通胀教会了中产阶级将大部分储蓄兑换成美元存在海外。精于财务的人在迈阿密和加拉加斯的账户之间转移资金。但资本管制让转移大笔资金的难度变大。人们需要其他抵御通胀的手段。

不动产是其中一种。去年，当反对专制总统尼古拉斯·马杜罗（Nicolás Maduro）的抗议活动达到顶峰时，一些外国人希望能以甩卖价抢购房屋。但根本没人甩卖。房产是一种太过宝贵的抵御通胀的工具。有一段时间，汽车不止是代步工具，还是储蓄工具。人们一度能以超过美元购入价的价格卖掉一辆车。但由于越来越多的人离开委内瑞拉并卖掉他们的资产，汽车不再是卖方市场。按美元计算的房地产价格也已稳定下来。少数精明的人把股市当作一种与通胀挂钩的银行，通过买卖股票来存取现金。一只备受青睐的股票是有海外业务的商业银行Banco Mercantil。

要准确充分地防范极端的通胀是不可能的。对许多人来说，这根本难以预防。穷人就没什么办法。在这方面，委内瑞拉的情况与其他地方是一样的。金融学术领域一个较新的方向是研究普通人如何理财。克里斯蒂安·巴达林萨（Cristian Badarinza）、约翰·坎贝尔（John Campbell）和塔伦·拉玛多莱（Tarun Ramadorai）所做的文献调查*总结了迄今为止的研究结果。一个关键的发现是富人和受教育程度高的人在理财方面错误较少。他们投资的资产更广泛，支付的费用更低，在利率发生变化时也能更快地对债务再融资。穷人因为较缺乏财务敏感而付出的代价不一定总是显而易见，但却是实实在在的。

这种代价在委内瑞拉更加明显。因此，它提供了一个生动的教训，让人们看到为何普通民众应当更密切地关注自己的理财方式。即使很小的变化也会对长期回报产生重大的影响。对委内瑞拉人来说这种智慧至关重要，因为当你要对付的是恶性通胀，长期就是下星期。

* 《国际家庭财务比较研究》（International Comparative Household Finance），全美经济研究所（NBER）22066号工作论文，2016年3月 ■



Inflation in Venezuela

You look a million bolívares

The money supply has expanded too much, and the cash supply too little

VENEZUELAN hawkers on the border with Colombia call it “money art”. The handbags, purses and hats they sell are made from nearly new Venezuelan banknotes and sold as mementos. Payment is in “real money”, meaning Colombian pesos. The handicrafts cost the equivalent of \$5 or so. The raw material—banknotes in denominations of two, five and even 100 bolívares—are still legal tender in Venezuela. But inflation is so high they are worth more folded up into origami objects than as cash. The free-market exchange rate is about 3.5m bolívares to a dollar.

The worthlessness of Venezuela’s currency is the result of inflation, 46,000% a year, which in turn is largely caused by the printing of money to finance the government’s deficit of 30% of GDP. But there is also a shortage of banknotes. In the looking-glass world of Venezuela’s economy, cash itself trades at a premium to its face value, making it slightly less worthless than bolívares in other forms.

Banknotes, like other necessities, are mostly imported. Four foreign firms—including Crane from the United States and De La Rue, a British firm—print the bulk of them. The central bank’s own printer, near the city of Maracay, produces less than 5% of cash. Two years ago the bank’s then-president, Nelson Merentes, predicted that Venezuela would become an exporter of banknotes, but that never happened. The printer can barely keep enough workers to fulfil its modest domestic order book, probably because they are paid in the same near-worthless currency they print.

Domestic or foreign, the printers are losing the race against inflation. In

December 2016 Venezuela's president, Nicolás Maduro, decreed that the 100-bolívar note, then the largest in circulation, would cease to be legal tender within three days. Venezuelans thronged the banks to get rid of the notes, but the promised larger denominations never showed up. The government had put in the order late and paid late. Queues formed again outside banks, this time to withdraw the notes that had been given a stay of execution.

Days later, official television broadcast live the arrival of new 500-bolívar notes on emergency flights, along with commentary suggesting this would save the economy. Alas, too few came and inflation had already eroded the value of each note to 20 cents. By mid-2017 banks restricted withdrawals to the equivalent of a dollar a day.

In November last year 100,000-bolívar notes finally arrived, but not enough to meet demand. So, even as their value plummets, traders sell bundles of assorted banknotes for up to three times their face value. Consumers still need them for bus fares and coffee, among other things. A similar thing occurred in Zimbabwe in 2007, which also suffered a cash crunch.

Much of Venezuela's economy now runs on debit cards and bank transfers. But tills with small screens cannot handle the billions of bolívares needed to buy, say, a television. Mr Maduro's latest wheeze is to replace the "strong bolívar" (introduced in 2008) with a "sovereign bolívar", worth a thousand times more. The new currency will fit more easily on screens, but will do little for the cash shortage and nothing for inflation. Again the government placed the order with the printers too late for the original launch date of June 4th. By the time sovereign bolívares appear, supposedly in August, they, too, will be nearly worthless. The biggest-value note in the new currency—500 sovereign bolívares—would be worth about 15 cents now.

Venezuelans' misery has at least boosted business at foreign printers, who

seem stunned by the windfall. "They just keep ordering more and more. Billions of notes. It never stops," said a source close to one of them. Sadly, they will soon be more useful for making purses than purchases. ■



委内瑞拉的通货膨胀

怎一个惨字了得

货币供给扩张无度，现金供应捉襟见肘

在本国与哥伦比亚接壤处做生意的委内瑞拉小贩管这叫“纸币艺术”。他们用几乎全新的委内瑞拉纸币制作手提袋、钱包和帽子，当作纪念品出售。买它们要用“真正的钱”，也就是哥伦比亚比索，价格相当于大概五美元。用作这些手工艺品原材料的2、5甚至100面额的玻利瓦尔在委内瑞拉仍旧是法定货币。但因通胀飙升，用它们折成的物件比它们作为现金本身更值钱。在自由市场上，一美元大约可兑换350万玻利瓦尔。

玻利瓦尔变得这么不值钱，原因是一年高达46,000%的通货膨胀率，而高通胀大体上又是因为该国为填补占GDP30%的财政赤字而大举印钞。但同时该国还存在纸币供应不足的问题。与钱不值钱的局面相对，委内瑞拉的经济还呈现出另一番景象：人们以高出纸币本身面值的价格买卖纸币，使得它们相比拿来折成物品的玻利瓦尔稍微值钱了一点。

和其他必需品一样，委内瑞拉的纸币大部分也靠进口。包括美国的Crane和英国的德纳罗（De La Rue）在内的四家印钞公司印制了其中的大头，而该国央行自己位于马拉凯（Maracay）附近的印钞厂只印制了不到5%。两年前，当时的央行行长纳尔逊·梅伦德斯（Nelson Merentes）预测委内瑞拉将成为纸币出口国，这并未成真。该国的印钞厂只能勉强留住足够的人手来完成数量不大的国内订单——也许是因为拿来支付他们薪酬的正是他们亲手印出来的、几乎一文不值的钞票。

不管是本国的印钞机还是外国的印钞机，都追不上该国通胀的脚步。2016年12月，委内瑞拉总统马杜罗签署政令，要求当时最大面值的100玻利瓦尔纸币在三天之内停止流通。银行里挤满了急于将该面值钞票脱手的民众，但政府承诺的更大面值的纸币始终没有出现。政府下印钞订单和付款都晚了一步。银行外又开始大排长龙：废钞令暂缓执行，这一次人们是来

提取100玻利瓦尔纸币的。

几天后，官方电视频道现场直播了运送面值500玻利瓦尔新版纸币的紧急航班抵达的画面，并解说称这将拯救该国经济。唉，可惜运来的纸币太少了，而且此时通胀已令每张新纸币的价值缩水到了20美分。到2017年年中，银行已将每日取款额限制在一美元以内。

去年11月，面值10万玻利瓦尔的纸币终于运达，但仍不足以满足需求。因此，即使纸币的价值暴跌，仍有小贩将不同面值的纸币捆束起来，以最多高出其面值三倍的价钱出售。毕竟消费者还是需要纸币来坐公交、买咖啡和其他东西。2007年同样遭遇了现金短缺危机的津巴布韦也发生过类似的情况。

如今委内瑞拉的经济很大程度要靠借记卡和银行转账来运作。但假如你要买一台电视机，收银机的小屏幕根本装不下几十亿玻利瓦尔那一长串数字。马杜罗最新的主意是用“主权玻利瓦尔”取代2008年发行的“强势玻利瓦尔”，前者比后者值钱1000倍。新货币能让商品价格在屏幕上更易完整显示，但对缓解现金短缺无甚帮助，在抗通胀方面更是毫无用处。政府本来计划在6月4日发行新钞，结果印钞订单又下晚了，未能赶上这一天。据推测，主权玻利瓦尔会在8月发行，但到那时就连它也会变得几乎一文不值。新货币中面值最大的500主权玻利瓦尔现在也就值15美分左右。

委内瑞拉的悲惨境地倒是增加了外国印钞公司的生意。如此横财似乎让它们目瞪口呆。“他们就是一直下单，越下越多。一下就是几十亿张纸币。一刻也没停过。”与当中一家印钞公司关系密切的知情人士说。可惜，过不了多久，这些钞票更大的用处就是做钱包而不是买东西。■



Bartleby

Degrees of separation

A welcome upgrade to apprenticeships

THE Advanced Manufacturing Research Centre (AMRC) in South Yorkshire, England, looks like the very model of a modern industrial site—bright, shiny, airy and clean. In June 1984 it was the site of a traumatic moment in British history—the Battle of Orgreave, when picketing miners clashed with police as they tried to stop lorries collecting supplies from a coking plant. The incident symbolised Britain's post-war record of industrial decline and bitter strikes.

The old coking plant is long gone. In its place is a promising attempt to create jobs for a new generation of workers, and to tackle an ancient and ridiculous British class divide. An important part of this divide is that universities have long been seen as a place for academic subjects, calling for essays and equations. People who got their hands dirty making stuff did not go to college. But as of last autumn apprentices at the AMRC have been able to study for degree courses. When they graduate they will have an engineering degree from Sheffield University in mechanical manufacture, maintenance engineering or manufacturing technology.

The centre is one element of an attempt by the British government to overhaul the apprenticeship system by mimicking German success. More than half of young Germans take an apprenticeship qualification. The youth-unemployment rate in Germany is much lower than in other European countries; its manufacturing prowess is widely envied.

The results of the British effort have been mixed so far. The number of Britons taking apprenticeships has dropped by 28% in the year since a

complex new levy on businesses was introduced. But turning apprenticeships into degrees has been a success: around 100 colleges and universities are now offering the option.

The idea of manufacturing research centres is copied from Germany's Fraunhofer institutes. As well as the AMRC in Sheffield, Britain has a range of high-value-added manufacturing centres, part-funded by the government, including sites at Coventry in the Midlands and Strathclyde in Scotland. American policymakers are also intrigued: they adopted the idea in 2012.

The Sheffield centre was established in 2001 with Boeing as the founding partner. Leading manufacturing firms such as Rolls-Royce and Airbus are also involved. The centre is not just a pipeline for young talent; it also acts as a problem-solving institute for member companies. One item on display in Sheffield is a Trent fan disc for a Rolls-Royce engine; the centre reduced the component's production time by 50%. The AMRC has over 100 member companies, with those in the top tier paying £300,000 (\$397,000) a year and getting a seat on the board.

Nikki Jones, who runs the apprentice programme, says that the centre works with employers to make sure the apprenticeships meet their needs. To take one example, employers said trainees needed to be taught both hydraulics and pneumatics. Over 300 firms send apprentices to be trained at the site, with 195 on a course at any given time. Around 1,000 have passed through the site; the first 14 degree apprentices will qualify in 2021.

The draw for the youngsters is clear, too. They go back to their employers regularly to hone their skills. When they finish the course, 98% of trainees stay in their jobs. Ms Jones works hard to find a diverse bunch of recruits. Teams visit local schools to tell the children about apprenticeships, and over 30% of trainees come from disadvantaged areas.

A focus on sophisticated apprenticeship programmes is a long-overdue change in Britain. The question is whether it is enough. Ms Jones says she would happily double the number of trainees at the site, but that would still be a drop in the bucket when half a million children leave school each year.

Perhaps more important than the numbers is the change in attitude that the degree apprenticeships represent. The British enthusiasm for “academic” subjects has always smacked of the Victorian era, when young gentlemen were expected to get a well-rounded education so they could keep up a conversation in polite society. To the extent that vocational education was promoted, it was in professions like law and medicine. Work in manufacturing was something for the lower classes.

In the long run, that attitude has produced too many graduates in subjects such as PPE (politics, philosophy and economics) and not enough engineers. That may help explain a lot, from Britain’s poor productivity record to the Brexit mess. Too much theory, not enough practice. ■



巴托比

改变阶层分隔

学位学徒制，一项可喜的升级

位于英国南约克郡的先进制造研究中心（AMRC）看上去绝对是现代工业园区的典范——明亮宽敞、光鲜洁净。1984年6月，这里却见证了英国历史上的伤痛时刻——奥格里夫战役（Battle of Orgreave）。当时的矿工纠察队试图阻止卡车从炼焦厂拉走焦炭，与警察发生冲突。此次事件是英国战后工业衰退和罢工加剧的缩影。

那座炼焦厂早已不复存在。取而代之的是一项充满前景的尝试：为新一代的工人创造就业机会，并打破英国古老而荒谬的阶级划分。这种划分的一个重要方面是：长期以来，大学一直被视为钻研学术的所在，需要的是论文和方程式。那些双手脏兮兮的制造业工人是不上大学的。但是从去年秋天开始，AMRC的学徒们可以攻读学位课程了。毕业时他们将获得谢菲尔德大学（Sheffield University）的机械制造、维修工程或制造技术等专业的工程学位。

英国政府希望通过借鉴德国的成功经验来改革学徒制度，AMRC便是其中一项尝试。一半以上的德国年轻人具有学徒的资格。德国年轻人的失业率远低于欧洲其他国家，其卓越的制造业实力广受钦羡。

迄今为止，英国这番努力的结果喜忧参半。自从一项复杂的新企业税开征一年以来，英国参加学徒培训的人数减少了28%。但把学徒制转变为学位却取得了成功：目前大约有100所高等院校提供这种选择。

制造研究中心的理念是从德国的弗劳恩霍夫研究所（Fraunhofer institutes）复制过来的。除了谢菲尔德的AMRC，英国还有一系列由政府部分资助的高附加值制造中心，包括位于英格兰中部考文垂（Coventry）以及苏格兰斯特拉思克莱德（Strathclyde）的中心。美国政策制定者对此也感兴趣，并在2012年采用了这一理念。

谢菲尔德的AMRC成立于2001年，波音公司为其创始合作伙伴。罗尔斯·罗伊斯和空客等领先的制造企业也参与其中。该中心不仅培养年轻人才，还帮助会员企业解决问题。那里有一件展品是罗尔斯·罗伊斯的一款遄达（Trent）发动机所用的风扇轮盘——该中心将该部件的生产时间减少了一半。AMRC有100多家会员企业，顶级会员企业一年支付30万英镑（39.7万美元），在董事会获得一个席位。

负责学徒项目的尼基·琼斯（Nikki Jones）表示，该中心与企业联手，是要确保学徒制符合它们的需求。举例来说，企业要求受训者液压和气动两门课都要学。超过300家公司将在学徒送到中心受训，任意时间里一门课上都有195人在学。已有约1000人修完了中心的课程，首批14人将在2021年取得学位学徒资格。

该项目对青少年的吸引力也是显而易见的。他们定期回到企业磨炼技能。课程结束后，98%的受训者会留在原来的岗位上。琼斯尽可能让新学员多样化。中心组织团队访问当地学校，向孩子们宣传学徒制，超过30%的受训者来自欠发达地区。

专注于先进的学徒制项目是英国早就该做出的改变。问题是改变是否足够。琼斯表示她很乐意将中心的受训人数增加一倍，但相比于每年有50万名孩子离开学校，这仍然是杯水车薪。

也许比数字更重要的是学位学徒制所体现的态度转变。英国人对所谓“学术”科目的热情总是带有维多利亚时代的味道，那个时代主张年轻绅士接受全面教育，这样才能在上流社会谈吐自如。如果说职业教育得到提倡，那只是局限于法律和医学等专业。制造业的工作是下层阶级的事情。

久而久之，这种态度造就了太多诸如PPE学科（政治、哲学和经济学）的毕业生，却没有足够的工程师。这或许可以帮助说明很多问题，比如英国一直低下的生产率、脱欧乱局等等。理论太多，实践不足。■



Bartleby

Open office, closed minds

It is more about cost-cutting than collaboration

“LONELINESS is a crowded room,” as Bryan Ferry of the band Roxy Music once warbled, adding that everyone was “all together, all alone”. The open-plan office might have been designed to make his point. That is not the rationale for the layout, of course. The supposed aim of open-plan offices is to ensure that workers will have more contact with their colleagues, and that the resulting collaboration will lead to greater productivity.

Ethan Bernstein and Stephen Turban, two Harvard Business School academics, set out to test this proposition*. The authors surveyed interactions between colleagues in two unnamed multinational companies which had switched to open-plan offices. They did so by recruiting workers to wear “sociometric” badges. These used infra-red sensors to detect when people were interacting, microphones to determine when they were speaking or listening to each other, another device to monitor their body movement and posture and a Bluetooth sensor to capture their location.

At the first company, the authors found that face-to-face interactions were more than three times higher in the old, cubicle-based office than in an open-plan space where employees have clear lines of sight to each other. In contrast, the number of e-mails people sent to each other increased by 56% when they switched to open-plan. In the second company, face-to-face interactions decreased by a third after the switch to open-plan, whereas e-mail traffic increased by between 22% and 50%.

Why did this shift occur? The authors suggest that employees value their privacy and find new ways to preserve it in an open-plan office. They shut

themselves off by wearing large headphones to keep out the distractions caused by nearby colleagues. Indeed, those who champion open-plan offices seem to have forgotten the importance of being able to concentrate on your work.

Employees also find other ways of communicating with their fellow workers. Rather than have a chat in front of a large audience, employees simply send an e-mail; the result (as measured at one of the two companies surveyed) was that productivity declined.

Cubicles do not offer a great work environment either; they are still noisy and cut off employees from natural light. But at least workers have more of a chance to give their work area a personal touch. Allowing plenty of room for pictures of children, office plants, novelty coffee mugs—these are ways of making people feel more relaxed and happy in their jobs.

Such comforts are completely denied when companies shift to “hot-desking”, as 45% of multinationals plan by 2020, according to CBRE, a property firm, up from 30% of such companies now. Workers roam the building in search of a desk, like commuters hunting the last rush-hour seat or tourists looking for a poolside lounger. If you planned to spend a morning quietly reading a research paper or a management tome, tough luck; the last desk was nabbed by Jenkins in accounts.

Hot-desking is a clear message to low-level office workers that they are seen as disposable cogs in a machine. Combine this with the lack of privacy and the office becomes a depressing place to work. Workers could stay at home but that negates the intended benefits of collaboration that open-plan offices bring.

The drive for such offices is reminiscent of the British enthusiasm for residential tower blocks after the second world war. One British wartime

survey found that 49% wanted to live in a small house with a garden; only 5% wanted a flat. But flats they got. Architects, who fancied themselves as visionaries like Howard Roark, the “hero” of Ayn Rand’s “The Fountainhead”, competed to create concrete temples for the masses to occupy. As David Kynaston, in his book “Austerity Britain” recounts, the desires of the actual residents were dismissed.

The real reason post-war architects built flats rather than homes is that it was a lot cheaper. And the same reason, not the supposed benefits of mingling with colleagues, is why open-plan offices are all the rage. More workers can be crammed into any given space.

Some people like them, of course, just as some like living in tower blocks. The only option for everyone else is to kick up a stink until executives change their minds and provide some personal space. In other words: workers of the world, unite. So you can separate again.

* “The impact of the ‘open’ workspace on human collaboration”, Philosophical Transactions, The Royal Society ■



巴托比

开放的办公室，封闭的心灵

更多是为削减成本，而非协作

“孤独是挤满人的房间，”Roxy Music乐队的布莱恩·费瑞（Bryan Ferry）曾这样唱道，“济济一堂，独来独往。”开放式办公室的设计大概是为了印证他的观点吧。当然，这不会是提倡这种布局的理由。采用这种办公室据说是为了确保员工和同事能有更多接触，并由此促进协作，带来更高的生产率。

哈佛商学院的两位学者伊森·伯恩斯坦（Ethan Bernstein）和斯蒂芬·特尔班（Stephen Turban）着手检验这种说法*。他们动员两家改为开放式办公的跨国公司（研究报告隐去了公司名称）的员工佩戴一部“社交测量仪”，以此观察他们的互动情况。这些仪器用红外线传感器探测员工之间何时发生互动，用麦克风判断他们何时在交谈或在听对方说话，用另一种部件监测他们的身体移动和姿势，用蓝牙传感器确定他们的位置。

作者发现，在第一家公司，面对面互动在满是小隔间的旧办公室要比在能一眼望见彼此的开放式空间里多出三倍多。相比之下，改成开放式办公区后员工互相发送的电子邮件数量却增加了56%。在第二家公司，面对面互动在改为开放式办公后减少了三分之一，发送电子邮件的数量增加了22%到50%。

为什么会发生这种转变？作者认为，员工重视自己的隐私，当他们身处开放式办公室中，就会寻找新的办法来保护隐私。他们戴上大大的耳机来隔绝身边同事的干扰。其实，那些提倡开放式办公室的人似乎忘记了让人能专注于自己的工作有多重要。

员工们还开始用其他方式和同事交流。他们不会在众人面前聊天，只要发封电子邮件就好；结果（在其中一家公司测量到的情况）就是生产率下降了。

隔间也不能提供完美的工作环境：周围还是很吵，有些员工接触不到自然光。但起码员工有更多机会给自己的工作区域增添一点个人色彩。有足够的空间供他们摆放孩子们的照片、绿植、造型新奇的咖啡杯，这些都能让人们在工作中感到更放松快乐。

如果企业转而采用非固定办公桌，这点慰藉就会被完全剥夺。房地产公司世邦魏理仕（CBRE）的数据显示，45%的跨国公司计划到2020年这么办（目前比例为30%）。为了找张办公桌，员工们在大楼里走来走去，就像上班族在通勤高峰时段寻找车上最后一个座位，或是游客在泳池边找张躺椅。要是你打算花一个上午安安静静地看一篇研究报告或是一本大部头管理著作，真不走运，最后一张桌子已经被财务部的詹金斯抢占了。

非固定办公桌向基层员工传达了一个明确的信息：他们被视为机器中可随意替换的齿轮。再加上没有隐私，办公室变成了一个让人沮丧的工作场所。员工们也可以呆在家里，但这就抹杀了开放式办公室原本想要在协作方面带来的好处。

对这种办公布局的推动让人想起二战后英国对高层住宅楼的热情。英国一战时调查发现，49%的英国人希望住在带花园的独栋小宅院里，只有5%的人想住在公寓里。但他们得到的只有公寓。建筑师们把自己想象成安·兰德（Ayn Rand）的《源泉》（The Fountainhead）一书中的主人公、英雄式人物霍华德·洛克（Howard Roark）那样的理想主义者，竞相建造钢筋水泥的神庙，供广大民众居住。正如大卫·基纳斯顿（David Kynaston）在《紧缩英国》（Austerity Britain）中所忆述的，那些实际居住者的愿望被忽略了。

战后建筑师建造公寓而非宅院的真正原因是公寓要便宜得多。同样，开放式办公室风靡的原因并不是能让员工打成一片这种人们假想的好处，而是能在给定的空间里塞进更多员工。

当然，有些人喜欢开放式办公室，就像有些人喜欢住高楼大厦一样。对所有其他人来说，唯一的选择就是起而反抗，直到高管们改变主意、提供一

些个人空间。换句话说就是：全世界无产者联合起来。这样你们就可以再次分开。

* 《开放式办公场所对人类协作的影响》，《哲学汇刊》，英国皇家学会





Economic and financial indicators

Economic outlook

The Economist's latest poll of forecasters, August



经济与金融指标

经济前景

《经济学人》8月对各家预测机构的最新调查



WeWork

The capitalist kibbutz

Sceptics abound, but there may be more to the American property startup than meets the eye

WITH his flowing locks and hip clothes Adam Neumann, co-founder and chief executive of WeWork, looks less like a property baron than the frontman of a rock group. He speaks expansively on the subjects of character, destiny and God. His four-year-old daughter wanders through his office during an interview with *The Economist*. Yet Mr Neumann, a veteran of the Israeli navy, also has a reputation for being an intense and demanding businessman. Both sides to his character come together in WeWork. Mr Neumann thinks of his property startup as a profit-making version of Israel's famed communal farms—a sort of “capitalist kibbutz”.

Shaking up the market for commercial offices globally is the firm's mission. WeWork's “co-working” offices, in more than 250 locations and over 70 cities worldwide, are a blend of small private spaces and large public areas designed to encourage a sense of community among its users. The firm rents huge chunks of space from landlords, kits them out and charges clients a membership fee starting at a few hundred dollars a month. Customers rent anything from one desk to whole buildings and range from tiny startups to giants such as General Motors and Samsung.

In the eight years since its founding WeWork has become the largest private-sector occupier of offices in central London, and the second-largest in Manhattan. Its expansion is being fuelled by SoftBank's near-\$100bn Vision Fund, which last year put several billion dollars into the firm, valuing it at \$20bn. This is more than most big property companies, even though it is not yet profitable. SoftBank is expected shortly to invest another \$3bn into the

company in a deal that could lift its valuation to \$35bn.

Big questions nonetheless swirl. Sceptics wonder about the model's viability in an unsentimental, margin-driven property industry that is prone to painful ups and downs. As a result, they scoff at its valuation. WeWork's top brass talk of its becoming a \$100bn firm; others regard a tag of \$20bn as already extremely stretched.

WeWork does deserve credit for reimagining the conventional corporate office. It has spread design innovations from tech companies such as Google. A large common area with sofas and work desks, fruit-infused water and open lines of sight welcomes visitors to every location. Each is manned by a concierge who gets to know "members" and curates events ranging from yoga classes to investor talks. The halls and stairways are deliberately made narrow as a way of encouraging people to interact. In lounges music is played loud enough to prevent eavesdropping. The firm uses a mixture of anthropological research, sensors and data analytics to hone and customise office designs.

At its location near Grand Central Station in midtown New York, a member working at an advertising startup says his old ad agency was so full of politics and corporate silos that he rarely socialised with colleagues. In his new co-working space he often enjoys beers or plays video games with people from other firms. Down the hall, a boss of an Icelandic yogurt firm says running instant focus groups on new flavours in the lounge speeds product development.

Research suggests that employees are happier in co-working environments like those run by WeWork. But the firm's real genius is that it is also far cheaper for their employers. Property experts estimate that firms typically spend anywhere between \$16,000 and \$25,000 per employee on rent, security, technology and related office expenses. Mr Neumann insists they

can get all of that from WeWork starting at \$8,000 per worker. Efficient use of space is one reason. Ron Zappile of Colliers, a property-services firm, reckons that typical corporate offices use some 185 square feet (17 square metres) per employee. WeWork members get by on 50 square feet per head.

WeWork has more than 250,000 members from a range of industries (see chart) and expects to double revenues this year for the ninth straight year. Last year it made \$886m in revenue, 93% of which came from memberships. Artie Minson, its chief financial officer, reckons the firm would need about 1.3m members to reach \$10bn in revenues. “On our current course and speed, it’s very achievable,” he says. The firm says it is going after only a slice of the \$2.5trn that firms spend worldwide on office-related services.

WeWork’s net losses also roughly doubled, however, from \$430m in 2016 to \$884m last year. As with many fast-moving startups, it explains its lack of profitability by pointing to big investments. It will open 15 new offices a month worldwide for the foreseeable future. Its bonds issued in April were rated as junk.

What worries observers is its similarity to Regus (now known as IWG), a pioneer of the serviced-office market. IWG expanded wildly during the dotcom boom, taking on piles of debt. Its American division was driven to bankruptcy when the tech bubble burst, and the firm was left with lots of rent to pay and too few tenants to cover outgoings. Mark Dixon, IWG’s long-time boss, says that the chief lesson he learned is that “you have to have a matched book or you will die. It’s not a question of whether but when.” WeWork is on the hook for about \$1.9bn worth of leases (typically 15 years in duration, with no more than 7% falling due each year) but its members are tied in only for short periods. A crash could mean lots of empty desks.

WeWork has devised ways to tackle this mismatch. Its leases are held in

special-purpose entities specific to one property, so the parent is somewhat insulated from blow-ups. The firm is increasingly using revenue-sharing leases. This gives away some upside to landlords in good times, but it means the firm bears less risk during a downturn. Buying buildings with outside money is another hedge. WeWork recently bought the former Manhattan flagship of Lord & Taylor, a troubled retailer, and is likely to buy more buildings using external capital. It has some \$2bn in cash, with more soon to come from SoftBank. Unlike the old Regus, it has relatively little debt even after its \$700m offering in April.

Yet the most important source of stability may well be a shift in its customers, from startups to big firms. A few years ago, WeWork's business was comprised almost entirely of small fry. In the year to September the enterprise segment (firms with over 1,000 staff) grew by around 370%. As of June, big firms accounted for about a quarter of its membership and revenues. More than 1,000 companies now take anything from one to 12,000 desks. In June, Facebook asked WeWork for an entire building for several thousand workers.

The average enterprise lease is close to two years and many new ones are three to five years long. Whereas big firms, used to conventional office leases of 10-20 years, see WeWork's contracts as flexible, the firm itself sees them as commitments that will help it weather a downturn.

As for the firm's dizzying valuation, WeWork has devised a measure of profitability that it calls "community-adjusted EBITDA", which strips out the costs associated with expansion but retains the costs of running existing locations. Despite the hippy-dippy name, analysts regard it as a reasonable measure, akin to the distinction made between "same-store" sales and new-store sales in analysing retailers. In 2016 WeWork's established locations had community-adjusted EBITDA margins of 22%, which rose to 27% last year thanks to higher occupancy and improved economies of scale. Mr

Minson expects it to reach 30% by year-end.

The cost of expansion is also coming down. One measure WeWork uses is the net capital expenditure involved in opening new space. This has declined from \$10,888 per desk in 2015 to \$5,631 per desk in 2017, and is expected to reach roughly \$4,000 per desk this year. This downward trend can be explained by growing economies of scale and vertical integration. Visit its forthcoming office space at 750 Lexington Avenue in Manhattan and you will find a surprisingly high-technology building site, featuring 3D-laser scanning of raw space and real-time online tracking of global construction activity. “We can systematically say how many desks we’ll open in a city in the future,” says Jennifer Berrent, the firm’s chief operating officer. The firm can go from lease-signing to tenancy in four months; old-fashioned landlords take six months to a year.

Mr Neumann thinks this in-house expertise will ignite new sources of revenue. He reckons that most growth will come from new products such as Powered by We, a service that brings WeWork’s design and operational capabilities to a customer’s site, where it revamps existing offices. So far it has attracted 30 enterprises.

WeWork also wants to advise firms on improving corporate culture. A forthcoming product, described in a case study prepared by Harvard Business School, envisages WeWork helping firms transform by applying its methods (which it calls its “Culture OS”). Mr Neumann observes that firms are often much better at taking care of their customers than they are at looking after their employees. In addition, WeWork offers a range of services for members, such as third-party health insurance for startups, which make up a small but growing part of revenues. It has acquired America’s Flatiron School, and offers its computer-coding classes to members. It recently launched WeWork Labs, whose services for startups include mentorship from seasoned entrepreneurs, matchmaking with big firms and other

benefits.

The firm's ambitions do not stop at the office. Mr Neumann is currently bidding against Elon Musk, the boss of Tesla and SpaceX, for the right to develop a large tract of public land near San Francisco's Golden Gate Bridge. In addition to co-working space, the complex would house WeGrow, a network of schools for young children that WeWork has designed, and WeLive, a "co-living" style of housing it is working on. The first such school, on the third floor of the firm's New York headquarters, will start classes this autumn. Two residences are already open, one near Washington, DC, and the other on Wall Street.

Some investors reckon that such initiatives are a distraction from its core business. The startup's stratospheric valuation is partly a matter of faith. Yet established corporates' growing interest is also a sign that the firm can endure. In the WeWork building west of Times Square in New York, the penthouse floor is occupied by employees from Nasdaq—just two blocks from the stock exchange's own spacious offices. Eric Folkemer, a manager, says that it wanted to attract talent from Silicon Valley firms, but that recruits were put off by its old-fashioned facilities. "It's a lot easier to get them to work for us in this building." ■



WeWork

资本主义的基布兹

怀疑论者比比皆是，但这家美国房地产创业公司可能不像表面上那么简单

WeWork的联合创始人兼首席执行官亚当·诺依曼（Adam Neumann）卷发及肩，衣着时尚，看着不像地产大亨，倒像摇滚乐队的主唱。他滔滔不绝地大谈品格、命运和上帝。在接受《经济学人》采访时，他四岁的女儿就在办公室里走来走去。然而作为商人，这位以色列海军的退役老兵也以认真严苛而闻名。他性格中的这两面在WeWork都有所体现。诺伊曼认为他这家房地产创业公司就是以色列著名的集体农场的营利形式——一种“资本主义的基布兹”。

WeWork的使命是重塑全球商业写字楼市场。其“联合办公”空间遍布全球70多个城市中的250多个地点，空间内除了小型私有空间外还设有大型公共区域，为的是在用户中鼓励一种社区意识。该公司从房东那里租下大量空间，装修并配备设备后出租给客户，向他们收取每月几百美元起的会员费。客户从租用一个办公桌到整栋楼的都有，既有小型创业公司也有通用汽车和三星等巨头。

公司成立八年以来，WeWork已成为伦敦市中心写字楼占用面积最大的私营企业，在曼哈顿名列第二。公司的扩张受到了软银规模近千亿美元的远景基金的推动，该基金去年向WeWork投资数十亿美元，对它估值为200亿美元。这一估值已高于大多数大型房地产公司，而WeWork尚未盈利。预计软银不久后会向该公司再投资30亿美元，这一次可能将其估值推高至350亿美元。

尽管如此，一些重大的质疑声甚嚣尘上。房地产这个行业受利润驱动且冷酷无情，还容易出现痛苦的动荡，怀疑论者质疑WeWork模式在这一行业的生存能力，因而对其高估值嗤之以鼻。WeWork的高层谈论公司市值将能升至1000亿美元，其他人则认为200亿美元的标价已经极度虚高。

WeWork重新构想了传统的办公空间，确实值得称道。它推广了源自谷歌等科技公司的设计创新。它开辟了视线开阔的大型公共空间，配有沙发、办公桌和果味水，欢迎访客前往各个区域。每个区域都配备一名管理员，他会逐步了解“会员”，策划从瑜伽课到投资人面谈等各种活动。走廊和楼梯间刻意设计得较窄，以鼓励人们多多互动。在休息室，背景音乐的音量足以避免聊天被旁人偷听。WeWork结合人类学研究、传感器和数据分析的结果来调整和定制办公室设计。

在曼哈顿中城区中央车站附近的一处WeWork空间里，一位就职于广告创业公司的会员表示，他以前工作的广告公司充满了办公室政治和企业孤岛，他很少与同事交流。在新的联合办公空间里，他经常和其他公司的人一起喝啤酒或玩电子游戏。在大厅的另一边，一家冰岛酸奶公司的老板说，在休息室为新口味开展即时焦点小组调查，能加快产品开发。

研究表明，员工在像WeWork这样的联合办公环境中更快乐。但这家公司真正的过人之处在于它还能大幅降低雇主的成本。房地产专家估计，企业在租金、安防、技术和相关办公费用上的花费一般为每名员工1.6万至2.5万美元。诺依曼强调这些成本在WeWork可以降到人均8000美元起。原因之一是WeWork能有效利用空间。物业服务公司高力国际（Colliers）的罗恩·泽皮尔（Ron Zapple）认为，通常情况下企业的人均办公面积约为185平方英尺（17平方米）。而WeWork的会员企业只要人均50平方英尺。

WeWork拥有超过25万名来自各行各业的会员（见图表），并预计今年将连续第九年收入翻番。去年它的收入为8.86亿美元，其中93%来自会员。首席财务官阿蒂·民森（Artie Minson）估计，公司需要约130万会员才能达到100亿美元的收入。“就我们目前发展的进程和速度而言，这很有可能实现。”他说。该公司称，全球企业在办公室服务上的支出高达2.5万亿美元，自己力争的只是其中一小部分。

然而WeWork的净亏损也翻了一番左右，从2016年的4.3亿美元增加到去年的8.84亿美元。与许多快速发展的创业公司一样，WeWork称大规模投资

是自己未能实现盈利的原因。在可预见的未来，它每个月将在全球开设15个新的办公空间。它在4月份发行的债券被评为垃圾级。

令观察家担心的是它与雷格斯（Regus，现名IWG）的相似性。IWG是服务式办公市场的先驱，它在网络泡沫时期大幅扩张，累积起大量债务。当科技泡沫破灭时，公司要支付大量租金，但租户太少，入不敷出，其美国分部被迫破产。在IWG长期担任CEO的马克·狄克逊（Mark Dixon）说，他学到的最大教训是“你的账目必须平衡，不然你就要完蛋。这不是会不会的问题，而是早或晚的问题。”WeWork担负着约19亿美元的租约（通常期限为15年，每年到期的不超过7%），但其会员签订的都只是短期租约，经济一旦崩溃就会出现大量闲置空间。

WeWork想出了多种方法来解决这种不匹配。它为每一处租赁物业都设立了子公司，租约由子公司签订，这样母公司在某种程度上就能免受冲击。WeWork越来越多地使用收益共享租约，这种安排在经济繁荣时期把一些好处让给了业主，但也降低了公司在经济衰退时承担的风险。用外部资金购买物业是另一种保障措施。WeWork最近购买了陷入困境的零售商Lord & Taylor在曼哈顿的旗舰百货店，而且还可能会用外部资金购买更多物业。它拥有大约20亿美元的现金，很快还会有更多来自软银的投资。和以前的雷格斯不同，即便是在4月份发行了7亿美元的债券之后，WeWork的债务仍相对很少。

然而，最重要的稳定因素很可能是其客户从创业公司转向大公司的变化。几年前，WeWork的客户几乎全部都是小虾米。在截至9月的一年中，企业客户（拥有1000名以上员工的公司）约增长了370%。截至6月，大公司约占会员和收入的四分之一。目前有超过1000家公司在租用WeWork的办公空间，租用规模从一张到1.2万张办公桌不等。6月，Facebook向WeWork租用了一整栋办公楼，供其数千名员工使用。

目前企业平均租约期限接近两年，许多新企业为三到五年。习惯了10到20年传统办公租约的大公司认为WeWork的合同很灵活，而WeWork自己则视这些合约为一种保证，能帮助自己度过经济衰退期。

至于公司令人晕眩的估值，WeWork设计了一种衡量盈利能力的指标，称之为“社区调整后EBITDA”。这个指标剔除了与扩张相关的成本，但保留了运营现有物业的成本。尽管名字有点标新立异，但分析师认为这个指标是合理的，类似于分析零售商时将“同店”销售和新店销售做出区分。2016年，WeWork现有办公空间的社区调整后EBITDA利润率为22%。由于入住率提高和规模经济扩大，去年该利润率上升至27%。民森预计到年底这一数字将达到30%。

扩张成本也在下降。WeWork使用的一个衡量指标是开辟新办公空间时的净资本支出。这项支出已经从2015年的每张办公桌10,888美元降至2017年的每张办公桌5631美元，预计今年将降到约4000美元。出现这种下降趋势的原因是不断扩大的规模经济和垂直整合。来到曼哈顿莱克星顿大道750号上正在兴建的办公空间，你会发现这是一个令人惊讶的高科技建筑工地，配备了对毛胚房的3D激光扫描和对全球建筑活动的实时在线跟踪。首席运营官詹妮弗·伯伦特（Jennifer Berrent）说：“我们可以系统性地确定将来会在一个城市增加多少张办公桌。”在WeWork，从签署租赁合同到入住只要四个月，而传统的房东需要六个月到一年的时间。

诺伊曼认为这种内部专长将打开新的收入来源。他估计大多数增长都将源自新产品，例如“Powered by We”。这项服务能把WeWork的设计和运营能力应用到客户的办公场所，为客户改造现有的办公室。这项服务已经吸引了30家企业。

WeWork还希望在改善企业文化方面为客户提供建议。哈佛商学院编写的一个案例研究中描述了WeWork即将推出的一个产品。预计WeWork将通过该产品，运用自己的一系列方法（WeWork称之为“文化操作系统”）来帮助企业转型。诺伊曼发现，企业对客户的照顾往往远胜于对自己员工的关怀。此外，WeWork还为会员提供各种各样的服务，例如创业公司的第三方健康保险，这些服务只占其收入的一小部分，但在不断增长。

WeWork已经收购了美国的编程培训职业学校Flatiron School，为会员提供计算机编程课程。最近它还推出了WeWork Labs，为创业公司提供服务和助益，包括来自资深企业家的指导、为它们与大公司的合作牵线搭桥等。

WeWork的野心不止于办公空间。诺伊曼目前正在和特斯拉与SpaceX的老板伊隆·马斯克竞标，争夺旧金山金门大桥附近大片公共土地的开发权。除了联合办公空间外，该综合项目还将包括WeWork设计的幼儿连锁学校WeGrow，以及它正在推动的“共居公寓”项目WeLive。位于WeWork纽约总部三楼的第一所WeGrow学校将于今年秋季开课。两处共享公寓已经开放，分别在华盛顿特区附近和华尔街。

一些投资者认为此类业务会分散WeWork对核心业务的关注。这家创业公司能获得超高估值一定程度上是由于市场对它有信心，但成熟企业对它的兴趣日增也是它能够持久发展的一个征兆。位于纽约时代广场以西的WeWork大楼里，在顶层办公的是纳斯达克的员工，这里距离这家股票交易所自己宽敞的办公室仅两个街区。纳斯达克的一位经理埃里克·福克默（Eric Folkemer）表示，公司希望吸引硅谷的人才，但老式的办公环境使得这类招聘难以推进。“吸引他们到这栋楼里为我们工作要容易多了。”■



Wildfires

Forewarned is forearmed

Software can model how a wildfire will spread—and how to stop it happening

LEST anyone doubt the speed with which a brush fire can strike, consider how rapidly flames engulfed Mati, a seaside resort near Athens, on July 23rd. Less than 90 minutes after fire was reported, flames had reached densely populated areas. Hordes of people fled into the sea, the only refuge, to escape. At least 91 were killed.

That toll could have been avoided, says Gavriil Xanthopoulos, a wildfire expert at Greece's Ministry of Rural Development and Food, if proper use had been made in advance of fire-simulation software. Fed with data on the area's vegetation, building materials, paved surfaces, paths to the sea and weather patterns, such software would have suggested, he says, those places where trees and brush should have been removed, roads widened and evacuation paths built—not to mention how zoning laws could have been better devised in the face of fire risk.

Greece, Dr Xanthopoulos laments, has been slow to adopt such software. Others are not so dilatory. America's Forest Service, for instance, uses a model developed by Esri, a geographic-information firm in Redlands, California, to assess fire risk. This model feeds on data on the distribution and types of trees, bushes and other vegetable ground cover, and on construction materials used in an area.

These data are collected mainly by satellites and aircraft, but rangers and crews of firefighters contribute detail from the ground. According to Chris Ferner, a wildland-fire technology specialist at Esri, even entering the diameters of tree trunks and the sites of clogged culverts (which alter

patterns of water flow) is grist to the software's accuracy.

Once a piece of fire-forecasting software such as Esri's knows how much inflammable stuff there is on the land, it can bring in data on rainfall, snowfall, sunshine, temperature and the like, to work out how this might change in the future, as well as how much moisture the vegetation holds. It can also take into account past fires and the lie of the land. A south-facing slope, for example, dries out faster (at least, in the northern hemisphere) than one facing north.

Another model, developed at the University of California, Santa Barbara, by Christina Tague, is called RHESSys. Dr Tague has loaded RHESSys with fuel-and moisture-data for roughly 800 square kilometres of wildland, most of it in California. This shows forestry officials where best to bulldoze fire breaks, cut down trees or clear scrub.

Rod Linn of Los Alamos National Laboratory, in New Mexico, who helped design yet another piece of modelling software, FIRETEC, describes this as "engineering" the behaviour of wildfires. FIRETEC is so sophisticated that it even models how the flames of a planned burn, intended to clear vegetation in a controlled way, will be fed by the wind they generate. This lets users (who include the forest services of Canada and France, as well as the United States) design precise patterns for planned burns, in order to clear surface vegetation without destroying tree canopies.

All of which is well and good for the purposes of prevention. But, if prevention fails, the question remains of whether software can then be used to forecast a fire's spread, assisting those fighting it, and helping those threatened get out in time.

This is a more challenging problem, for forecasting a fire's behaviour requires a staggering number of calculations. FIRETEC, for example, divides

the fire-threatened space under analysis into one-metre cubes called voxels, and then crunches estimates for each voxel of fuel, moisture, temperature and airflow, taking into account drag created by foliage and other objects. As a simulation progresses, the values in each voxel affect adjacent ones, thus creating feedback which produces impressive verisimilitude. Unfortunately, it does not do so quickly. FIRETEC's simulations run more slowly than real fires burn, making it useless for real-time forecasting.

To calculate, in a useful amount of time, the spread of a fire that has already started thus requires compromise. A model called CAWFE has voxels with sides 370 metres by 370 metres by ten metres. That makes it less accurate than FIRETEC, but according to Janice Coen, of the National Centre for Atmospheric Research, in Boulder, Colorado, who is leading the development of the software, it spits out a forecast of a wildfire in just a quarter of the time that the fire takes to burn.

Such forecasts are about to get better. Using infrared images captured by aircraft, Dr Coen is training CAWFE to predict when and where a wildfire is likely to produce several infrequent but terrifying types of tendrils that reach out beyond the fire line. These include “fire whirls” (see picture), which can snap and hurl trees; pairs of counter-rotating “horizontal roll” fire vortices that form in mid-air but can collapse onto the ground; and “flame fingers” that have smitten firefighters even 100 metres from a fire’s edge.

The most extreme 1% or so of wildfires, however, are likely to remain unmodellable for some time. These include the “explosive” wildfires that ravaged central Portugal last year. On June 17th 2017 wildfires broke out around Pedrógão Grande, near Coimbra. Initially, meteorologists reckoned that these fires would advance at about 3kph, but the soaring flames soon changed direction and accelerated to six times that speed. Sixty-seven

people died, nearly half of them trapped motorists.

Flames that rose roughly 100 metres into the sky during these fires generated a gale and searing “pyrocumulus” clouds, a process too complex for today’s best software to model, according to Marc Castellnou, a member of the technical commission that studied the disaster. Francisco Castro Rego, an expert on fire forecasting at the University of Lisbon, reckons that at least two more years of development will be needed to model such fires.

Fire-modelling is, however, getting better all the time. New satellites, with shortwave-infrared sensors, can detect fires as small as a backyard barbecue. Satellites and aircraft with rangefinders that use lidar, an optical version of radar, can map the height of vegetation precisely, which helps forecasting software work out whether a brush fire is likely to ignite trees. As statistics on fires accumulate, new correlations will be identified, such as how fluctuations in average temperature influence burn sizes on a given landscape. Such intelligence will be needed increasingly in the future. Predictions based on the likely effects of climate change suggest that, by the middle of the century, fires will burn twice as much acreage as they do today. ■



山火

有备无患

软件可以模拟山火蔓延的情况，以及阻止它的方法

如果有人置疑灌丛火灾蔓延的速度，那就想想7月23日发生在马蒂（Mati）的火灾。那天，这个雅典附近的海滨度假胜地转眼间就被大火吞噬。发现火情后不到90分钟，大火就已经烧到了人口密集区。大海成了唯一的避难所，成群的人涌向海里逃生。至少91人丧生。

希腊农村发展和粮食部的山火专家加夫里尔·克桑索普洛斯（Gavriil Xanthopoulos）表示，如果事先好好利用火灾模拟软件，这样的人员伤亡本可避免。他说，向这种软件输入该地区的植被、建筑材料、路面铺筑、通向大海的道路以及天气模式等相关数据，就能得到哪些地方该清除树丛、拓宽道路以及建设疏散路径的建议——更不必说还能根据火灾风险设计更合理的区域规划法规。

希腊迟迟没有采用这种软件，克桑索普洛斯很是痛惜。其他国家就没有如此拖拉。位于加州雷德兰兹市（Redlands）的地理信息公司Esri开发了一种模型，被美国林务局用来评估火灾风险。这种模型以两类数据为依托：某一地区的树木、灌木和其他地被植物的类型与分布，以及该地区使用的建筑材料。

这些数据主要由卫星和飞机收集，但也需要由护林员和消防队员提供地面细节。Esri的野外火灾技术专家克里斯·费尔纳（Chris Ferner）指出，即便录入的是树干直径和堵塞的涵洞（这些涵洞会改变水流的模式）位置，都能提高软件的准确性。

一旦一款像Esri这样的火灾预报软件了解了陆地上有多少易燃物，它便可以结合降雨、降雪、阳光、温度等数据计算出易燃物在未来的变化趋势，以及植被的含水量。软件同时还能把以往的火灾和地形等因素考虑进去。例如，南坡比北坡更容易变干，至少在北半球是如此。

加州大学圣芭芭拉分校的克里斯蒂娜·塔格（Christina Tague）开发了另一个名为RHESSys的模型。塔格向RHESSys输入了约800平方公里林野（大部分在加州）的易燃物及湿度数据，为林业官员指明最好在哪些地方开辟防火带、砍倒树木或者清除灌木丛。

新墨西哥州洛斯阿拉莫斯国家实验室（Los Alamos National Laboratory）的罗德·林（Rod Linn）帮助设计了另一款模拟软件FIRETEC。他把火灾建模描述为“设计”山火的延烧模式。FIRETEC非常复杂，甚至可以模拟出在林业人员为减灾而开展的预防性燃烧（以可控方式清除植被）中，火焰产生的风力如何助长了火情。除了美国，加拿大和法国的林业机构也在使用这款软件，为预防性燃烧设计出精准的模式，以便在不毁坏树冠的情况下清除地表植被。

所有这些作为预防措施当然很好。但如果预防失败，接下来的问题是：软件能否用来预报火灾的蔓延情况，协助灭火人员，并帮助人们及时脱险。

这就更具挑战性了，因为预测火势需要执行数量惊人的计算。以FIRETEC为例，它将受火灾威胁的空间划分为一个个一米见方的立方体——称之为“体素”，然后计算出各个体素内的易燃物、湿度、温度和气流等估计值，同时还要考虑到叶子和其他物体产生的阻力。随着模拟的推进，相邻体素中的值会相互影响，从而产生反馈，形成非常逼真的模拟。遗憾的是，模拟的速度不够快。FIRETEC的模拟速度比真实火灾燃烧的速度要慢，也就起不到实时预报的作用。

因而，要在有效的时间范围内对业已发生的火灾做出估测需要折中方案。一个名为CAWFE的模型采用了长宽高分别为370米、370米和10米的体素，所以不如FIRETEC精确。但是，该软件的研发主管、来自科罗拉多州博尔德市（Boulder）的国家大气研究中心（National Centre for Atmospheric Research）的贾尼丝·科恩（Janice Coen）表示，这款软件的预测速度是火势蔓延速度的四倍。

这类预报会越来越先进。利用飞机捕捉到的红外图像，科恩正在训练

CAWFE预测山火可能会在何时何地产生几种虽不常见但非常可怕、延伸到防火带之外的火羽流。它们包括可将树木折断并抛出的“火旋风”（见图）；成对的反向旋转“水平滚动”的火旋涡——它们在半空中形成，但可能会突然跌至地面；以及甚至能从距火场边缘100米开外的地方伤害消防员的“火焰手指”。

然而，约1%最异乎寻常的山火可能一时还无法模拟。去年肆虐葡萄牙中部的“爆炸性”山火就属于此类。2017年6月17日，科英布拉市（Coimbra）附近的大佩德罗冈市（Pedrógão Grande）周围爆发山火。起初，气象学家认为火势会以大约每小时3公里的速度蔓延，但猛烈的火焰很快改变方向，并加快到预期速度的六倍。67人死亡，其中近一半是受困的司机。

在那次火灾中，约100米高的火柱直冲天空，其间产生了狂风和灼热的“火积云”。研究这场灾难的技术委员会成员马克·卡斯泰尔努（Marc Castellnou）表示，这一过程过于复杂，当今最先进的软件也无法模拟。里斯本大学的火灾预测专家弗朗西斯科·卡斯特罗·雷戈（Francisco Castro Rego）认为，要模拟此类火灾至少还需要两年的研发时间。

不过，火灾模拟技术一直在改进。带短波红外传感器的新型卫星能够探测到小至后院烧烤炉的火源。安装有激光雷达（一种光学雷达）测距仪的卫星和飞机能够精确绘制出植被的高度，这有助于预报软件计算出灌丛火灾是否可能引燃树木。随着火灾统计数据的积累，新的关联将被发现，比如平均温度的变化如何影响特定地形的火灾面积。未来我们将愈发需要此类分析能力。研究人员根据气候变化可能带来的影响预测，到本世纪中叶，火灾面积将是现在的两倍。■



Russia and nuclear power

Atoms for peace

The world's worrying reliance on Russian nuclear technology

IN MARCH 2011 a tsunami engulfed the Fukushima power plant in Japan, ultimately causing a meltdown. The worst nuclear disaster since Chernobyl, it was a devastating blow to an industry that has been in the doldrums since the 1980s. Nuclear plants closed around the world. The amount of electricity generated by nuclear power plunged 11% in two years and has not recovered since. Within this declining industry, one country now dominates the market for design and export of nuclear plants: Russia.

Flat domestic demand for electricity has curtailed construction of new plants at home, so Rosatom, Russia's state-owned nuclear-power company, has been flogging its wares abroad. It is focused on what Stephan Solzhenitsyn, a nuclear-energy analyst with McKinsey, calls the "great grand middle": countries that are close allies of neither the United States nor Russia. In April Russia started building Turkey's first nuclear plant, worth \$20bn. Its first reactor is due for completion in 2023. Rosatom says it has 33 new plants on its order book, worth some \$130bn. A dozen are under construction, including in Bangladesh, India and Hungary.

Energy exports have long been a pillar of Russian foreign policy, typically in the form of its abundant oil and gas supplies. Exporting nuclear plants is trickier, but in some ways a better bet, says Mr Solzhenitsyn. Reactor sales bring in more money than fossil fuels, as they are generally accompanied by a suite of services, including provision of nuclear fuel, training for engineers and regulatory consulting. Each plant is a multi-billion-dollar project, unaffected by swings in commodity prices, and locks customers into decades-long relationships with Russia.

Once completed, the plants offer an obvious diplomatic lever in the form of sway over a large portion of a country's electricity-generation capacity. In theory Russia might threaten to raise the price of uranium, or simply to close a reactor operated by Rosatom. The relationship between exporter and customer is particularly close in a nuclear plant's early years, when local employees are still being trained and the exporting country is directly involved in the plant's operation. The threat is especially potent in countries where a new nuclear plant represents a significant share of the electricity supply. Rooppur, the Russian-built nuclear-power station in Bangladesh, for instance, will provide 2,400 megawatts, accounting for 15% of total generation capacity.

Vulnerable countries have long grown accustomed to Russia's habit of wielding energy as a geopolitical weapon. Ultimatums over gas supplies were once a regular feature of eastern European winters, but lately the threat has grown more sophisticated. In 2015 Russia launched a cyber-assault on Ukraine's electrical transmission system. In late July America's department of homeland security said that Russia's military intelligence agency had hacked into the control rooms of American power plants. Cautious hosts might be forgiven for wondering whether their new Russian nuclear plants come with back doors that would enable similar attacks.

Still, Agneta Rising, director general of the World Nuclear Association, says that geopolitics tends not to complicate Rosatom's export plans. Any influence the Kremlin can exert through its plants is limited by the supervision of the International Atomic Energy Agency. Rosatom's influence weakens over time, because customers typically insist that it trains local engineers to run their plants. Customers can source their nuclear fuel elsewhere. And Russian potential mischief-making would spook buyers in other countries.

Yet concerns persist. In 2017 a South African court blocked a \$76bn deal with Rosatom that had been secretly brokered between Presidents Jacob Zuma and Vladimir Putin. Closer to home, this year Rosatom started building a reactor in Hungary months after Mr Putin was warmly received in Budapest by Viktor Orban, Hungary's prime minister. The deal is financed by a €10bn (\$11.6bn) loan from Russia, and Rosatom will operate the plant and supply its fuel. That prompts fears that Russia could use the plant as diplomatic leverage.

Russia's nuclear programme has endured for two main reasons. Its designs are cheap, and Rosatom enjoys the backing of the state, which helps it absorb hard-to-insure risks like nuclear meltdowns. Its competitors trail hopelessly: France's Areva (now Orano) has started building only two plants in the past ten years, in Finland and China; both are delayed and over budget. KEPCO, South Korea's energy company, is facing a domestic backlash against nuclear power, while Westinghouse, in America, is only now emerging from bankruptcy.

Russia's only real competitor is China, another country where government and business are tightly entwined. Until recently China has focused on meeting soaring demand for electricity at home. But importing raw materials and exporting technology is a better long-term bet, and so it has started to look abroad. A Chinese state-backed firm is partly funding Hinkley Point in Britain, and others are involved in plants in Argentina and Turkey. Yet although China will surely catch up, for now Russia has no serious rivals in the export of nuclear technology. In a world that needs to generate much more electricity from nuclear power if it is to take decarbonisation seriously, that is a sobering thought. ■



俄罗斯与核电

和平利用原子能

世界对俄罗斯核技术的依赖令人担忧

二〇一一年三月，一场海啸吞噬了日本的福岛核电站，最终致其堆芯熔毁。这是继切尔诺贝利核泄漏事故之后最严重的核灾难，对上世纪80年代以来一直处于低迷状态的核行业造成了毁灭性的打击。世界各地相继关闭核电站。核电发电量在两年内下降了11%，之后一直没有恢复。在这个衰退的行业中，有一个国家如今主导着核电站的设计和出口市场：俄罗斯。

俄罗斯国内电力需求萎靡，抑制了国内新核电站的建设，因此俄罗斯的国有核电公司俄罗斯国家原子能公司（以下简称Rosatom）一直在海外做生意。用麦肯锡核能分析师斯蒂芬·索尔仁尼琴（Stephan Solzhenitsyn）的话说，俄罗斯重点关注的是“巨大的中间市场”，也就是那些既不是美国也不是俄罗斯的亲密盟友的国家。4月，俄罗斯开始建造土耳其的第一座核电站，价值200亿美元。第一座反应堆将于2023年完工。Rosatom称自己持有33座新核电站的订单，总价值约1300亿美元。目前孟加拉、印度和匈牙利等国的十几个核电站正在建设中。

长期以来，能源出口一直是俄罗斯外交政策的一个支柱，通常出口的能源是该国丰富的石油和天然气资源。索尔仁尼琴表示，出口核电站要更复杂，但在某些方面来说是更好的选择。核反应堆销售带来的收入比化石燃料更高，因为它们通常要配合一系列服务，包括提供核燃料、培训工程师和监管咨询。每个核电站项目都价值几十上百亿美元，而且不受大宗商品价格波动的影响，还能在进口国与俄罗斯之间锁定数十年的合作关系。

这些核电站建成之后会影响一个国家很大部分的发电量，这让俄罗斯获得了在外交上明显的筹码。从理论上讲，俄罗斯可能会威胁提高铀的价格，或者直接关闭一个由Rosatom运营的核反应堆。在核电站运行的头几年，出口国和进口国之间的关系尤为密切，这时当地员工仍在接受培训，出口

国也直接参与核电站的运营。在新核电站发电量占供电比例较高的国家，这种威胁尤为明显。例如，俄罗斯在孟加拉建造的卢普尔核电站（Rooppur）发电能力为2400兆瓦，占全国总装机容量的15%。

俄罗斯惯于把能源用作地缘政治武器，弱势国家对此早已习以为常。就天然气供应发出最后通牒曾是东欧冬季的常见戏码，但近年来这一威胁已变得更加复杂。2015年，俄罗斯对乌克兰的电力传输系统发动了网络攻击。7月底，美国国土安全部门表示，俄罗斯的军事情报机构入侵了美国多家发电厂的控制室。那些谨慎的国家想知道它们从俄罗斯进口的新核电站是否留有后门供俄罗斯发起类似的攻击，也是情有可原的。

不过，世界核能协会（World Nuclear Association）总干事阿格尼塔·瑞新（Agneta Rising）表示，地缘政治不会让Rosatom的出口计划复杂化。克里姆林宫要通过核电站施加任何影响都受限于国际原子能机构（International Atomic Energy Agency）的监督。Rosatom对核电站的影响力随时间推移而逐渐减弱，因为客户通常都会坚持要求Rosatom培训本国工程师来管理自己的核电站。客户可以从其他地方采购核燃料。而俄罗斯如果有什么小动作，也会吓走其他国家的买家。

然而担忧挥之不去。2017年，南非一家法院阻止了一项与Rosatom的核电站交易，该交易由南非总统祖玛和普京秘密达成，价值760亿美元。今年，Rosatom开始在离自己老家更近些的匈牙利兴建一座核反应堆。数月前匈牙利总理维克托·奥尔班（Viktor Orban）在布达佩斯热烈欢迎普京到访。这笔交易得到了俄罗斯100亿欧元（116亿美元）的贷款，将由Rosatom负责运营并提供核燃料。这引发了对俄罗斯可能将该电厂用作外交杠杆的担忧。

俄罗斯的核出口得以延续主要有两个原因。一是设计成本低廉，二是Rosatom有政府支持，这能帮助它应对像堆芯熔毁这种难以承保的风险。Rosatom的竞争对手落于下风，毫无胜算：法国的阿海珐（Areva，现名欧安诺Orano）在过去十年里仅在芬兰和中国开建了两座核电站，两个项

目都逾期且超支；韩国的能源公司韩国电力公司（KEPCO）正面临国内对核电的强烈抵制；美国的西屋公司（Westinghouse）刚刚才摆脱破产的威胁。

俄罗斯唯一真正的竞争对手是中国，这也是个政府与企业联系紧密的国家。直到最近，中国一直在致力于满足国内飙升的电力需求。但长期而言，进口原材料和出口技术是一个更好的选择，因此中国已经开始将目光投向国外。一家中国国企正在为英国的欣克利角核电站（Hinkley Point）提供部分资金，其他中国企业参与了阿根廷和土耳其的核电项目。然而，尽管中国一定会迎头赶上，就目前而言俄罗斯在核技术出口方面并没有能构成威胁的竞争对手。如果全球要严肃对待脱碳目标，就需要大幅增加核电生产。俄罗斯的一家独大需要警觉。 ■



Chinese investment in Silicon Valley

Cheques and balances

China's ability to invest in American startups is looking more uncertain

BUYER'S remorse is often experienced in Silicon Valley by investors who plough money into risky startups only to see them fail. Some technology entrepreneurs are now suffering from seller's remorse. They are those whose young companies have grown big in part thanks to Chinese financial backing, but now feel under scrutiny because of an escalating fight between the two tech superpowers.

One entrepreneur who took money from Danhua Capital, a Chinese venture-capital firm based near Stanford University, for example, only recently learned that the firm was established with help and funding from China's government. "You're going in blind. If there are issues down the line you may not know who you're dealing with," he laments.

On August 13 President Donald Trump signed into effect the Foreign Investment Risk Review Modernisation Act (FIRRMA), which established more vigilant reviews of foreign investments into American companies, including startups, on national-security grounds. While Mr Trump and China continue to spar over trade tariffs, FIRRMA reflects a fight over Chinese investment in American technology startups that is less visible but which nonetheless may have serious consequences for Silicon Valley.

Big deals with national-security implications have long been scrutinised. America's powerful Committee on Foreign Investment in the United States (CFIUS) has reviewed attempts by foreigners to take controlling stakes in domestic firms where their presence could weaken national security. But minority investments in startups went unremarked, though the firms may

hold sensitive innovations in areas such as robotics, artificial intelligence (AI), biotechnology, 3D printing and more.

China is not mentioned in FIRMA but is the main target. In recent years China's government and several firms have backed more than a dozen accelerators that cultivate startups and have opened "corporate innovation" centres in Silicon Valley. Baidu, the Chinese tech giant that is considered closest to the government, runs a centre focused on AI, and ZGC Capital, a group directly funded by Beijing's government, has opened an innovation outpost. Next year a Chinese firm will open Oceanwide Centre, the second-tallest building in San Francisco, a symbol of China's ambition to play a role in America's technology capital.

But China's main influence comes from investing directly in startups. Estimates are hard to obtain, because venture-capital investments are private and notoriously opaque. But according to an analysis by the Defence Innovation Unit Experimental (DIUX), a group founded by America's Department of Defence (DoD), in 2015 Chinese investors put \$3bn-4bn into early-stage venture deals. Many prominent startups, including the ride-hailing firms Uber and Lyft, the messaging app Snap, virtual-reality firm Unity Technologies, cancer-testing firm Grail, financial-tech firm Sofi, augmented-reality firm Magic Leap and others, have taken Chinese money. From 2015-17, according to DIUX, China contributed 13% of total funds into American venture-capital-backed companies and ranked only second to Europe as the largest foreign source of capital for startups.

Some investors are simply seeking strong returns in a big market outside mainland China. Yet American politicians fret that distinguishing private Chinese capital from government funds is hard and that more is in play than profit.

That is because China's sovereign, provincial and local governments, state-

owned enterprises, firms and individual investors often form their own funds and pool their money in each other's investment vehicles. Many Chinese funds also have Western-sounding names, such as Westlake Ventures, which is owned by the city government of Hangzhou. SAIC Capital, backed by a Chinese state-owned car company, has its office on Sand Hill Road, the main thoroughfare for illustrious venture-capital firms.

Chinese money has come with extra perks for entrepreneurs. The investors usually agree to higher valuations to get access to deals. "We're outsiders. We don't have the years of connections we can offer to entrepreneurs, so we have to offer them something else," explains one. The Chinese have also been more willing to invest in more speculative technologies that are less likely to accrue big financial gains in the near term but require lots of capital.

Until recently startup bosses treated Chinese funds like any other. Aside from a few cautionary tales, Chinese money was broadly welcomed. Now defence experts worry that investors are not seeking financial returns so much as insight into the plans of startups. A recent report by DIUX, entitled "China's Technology Transfer Strategy", analysed this; its findings catalysed the FIRMA legislation. Investing several billion dollars is ultimately "a small price to pay to see a significant share of American startups' innovation," says Michael Brown, ex-boss of Symantec, a cyber-security firm, and co-author of the DIUX report.

Putting money into startups in sensitive areas, some analysts believe, may also be a way to keep them out of the reach of America's military. The DoD does not use technologies supplied by young companies that have foreign investors, for fear they could share or steal information or secretly offer a backdoor into computer systems. That theory may be unproven, but startups are just one domain of an escalating fight over technology. Mr Trump has made Chinese theft of American intellectual property a theme of

his presidency. Industrial espionage is also getting more attention: in July American authorities charged a former employee of Apple with trying to flee to China with information about its self-driving cars.

Passage of FIRRMA will give CFIUS new discretion to review property transactions, minority investments in companies that supply “critical technology” and firms that hold “sensitive personal” data on American consumers. But no review will be triggered by passive investments in companies that do not come with board seats or access to material, non-public information, so lots of investments in startups will not be scrutinised. There is also ambiguity about what will be considered a “critical technology”. According to Rhodium Group, 15-25% of Chinese venture deals will be reviewable under the new regime, but if a broad definition is adopted, that could rise to 75% of deals. It is likely that America will continue to identify and add new sensitive technologies to its list over time, says Christian Davis, a lawyer with Akin Gump.

Chinese investors are thinking up coping mechanisms. According to one executive who makes tech investments on behalf of a large Chinese company, they could simply try to hire a team instead of investing in their startup, or ask them to move to Canada before an investment is made. Other investors are planning to take their money elsewhere (though other countries are tightening up their screening mechanisms, too). “If the environment is not friendly for us to invest in America, then it costs us nothing to pull out and do more in Europe and Israel,” says the boss of a Chinese venture-capital firm mentioned in the DIUx report. “Tense” is how one participant summed up the mood at a gathering in June near Silicon Valley, called the US-China AI Tech Summit. Several high-profile Chinese tech bosses and government officials cancelled.

Given the past interest of Chinese investors in frontier technologies, startups working on hardware, biotechnology, quantum computing and

other areas that require “patient” capital could suffer. That is probably what worries Valley-watchers the most about the recent shift. If America makes life difficult for Chinese investors, the government should provide some sort of improved tax treatment or otherwise encourage more American investors to step in, argues Matt Ocko, co-founder of DCVC, a venture-capital firm. “Startups already deal with so much uncertainty,” adds Roy Bahat of Bloomberg Beta, an investor. “Anything that reduces their options or increases their risk makes them more likely to die.” ■



中国对硅谷投资

支票与制衡

中国对美国创业公司的投资前景愈发不明朗

在硅谷，投资者经常会因为向高风险创业公司砸了钱却只等来它们失败而经历“买家后悔症”。现在，一些科技企业家则患上了“卖家后悔症”：他们创办的公司在一定程度上得益于中国的投资而壮大，但现在却由于中美两大技术强国纷争不断升级而感受到了审查压力。

例如，一位美国企业家接受了中国风投公司丹华资本的投资，最近他才知道这家总部位于斯坦福大学附近的公司是在中国政府出资和帮助下成立的。“你是两眼一抹黑啊。如果往后出现什么问题，你也许都不知道自已在跟谁打交道。”他感叹说。

本月13日，美国总统特朗普签署实施《外国投资风险评估现代化法案》（Foreign Investment Risk Review Modernisation Act，以下简称FIRRMA）。该法案以国家安全为由，对外国向美国公司（包括创业公司）的投资进行更严格的审查。特朗普和中国围绕贸易关税问题争执不休，FIRRMA则反映了围绕中国对美国技术创业公司投资的争端，这场争斗相对不那么显眼，但可能对硅谷造成严重影响。

涉及国家安全问题的重大交易一直以来都要接受严格审查。美国外国投资委员会（以下简称CFIUS）大权在握，负责审查那些外国人意欲掌握美国公司的控股权而可能对美国国家安全构成威胁的交易。但对创业公司的少数股权投资则未受注意，尽管这些公司可能拥有机器人、人工智能（AI）、生物技术、3D打印等领域的敏感创新技术。

FIRRMA中没有提及中国，但中国就是它的主要打击目标。近年来，中国政府和几家公司资助成立了十多家培育创业企业的企业加速器，还在硅谷开设了“企业创新”中心。被认为与政府关系最为密切的中国科技巨头百度设立了一个专注AI技术的创新中心。由北京政府直接资助的中关村发展集

团海外子公司（ZGC Capital）则建立了一个创新前哨基地。由一家中国公司开发建设的泛海中心（Oceanwide Centre）将于明年在旧金山落成揭幕，届时将成为该市第二高楼，象征着中国意欲在美国科技之都占据一席之地的野心。

但中国的主要影响力来自对创业公司的直接投资。相关估计数据很难获取，因为风险投资属私人性质，而且过程出了名地不透明。但据美国国防部下属的国防创新试验小组（以下简称DIUX）分析，2015年中国投资者共向早期阶段的企业投资了30亿至40亿美元。网约车公司优步和Lyft、消息应用Snap、虚拟现实公司Unity Technologies、癌症检测公司Grail、金融科技公司Sofi、增强现实技术公司Magic Leap等许多知名创业公司都曾接受来自中国的资金。DIUX的分析显示，2015年至2017年间，美国公司接受的风险投资中，中国贡献了13%，是美国创业公司的第二大外国资本来源，仅次于欧洲。

部分投资者只是想在中国大陆以外的庞大市场追求强劲回报。但美国政界人士担心难以区分中国的私人资本与政府资金，而且认为此中目的并非只为追逐利润那么简单。

那是因为中国的中央及省市各级政府、国有企业、私人公司和个人投资者经常成立自己的基金，并把资金汇集到彼此的投资工具中。许多中国基金还起了洋名字，例如杭州市政府出资成立的杭州硅谷孵化器的英文名为Westlake Ventures。上汽投资（SAIC Capital）是一家中国国有汽车集团旗下的风投部门，在聚集众多知名风投公司的硅谷沙丘路（Sand Hill Road）设立了分支机构。

中国资金还为企业家带来了额外的好处。为获得投资机会，中国投资者通常愿意接受较高的估值。“我们是外来户，不能给企业家带来多年积累的人脉，所以我们必须给他们提供点别的东西。”一位中国投资者解释说。中国人也更愿意投资那些大量烧钱却不太可能在短期内带来巨大财务收益的高风险技术。

直到最近，创业公司的老板们对中国资金并未作区别对待。除了少数警示性案例，中国资金还是广受欢迎。但现在，国防专家担心投资者的主要企图并非财务回报，而是深入了解创业公司的计划。DIUX最近一份题为《中国的技术转让战略》（China's Technology Transfer Strategy）的报告对此做了一番分析，其研究结果推动了FIRRMA立法。几十亿美元的投资说到底“只是为见识美国创业公司的大量创新技术而付出的小小代价。”迈克尔·布朗（Michael Brown）说，他是网络安全公司赛门铁克（Symantec）的前总裁，也是DIUX报告的作者之一。

一些分析人士认为，向敏感领域的创业公司投资也可能是让美国军方无法利用这些公司的一种办法。美国国防部不采用有外国投资的创业公司所开发的技术，担心其中存在共享、窃取信息或在计算机系统植入后门的可能。这套理论可能尚无法验证，但创业公司只是这场不断升级的科技争夺战的战场之一。特朗普已将中国窃取美国知识产权作为其总统任内的一大工作主题。商业间谍活动也越来越受到关注：7月，美国当局指控一名苹果前雇员企图携带该公司无人驾驶汽车的信息逃到中国。

FIRRMA的签署将给予CFIUS新的自由裁量权，对房地产交易、提供“关键技术”的企业和持有美国消费者“敏感个人数据”的公司获得的少数股权投资进行审查。但投资者未获得董事会席位或对重大非公开信息的访问权的被动投资是不会引发任何审查的，因此大量对创业公司的投资都不会受到审查。而对什么是“关键技术”的界定也模糊不清。根据荣鼎集团（Rhodium Group）的数据，在新政策下，15%到25%的中资风投交易将需要审查，但如果对“关键技术”采用更宽泛的定义，那么受审查的交易比例可能上升至75%。艾金·甘普律师事务所（Akin Gump）的律师克里斯蒂安·戴维斯（Christian Davis）表示，美国很可能会继续识别并在清单中添加新的敏感技术。

中国投资者正在考虑应对机制。在一家大型中国公司负责技术投资的高管表示，他们可以干脆把一整个团队聘请过来，而不是投资其创业公司，或者在投资之前让对方搬到加拿大。也有投资者计划将资金转移到其他地方（尽管其他国家也正在收紧筛查机制）。DIUX报告中提到的一家中国风

投公司的老板说：“如果美国的投资环境对我们不友好，那我们就撤出美国，到欧洲和以色列多做点事，我们也没什么损失。”6月，美中人工智能技术高峰论坛在硅谷附近举行，一位与会人士用“紧张”来概括会上气氛。多位高知名度的中国科技公司老板和政府官员取消出席该峰会。

鉴于中国投资者过去对前沿技术的兴趣，硬件、生物技术、量子计算及其他需要“耐心资本”的领域里的创业公司可能会受到影响。这可能是硅谷观察者对近期变化最担心的问题。美国风投公司DCVC的联合创始人马特·奥科（Matt Ocko）认为，如果美国限制中国投资者，政府就应该提供某种更好的税务优惠或鼓励更多美国投资者加入。“创业公司已经要应付那么多的不确定性了，”风投公司Bloomberg Beta的罗伊·巴哈特（Roy Bahat）补充说，“任何减少它们的选择或增加风险的事情都加大了它们死亡的几率。”■



Charlemagne

Too much of a good thing

The European backlash against Airbnb is in full swing

TO WAKE up in an Airbnb apartment can be briefly disorientating. Where are you? The brushed steel, the exposed lightbulbs, the mid-century furnishings. The lively walls and bookshelves (a guide for hosts recommends accentuating “personality, not personal items”). The laminated guide to the neighbourhood, the English slightly askew and peppered with exclamation marks. The excellent Wi-Fi. You could be in Lisbon; but perhaps it is St Petersburg? The Verge, an online magazine, describes this Airbnb aesthetic as the “hallucination of the normal”, a phrase borrowed from Rem Koolhaas, a Dutch architect. That is why it can also offer the jaded traveller the sense of a home from home.

Not all Europeans feel the same. Tourists packing for this year’s holiday season might brace themselves for an awkward welcome. Anti-tourist protests in some cities have become a summer ritual. Last August 200 locals occupied a beach in Barcelona to tell visitors to shove off (or at least to stay in hotels). In several cities a plaintive theme has emerged. Airbnb out-of-towners warp districts and upset residents. Grocery shops and libraries that cater for locals are replaced by identikit cafés and bike-rental outlets that serve tourists. As rental homes colonise new areas, residents are forced further out (18% of the properties in central Florence are listed on Airbnb, according to one study.) Airbnb “oligarchs” hoard properties and profits. Tight housing markets in cities like Amsterdam are squeezed further when landlords withdraw properties from sale or long-term rental in favour of the holidaymakers. Not all these allegations are about Airbnb. But the brand funnels anxieties afflicting European cities that feel besieged by mass tourism, and politicians have started to notice. In 2015 Barcelona elected a

left-wing mayor who promised to clamp down on the excesses of tourism. She started with Airbnb, fining it for letting out unregistered properties.

If Uber was the terrible toddler of the sharing economy, Airbnb, which celebrates its tenth anniversary this week, behaved as the quieter older sibling. Uber preached (and practised) disruption and chaos, and generally lost its scraps with regulators in Europe. But Airbnb spun a gentler tale, of tourists swapping the anonymity of hotels for the authenticity of districts; of homeowners weaving a few bob out of the spare room. Your columnist's unscientific Facebook survey uncovered a surprising degree of affection for Airbnb among both hosts and visitors.

Yet if the backlash started in America, Airbnb's first market, it is now liveliest in Europe, its biggest. From Amsterdam to Berlin to Madrid, city officials are tightening the screws, limiting the number of days for which an apartment may be rented and slapping fines on violators. Paris, the European jewel in Airbnb's crown, is suing it for failing to take down unregistered listings. (In July, New York moved to require registration too.) The European Commission, the 800-pound regulatory gorilla (see Business section), has generally hesitated to step in. But last month it ordered Airbnb to make some of its charges more transparent or face legal action. The honeymoon is, it seems, over.

In part these are simply the growing pains that accompany any innovation that the old rules do not suit. Even Airbnb's biggest foes, in the hotel industry it has upended, do not seek its demise (at least not publicly). Some regulatory overreach has been reined in; Berlin, for example, no longer bans apartment rentals on Airbnb outright. Authorities in Amsterdam say their limits on rentals have reduced the number of illegal hotels in the city.

Few think the tensions are over. Residents and tourists in effect operate on different time zones, says Fabiola Mancinelli, of the University of Barcelona.

That mattered less when tourists gawped at a few churches before retreating to a large hotel. But it is harder to ignore the visitors who pose for selfies in the local market, sign up for mass bicycle tours, occupy your favourite bar and rattle their wheelie suitcases over cobblestones on their way to catch an early flight. Ironically, visitors who seek to weave themselves for a while into a city's fabric may cause residents more trouble than those who simply poke around.

Tighter regulations have hardly crushed Airbnb, as a glance at its listings will show. European cities appear prominently on its latest list of "trending" destinations. Yet to fuel further growth in the run-up to an expected flotation in the next two years, it will need to probe new markets. Business travel is one. Airbnb already allows hosts to sell "experiences" (think kimono-dressing ceremonies or vintage-photography classes). A more marked Airbnb presence could mean more potential tension with residents.

Yet the platform can hardly be blamed for every woe of the mass-tourism age. In contrast to the cruise-ship hordes that have made the centres of Venice and Dubrovnik unbearable, Airbnbers by definition stay in a city. There is some evidence that Airbnb encourages new trips or at least lengthens existing ones, which suggests tourists are spending cash that would otherwise have stayed at home. Residents of eastern European cities like Warsaw and Zagreb say Airbnb visitors improve standards and foster a spirit of friendliness. And for every weary traveller who thinks Airbnb has lost its soul, ten more appreciate the choice, convenience and competition it offers.

"Great hotels have always been...mirrors to the particular societies they serve," wrote Joan Didion, a Californian author. Airbnb highlights a quirk of our own age, in which the thirst for the authentic can come at the expense of the locals who are supposed to provide it. Perhaps a regulatory squeeze will eventually return the service to its kip-in-the-spare-room roots, as many

European officials hope. Your columnist is among those who have found themselves turning away from Airbnb's ersatz authenticity in favour of hotels that do not aspire to be anything other than what they are. ■



查理曼

过犹不及

欧洲抵制爱彼迎火力全开

在一间爱彼迎民宿中醒来，有那么一瞬，你感到一片茫然。这是在哪儿？抬眼看去，拉丝钢的器具，光秃秃没安灯罩的灯泡，上世纪中期风格的室内陈设。墙壁和书架布置得富有生趣（一份房东指导手册建议突出“个性，而非个人物品”）。一份周边游览指南压了塑料膜，上面的英文字有些歪歪扭扭，画了很多感叹号。Wi-Fi信号很棒。你可能是在里斯本。但也有可能是在圣彼得堡？在线杂志The Verge借用了荷兰建筑师雷姆·库哈斯（Rem Koolhaas）的一个表达，将爱彼迎的这种美学描述为“一切如常的幻觉”。这就是为什么这种美学也能让倦怠的旅人感到仿佛回到了另一个家中。

但不是所有欧洲人都这么觉得。正在为今年的旅游季打点行装的游客可能得做好准备，迎接他们的会是一场尴尬的体验。在一些城市，反观光客抗议已成为夏季的一项固定活动。去年8月，200个本地人占领了巴塞罗那的一处海滩，叫嚣着让游客滚蛋（或者至少待在酒店别出门）。一些城市哀声四起。外来的爱彼迎住客把各地搞得面目全非，让居民心烦意乱。服务本地人的杂货店和图书馆被面向游客的千篇一律的咖啡馆和自行车出租店取代。短租房一步步向新区域挺进，居民只得搬到更远的地方（一项研究显示，佛罗伦萨市中心18%的房屋都已成为爱彼迎的房源）。那些爱彼迎“寡头”囤积房产资源，积聚利润。阿姆斯特丹等城市的业主将房产从卖房或长租市场中撤出，供度假客租住，令本已紧张的当地住房市场进一步受压。并非所有指控都针对爱彼迎，但在那些感到被游客攻陷的欧洲城市，这个品牌成了发泄焦虑的集中去向，并已引起政客的注意。2015年，巴塞罗那选出了一位承诺将限制旅游业过度发展的左翼市长。她首先拿爱彼迎开刀，以出租未注册房产为由向它开出罚单。

如果说优步是共享经济中让人头痛不已的学步小儿，那么本周迎来十周年

生日的爱彼迎就像它更安静规矩的兄长。优步宣扬（并实践）的是颠覆和混乱，在与欧洲各地监管机构的交锋中已经基本败下阵来。但爱彼迎编织的是一套更温和的说辞：游客放弃毫无特色的酒店，转而追寻原汁原味的本地体验；而房主则能靠闲置的房间小赚一笔。本专栏作者在Facebook上做了一番不科学的调查，发现不管是房东还是住客都对爱彼迎怀有令人惊讶的喜爱之情。

然而，如果说爱彼迎最初遭遇反弹是在它的首个市场——美国，那么如今抵制它最激烈的地方就是它最大的市场——欧洲。从阿姆斯特丹到柏林再到马德里，市政府官员正在收紧监管，对一间公寓可供出租的天数做出限制，并向违规者罚款。在欧洲，巴黎是爱彼迎皇冠上的明珠，然而巴黎市政府正因爱彼迎未撤下未登记房源而对其发起诉讼。（7月，纽约也开始要求爱彼迎房东登记房源。）欧盟委员会这个监管领域里“800磅重的大猩猩”多数时候并不愿出手干预，但上月它要求爱彼迎提高部分收费项目的透明度，否则将对它采取法律行动。看起来两者的蜜月期结束了。

一定程度上，这些只是“成长的烦恼”，任何不适合用旧法规来监管的创新都会经历到。就算是在被爱彼迎搅得天翻地覆的酒店行业里，它那些大仇敌也没盼着它完蛋（起码没公开表露过）。一些监管过度的情况已有所克制，例如柏林已不再全面禁止在爱彼迎上出租公寓。阿姆斯特丹有关部门表示，对短租公寓作出限制后，该市非法旅店的数量有所减少。

很少有人认为紧张的拉锯已经结束。巴塞罗那大学的法比奥拉·曼奇内利（Fabiola Mancinelli）说，居民和游客实际上是在不同的时区活动，如果游客逛了几座教堂就回到某个大型酒店，问题就没那么严重。但如果他们在商场里自拍、一大帮人骑自行车观光、霸占你最喜欢的酒吧、一大早咔啦啦地拖着行李箱走在石子路上赶早班飞机，那就很难无视他们了。讽刺的是，比起那些随意走走看看的人，设法在一段时间内融入城市肌理的游客可能会给当地居民带来更多麻烦。

监管收紧并没有击垮爱彼迎，扫一眼它的房源就知道。在它最新的“热门”目的地清单中，一众欧洲城市赫然在列。但如果爱彼迎要在两年内申请上

市之前进一步刺激增长，它还需要探寻新市场。商务旅行是其一。爱彼迎也已经允许房东出售“体验”（想想和服穿戴仪式和复古摄影课程）。爱彼迎的影响力越显著，就越可能与当地居民关系紧张。

然而，很难将大众旅游时代所有的问题都归咎于这个平台。威尼斯和杜布罗夫尼克（Dubrovnik）的市中心因聚集大量游船而变得让人不堪忍受，相比之下，爱彼迎住客必然是在城中各处逗留。一些证据显示，爱彼迎鼓励了人们更多出门旅行，或者说至少让出游者延长了游玩的天数，这也就是说，游客们把原本留在本地的现金都拿出来消费了。华沙和萨格勒布（Zagreb）等东欧城市的居民称爱彼迎游客帮助提高了行为标准，培养了友爱的精神。而且，每有一个疲倦的旅人觉得爱彼迎已失去了它的灵魂，就有十个人表示欣赏它提供的选择以及带来的便利和竞争。

“好酒店从来都是一面镜子，映照出它们所服务的群体。”加州的作家琼·狄迪恩（Joan Didion）写道。爱彼迎突显出我们这个时代的怪象：人们渴望了解原汁原味的当地风情，但为满足这种需求，却要求当地人提供这种体验而可能为此付出代价。也许在严格监管的作用下，爱彼迎的短租服务会像许多欧洲官员希望的那样，回归帮助游客“在别人的空房间睡一夜”的初衷。一些人已不再对爱彼迎那人造的原汁原味感兴趣，而是更喜欢酒店，本专栏的作者就是其中之一。酒店只想做酒店，并不渴望成为别的什么。





Bartleby

The A teams

The fashion for agile management is spreading

AGILITY is such a modish word in modern management theory that it can seem as if the ideal corporate executive would be a combination of Spider-Man and Simone Biles, a gymnast. The concept has its roots in the idea of “lean management”, developed by Toyota in car manufacturing, and in the “Agile manifesto” drawn up by a group of software developers back in 2001.

Big software-development projects were (and are) notorious for producing costly, late and cumbersome results. The idea of agility was to focus on small, innovative and multi-disciplinary teams. Among the manifesto’s principles were that “individuals and interactions” were more important than “processes and tools”, and that responding to change was better than sticking to the plan.

Somehow, the teams concept acquired the name “scrum”. This moniker was clearly bestowed by someone who had never seen a real rugby game. An actual scrum involves 16 people pushing hard, getting nowhere and usually ending up collapsing or being penalised by the referee for foul play.

Management scrums aim to be a bit more mobile than that. In his recent book, “The Age of Agile”, Stephen Denning recounts how a team at Spotify, a music-streaming provider, developed the “Discover Weekly” service, which suggests new songs to users. The team pulled together a prototype within a couple of weeks and tested it first on their fellow-employees and then on very active users. All Spotify customers were offered the Discover service within just four months of the concept being created.

Another author, Simon Hayward, writes in his book, “The Agile Leader”,

that the aim of agility is to bring the company as close to the customer as possible. Ideas can be tested on a small scale and abandoned if they fail to work. Feedback from the customer is essential at every stage. Teams work on small tasks in short cycles, achieving their immediate goal and quickly moving on to the next.

This way of thinking seems sensible enough for specific projects. But companies are now starting to test whether an entire business can become agile—corporate versions of the Chinese state circus. A recent article for the *Harvard Business Review* (HBR)* describes companies that have adopted an agile approach, including Bosch, a German electronics and engineering firm, USAA, an American financial-services company, and the health-information systems division of 3M, a multinational. Perhaps the most striking example is Saab, Sweden's defence firm, which created more than 100 agile teams, covering software, hardware and the fuselage, to build its Gripen fighter jet.

These firms have helped show that transforming groups into agile companies is possible. But it is not easy, says Darrell Rigby of Bain, a consultancy, one of the HBR authors. Just creating teams is not enough; the leadership and culture of the whole company must change. Items such as budgets and employee pay have to be altered to reflect the much shorter timeframes of team operations.

A much bigger agenda lies behind the emphasis on agility. Some argue that the old, top-down corporate model, associated with Alfred Sloan at General Motors in the second quarter of the 20th century, is no longer relevant. Instead, companies need to adapt to a world that is VUCA (volatile, uncertain, complex and ambiguous) and which requires continuous innovation in order to keep up. Agile teams are the equivalent of in-house startups.

It is worth remembering, however, that many startups fail to gain traction. There is a danger that, while a firm's best talent is off pursuing new ideas, the core revenue-generating business deteriorates due to neglect. Permanent revolution may sound an enthralling idea in theory but may lead to chaos in practice.

And what is the role of the chief executive at a big company in an agile world? Most of the innovation and big decisions will have been delegated down to the level of the team. The boss will of course still have an important role in allocating capital to the various teams. But will that role really justify the \$10m-plus salaries that chief executives often enjoy? Indeed, if agility is really the characteristic of business success, then perhaps the very structure of a public corporation is not the most appropriate one. Small businesses, by their nature, are more likely to be agile. The best gymnasts, after all, don't tend to be built like rugby forwards.

Economist.com/blogs/bartleby

* "Agile at Scale" by Darrell Rigby, Jeff Sutherland and Andy Noble, HBR, May-June 2018 ■



巴托比

敏捷特攻队

敏捷管理之风越刮越劲

在现代管理理论中，“敏捷”是个很时髦的词儿，就好像一名理想的企业高管应该是蜘蛛侠和体操运动员西蒙·拜尔斯（Simone Biles）的结合体。这个概念源于丰田在汽车制造业中创造的“精益管理”理念，以及在2001年由一群软件开发人员起草的“敏捷宣言”。

大型软件开发项目曾经出了名的烧钱、拖拉又庞杂（现在仍然如此）。“敏捷”的理念是指专注于创新的多学科小型团队。宣言的原则中写道，“个体和互动”高于“流程和工具”，响应变化高于遵循计划。

不知何故，这一团队理念获名“scrum”（橄榄球中的并列争球）。给它起这个名的人肯定没看过一场真正的橄榄球赛。真实的争球有16个人奋力推搡，乱作一团，结果往往以人仰马翻或因犯规受到裁判处罚而告终。

管理中的“争球”力求比这更灵活些。斯蒂芬·丹宁（Stephen Denning）在他的新书《敏捷时代》（The Age of Agile）里讲述了音乐流媒体供应商Spotify的一个团队是如何开发出“每周发现”（Discover Weekly）这项服务的。这是一个向用户推荐新歌曲的功能，团队在几周内捣鼓出一个原型，先由同事测试，然后再由非常活跃的用户测试。在提出概念后短短4个月内，这项服务就覆盖了Spotify的所有用户。

另一位作者西蒙·海沃德（Simon Hayward）在他那本《敏捷领导者》（The Agile Leader）中写道，敏捷的目标是让公司尽可能地贴近客户。想法可以小规模测试，失败了就抛弃。客户的反馈在每个阶段都必不可少。团队在短周期内完成一个个小任务，实现眼下的目标，然后迅速投入下一个。

这种思维方式用在具体的项目上似乎很合理。但企业已经开始测试，看整

个公司能否也能变得敏捷，成为“中国杂技团”的企业版。《哈佛商业评论》最近的一篇文章*介绍了那些采用敏捷模式的公司，包括德国电子和工程公司博世、美国金融服务公司USAA，以及跨国公司3M的医疗信息系统部门。也许最引人注目的例子是瑞典的防务公司萨博（Saab）。为了制造鹰狮战斗机，它创建了一百多个敏捷团队，涵盖软件、硬件和机身等。

这些企业已经表明集团有可能转变为敏捷的公司。但《哈佛商业评论》文章的作者之一、贝恩咨询公司的达雷尔·里格比（Darrell Rigby）表示，这不容易。光创建团队是不够的；整个公司的领导方式和文化也必须改变。预算和员工薪酬等项目必须做出调整，以反映比之前短得多的团队运营时间表。

在强调敏捷性的背后还有一个大得多的诉求。有些人认为，在上世纪20年代到40年代由通用汽车的阿尔弗雷德·斯隆（Alfred Sloan）创建的自上而下的旧企业模式已不再适用于新时代。相反，公司要适应一个“VUCA”（动荡、无常、复杂、模糊）的世界，必须不断创新才能跟上这样的世界。敏捷团队就相当于内部创业公司。

不过，要记住许多创业公司并未获得成功。危险之一是，当一家公司最优秀的人才致力于追求新想法时，核心的创收业务会因受忽视而恶化。永久革命在理论上可能是个令人着迷的想法，但在实践中可能导致混乱。

在敏捷的世界里，大公司的CEO会扮演什么角色？大多数的创新和重大决策将被下放到团队的层面。当然，老板仍将在向各个团队分配资金方面发挥重要作用。但这一角色真的能证明CEO们配得上他们经常享受的超千万美元的年薪吗？实际上，如果敏捷性真的是商业成功的特质，那么上市公司的结构可能就不是最合适的选择。小企业本身的规模就决定了它们更可能做到敏捷。毕竟，最好的体操运动员并不像橄榄球前锋那样高大强壮。

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《大规模敏捷》，达雷尔·里格比、杰夫·萨瑟兰和安迪·诺贝尔著，《哈佛商业评论》，2018年5至6月刊■



Economic and financial indicators

Manufacturing activity

The latest purchasing managers' indices painted a bleak picture

The latest purchasing managers' indices (PMI) painted a bleak picture. Despite mild improvement on June's 18-month low, the euro zone posted its second-weakest expansion since November 2016, reflecting worries over tariffs. Russia's manufacturing sector contracted for the third successive month, on higher raw-material costs and weakening foreign demand. And Britain's PMI dipped to a three-month low of 54.0, largely because of Brexit concerns and a sluggish economy. China too may be suffering from trade tensions; its PMI slipped to just 50.8. Cost pressures also led America's PMI to slip, though confidence remained strong. ■



经济与金融指标

制造业活动

最新的采购经理指数描绘出一幅惨淡的图景

最新的采购经理指数（以下简称PMI）描绘出一幅惨淡的图景。欧元区在6月创下PMI数值18个月新低，尽管之后出现小幅好转，但近期还是录得了自2016年11月以来第二弱的扩张幅度，反映出人们对关税的担忧。俄罗斯的制造业连续第三个月收缩，原因是原材料成本上涨和海外需求减弱。英国的PMI数值降至三个月以来的低点，为54.0，主要是因为脱欧引发担忧以及经济不景气。中国也可能正因贸易紧张局势受挫，PMI数值下滑至50.8。成本压力也造成美国的PMI数值下降，不过该国制造业仍保持了较强的的信心。 ■



Trouble in Tianjin

Where are the people?

What used to be China's fastest-growing region is now its slowest

TIANJIN, a northern mega-city, has produced some of China's wittiest comedians. It is a good thing that its 15m residents have a sense of humour. Their hometown was, at points over the past decade, the fastest-growing of China's 31 provincial-level regions. Since the beginning of last year it has been the slowest (see chart). Businesses joke that the sole part of the local economy that is expanding these days is the value of assets seized from corrupt officials. The city's sharp deceleration serves as a stress test of China's economic problems, and as a warning of the difficulty in fixing them.

Other areas of China are also grappling with subdued growth. Commodity-producing regions have struggled to adapt to a modernising economy, as has the rust-belt north-east. But Tianjin stands out as a place that should be doing better. It boasts a busy port and good universities. A skilled manufacturing hub, it has attracted firms from Airbus to Motorola. Just half an hour from Beijing by train, it is well situated.

The problem is that the city's planners got far ahead of themselves. They built a big new financial district, which they billed as China's Manhattan, in the Binhai district, on the city's far-east side. Nearly 70% of offices there are vacant, according to Jones Lang LaSalle, a property-services firm. That flatters the reality. One whole floor of the New Finance Building, a glistening complex, has been converted into "escape rooms" for adventure games. "The buildings are great," Zhang Junkai, a port worker who lives nearby, says with a wry smile. "It's just that we don't have enough people in them."

Some 60km away, on the city's western fringes, the waste is even more striking. A private developer wanted to create a high-tech zone, anchored by the world's fifth-tallest skyscraper. Construction all but stopped a few years ago. The skyscraper's skeleton is nearly 600 metres tall, and surrounded by a dozen other abandoned building sites, which are a short drive from a fledgling polo club, itself ringed by empty luxury residences.

Corruption fuelled the excesses. In the city centre, Zhao Jin, a property magnate, paid off bureaucrats to flout zoning rules. He had permission to build three towers of no more than 35 storeys, but instead went for 66 storeys. He and the bureaucrats (some of them, anyway) are now in jail; his development, an unfinished eyesore, was listed for demolition. In another case, at the port, managers of a chemical warehouse exploited connections to pass inspections on matters from fire safety to chemicals handling. In August 2015 a massive explosion obliterated the warehouse and the surrounding area, killing 173.

The deadly blast seems to have marked a turning point. Huang Xingguo, mayor since 2007, was jailed last year for corruption. Li Hongzhong, Tianjin's new Communist Party boss, has presided over a clean-up. Corruption investigations in the first half of this year have already exceeded the total for 2015. The government has also changed its economic course. It has tightened its belt, budgeting nearly 15% less spending this year. Once-busy building sites have attracted scavengers. Ads for metal-recycling services are plastered on construction walls in the high-tech zone.

Tianjin, along with a handful of other Chinese regions, has admitted that its economic record was grossly inflated. Binhai, which accounts for half the city's output, declared in January that its GDP was a third smaller than previously reported. Partly as a result of correcting for past fabrication, Tianjin's annual GDP growth has averaged just 3.5% since 2017, compared with 13.5% under Mr Huang, a precipitous drop.

Tianjin's woes are an extreme version of China's. Over the past decade cities have rushed to expand. Yang Weimin, a senior official, revealed this year that, based on electricity usage, China's housing vacancy rate is higher than Japan's, which stands at 13%. In downtown Tianjin that is almost palpable. Colonial buildings, dating to the 19th century, have been beautifully restored. Yet they are eerily quiet. "All the units have been sold, but few people have moved in," says a guard at the Tai'an Avenue luxury complex.

The question of whether Tianjin can recover, then, is of national salience. Coming clean about its problems is a good first step. But in two other ways, the Tianjin example is worrying. First, local officials appear willing to tolerate only a limited reckoning. Tianjin, like other parts of China, has relied on government-owned companies to pay for investments. Zhang Zhiwei, an economist with Deutsche Bank, has estimated that in Tianjin these companies only have enough revenue to cover about 40% of what they owe in interest, the third-worst ratio among China's provinces. Tianjin is, he says, a "pilot experiment" for how the government will resolve its debts.

The experiment is not going all that well. In May two city-owned developers flirted with defaults on loans that together were worth 700m yuan (\$103m). In both cases they conveniently came up with cash in the end. But some analysts saw that as a missed opportunity. In the absence of genuine defaults banks will go on lending to rotten state firms, knowing the government will always prop them up. "China hasn't killed off this implicit guarantee," Mr Zhang says.

Second, Tianjin shows that China's preferred solution to debt problems—growing out of them—is getting harder. As the economy slows, it takes longer to digest bad investments. Binhai is not a ghost city, but it is far from attaining critical mass. The train to Tianjin's centre is a tenth full during rush hour. The big excitement these days is that the Juilliard School, an American performing-arts conservatory, will open a campus in Binhai

next year, its first such venture abroad. But it is also a marker of reduced ambitions. The Juilliard will occupy just one new building. Planners hoped that many more would house big firms by now.

The appeal of Tianjin for foreign investors has waned amid soaring labour costs. Its GDP per person has passed \$17,000, ten times higher than in the late 1990s, when manufacturing firms flocked to the city. Samsung, a South Korean electronics giant, once operated several factories in Tianjin. It has shifted its focus to Vietnam, where labour is much cheaper.

It does not help that Tianjin is also one of China's most rapidly ageing cities. Nearly a quarter of those with local *hukou*, or residency permits, are more than 60 years old, up from a tenth in the 1980s. As pension and health-care costs rise, social-security provisions will consume nearly half of Tianjin's pared-down budget this year. Younger migrants have also started to drift away to faster-growing regions in China's interior. Tianjin lost 52,000 residents last year, its first such decline in five decades.

In May the city made a bold move to attract young professionals. It offered *hukous*, usually hard to obtain in big cities, to anyone under 40 with a university degree willing to live in Tianjin. In one day 300,000 people applied. With a Tianjin *hukou*, they could send children to local schools, a big enticement. But many applicants simply wanted to base their families in the city. So officials added a condition, requiring applicants to work there, too. Just 5,800 applicants made the first cut.

There is one big wild card in Tianjin's future. The central government talks of unifying it with Beijing, to create a huge city cluster. If it truly did that, and moved some government functions from Beijing, Tianjin's office gluts could vanish, says Tin Sun of CBRE, an international property agency. So far it has taken only baby steps.

In the meantime Tianjin is trying to pick itself up. It is pitching itself to companies in Beijing as a location for back-offices. Tech firms, including Bytedance, a developer of popular apps, have based censorship teams in Tianjin. This is not the glitzy future of the city's dreams, but it pays the rent. On July 17th, when Tianjin officials reported a grim batch of economic data, they added a rallying cry: "we must summon the courage that it takes to roll a rock up a mountain." A worthy ambition, so long as they can avoid the fate of Sisyphus. ■



天津的困境

人都去哪儿了？

曾是中国增速最快的地区如今成了垫底的

从中国北方大城市天津走出了一批中国最机智风趣的笑星。这里的1500万居民很有幽默感，这是件好事。过去十年的某些时候，他们的家乡在中国31个省级行政区（不含港、澳、台）中发展速度最快，然而自去年年初开始却变成了最慢的一个（见图表）。一些企业开玩笑说，如今当地经济唯一扩张的部分是从贪官那里没收的资产的价值。天津发展速度急剧下降既是对中国种种经济问题的压力测试，也警示着要解决这些问题困难重重。

中国其他地区也在努力应对增长放缓的问题。那些生产大宗商品的地区难以适应正走向现代化的经济，东北的“锈带”也是如此。但天津显得尤为突出，因为它原本应该表现得更好。它拥有繁忙的港口和优质的高校。作为一个技术成熟的制造中心，它吸引了空客和摩托罗拉等众多公司。它距北京仅半个小时的火车车程，地理位置优越。

天津的问题在于它的规划者好高骛远。他们在位于天津最东边的滨海新区新建了一个大型金融区，将之标榜为“中国的曼哈顿”。据房地产服务公司仲量联行（Jones Lang LaSalle）称，那里将近70%的办公室都是空置的。这种说法已经美化了现实。在新金融大厦这个耀眼的建筑群里，整整一层楼被改造成了玩冒险游戏“密室逃脱”的场所。“房子都是很好的，”住在附近的码头工人张俊凯（音译）苦笑着说，“就是住在里头的人不够多。”

在大约60公里开外的天津最西边，空置的情况甚至更严重。一个私营开发商曾想建造一栋世界第五高的摩天大楼，并以它为依托打造一个高新技术区。工程差不多在几年前就停止了。这栋摩天大楼的主体框架已接近600米高，四周环绕着十几个同样废弃的建筑工地。从这里开车出发，不一会儿就到了一家开业不久的马球俱乐部，周围也都是些空置的高档住宅。

腐败加剧了过度开发。在市中心，地产大亨赵晋向官员行贿以绕过区域规划法规。他获批建造三幢不超过35层的塔楼，但他盖了66层。他和那些官员（至少是其中一部分）锒铛入狱。他的开发项目成了刺眼的烂尾楼，已被列入拆除名单。在另一个案例中，天津港一个化学品仓库的管理人员利用关系，通过了从消防安全到化学品安置等各方面的检查。2015年8月，一场特大爆炸将这间仓库及周边区域夷为平地，173人丧生。

这次惨痛的爆炸事故似乎成为了一个转折点。去年，自2007年开始担任市长的黄兴国因腐败入狱。现任市委书记李鸿忠主持了反贪整顿行动。今年上半年开展的反腐败调查数量已超过2015年全年的总和。市政府还改变了经济方针。它开始勒紧裤腰带，将今年的支出预算减少了近15%。曾经喧嚣的建筑工地引来了拾荒者。高新区工地的外墙上贴满了回收废金属的广告。

天津以及其他几个行政区已经承认自己的经济数据严重注水。1月，占该市产出一半的滨海新区宣布，其GDP较之前发布的数字缩水三分之一。一定程度上由于对之前虚假数据的修正，自2017年以来天津的GDP年均增速仅为3.5%，从黄兴国主政时的13.5%暴跌。

天津的困局是中国所面临困境的极端案例。过去十年里，中国的城市急于扩张。今年，高官杨伟民透露，根据用电量判断，中国的房屋空置率要高于日本，后者为13%。在天津市中心，这一点显露无疑。建于19世纪的殖民时期建筑经过精心修缮，里头却安静得出奇。“所有单元都卖掉了，但没什么人搬进来。”泰安道高档楼群的一名门卫说。

因此，天津能否恢复就成为了一个全国性的焦点。公开承认自己存在的问题是个良好的开端。但天津的困境还在其他两个方面令人担忧。首先，当地官员看起来只愿意忍受程度有限的清算。和中国其他地方一样，天津也依靠国有企业为投资买单。德意志银行的经济学家张智威估计，在天津，这些企业的收入仅够它们支付约40%的借款利息，这个比例在全国各个省份中排在倒数第三。他说，天津是中国政府解决债务问题的“试验试点”。

这场试验的进展并不理想。5月，两家市政府所属的开发商差点就要对总计7亿元（1.03亿美元）的债务违约。最终两家企业都顺利地筹到了资金。但一些分析人士认为这是一次错失的良机。如果没有真正的违约，银行就会继续向朽烂的国企提供贷款，因为它们知道政府总会出手救助这些企业。“中国尚未铲除这种隐性担保。”张智威说。

第二，天津的案例显示，中国更青睐的解决债务的方法——在经济增长中消化掉债务——越来越难以奏效。随着经济增长放缓，消化不良投资要耗费更长的时间。滨海新区虽非鬼城，但人口远未达到要持续发展所需的最低数量。从滨海站到天津市中心的列车在交通高峰时段有九成座位空着。近期有一件事颇令人兴奋：美国表演艺术院校茱莉亚学院将于明年在滨海新区开设首个海外分校。不过，从中也可看出天津的野心已经缩减。茱莉亚学院只会占用一栋新楼，而按规划人员原本的期望，到这会儿应该已经有多得多的大公司入驻了。

随着劳动力成本激增，天津对外国投资者的吸引力已经降低。上世纪90年代末，大量制造企业涌入天津，如今天津的人均GDP已超过17,000美元，是当时的十倍。韩国电子产业巨头三星曾在天津设有几家工厂，如今已将重心转移到劳动力成本低得多的越南。

雪上加霜的是，天津也是中国老龄化最快的城市之一。拥有当地户口的居民中，将近四分之一超过60岁，上世纪80年代这个比例是十分之一。由于养老和医疗费用的提升，今年经削减后的预算中有近一半要用到社会保障上。年纪较轻的外来人员已开始向发展速度更快的内陆地区转移。去年，天津常住人口较前年减少5.2万人，是50年来首次。

为吸引年轻的专业人才，天津于5月做出了一项大胆的尝试。大城市的户口通常很难获得，而天津降低了落户条件，任何想在天津生活的40岁以下本科学历者都能拿到户口。一天之内便有30万人申请落户。有了天津户口，子女就可在当地学校入学，这是个很大的诱惑。但很多申请者只是想把家安置在天津，因此当地官员补充了一项条件，要求申请者还要在天津工作。最终只有5800人通过首批申请。

天津的未来还有一个重大的未知因素。中央政府谈及京津合并，打造一个巨大的城市集群。国际地产代理世邦魏理仕（CBRE）的孙祖天表示，如果政府真这么干，并将部分政府职能从北京迁出，那么天津办公楼过剩的问题就会迎刃而解。目前，政府才刚刚开始朝这个方向迈出小步。

与此同时，天津正努力重整旗鼓。该市正竭力向北京的企业推销自己，希望吸引它们将后台办公室设在天津。开发了若干流行应用的字节跳动等科技公司已将审核团队安置在天津。这并不是这座城市梦想中的璀璨未来，但起码会贡献房租。7月17日，天津官员公布了一组惨淡的经济数据，随后又振臂高呼：我们“要有‘滚石上山’的勇气。”如此雄心值得称道，只要他们能避免西西弗斯的命运就好。 ■



Property prices

Housing correction

Our new cities house-price index suggests that the market is slowing

FROM Auckland to Amsterdam, Sydney to San Francisco, house prices in the best locations have gone through the roof. *The Economist's* new house-price index covers 22 of the world's most vibrant cities (see table). They are home to 163m people, with an economic output equal to Germany and Japan combined. The average price of a home in these cities rose by 34% in real terms over the past five years. In seven cities it rose by more than half.

Some of this is a rebound from the global financial crisis, which started with a housing bust. Prices in our cities fell by an average of 22% in real terms, peak to trough—in Dublin by 62%, and in San Francisco by 42%. But they have since risen by an average of 56%, in real terms, from their lowest points. In 14 cities prices are above their pre-crisis peak—by an average of 45%.

Before the crisis, city and national prices broadly rose in tandem. They fell together, too, after the bust. But when they started to rise again, they did so on average twice as fast in our cities as nationally. Moreover, according to the IMF house-price inflation in capital cities is increasingly synchronised.

To gauge whether house prices reflect fundamentals or froth, *The Economist* has compared them with rents and median household incomes. If prices rise faster in the long run than the revenue a property could generate or the earnings that service mortgages, they may be unsustainable. Or, at least, incomes or rents will eventually have to rise.

Taking the average ratio over the past 20 years (or more if data exist) as “fair value”, national house prices in Australia, Canada and New Zealand have

been more than 20% above fair value compared with income and 30% above fair value compared with rents for the past three years. They have now hit 40% above fair value for both metrics. Data for rents at the level of cities are lacking. But compared with long-run median incomes, prices appear even bubblier at city level than nationally.

Prices in Vancouver are 65% overvalued by the same metric. The figures for Amsterdam, Copenhagen and Sydney are around 50%, and for London 59%, with rent consuming half of gross pay. In just four of our cities are prices at or under fair value: Tokyo, Milan, New York and Singapore.

But our index suggests that property prices may be near a turning point. The average rate of house-price inflation across our 22 cities has slowed, from 6.2% annually 12 months ago to 4.7% now. In six cities prices have fallen from recent peaks.

The three reasons why cities have experienced a property boom—and why it may now be ending—are demand, supply and the cost of money. In recent years people and jobs have flocked to the biggest cities from other parts of their own countries and elsewhere. More than a third of London's population was born abroad. For Toronto, the share is more than half. The population of our 22 cities rose, on average, by 12% over the past decade. A further boost to demand has come from foreign investors. Auckland, London, Sydney and Vancouver have attracted large inflows, particularly from China.

But according to the Economist Intelligence Unit (EIU), our sister company, the growth in globalised cities' population will soon start to slow. A few might shrink. London lost 100,000 people to the rest of Britain in the 12 months to June 2017, and the EIU expects its population to fall over the coming decade.

One reason people may stop flocking to cities is that they have been priced out. And cities are becoming less welcoming to foreign capital, too. Vancouver has made it harder for foreigners to buy property. Australia has increased property-transaction taxes for non-residents. New Zealand is considering a ban on foreigners buying property. Tighter capital controls in China add to the squeeze.

Second, planning restrictions, local campaigns against new developments and developers sitting on land they think will rise in value have conspired to make new housing scarce. In the five years to 2016 London's population grew almost twice as fast as its housing stock. Comparing new-builds with population growth (an imperfect measure, since household composition may change, but the best available) suggests a shortfall across ten of our cities of 28,000 homes a year in the past decade.

But the calculus here, too, may be changing. Prices seem to have climbed high enough to encourage new supply. London added 40,000 homes last year—the most for decades. New-builds have added almost a fifth to Sydney's stock of apartments in the past three years.

Finally, loose monetary policy since the financial crisis has made mortgages extremely cheap. This has “super-charged” prices, says Liam Bailey of Knight Frank Global Research, a property consultancy. Cheap money has also lowered bond yields, pushing investors into other assets, including property. As central banks tighten, servicing a property loan will become more expensive and fewer investors will seek alternatives to fixed-income assets.

London, vulnerable because of Brexit, may be a bellwether. Agents say developers have started to offer discounts of as much as 10% to close sales. As demand weakens, supply strengthens and mortgage rates rise, the bull run in global cities' housing may be drawing to an end. ■



房价

房市修正

本刊最新城市房价指数显示，房地产市场增速正在放缓

从奥克兰到阿姆斯特丹，从悉尼到旧金山，黄金地带的房价已经一飞冲天。本刊最新的房价指数追踪了全球最具活力的22个城市（见表）。这些城市共有1.63亿居民，经济产出相当于德国和日本的总和。过去五年里，这些城市的平均房价实际增长了34%，其中七个城市的涨幅超过50%。

这番上涨一部分源于全球金融危机后的反弹，而那次危机便是从房地产崩溃开始的。当时本刊指数所涵盖城市房价下跌的峰谷差实际平均值为22%——都柏林的数字是62%，旧金山为42%。但自那以后，它们自谷底实际平均上涨了56%。14个城市的房价超过了危机前的峰值——平均较峰值上涨了45%。

金融危机发生前，城市和全国的房价大体上同步上涨。危机爆发后也一起下跌。但当两者再次上涨，我们所追踪的城市的增速平均是全国增速的两倍。此外，国际货币基金组织称，各个首都城市的房价上涨步伐愈加趋于一致。

为判断房价反映的是基本面还是泡沫，本刊将房价与两个指标——房租以及家庭收入中位数——做比较。如果从长远来看，房价增速快于房产可创造出的收入或用来偿还按揭的家庭收入的增速，那么这样的房价也许就不可持续。或者，至少收入或房租最终必须上涨。

将过去20年的平均比率（如果有数据可查则覆盖更久）作为“公允值”来参考，那么过去三年里，澳大利亚、加拿大和新西兰的全国房价与收入之比相较公允值高出20%，房价与租金之比相较公允值高出30%。而目前两个比率都已经超出公允值40%。在城市层面，房租数据缺失，但当与长期收入中位数做比较时，城市房价的泡沫程度比全国房价还要高。

以同样的标准衡量，温哥华的房价被高估了65%。阿姆斯特丹、哥本哈根和悉尼的房价被高估50%左右。伦敦为59%，而当地的房租已经占到人们工资收入的一半。我们的指数中只有四个城市的房价处于或低于公允值：东京、米兰、纽约和新加坡。

但我们的指数显示，房地产价格的拐点也许近在眼前。22个城市的房价上涨平均速度已经放缓，年增速从12个月前的6.2%降至如今的4.7%。其中六个城市的房价已从近期的峰值下跌。

造成城市房地产繁荣的原因——也是这种繁荣可能即将终结的原因——有三个：需求、供应和资金成本。近些年，人口和工作机会纷纷从本国其他地区和其他国家涌向那些全球最大的城市。超过三分之一的伦敦人口出生于海外。在多伦多这个比例超过一半。过去十年里，我们指数中的22个城市人口平均增长了12%。外国投资者进一步促进了需求。奥克兰、伦敦、悉尼和温哥华吸引了大量外国投资者，尤以中国人居多。

但本刊的姐妹公司经济学人智库（EIU）认为，那些全球化城市的人口增速很快会开始放缓，一些可能还会萎缩。在截至2017年6月的12个月里，有10万人离开伦敦，迁居至英国各处。经济学人智库预计，未来十年伦敦的人口将下跌。

人们也许不再涌向城市的原因之一是负担不起在那里生存的高昂成本。而城市也不再像从前那样欢迎外国资本。温哥华提高了外国买家的置业门槛。澳大利亚提高了非本国居民的房地产交易税。新西兰正考虑禁止外国人购买该国房产。中国加强资本管制也增加了海外置业的难度。

其次，城市规划限制、地方上反对开发新项目、开发商认为地皮会升值而“捂地惜建”——这些因素共同造成了新建房屋的短缺。2011年到2016年，伦敦人口的增速接近该市住宅存量增速的两倍。将新建房屋与人口增长做比对（考虑到住户结构可能改变，这不是一个完美的衡量指标，但已是可用指标中最好的了），显示我们指数中的十个城市在过去十年里每年的住宅缺口为2.8万套。

但同样地，供应上的势态可能也在变化。房价似乎已攀升至足以刺激新供应的水平。伦敦去年新增4万套住宅，为几十年来之最。过去三年，悉尼的新建房屋差不多令该市的公寓存量增加了五分之一。

最后，自金融危机后采取的宽松货币政策让抵押贷款变得极其廉价。房地产顾问服务公司莱坊（Knight Frank）全球研究部门的利亚姆·贝利（Liam Bailey）表示，这“大大刺激”了房价。低息贷款还压低了债券收益，促使投资者转向包括房地产在内的其他资产。但随着各地央行收紧货币政策，偿还房贷的成本将变得更高昂，寻求固定收益资产替代品的投资者也将减少。

因脱欧而备显脆弱的伦敦也许是个风向标。地产中介称，开发商为能最终成交，已开始提供高达10%的折扣。在需求减少、供应增加而按揭利率上升的作用下，全球城市的房地产牛市可能行将结束。 ■



Schumpeter

A wall of money

Quite suddenly tech firms have become the corporate world's biggest investors

A COMMON way to describe the history of the technology industry is by product cycles. The 1990s was the era of the PC; then came the internet and related services, followed by mobile; and now artificial intelligence looms. But there is a different way to think about tech: it is switching from an era of hoarding profits to one of reinvestment. Take a crude yardstick of spending: the physical footprint of the five most valuable American tech firms. A decade ago if you added up all the land they occupied, you got to an area one and a half times the size of Central Park. Now an ongoing splurge means they use ten times more space, or 600m square feet (55m square metres), roughly the size of all of Manhattan. This shift to redeploying profits is seismic.

Amazon accounts for two-fifths of that space—the equivalent to anything south of Grand Central. Way back in 1998, its boss, Jeff Bezos, had a different message, telling his shareholders that its business model was “cash-favoured and capital efficient”. The capital-light approach was in vogue in China, too, until recently. At the end of last year Alibaba’s market value was similar to the total for China’s biggest 700 industrial firms, yet it had 12% of their assets. Investors loved tech firms’ ability to crank out huge profits with tiny balance-sheets, but economists were alarmed by it. Two years ago Lawrence Summers fretted that tech might depress overall investment. Digital disrupters would sap incumbent firms’ confidence to invest while spending little themselves. This was part of a wider malaise he called “secular stagnation”.

But over the past two years it has become clear that tech firms no longer

skimp. Mr Bezos's firm had capital expenditure of \$25bn last year (including leases), making it the fourth-biggest spender in the world, just above Gazprom, a Russian energy monster with 172,000km of pipelines. America's national accounts take a broader view of investment than company accounts do, by including research and development (R&D) and content creation. Using this definition, total investment by a sample of the ten biggest American and Chinese tech firms has tripled over five years, to \$160bn. If you include acquisitions and stakes bought in smaller firms, this rises to \$215bn. Of this figure, two-fifths was spent on intangible assets, a third on physical plant, and the rest on deals. Overall, these firms now have the same propensity to reinvest as other listed companies.

It is not just the giants. Xiaomi, a Chinese smartphone company, spent \$2bn over the past three years. WeWork, an office-rental operation that is viewed by some as a technology play, invested a billion dollars on physical assets in 2017. In America, if you include all firms, public and private, tech accounts for an estimated fifth of all investment across the economy and at least half of the absolute growth in investment.

The boom has four causes. First, tech firms are undertaking activity on behalf of other companies. Instead of building data centres, non-tech companies lease capacity from cloud-based providers such as Amazon Web Services (AWS, the giant's cloud arm) and Microsoft, and in China, from Alibaba and Tencent. AWS is investing \$9bn a year, or about the same as General Motors. Second, the online and physical worlds are blurring. Chinese consumers roam between e-commerce sites and shops, so tech firms there are building retail outlets. Alibaba has a chain called Hema. Amazon bought Whole Foods last year. As tech sprawls into the old economy, it is acquiring more heft. Alphabet's "other bets division", which includes its self-driving cars, contains over \$2bn of physical assets.

A third trend is that tech firms are acquiring access to technology and data.

Microsoft bought LinkedIn for \$24bn in 2016. Chinese firms are obsessed with taking non-controlling stakes in startups. Alibaba and Tencent have spent \$21bn in the past five years, making them dominant in China's venture-capital scene. A final probable cause of the investment boom is sheer indiscipline. One warning sign is a rash of flash property activity. Apple's new headquarters in California reportedly cost \$5bn. Finalising the doorknob designs took a year and a half.

For investors, tech's pivot is a conundrum. Monopolies that crank out profits on little investment are very valuable. If they can reinvest those profits at high returns they are even more so. But the danger is a loss of focus. For the sample of ten big tech firms each dollar of fixed assets cranks out five dollars of sales, half the level of a decade ago. The more diverse firms get, the more ordinary the returns may be. Longtime big spenders such as Shell and Intel are experts at allocating capital. Compare that to Facebook. Its annual investment (including R&D) has gone from \$3bn to \$14bn in five years. Based on its approach to customer privacy, it is easy to imagine that behind the scenes things are slapdash.

For the economy, tech's pivot has plenty of benefits. Apple's headquarters has created at least 13,000 full-time construction jobs, according to Reuters. And the big tech firms' savings are no longer rising as a share of the economy. Take Alphabet, Amazon, Apple, Facebook, Microsoft and Netflix. Their free cashflow (the cash they have left over after investment), has dropped slightly as a share of American GDP, to about 0.6%. Some blue-chip firms such as Ford and Walmart are fighting back by investing heavily in new technologies, too. The last tech craze, in 1998-2001, created a glut of network capacity that ultimately boosted productivity.

In the long run the drawback is that the more the tech giants reinvest, the larger they will get, amplifying an already glaring antitrust problem. In the short run the catch is that the tech boom, which is already frothy, could

burst, and a sudden cutback in capital spending could hurt the economy more deeply than most people realise. Tech is already integral to America's news cycle, its political cycle and the rhythms of its stockmarket. Now it may have a large sway over the investment cycle, too. ■



熊彼特

巨额投资

科技公司摇身一变，成为企业界最大的投资者

人们通常用产品周期来描述科技行业的历史。上世纪90年代是个人电脑时代，随后便进入互联网和相关服务的时代，再之后是手机时代。如今，人工智能时代正在逼近。但是，还有另一种看待这个行业的角度：它正从囤积利润的时代转向再投资的时代。对此有一个粗略的衡量支出的指标：美国市值排名前五的科技公司的“实体足迹”。十年前，这五家公司的占地面积加在一起是纽约中央公园的1.5倍。而目前这轮持续的高投入使得它们的总占地面积比那时多10倍，达到6亿平方英尺（5500万平方米），大概相当于整个曼哈顿。这种重新配置利润的转变影响重大。

亚马逊占据了其中五分之二的面积，相当于纽约中央车站以南的整个区域。早在1998年，老板杰夫·贝佐斯就出语不凡，告诉股东们亚马逊的商业模式是“偏好现金且讲求资本效率”。直到不久前，这种轻资本模式在中国也很流行。截至去年底，阿里巴巴的市值与中国最大的700家工业企业的总市值相当，资产却只有它们的12%。投资者喜好科技公司以少量资产赚取巨额利润的能力，但经济学家对此却深感忧虑。两年前，劳伦斯·萨默斯（Lawrence Summers）就担心科技行业可能会抑制总体投资。掌握数字技术的颠覆者们不光自己花钱少，同时还将挫伤传统企业的投资信心。这是萨默斯所说的更广泛的“长期停滞”问题的一部分。

然而，在过去的两年里，科技公司显然不再吝啬。亚马逊去年的资本支出达250亿美元（包括租赁），略高于拥有17.2万公里输气管道的俄罗斯能源巨头俄罗斯天然气工业股份公司（Gazprom），成为全球排名第四的花钱大户。美国的国民经济核算对投资的定义比企业账目更宽泛，囊括了研发和内容创建。按照这一定义，以美国和中国的十大科技公司为样本，这十大公司的总投资五年内增长了两倍，达1600亿美元。如果把并购和买入的较小公司的股份也计算在内，则升至2150亿美元。这其中五分之二花在

无形资产上，三分之一投向实体工厂，剩下的用于各种交易。总体来说，这些公司现在和其他上市公司一样倾向于再投资。

一掷千金的不仅仅是巨头公司。中国智能手机公司小米过去三年间花掉了20亿美元。办公租赁企业WeWork在某些人看来也属于科技公司，2017年该公司在实体资产上投资了10亿美元。在美国，如果把包括上市和非上市的所有企业都算在内，科技公司的投资大约占到整个经济所有投资的五分之一，并至少贡献了投资增长绝对值的一半。

这种激增有四方面原因。首先，科技公司为其他企业承担了部分业务运作。非科技公司并不自建数据中心，而是从云计算服务提供商那里租赁计算和存储能力，如亚马逊的云计算部门AWS、微软，以及中国的阿里巴巴、腾讯等。AWS每年投资90亿美元，与通用汽车差不多。其次，网络和现实的界限日益模糊。中国的消费者既浏览电子商务网站也逛实体店，因此中国的科技公司正在建设自己的零售门店。阿里巴巴拥有连锁超市盒马。亚马逊去年收购了全食超市（Whole Foods）。随着科技公司向传统经济领域延伸，它们也变得更笨重。Alphabet旗下包括无人驾驶汽车在内的“其他赌注部门”拥有超过20亿美元的实体资产。

第三个趋势是科技公司正在获取技术和数据。2016年，微软以240亿美元收购领英（LinkedIn）。中国公司则热衷于成为创业公司的非控股股东。过去五年里，阿里巴巴和腾讯已花费210亿美元，成为中国风险投资领域的主导者。最后，投资激增可能是因为极度缺乏约束。企业在物业上频频摆阔就是个警示性征兆。据报道，苹果在加州的新总部耗资50亿美元。光是门把手的设计就花了一年半时间。

对投资者来说，科技公司的转变是一个复杂的谜题。只需很少的投资就能获利的垄断企业极具价值。如果将这些利润再投资并获得高回报，它们的价值会更高。但风险是科技公司会失去核心聚焦。以样本中的十大科技公司为例，目前每一美元的固定资产可以产生五美元的销售额，只有十年前的一半。公司经营越多元化，回报可能就越平庸。长久以来都是花钱大戶的壳牌、英特尔等公司深谙资本配置之道。相比之下，Facebook的年投资

额（含研发）在五年内从30亿美元增至140亿美元。从Facebook对客户隐私的处理上不难想象，其背后的很多资本配置都很草率。

科技公司的转变对整个经济来说好处多多。据路透社报道，苹果总部至少创造了1.3万个全职建筑工作岗位。大型科技公司的存款在整个经济中的占比不再上升。以Alphabet、亚马逊、苹果、Facebook、微软以及Netflix为例，它们的自由现金流（投资后剩余的现金）在美国GDP中的占比已有小幅下降，约为0.6%。福特、沃尔玛等一些蓝筹股公司也在奋起还击，大力投资新科技。上一轮科技热潮（1998年至2001年）造成的网络容量过剩最终提高了生产率。

长远的弊端在于，科技巨头再投资越多，它们的规模就越大，本已显著的反垄断问题也就更加突出。短期的隐患是科技热潮的泡沫可能会破灭，而资本支出骤减对经济的伤害可能超出多数人的想象。科技已然成为美国的新闻周期、政治周期及股市周期变化中不可或缺的部分。如今它还可能对投资周期产生重大影响。 ■



The technology industry

FATWIN v MAGA

The era of the FAANGs may be over

IN THE end, it wasn't enough, at least for now. On July 31st Apple announced results for its third quarter that handily beat analysts' expectations. Revenues rose by 17% compared with the same period in 2017, and profits were 32% higher. The firm's shares jumped by nearly 4% in after-hours trading.

The near miss is a fitting coda to the latest round of results in techland. Momentum in this most upwardly mobile of industries is unbroken; sales and profits are still rising. But the laws of economic gravity have not been repealed. In fact, the era of the FAANGs— as Facebook, Amazon, Apple, Netflix and Google's parent, Alphabet, are collectively known—may be coming to an end, giving way to a period in which two groups of tech firms follow different trajectories.

This year the FAANGs and a few other high-flying tech firms provided more than half the returns in the S&P 500 share index. Netflix's share price, for instance, more than doubled between January and July. Twitter's almost did so. Facebook's market value quickly recovered from a low in March, after revelations that its data on 87m users had leaked to a British political-campaign firm.

With their shares priced for near-perfect results, the firms were vulnerable to bad news. This duly arrived, starting with Netflix, a video-streaming service, which said in mid-July that it had added fewer subscribers than expected. A few days later Facebook gave downbeat guidance about future growth and margins. Then Twitter, a microblogging site, announced that its

number of active users had declined. All three firms' share prices plunged by about a fifth.

News of the wipeout overshadowed the fact that the other tech titans continue to do well, as also evidenced in July. Microsoft, the world's biggest software firm, reached \$100bn in annual revenue for the first time. Alphabet shrugged off the \$5bn fine recently imposed on it by European trustbusters and posted strong results. Amazon announced a record quarterly profit.

These diverging results point to a broader development. Throwing all the FAANGs and other big tech firms into one basket has always been lazy. In the future they will probably be seen as two different groups: a consumer-oriented one, which could, somewhat awkwardly, be called "FATWIN" (Facebook, Twitter and Netflix) and a more business-to-business group, which some already dub "MAGA" (Microsoft, Amazon, Google and Apple).

The first group shows signs of reaching maturity. It is not that the firms will now stagnate. Facebook's revenues grew by 42%; Twitter's were up by 24%. But signs abound that social media's best days are over. Advertising revenues are not infinite. Users are exhibiting social-media fatigue. And regulators will continue to prod firms to police their platforms (one of the reasons for Facebook's shrinking margins is that it has been hiring thousands of moderators to vet users' posts). The firm's earnings call should be seen as a "big reset of investor expectations", says Mark Mahaney of RBC Capital Markets, a bank.

The second group benefits from the fact that companies continue to embrace cloud computing, particularly as it starts to encompass artificial-intelligence services. Amazon's record profits were generated by its cloud-computing arm, as were Microsoft's expanding revenues. Google, too, is making more money from the cloud, although it still depends on advertising as its main engine. As for Apple, being mainly a hardware-

maker, it stands apart. Although it did not ship as many iPhones as expected, it sold them at a higher average price. Its services business, which includes the iTunes music store and the iCloud bundle of offerings, had its best quarter ever, posting revenues of nearly \$10bn.

Overall, tech firms will continue to thrive, says Brian Wieser of Pivotal Research. Yet all bets will be off should America's trade war with China continue to get hotter. Apple is most vulnerable. Not only are most of its devices made in China, but the country is its second-largest market. If Apple gets hit by tariffs, another company is likely to get to \$1trn first. But right now, that prize seems within its reach. ■



科技行业

FATWIN对阵MAGA

“大獠牙帮”时代可能已经落幕

最终，一切还是不够好，至少目前是如此。7月31日，苹果公司宣布其第三季度业绩轻松超过分析师预期。收入比2017年同期增长17%，利润增长32%。其股价在盘后交易中上涨近4%。

这一次功败垂成给科技业最近一轮业绩报告做了恰当的收尾。在这个发展最强劲的行业里，势头从未间断，销售额和利润仍在攀升。但经济领域里的万有引力定律并未失效。事实上，“大獠牙帮”（FAANG，即Facebook、亚马逊、苹果、Netflix及谷歌母公司Alphabet的总称）时代可能已经走到了尽头，取而代之的是两类科技公司在不同轨道上行进的新时期。

今年，标普500指数中超过一半的回报来自“大獠牙帮”和其他几家业绩突出的科技公司。例如Netflix的股价从1月到7月翻了一倍多。推特的股价也差不多。在被揭露向一家英国政治竞选公司泄露了8700万用户的数据之后，Facebook的市值已从3月的低位迅速反弹，收复失地。

由于它们的股票是按几近完美的业绩定价的，这些公司特别容易受坏消息的影响。而该来的还是会来，先是视频流服务公司Netflix在7月中旬公布订阅用户增长低于预期。几天后，Facebook对未来增长和利润做出悲观预测。之后是微型博客网站推特宣布活跃用户数量下降。三家公司的股价均下跌了约五分之一。

这些失利消息盖过了同样在7月里呈现的一个事实：其他科技巨头维持了不俗的表现。全球最大的软件公司微软的年收入首次突破千亿美元。Alphabet不受最近被欧盟反垄断机构判罚50亿美元的影响，公布了强劲业绩。亚马逊宣布取得破纪录的季度利润。

这些不同的结果表明了更广泛的发展路径。把“大獠牙帮”和其他大型科技公司扔进同一个篮子里一直都过于简单粗暴。未来，这些公司可能会被视为两类：一类面向消费者，可勉强简称为“FATWIN”（即Facebook、推特和Netflix），另一类更多面向企业，已有人将之称为“MAGA”（即微软、亚马逊、谷歌和苹果）。

第一类公司已有接近成熟的迹象。这并不意味着这些公司会就此停滞不前。Facebook的收入增长了42%，推特的收入增长了24%。然而各种迹象显示，社交媒体的好日子到头了。广告收入并非无穷无尽。用户正在显现社交媒体疲劳。而监管机构将继续督促各个平台自我监管（Facebook利润缩减的原因之一是公司雇用了数千名管理员来审查用户发帖）。加拿大皇家银行资本市场（RBC Capital Markets）的马克·马哈尼（Mark Mahaney）表示，Facebook的业绩报告电话会议应被看作是“对投资者预期的一次大修正”。

第二类公司受益于企业对云计算技术的持续追捧，尤其是当这些科技公司开始推出人工智能服务。亚马逊创纪录的利润来自其云计算部门，微软的收入增长也一样。谷歌尽管仍依赖广告作为主要收入来源，但通过云计算获得的收益也是越来越大。至于更多是硬件制造商的苹果，情况则与众不同。尽管iPhone销量不及预期，但iPhone的均价提高了。其服务业务（包括iTunes音乐商店和iCloud产品组合）取得了有史以来的最佳季度业绩，收入近100亿美元。

Pivotal Research的布莱恩·威泽（Brian Wieser）表示，总体而言，科技公司将继续蓬勃发展。不过如果中美贸易战继续升温，一切就都说不准了。苹果最易受到冲击。因为中国不仅制造了该公司大多数的设备，还是其第二大市场。如果苹果受到关税的打击，率先攻破万亿美元市值关口的可能就会是另外一家公司。但就目前来看，这对苹果似乎触手可及。■



Infrastructure

The bridges of decay

It is not just in Italy that bridges are failing

CONCRETE can last a very long time. The roof of the Pantheon in Rome is the world's largest unreinforced concrete dome; it was completed in around 125AD by Hadrian, an emperor. But concrete structures can also fail, with tragic consequences. Although it is too early to know the cause of its collapse, something clearly went very wrong with the Morandi bridge in Genoa, which was completed in 1967 and crashed to the ground on August 14th with the loss of at least 38 lives.

In Italy itself fingers are already being pointed: at the operator of the bridge, at the bridge's designer, at politicians at home and abroad (see Europe section). But the Genoa disaster also carries a warning that stretches well beyond the country's borders. Concrete, on which the Morandi bridge relied, has become the world's most widely used building material. The sort reinforced with steel is found in all manner of construction. And unlike the stuff in the dome of the Pantheon, reinforced concrete comes with a problem.

The reinforcing is done by encasing steel bars—or the ties that support bridges, as in the design of the Genoa structure—within the concrete. The difficulty with using metal is that it introduces a potential weakness. Tiny cracks can develop in concrete from battering by the weather, vibrations from traffic, movements in the foundations and other causes. These cracks allow water to creep inside the structure, and once in contact with the metal contained therein, cause it to corrode. That process can dramatically weaken the structure. Bridges are of particular concern because they can be subjected to unusually large stresses and strains, and many span long

distances with nothing below them for support.

The risk of deterioration inherent in reinforced concrete can be accelerated by many factors. Shoddy workmanship in the first place does not help. In the case of bridges designed in the 1960s, the loads placed on them have become far higher because traffic volumes are greater, cars are bigger and lorries much heavier. Extreme weather can also play a part, not least because concrete expands when it gets hot and contracts in the cold. Floods are able to undermine foundations. In the normal course of things, most bridges built using reinforced concrete may survive individual events. But if they have been weakened and that vulnerability has not been detected by regular inspections and repaired, for whatever reason, a vital margin of safety has been removed.

So it is not just in Italy that questions should be asked about monitoring and maintenance regimes. Bridges throughout Europe, America and Asia are all showing signs of deterioration. As long ago as 1999, one study showed that 30% of road bridges surveyed in Europe had some sort of defect, often involving corrosion of their reinforcement. And a report this year found that more than 54,000 out of the 613,000 bridges in America are rated “structurally deficient”. These dodgy bridges are crossed 174m times a day.

In many cases, structures that might have been expected to last a century or so will now probably have to be replaced in half the time because of various forms of structural deterioration. New technologies will help with much closer monitoring; new materials will allow stronger replacements (see Science section), which might turn out to be a cheaper option than restoration. With the world covered in reinforced concrete, this is a problem that spans countries. The failure of the Morandi bridge shows that it must not be ignored. ■



基础设施

破败的桥梁

不止意大利有桥梁失修的问题

混凝土可以维持非常久远的时间。罗马万神殿的屋顶是世界上最大的无筋混凝土穹顶，由罗马皇帝哈德良（Hadrian）下令建造，约在公元125年完工。但混凝土结构也可能破败垮塌，造成悲剧性后果。虽然现在还不能确定坍塌的原因，但热那亚的莫兰迪大桥显然存在严重的问题。这座建成于1967年的大桥在8月14日坍塌，导致至少38人死亡。

意大利国内对事故责任议论纷纷，矛头分别指向桥梁运营商、桥梁设计者和国内外政客。但这场灾祸引发的警报远远超出了意大利国界。莫兰迪大桥所倚赖的混凝土已经是全球使用最广泛的建筑材料。用钢筋加固的混凝土被用于各式各样的建筑中。而有别于万神殿穹顶中使用的材料，钢筋混凝土存在一个问题。

钢筋混凝土通过在混凝土内加入钢筋来加固，有时加入的是支撑桥梁的拉索，比如莫兰迪大桥的结构设计就是如此。使用金属的问题在于会带来一个潜在弱点。日晒雨淋、车来车往的震动、地基位移等因素都可能导致混凝土出现微小的裂缝。有了裂缝，水就会渗入结构的内部，一旦与其中的金属接触便会发生腐蚀。这个过程会大大削弱建筑物的结构。桥梁尤其令人担心，因为它们可能承受极大的应力和应变，而且许多大跨度桥梁下方没有任何支撑。

许多因素都可能加速钢筋混凝土固有的退化风险。首当其冲的问题就是粗制滥造。而对于上世纪60年代设计的桥梁而言，如今交通流量更大，汽车个头更大，卡车载重大幅增加，大大加重了这些桥梁的负担。极端天气也可能产生影响，特别是因为混凝土会热胀冷缩。洪水又会破坏地基。正常情况下，大多数钢筋混凝土桥梁能熬过单次天灾的考验。但如果桥梁结构已经受损，又因种种原因未能在定期检查中发现问题并修复，那么至关重

要的安全裕度就已经不复存在了。

所以不仅仅是意大利，全世界都应该关注混凝土建筑的监测和维护机制。欧洲、美洲和亚洲各地的桥梁都显现出退化的迹象。早在1999年的一项研究显示，在欧洲，被调查的公路桥中有30%存在某种缺陷，通常涉及加强钢筋受腐蚀的问题。今年发表的一份报告发现，美国的613,000座桥梁中有54,000多座被评定为“有结构性缺陷”。而这些有隐患的桥梁每天的通行量达1.74亿次。

在许多情况下，由于各种形式的结构退化，原本预计可使用百年的建筑可能在50年左右就必须更换。新技术将有助于更密切地监测；新材料能建造出更结实的替代建筑，而且可能会是比修复更经济的选择。鉴于钢筋混凝土建筑遍布全球，这一问题跨越国度。莫兰迪大桥的坍塌表明这一问题不容忽视。 ■



Summer camps

Mutually assured distraction

The ever more competitive world of the summer “enrichment” programme

IN A classroom at Imperial College London, students sit hunched over laptops, typing lines of code. Just nine years old, they are attending Firetech, a British technology summer camp for children. Courses include “Junior Augmented Reality” and “Creating for YouTube”. Such programmes are proliferating in many countries. They pander to two common demands from well-off parents: to entertain children over the long summer holidays and to give them a leg-up over their peers.

At most American summer camps children still commune with nature and sing around a campfire. But some camps cater to more niche interests, such as neuroscience, outer space or even atheism. Tom Rosenberg, chief executive of the American Camp Association, says a growing number focus on skills in demand at modern workplaces. The proportion offering science, technology, engineering or maths programmes, for instance, rose from less than a quarter in 2014 to almost a third in 2017.

Students often have an eye on university. Alexandra Boyt and David Stephenson, who run a residential Latin camp in western England, say a lot of students come to prepare for interviews at Oxford and Cambridge. Princeton asks applicants how they spent their past two summers. Entry to the camps themselves can be competitive. Canada/USA Mathcamp accepts just 15% of applicants.

In East Asia some parents use the summer to boost their children’s English skills. In a packed classroom at SNT Academy, a private language school in an affluent part of Seoul, the South Korean capital, a group of eight-

and nine-year-olds practise debating (topic: should cosmetic surgery be banned?). Many wealthy Chinese parents go further, sending their children on study tours abroad. Ctrip, a Chinese travel agency, believes that 1m Chinese students will go on such trips this year, spending \$4.5bn.

The fanciest summer programmes can be expensive. Firetech charges £1,300 (\$1,700) for week-long residential courses; a week at Space Camp, in Huntsville, Alabama, can cost up to \$1,200. Mr Rosenberg says there is a camp for every budget. But as wealthier parents splash out on ever more specialised programmes, it is getting harder for the less well-to-do to keep up in the summer-camp arms race. ■



夏令营

娱乐军备竞赛

暑期“强化”项目竞争日益激烈

在伦敦帝国理工学院的一间教室里，学生们对着笔记本电脑埋头输入一行行代码。年仅九岁的他们正在参加英国Firetech的儿童科技夏令营。课程包括“初级增强现实”和“为YouTube创作”。此类项目在许多国家日渐增多，迎合了富裕父母的两个普遍需求：让孩子在漫长的暑假得到快乐，也让他们比同龄人领先一步。

在美国大多数夏令营中，孩子们仍在亲近自然，围着篝火唱歌。但有一些夏令营迎合较小众的兴趣，例如以神经科学、外太空甚至无神论为主题。美国营地协会（American Camp Association）的首席执行官汤姆·罗森伯格（Tom Rosenberg）表示，越来越多的夏令营注重现代职场需要的技能。举例来说，提供科学、技术、工程或数学课程的夏令营比例从2014年的不到四分之一上升至2017年的近三分之一。

学生们往往是为了考大学。亚历山德拉·博伊特（Alexandra Boyt）和大卫·斯蒂芬森（David Stephenson）在英格兰西部经营一个拉丁语住宿营地。他们表示，很多学生来参加夏令营是为牛津大学和剑桥大学的面试做准备。普林斯顿大学会问入学申请人过去两个暑假是如何度过的。申请参加夏令营本身也充满竞争。“美加数学营”（Canada/USA Mathcamp）仅接受15%的申请者。

在东亚，一些父母利用暑假来提高孩子的英语能力。在韩国首都首尔富人区一所私立语言学校SNT学院（SNT Academy）的教室里，一群八九岁的孩子挤在里面练习辩论（辩题是是否该禁止整容手术）。大批富裕的中国父母更是把孩子送去参加游学课程。中国旅行社携程认为，今年将有100万中国学生参加这样的旅行，花费达45亿美元。

那些最时髦高深的夏令营可能收费不菲。Firetech为期一周的住宿课程收费1300英镑（1700美元）；美国阿拉巴马州亨茨维尔市（Huntsville）的太空夏令营一周的费用可高达1200美元。罗森伯格表示，总有不同价位的夏令营适合各人预算。但随着富裕家庭为更专门化的夏令营大把撒钱，囊中羞涩的父母越来越难以跟上这场夏令营军备竞赛了。 ■



Economic and financial indicators

Agricultural commodities

Prices of edible oils have fallen over the past year, reflecting rising production throughout the 2017-18 season

Prices of edible oils have fallen over the past year. This reflects rising production throughout the 2017-18 season, after weakness the year before when El Niño, a climatic phenomenon, played havoc with crops. An ample supply of palm oil in Indonesia and Malaysia, as well as of coconut oil in the Philippines, has dampened prices. In July the price of soyabeans hit a ten-year low, because of concerns that impending Chinese tariffs would reduce demand from the world's largest consumer of them. The price of wheat, on the other hand, has risen. Scorching temperatures have created drier conditions for the crop, with smaller European harvests likely. ■



经济与金融指标

大宗农产品

过去一年里食用油价格下跌，反映了整个2017-18榨油季产量增加

食用油价格在过去一年里已经下降，反映了整个2017-18榨油季产量增加。一年前，厄尔尼诺现象导致农作物严重受损，食用油生产疲软。之后，印度尼西亚和马来西亚的棕榈油、菲律宾的椰子油供应充足，抑制了价格。7月，大豆价格降至十年新低，因为市场担忧中国即将加征的关税会令这个世界最大的大豆消费国需求降低。另一方面，小麦的价格已经上涨。炎热天气令小麦的生长环境变得更干旱，欧洲的收成看来会减少。■



Romance in the digital age

Modern love

Online dating has changed the search for a mate, for better more than for worse

THE internet has transformed the way people work and communicate. It has upended industries, from entertainment to retailing. But its most profound effect may well be on the biggest decision that most people make—choosing a mate.

In the early 1990s the notion of meeting a partner online seemed freakish, and not a little pathetic. Today, in many places, it is normal. Smartphones have put virtual bars in people's pockets, where singletons can mingle free from the constraints of social or physical geography. Globally, at least 200m people use digital dating services every month. In America more than a third of marriages now start with an online match-up. The internet is the second-most-popular way for Americans to meet people of the opposite sex, and is fast catching up with real-world “friend of a friend” introductions.

Digital dating is a massive social experiment, conducted on one of humanity's most intimate and vital processes. Its effects are only just starting to become visible (see Briefing).

Meeting a mate over the internet is fundamentally different from meeting one offline. In the physical world, partners are found in family networks or among circles of friends and colleagues. Meeting a friend of a friend is the norm. People who meet online are overwhelmingly likely to be strangers. As a result, dating digitally offers much greater choice. A bar, choir or office might have a few tens of potential partners for any one person. Online there are tens of thousands.

This greater choice—plus the fact that digital connections are made only

with mutual consent—makes the digital dating market far more efficient than the offline kind. For some, that is bad news. Because of the gulf in pickiness between the sexes, a few straight men are doomed never to get any matches at all. On Tantan, a Chinese app, men express interest in 60% of women they see, but women are interested in just 6% of men; this dynamic means that 5% of men never receive a match. In offline dating, with a much smaller pool of men to fish from, straight women are more likely to couple up with men who would not get a look-in online.

For most people, however, digital dating offers better outcomes. Research has found that marriages in America between people who meet online are likely to last longer; such couples profess to be happier than those who met offline. The whiff of moral panic surrounding dating apps is vastly overblown. Precious little evidence exists to show that opportunities online are encouraging infidelity. In America, divorce rates climbed until just before the advent of the internet, and have fallen since.

Online dating is a particular boon for those with very particular requirements. Jdate allows daters to filter out matches who would not consider converting to Judaism, for instance. A vastly bigger market has had dramatic results for same-sex daters in particular. In America, 70% of gay people meet their partners online. This searchable spectrum of sexual diversity is a boon: more people can find the intimacy they seek.

There are problems with the modern way of love, however. Many users complain of stress when confronted with the brutal realities of the digital meat market, and their place within it. Negative emotions about body image existed before the internet, but they are amplified when strangers can issue snap judgments on attractiveness. Digital dating has been linked to depression. The same problems that afflict other digital platforms recur in this realm, from scams to fake accounts: 10% of all newly created dating profiles do not belong to real people.

This new world of romance may also have unintended consequences for society. The fact that online daters have so much more choice can break down barriers: evidence suggests that the internet is boosting interracial marriages by bypassing homogenous social groups. But daters are also more able to choose partners like themselves. Assortative mating, the process whereby people with similar education levels and incomes pair up, already shoulders some of the blame for income inequality. Online dating may make the effect more pronounced: education levels are displayed prominently on dating profiles in a way they would never be offline. It is not hard to imagine dating services of the future matching people by preferred traits, as determined by uploaded genomes. Dating firms also suffer from an inherent conflict of interest. Perfect matching would leave them bereft of paying customers.

The domination of online dating by a handful of firms and their algorithms is another source of worry. Dating apps do not benefit from exactly the same sort of network effects as other tech platforms: a person's friends do not need to be on a specific dating site, for example. But the feedback loop between large pools of data, generated by ever-growing numbers of users attracted to an ever-improving product, still exists. The entry into the market of Facebook, armed with data from its 2.2bn users, will provide clues as to whether online dating will inexorably consolidate into fewer, larger platforms.

But even if the market does not become ever more concentrated, the process of coupling (or not) has unquestionably become more centralised. Romance used to be a distributed activity which took place in a profusion of bars, clubs, churches and offices; now enormous numbers of people rely on a few companies to meet their mate. That hands a small number of coders, tweaking the algorithms that determine who sees whom across the virtual bar, tremendous power to engineer mating outcomes. In authoritarian societies especially, the prospect of algorithmically arranged marriages

ought to cause some disquiet. Competition offers some protection against such a possibility; so too might greater transparency over the principles used by dating apps to match people up.

Yet such concerns should not obscure the good that comes from the modern way of romance. The right partners can elevate and nourish each other. The wrong ones can ruin both their lives. Digital dating offers millions of people a more efficient way to find a good mate. That is something to love. ■



数字时代的浪漫

现代爱情

在线约会改变了人们寻找配偶的方式，其好处大于坏处

互联网改变了人们工作和沟通的方式。它颠覆了从娱乐到零售等各个行业。但它造成最深刻影响的很可能是大多数人此生所做决定中最大的一个——择偶。

回到上世纪90年代初，那时在网上找伴侣的想法还显得很古怪，而且让人觉得很可悲。如今在许多地方这已毫不稀奇。智能手机把虚拟酒吧放进了人们的口袋，单身人士可以在这里摆脱社会分布或现实空间的限制，自由交往。在全球，每月至少有两亿人使用数字约会服务。在美国，现在超过三分之一的婚姻是从在线配对开始。互联网是美国人第二喜欢的结交异性的方式，并且正在迅速赶上现实世界中“朋友的朋友”这种介绍方式。

数字约会是一项大规模的社会实验，在人类最私人也最重要的活动之一中展开。它的影响才刚刚开始显现。

在网上结识配偶与线下交往完全不同。在现实世界中，人们在家庭网络或朋友和同事圈中找到另一半。结识朋友的朋友是常态。而在网上遇到的人绝大多数都是陌生人。因此，数字约会提供的选择要多得多。酒吧、合唱团或办公室可能会为任何一个人提供几十个潜在的伴侣，而网络能提供千千万万个。

由于选择更多，再加上数字联系只有在双方同意的情况下才能建立起来，数字约会市场的效率远远高于线下。对有些人来说，这是个坏消息。由于两性在挑剔程度上的巨大差异，一些直男注定永远不会在网上得到配对。在中国的应用“探探”上，男性对他们看到的60%的女性表示感兴趣，但女性只对6%的男性感兴趣。这种差异意味着有5%的男性从未获得过任何匹配。在线下约会中，可选男性的数量要少得多，直女因而更有可能与那些在网上没机会被选中的男性牵手。

然而，对于大多数人来说，数字约会能带来更好的结果。研究发现，在美国，相识于网络的人们缔结的婚姻可能会更持久；这些伴侣自称比那些在线下相识的人更幸福。约会应用引发的些微道德恐慌被极大地夸大了。鲜有证据表明网上约会的机会会助长不忠行为。在美国，互联网出现之前离婚率一直在攀升，之后便开始下降。

在线约会尤其为那些有非常特定的要求的人提供了便利。例如，Jdate能让约会者过滤掉不考虑皈依犹太教的对象。对于同性恋者来说，一个远远扩大的市场已经产生了非凡的影响。在美国，有70%的同性恋者是通过网络与伴侣相识的。可根据各种性取向搜索求偶者是一个福音：更多人可以找到他们寻求的亲密关系。

然而，这种现代爱情方式也存在问题。在面对数字约会市场的残酷现实及自己在其中的处境时，许多用户都抱怨压力大。有关身体形象的负面情绪在互联网出现之前就已存在，但当陌生人可以随意草率地发布对自己吸引力的评判时，就放大了这些情绪。已发现数字约会是抑郁症相关因素。从诈骗到虚假账户，困扰其他数字平台的问题同样也出现在数字约会领域：所有新创建的交友资料中有一成是虚假档案。

这个新的浪漫世界也可能为社会带来意想不到的后果。既然约会者的选机会极大增加，他们之间的阻隔就可能被冲破：证据表明，由于可以绕过同质社会群体，互联网正在促进跨种族婚姻。但与此同时，约会者也更能够选择与自己相像的伴侣。所谓的“同型婚配”，也就是具有相似教育和收入水平的人配对，已被指为导致收入不平等的原因之一。而在线约会可能会使这种影响愈加明显，这是因为受教育水平的信息就那么显眼地摆在个人介绍上，而在线下永远不会这么展示。不难想象，未来的约会服务可能会根据用户上传的基因组信息通过优选特征来匹配对象。约会公司也面临固有的利益冲突：完美配对又会让它们失去付费客户。

另一个引人担忧的问题是在线约会市场被少数公司及它们的算法控制。约会应用并不完全得益于其他科技平台那种网络效应，比如它并不需要一个人的朋友们也出现在同一个交友网站上。但是，由不断完善的产品不断吸

引而来的用户所产生的大量数据之间的反馈回路仍然存在。手握22亿用户数据的Facebook已经进入了数字约会市场，可以通过它来观察在线约会是否会无可避免地整合到少数几个大平台上。

但是，即使约会市场没有变得更加集中，伴侣结合（或不结合）的过程无疑已经变得更集中。谈情说爱曾经是一个分散的活动，发生在无数的酒吧、俱乐部、教堂和办公室里；现在，不计其数的人依靠少数公司来与伴侣相识。这样，调整算法来决定谁与谁在虚拟酒吧相见的少数程序员就获得了巨大的权力，可以影响婚配结果。特别是在威权社会中，算法决定婚姻的前景应该会引起一些不安。竞争会在一定程度上防止这种可能性出现，而让约会应用的匹配原则更透明也会有同样的效果。

然而，这些担忧不应该掩盖这种现代的浪漫形式所带来的好处。合适的伴侣可以相互促进，相互成就，而错误的配对则可能毁掉彼此的生活。数字约会为千百万人提供了一种更有效的寻找佳偶的方式。这一点值得我们爱它。 ■



Higher education and the internet

Learning difficulties

A third of America's graduate degrees are now taken online. But the bulk of the spoils go not to famous universities but to obscure firms

"THERE'S only two things you do in the navy," says Vice-Admiral Al Harms, former commander of the *USS Nimitz*, a nuclear-powered aircraft carrier that is one of the world's biggest ships. "You fight, and you train to fight. Hopefully, most of the time you're training." The navy got Mr Harms hooked on continuous education, and in his 60s he felt the need for a top-up, so he took the online MBA programme of the University of Illinois (UoI), alongside his son. "I found it a very cool way to learn. You have the self-directed portion, working by yourself, and the enriching portion with class projects."

When the web started to shake up higher education a decade or more ago, it was widely expected that the Massive Open Online Courses (MOOCs) it spawned would disrupt universities in the same way that digital media undermined newspapers and music firms. But that assumption rested on a misunderstanding of what students are paying for. They are not buying education for its own sake, but rather a certificate from a respected institution.

If the value created in a business is an incumbent's stamp of approval, it follows that the business will be hard to disrupt. Providers of MOOCs have thus struggled to make much money. What has turned out to be a real business, by contrast, is putting incumbents online. An industry of "online programme managers" (OPMs), who also recruit students, has sprung up. With their help pioneers such as Arizona State University have been followed by big guns like Berkeley, Yale and Harvard, which focus on

graduate education.

For universities the internet opens up a vast new market: professionals who can't leave jobs and families but would like to boost their careers with a master's, a professional degree or executive education. The wage premiums for a master's degree and a professional degree over a bachelor's are 19% and 57% respectively. Technological change also means that knowledge acquired years ago may be out of date. "I wanted to build the skills necessary for the next phase of my career, to remain relevant to my industry and my clients," says Ann Cleland, a partner in Horne, an accountancy firm, who is taking the Harvard Business Analytics Programme while still leading a disaster-recovery compliance programme in Puerto Rico. For her, as for many, an on-campus course was not an option.

Going digital also frees universities from the physical constraints of their campus—the UoI has 99 MBA students on campus and 1,750 more enrolled online. UoI's MBA, at \$22,000, is unusually cheap: most online degrees are at least as costly as, and often more expensive than, on-campus programmes—usually in the \$50,000-100,000 range.

Around a third of graduate education in America is now online, according to Richard Garrett of Eduventures, a consultancy. Many universities take a do-it-yourself approach, but the better-known ones tend to go into partnership with the OPMs. 2U, a ten-year-old startup, led the way, and has been followed into the business by, among others, Pearson, an educational publisher, and Coursera (which started off as a provider of MOOCs). Coursera joined up with UoI to create its online MBA programme.

Investors reckon this looks like a good business opportunity. 2U has a market capitalisation of \$5bn, despite losses of \$29m on revenues of \$287m in 2017. Putting a programme online involves large upfront costs, but the ten-year contracts that 2U signs—it takes almost two-thirds of the revenue

from tuition fees—are extremely attractive over the long term. Revenues have risen by over 30% annually for the past three years and according to Chip Paucek, 2U's chief executive, they will continue to do so for the foreseeable future.

Further opportunities beckon outside America. In the autumn of 2019 University College London will launch an online MBA in partnership with 2U, and London's Imperial College will offer an online global public health masters with Coursera. Since announcing the course in March, Imperial has had 10,000 expressions of interest from 170 countries for 75 places.

Some think the OPM business is a bit too good, and that universities are giving up too much revenue. John Katzman, who founded 2U and left it in 2012, explains that he came to feel that the company, like other OPMs, had tilted towards shareholders and away from students. Full-service OPMs, he says, are too expensive. Better tech means it now costs \$2m-3m to put a programme online, against \$10m-15m when he started, but the revenue split has hardly shifted. That won't last, says Mr Katzman, who has founded a budget option—Noodle Partners, which offers deals based on a fee as well as a revenue split. "As students understand they're paying for Wall Street profits, as faculty understand that their work is just fuelling the next billion dollars of market cap, I will end up eating the OPMs' lunch," he says.

Such criticisms chime with broad concerns about for-profit education, but 2U's Mr Paucek is unmoved. "It's not going into Wall Street pockets. It's going into a long-term engine of social mobility." He has never lost a customer, he says.

Nonetheless, 2U's numbers will encourage competition. OPMs are proliferating, just as student-recruitment costs are rising. "Student-acquisition costs have been going up," says Iwan Streichenberger, president of Pearson Online Learning Services, "because of the premiums that Google

and Facebook are charging." Along with LinkedIn, these are the main marketing channels. Over time universities will surely try to take a larger slice of revenues themselves. It doesn't take a master's degree to work out what these developments will do to the OPMs' margins. ■



高等教育和互联网

学习障碍

美国有三分之一的研究生学位在线上获得。但拿走收益大头的不是知名大学，而是无名公司

“在海军就做两件事，”世界上最大的舰艇之一、美国尼米兹号核动力航空母舰前舰长、海军中将阿尔·哈姆斯（Al Harms）说，“作战，和准备作战。但愿，大部分时间你都是在训练。”海军生涯让哈姆斯迷上了继续教育，60多岁时他觉得需要充电，就和儿子一起参加了伊利诺伊大学的在线MBA课程。“我发现这种学习方式非常酷，一部分是自主学习，一部分通过课堂项目深化提升。”

十年或更早以前网络开始冲击高等教育时，人们普遍预计由此而生的大规模开放式网络课程（MOOC）会像数字媒体颠覆报纸和音乐公司那样颠覆大学。但这种假设误解了学生支付学费的目的。他们花钱上学不是为了受教育，而是为了从知名学府获得一纸文凭。

如果一项业务创造的价值是业内既有机构发出的认可，那么这项业务将难以被颠覆。这就是为什么MOOC的供应商一直难以实现高盈利。相比之下，真正显现出盈利能力的业务是把既有机构的课程放到网上。一个“在线课程管理服务”（以下简称OPM）行业已经迅速成长起来，同时它也负责招生。在这些公司的帮助下，亚利桑那州立大学等高校首先试水，伯克利、耶鲁和哈佛等注重研究生教育的大牌名校纷纷加入。

互联网为大学开辟了一个巨大的新市场：有大批职业人士不便脱离工作和家庭，但又希望获得硕士学位、职业学位或高层管理教育来提升自己的职业生涯。硕士学位和职业学位的工资水平相比学士学位分别高19%和57%。技术变革还意味着多年前获得的知识可能已经过时。会计师事务所霍恩（Horne）的合伙人安·克莱兰德（Ann Cleland）说，“我希望为我职业生涯的下一阶段积累必要的技能，在行业中面对客户时与时俱进。”她正在参加哈佛商业分析课程（Harvard Business Analytics Programme），

同时还领导着波多黎各的灾难恢复合规计划。对她和其他许多人来说，在校课程不现实。

在线课程也让大学不再受校园的物理局限。伊利诺伊大学的MBA课程有99名在校生和1750名注册在线课程的学生。该课程的学费为2.2万美元，非常便宜。大多数在线学位的学费至少与校园课程持平，常常还更贵，一般在5万至10万美元之间。

咨询公司Eduventures的理查德·加内特（Richard Garrett）表示，美国约三分之一的研究生教育现已上线。许多大学自己管理在线课程，但知名度较高的大学倾向于与OPM合作。成立十年的创业公司2U是OPM中的先行者，教育出版集团培生（Pearson）和从提供MOOC起家的Coursera等公司随后加入。Coursera与伊利诺伊大学联手创建了其在线MBA课程。

投资者认为这看起来是一个很好的商机。2U在2017年的收入为2.87亿美元，亏损2900万美元，但市值仍高达50亿美元。上线一个学位项目需要大量的前期成本，但2U签署的十年期合同从长远来看极具吸引力（其近三分之二的收入来自学费）。过去三年中，2U的收入每年增长超过30%，首席执行官奇普·波塞克（Chip Paucek）表示，在可预见的未来，公司还将继续保持这样的增速。

美国以外的地方也有更多机会显现。明年秋季，伦敦大学学院将与2U合作推出在线MBA课程；伦敦帝国理工学院将和Coursera联合推出全球公共卫生在线硕士课程。帝国理工的课程共有75个名额，自3月份宣布推出以来，已有来自170个国家的一万人表达了报名意向。

有些人认为OPM业务有点好过头了，还认为大学放弃了太多的收入。2U的创始人约翰·卡茨曼（John Katzman）在2012年离开了这家公司，他解释说这是因为自己开始觉得公司和其他OPM一样，更重视股东而非学生。他说，提供全方位服务的OPM太贵了。由于技术进步，现在上线一个课程的投入为200至300万美元，而在他创业之初需要1000到1500万美元，然而收入的分成比例却几乎没有变化。卡茨曼认为这种情况不会长久。他成

立了Noodle Partners来提供一种廉价的方案，基于一项收费和收入分成来提供服务。他说：“等学生明白他们交的学费变成了华尔街的利润，老师们认识到自己的努力只是在助力下一个十亿美元市值的企业时，我就会吃掉OPM的午餐。”

这类批评和对营利性教育的广泛担忧是一致的，但2U的波塞克不为所动。“这不是为了让华尔街赚得盆满钵满，而是为社会流动性提供长期推动力。”他说他还从未失去过一个客户。

即便如此，2U的收入数字将引发竞争。OPM公司正在激增，同时招生成本也在上升。培生在线学习服务公司（Pearson Online Learning Services）总裁伊万·史特莱申伯格（Iwan Streichenberger）说，“由于谷歌和Facebook收取的溢价，招生成本一直在上升。”谷歌、Facebook，以及领英都是在线课程的主要营销渠道。随着时间的推移，大学势必会试图分得更多的收入。无需硕士学位也能明白这些变化将对OPM的利润产生什么影响。 ■



Schumpeter

How to save it

Singapore is a model for how to reform some of the world's most flawed investment vehicles

IN MOST countries the priority with the public finances is how to stop debt spiralling. But some places have the opposite difficulty: how to manage piles of savings. China and Saudi Arabia are examples. Globally, governments have over \$20trn stashed in state-run investment vehicles. That sum is three times the size of BlackRock, the world's biggest asset manager. Managing it is fraught and becoming more so owing to protectionism. Governments with spare funds should study Singapore, which, as in many aspects of administration, has its head screwed on.

State investment funds come in several flavours. There are currency reserve funds, which are often managed solely by central banks. Then there is an array of entities that are lumped together under the “sovereign-wealth fund” label, which typically manage pension assets, oil revenues, some currency reserves, or own stakes in companies that governments view as strategic.

Central bank reserve kitties have existed for centuries, and sovereign-wealth funds date back to the 1950s, but both became prominent in 2004-08. High oil prices, trade surpluses and capital inflows meant that Asian and Arab countries were knee-deep in foreign earnings, which they reinvested in safe treasury bonds and also in riskier assets such as stakes in foreign firms. The spending spree peaked in 2008. By that point Western governments had become uneasy about the funds' power.

There are still problems. Often the funds' objectives are muddled. Some have their capital depleted by profligate politicians; others cannot decide whether to invest at home as well as abroad. It is a constant struggle to avoid

cronyism and to persuade other countries that they are not a tool of foreign policy.

Judged by their size, state funds have trodden water. Since 2015 emerging countries have burned up reserves as capital flows reversed and commodity prices fell. Adding up all global currency reserves and sovereign-wealth funds, their weight in the financial system has stayed flat over the past six years, at 12% of the market value of all shares and bonds. Governance is patchy. A Malaysian state fund, 1MDB, has been at the centre of a corruption scandal. The \$250bn Saudi Public Investment Fund is making huge, wild, bets on Silicon Valley and pursuing the pet projects of Muhammad bin Salman, the crown prince.

China has pots of money but has made little progress on reform. A body called SASAC owns stakes in firms at home, but fails to insulate them from political influence. Another fund, CIC, styles itself as an independent global asset manager, but holds stakes in local banks, talks up foreign policy aims such as the Belt and Road Initiative, and wants approval to play in the sagging domestic stockmarket. Even Norway's \$1trn fund has seen political rows over its approach to private investment and energy firms.

Relative to the pack, Singapore is doing well. Its funds have assets of about \$770bn—the exact figure is secret. They have made an annual return (in dollar terms) of about 6% over the past two decades, slightly more than an indexed portfolio with two-thirds of its assets in shares and one-third in bonds. Their income pays for a fifth of government spending. The funds are free of scandal and enjoy a solid reputation both in China and the West.

There is a clear division of labour. The central bank runs \$290bn of liquid reserves. A national piggy-bank manager called GIC runs an estimated \$250bn, long-term, diversified foreign portfolio. Then a holding company, Temasek, has the rest, keeping a quarter of its portfolio in stakes in

Singaporean firms. It also makes punchy bets abroad.

On the funds' boards sit a combination of officials, politicians and captains of industry; Singapore's elite can sometimes seem too tightly knit. Yet overall governance is good. The city-state's leaders view reserves-management as a national mission. Advisory boards and staff include lots of outsiders: 37% of the total employees of Temasek and GIC are foreign, versus under 10% at CIC. There is little evidence of Temasek meddling in the local champions in which it invests, such as DBS, a bank. In 2014 it did raise its stake in Olam, a struggling local commodities firm, but made a modest profit on the deal. In 2015 it unsentimentally sold control of Neptune Orient, a shipping line, to a French firm.

The fiscal framework is admirably clear. The reserves have special protection under the constitution. Under rules put in place in 2008, the government can spend up to half of the long-term expected annual real return of its net reserves each year. In practice this equates to about 1.6% of the funds' capital value. The aim is to ensure that the pool of reserves and their income remain constant as a share of GDP over time, which Singapore has achieved; its capital is about 220% of GDP, the same as in 1997, *The Economist* estimates. While the official calculations are confidential, a rough estimate is that annual nominal returns would need to drop below 5.5% before the state eats into its inheritance.

Few countries have Singapore's graft-free civil service and polity, which make technocratic excellence easier. And there are blemishes. The funds are now so big that there is more risk of pointless duplication. In June, for example, both GIC and Temasek invested in Ant Financial, a Chinese fintech firm. Mistakes happen: in 2007-08 both funds made some badly timed bets on Western banks. As Singapore's population ages, state health-care costs will rise by almost one percentage point of GDP over the next decade. There will be pressure to raid the piggy bank, or for the funds to juice up their

returns by taking bigger risks.

Nonetheless, for many countries, including China and Saudi Arabia, Singapore's model for state investment funds is the one to emulate. Markets are frothy, so rash investment decisions can be very expensive. And protectionism means that countries lacking a credible, apolitical investment process may suffer a worse fate: having their state funds locked out of foreign markets. ■



熊彼特

如何管理储备

在改革世界上一些缺陷最多的投资工具方面，新加坡可以作为典范

在大多数国家，公共财政的首要任务是遏止债务飙升。但有些国家面对的却是相反的难题：如何管理堆积如山的储蓄。比如中国和沙特阿拉伯。全球范围内，各国政府共有超过20万亿美元的资金堆积在国有投资工具中。这个数额是世界最大资产管理公司贝莱德（BlackRock）所管理的资产规模的三倍。管理这样的资产本身就很有难度，而在目前保护主义盛行的情况下就更是如此。资金充裕的政府应该研究新加坡的做法。在这方面，这个国家就和它在行政管理的诸多方面一样精明能干。

国家投资基金分几类。有通常由央行独家管理的货币储备基金。还有被笼统归类为“主权财富基金”的一系列实体，通常管理着养老金资产、石油收入、某些货币储备，或持有政府认为具有战略意义的公司的股份。

央行储备金已经存在了几个世纪，主权财富基金则可以追溯到上世纪50年代，但两者在2004至2008年间都变得引人瞩目。高油价、贸易顺差和资本流入导致亚洲和阿拉伯国家的外汇收入滚滚而来，这些国家把外汇收入再投资于安全的国债以及风险较高的资产，如外国公司的股份。投资热潮在2008年达到顶峰。那时，西方政府对这些基金的影响力已经感到不安。

现在问题仍然存在。这些基金的目标往往模糊不清。有些基金被挥霍无度的政客耗尽，其他一些无法决定是否要既在海外投资，也在国内投资。一个持续存在的挑战是避免裙带关系，以及说服其他国家这些基金并非外交政策的工具。

从规模上看，国家基金已经停滞不前。2015年以来，由于资本流动逆转和大宗商品价格下跌，新兴国家已经用光了储备。把所有全球外汇储备和主权财富基金加起来，它们在金融体系中的权重在过去六年中没有变化，占所有股票和债券市值的12%。基金的治理良莠不齐。马来西亚国家基金一

马发展公司（1MDB）一直处于腐败丑闻的风口浪尖。规模达2500亿美元的沙特公共投资基金（Saudi Public Investment Fund）正在疯狂对硅谷下注，同时还在投资王储穆罕默德·本·萨勒曼（Muhammad bin Salman）个人偏好的项目。

中国拥有巨额资金，但在改革方面进展甚微。国资委拥有国内企业的股份，但未能让它们免受政治影响。另一家基金中投公司自称是独立的全球资产管理公司，但它持有本地银行的股份，经常畅谈“一带一路”倡议等外交政策目标，还希望获准进入低迷的国内股市。即便是挪威1万亿美元的基金也在私人投资和能源公司方面出现了政治争议。

相对于以上国家，新加坡表现不凡。它的基金拥有约7700亿美元的资产——确切数字秘而不宣。在过去20中，这些基金的年回报率（按美元计算）约为6%，略高于一个三分之二资产为股票、三分之一为债券的指数投资组合。基金的收入支付了五分之一的政府支出。这些基金没有丑闻，在中国和西方都享有良好的声誉。

新加坡的基金管理分工明确。央行拥有2900亿美元的流动性储备。名为新加坡政府投资公司（以下简称GIC）的国家外汇储备管理机构经营着估计达2500亿美元的长期多元化外国投资组合。控股公司淡马锡（Temasek）管理其余储备，其投资组合中有四分之一是新加坡公司的股份，同时也在国外大力投资。

这些基金的董事会由官员、政客和企业界领袖组成。新加坡的精英们有时看起来关系太过紧密了。但总体治理是好的。这个城市国家的领导人将储备管理视为国家使命。顾问委员会和工作人员中有许多外籍人员：淡马锡和GIC的全体员工中有37%是外国人，而中投的这个比例不到10%。几乎没有证据表明淡马锡干预其投资的本国优秀企业，如星展银行（DBS）。2014年，它确实增加了对奥兰国际有限公司（Olam）的持股，这家新加坡大宗商品公司当时陷入困境，但淡马锡在这笔交易中获得的利润并不多。2015年，它毫不留恋地将航运公司东方海皇（Neptune Orient）的控制权出售给了一家法国公司。

新加坡的财政框架清晰得令人赞叹。根据该国宪法，储备金享有特殊保护。根据2008年实施的法规，政府每年可将其净储备的长期预期年度回报实值的一半用于支出。在现实中，这相当于基金资本价值的约1.6%。其目标是确保储备金及其回报占GDP的比重长期保持不变。新加坡做到了这一点。《经济学人》估计，该国储备金目前约为GDP的220%，与1997年相同。虽然官方的统计方法是保密的，但粗略估算显示，其基金的年度名义回报率要降至5.5%以下，新加坡才需要“吃老本”。

很少有国家拥有新加坡那样廉洁的公务部门和政治体制，这令它更容易实现卓越的专家治国。不过也有不足之处。现在基金规模很大，可能导致更多无意义的重复。例如，6月，GIC和淡马锡都投资了中国金融科技公司蚂蚁金服。也出现了错误：2007至2008年间，这两只基金都对西方银行做出了一些时机不当的押注。随着新加坡人口老龄化，未来十年该国的医疗保健开支占GDP的比例将上升近一个百分点。新加坡将面临压力，要么吃老本，要么加大基金投资的风险来增加回报。

尽管如此，对于包括中国和沙特阿拉伯在内的许多国家而言，新加坡的国家投资基金模式仍可以效仿。市场充满泡沫，因此轻率的投资决策可能会导致非常高昂的代价。而地方保护主义意味着如果国家缺乏诚信的、脱离政治的投资过程，可能会迎来更糟糕的命运：它们的国家基金被国外市场拒之门外。■



Commodities

Raw materiel

Global tensions, from commerce to currencies, rattle crops, metals and oil

THEY make an intriguing posse: about 160 “scouts” in jeans and muddy boots, jumping out of cars with ropes in hand, plunging deep into corn (maize) and soyabean fields across the American Midwest. They are not just farmers. They include commodity traders and hedge-fund managers. Their quest: to predict this year’s harvest by using ropes as a measure and counting, to the last ear of corn and soyabean pod, the yield in a given area. “We have a really beautiful crop. I think this is going to be a record,” says Ted Seifried, a market strategist at Zaner Group, a commodities brokerage in Chicago, during a stop in Nebraska on August 21st. The mud on his boots is a reassuring sign of ample moisture in the soil.

But when he gets back into the car with others on the Pro Farmer Midwest Crop Tour, the talk turns to darker subjects, such as trade tensions, collapsing currencies and what he calls the start of an “economic cold war” between America and China. “While we’re driving the 15-25 miles from field to field, we certainly have a lot to talk about. By and large the American producer thinks the fight with China is just. But it’s very much affecting the pocketbook.”

From the midwestern farm belt to the commodity markets of Chicago, New York, London and Shanghai, this is a tricky time to be producing and trading commodities. Americans may relish their stockmarkets soaring (see later article). But a rising dollar, higher American interest rates, sliding emerging-market currencies and fears of a tariff-induced blow to exports to China have taken a toll on commodity prices in recent months (see chart 1).

In the background lurks climate change, fears of which have grown with the heat and drought battering Europe's wheat crop this summer. European grain prices have surged as a result. But those of many other commodities are sagging. On August 22nd a pound of arabica coffee fell below \$1, less than the cost of a takeaway brew and the lowest in 12 years. Raw sugar was also at ten-year lows. Both have been hit by oversupply in Brazil, as well as a slide in the value of the real, the Brazilian currency, which makes it more compelling to sell crops, priced in dollars, rather than store them.

The previous week, prices of copper fell into bear-market territory, down by more than 20% since June, on fears that protectionism would dampen global growth, especially in China, whose efforts to crack down on financial leverage are another drag on expansion. Oil prices have dipped for seven straight weeks, also because of concerns about lacklustre demand in emerging markets and because a strong dollar makes it dearer for those with weak currencies to buy crude. Gold has developed a strange habit of sliding in sync with the Chinese yuan.

American corn and soyabean prices, meanwhile, continue a long streak of weakness caused mainly by harvests that get more bountiful by the year. The Department of Agriculture is forecasting a record corn yield this year and the biggest harvest of soyabbeans ever, something the crop tour is likely to validate, Mr Seifried says. But that is lousy timing, given that China, which was America's biggest buyer of soyabbeans, raised retaliatory tariffs on the crop in July. Farmers hope to sell more in Europe, where soyameal for animal feed is in high demand because of the high cost of wheat. But the slide in the real also makes Brazilian soyabbeans more competitive.

Optimism flickers from time to time. Many commodities rallied in the run-up to the latest trade talks between American and Chinese officials, which were due to end after *The Economist* went to press. The dollar fell, bolstering some commodities, after President Donald Trump said in an

interview with Reuters on August 20th that he was “not thrilled” with the Federal Reserve’s policy of raising American interest rates. Progress in talks on the North American Free-Trade Agreement would also be good news (see Business section).

But BHP, the world’s biggest miner, issued a blunt assessment of the longer-term dangers to its products during its otherwise promising year-end results on August 21st. It said protectionism was “exceedingly unhelpful” for broad-based global growth, adding that Sino-American trade tensions could weaken both countries’ GDP growth by a quarter to three-quarters of a percentage point, absent counter-measures. Both America and China imposed another tranche of tariffs, on a further \$16bn-worth of each other’s goods, on August 23rd.

Analysts point to two main ways in which these tensions hurt commodity prices. The first is because of the rising importance of emerging markets to demand. In a report in June, the World Bank calculated that almost all the growth in the past 20 years in global metal consumption, two-thirds of the increase in energy demand and two-fifths of the rise in food consumption came from seven countries: Brazil, China, India, Indonesia, Mexico, Russia and Turkey. This group now exceeds the Group of Seven industrial nations in consumption of coal and all base and precious metals, as well as of rice, wheat and soyabean. Commodity prices are therefore far more sensitive to these countries’ fortunes than they used to be. Hence their walloping last week when the plunging Turkish lira gave a shock to other fragile currencies.

The second is speculation. Ole Hansen, head of commodities strategy at Saxo Bank, says that fears of a trade war have clobbered prices of the most globally traded commodities, notably copper, as short positions by speculators have surged (see chart 2). China accounts for half the world’s demand for copper, the same share as its consumption of steel. Yet steel

prices have fared much better because the most liquid steel contract is in China, which is much more affected by domestic supply and demand factors than big global bets. A steel-futures contract in Shanghai touched a seven-year high on August 22nd.

As ever, demand from China remains the biggest swing factor for commodities. BHP reckons China will use fiscal and monetary expansion to help offset the impact to its exports from the trade conflict, which could benefit commodities. But even if the worst is now priced in, plenty of volatility lies ahead. As Mr Seifried quips from the cornfields of Nebraska, “predicting the future is a son of a bitch”. ■



大宗商品

原材料

从贸易到货币的全球紧张局势令农作物、金属和石油市场动荡不安

44

分析师指出，紧张局势主要以两种方式打击大宗商品价格。首先是在需求方面，新兴市场的重要性日益提高。在6月发表的一份报告中，世界银行估算，过去20年全球金属消费量的几乎所有增长、能源需求增长的三分之二，以及食品消费增长的五分之二均来自七个国家：巴西、中国、印度、印度尼西亚、墨西哥、俄罗斯和土耳其。目前，这几个国家在煤炭、所有贵贱金属、大米、小麦和大豆上的消费量已经超过了七大工业国。由此，相比以往，这些新兴国家的运势对大宗商品价格的影响大大提高。因此，当8月中旬土耳其里拉的暴跌冲击其他脆弱货币时，大宗商品价格大幅下跌。

其次是投机。盛宝银行（Saxo Bank）的大宗商品策略负责人奥勒·汉森（Ole Hansen）表示，随着投机者的空头寸飙升（见图表2），贸易战引发的担忧已重创全球交易量最大的一些大宗商品的价格，尤其是铜价。中国占到了全球铜需求量的一半，与它在全球钢铁消费量中的占比相同。然而，由于最具流动性的钢铁合约来自中国，它们更多受国内供求因素而非全球大型投机的影响，所以钢铁价格的表现要好得多。8月22日，上海一份钢铁期货合约的价格触及七年来的最高点。

与以往一样，中国的需求仍是引起大宗商品价格波动的最大因素。必和必拓认为，中国将利用扩张性的财政和货币政策来抵消贸易冲突对其出口的影响，这可能使大宗商品受益。但即使最坏的情况已经体现在目前的价格中，未来仍会有很多波动。正如赛弗里德在内布拉斯加的玉米地里打趣说的：“预测未来根本就是瞎扯淡。”■



Schumpeter

Life on Mars

Elon Musk has pushed his firm to breaking point—and reinvigorated the public company

WHEN Elon Musk started Tesla in 2003 the world was a different place. The carnage of the dotcom crash was still visible—although Mr Musk had made \$200m after PayPal, which he co-founded, was bought by eBay in 2002. The car industry was belching out fumes and complacency. General Motors had double the number of staff it does now. Chrysler was being run into the ground by Daimler, its then owner. Sergio Marchionne, who later saved Fiat and Chrysler, was a nobody toiling at a Swiss industrial-testing company. In 2010 Tesla floated its shares. Going public was the obvious thing to do. No one had heard of “unicorns”—multi-billion-dollar tech firms that are financed privately.

A stifling orthodoxy then held sway in corporate America. Inspired by Warren Buffett and Jack Welch, a former boss of General Electric, this doctrine held that the only attractive businesses were well-established ones, with a high market share, a “moat” to protect them against competition and lavish cashflows. Even the new tech darling of those years, Google, which floated in 2004, conformed to this conservative ideal. It made a profit in its first quarter as a listed firm, invested peanuts and, by 2010, controlled the search market. Meanwhile, passive investing was taking off. Its premise was that it was pointless to back individual companies—better just to own the entire market and go to sleep.

At first, Mr Musk’s approach to running a public company was exhilaratingly different. He persuaded institutional investors such as Fidelity and Baillie Gifford to make huge bets on his loss-making firm. Its mission was outlined

in a 2006 “Masterplan”: to make the internal-combustion engine extinct by mass-producing electric vehicles (EVs). When sales of Tesla’s Model-S sedan took off in 2013, its shares soared. Tesla’s public listing complemented its brand-building efforts. Fanatical customers lined up to give Tesla deposits in order to reserve cars that it had not yet built.

But somewhere along the line this liberated spirit has morphed into a crusade or a tragedy or a farce, depending on your view. Mr Musk, who thrives by stoking expectations to excess, is partly to blame. So is the tech boom, which Tesla has got caught up in, prompting comparisons with Apple or Amazon. But Tesla has little in common with these firms. It is capital-intensive, enjoys no network effects and has no breakthrough technology (Panasonic supplies its batteries). It also has higher unit costs than rivals, despite trying to automate production. The firm is trying to compete in an industry that has abysmal returns on capital, as the late Mr Marchionne loved to point out.

Cloaked in the glitter of Silicon Valley but facing a grimy fight with Detroit, Tesla’s position is stretched on every dimension. Its valuation of \$70bn, including net debt, implies that sales will be six times bigger in a decade and is acutely sensitive to changes in assumptions. To justify it, Tesla says it can lift production fast. In the long run it would need to have about a 3% share of the global car industry by revenues to support its value. Today it is at 0.6%. Losses mean the firm has \$11bn of debt, \$3bn of which matures before 2020, leaving it vulnerable to dips in confidence.

This high-wire act has led over 20 executives to leave in the past 24 months. Meanwhile, the tech boom has made life difficult for Wall Street’s short-sellers, leading them to escalate their attacks on Tesla, an easy target. And the price signal sent by Tesla’s valuation has stimulated a response. Conventional car firms are piling into EVs—by 2020 there will be dozens of new models.

Somehow, Mr Musk must keep the plates spinning. There has been nutty conduct, from a wild interview with *Rolling Stone* to his slandering of a diver in the Thai cave rescue. But more revealing is his hyperactive rummaging for a plan that reinvents Tesla or changes how it is perceived. In 2016 it bought Solar City, an energy firm. In July it said it would build a huge factory in China. Mr Musk is giving detailed short-term guidance (he expects a profit next quarter). On August 7th he tweeted that he might take Tesla private at \$420 per share (the price was \$342 the day before) and that funding was secured. Later, he clarified that he expected half of outside shareholders to stay invested, and that Saudi Arabia's sovereign-wealth fund might help him out. That may have been insufficiently solid to back up the tweet; the Securities & Exchange Commission has reportedly sent subpoenas to Tesla.

Going private sounds rather like a sabbatical from reality. It is far from clear what it would solve. The circus around Tesla is mainly due to Mr Musk, not to how public securities are regulated. For loyal shareholders a deal might mean part-financing a buy-out of a minority of investors at a premium, and after that, less liquidity and transparency. Any new investor would be paying 50% more than they would have spent buying shares in May, which should make even the indisciplined Saudis think twice. If the private plan flops, Tesla's likely destiny is a soggy share price and a long struggle to ramp up production. At a lower valuation a big car firm might eventually buy it or take a stake.

Entrepreneurs often have it tough—Charles Goodyear went to a debtor's prison before patenting a process to vulcanise rubber in 1844. But Mr Musk may not have the stomach for more years of slog. In a 2006 memo he named SpaceX, his private rocket firm, as his day job. What he might view as a disappointment would be a success by any other standard. Even if Tesla's shares halve, it will have created \$20bn of shareholder wealth, including \$4bn for Mr Musk. Its soaring ambition has kindled investment across the

car industry, in a process of disruption first described by Joseph Schumpeter, after whom this column is named. Thanks in part to Mr Musk's example, it is fashionable again for an elite of public firms to invest heavily, including Netflix, and Amazon in recent years. Most boardrooms now are less obsessed with defensive hoarding. Mr Musk has tested the limits of the public firm, but he has reminded America of its possibilities. ■



熊彼特

火星上的生活

伊隆·马斯克将特斯拉推到了极限，也为上市公司重新注入了活力

伊隆·马斯克2003年创办特斯拉时，世界与现在大不同。网络泡沫破裂的浩劫尚未平息，不过马斯克联合创立的支付平台PayPal在2002年被eBay收购，他从中赚到了两亿美元。汽车产业大肆排放尾气，安于现状。通用汽车的员工人数是现在的两倍。戴姆勒把收购来的克莱斯勒搞得一团糟。后来拯救了菲亚特和克莱斯勒的塞尔吉奥·马尔乔内（Sergio Marchionne）此时还名不见经传，在瑞士一家工业测试公司里埋头苦干。2010年，特斯拉的股票上市。那时候，让公司上市是显而易见的选择。人们还没听说过“独角兽”这东西——估值数十亿美元的私人融资的科技公司。

当时，一套沉闷的正统理念主导着美国企业界。受沃伦·巴菲特和通用电气前总裁杰克·韦尔奇（Jack Welch）的影响，这套理念认为只有成熟稳健的企业才有吸引力。这类企业拥有较高的市场份额，这一点是保护它们免于竞争和大量耗费现金流的“护城河”。即便是那些年里的科技界新宠谷歌（2004年上市）也遵循这一保守理念，上市后的第一个季度就实现盈利，投资极少，到2010年已经称霸整个搜索市场。与此同时，被动投资理念兴起。这一理念认为投资个别公司毫无意义，更好的方法是投资大市然后安然等待。

起初，马斯克经营上市公司的方式令人眼前一亮。他说服了富达基金（Fidelity）和贝利·吉福德资产管理公司（Baillie Gifford）等机构投资者对自己仍处于亏损的公司押下重注。2006年的“总体规划”概述了公司的使命：通过大规模生产电动汽车来消灭内燃机。特斯拉Model-S轿车的销量在2013年激增，公司股价随之飙升。特斯拉的公开上市进一步帮助它打造自身品牌。狂热的客户排队向特斯拉交付订金，预订还没造出来的汽车。

但不知何时，特拉斯这种突破传统的方式演变成了一场圣战，或者说一出

悲剧，又或是闹剧，全看你怎么看。在某种程度上，这要归咎于马斯克，他的崛起有赖于过度煽动人们的预期。另外也要归因于特斯拉如今恰逢科技热潮，导致人们常把它和苹果或亚马逊放在一起比较。但特斯拉与这些公司少有相通之处。特斯拉是资本密集型企业，不享有网络效应，也没有突破性技术（其电池由松下供应）。尽管尝试采用自动化生产系统，其单位成本仍高于竞争对手。特斯拉要在汽车行业里竞争，而这个行业——正如马尔乔内生前经常指出的那样——资本回报率非常低。

特斯拉自带硅谷光环，但面对的是与底特律汽车制造商的恶战，在各方面处境都很不妙。公司目前市值为700亿美元（包括净债务），意味着销售额要在十年内增长六倍，并且其估值对市场假设的变化高度敏感。为证明市值合理，特斯拉称自己能快速提升产量。从长远来看，该公司要能贡献全球汽车业收入的3%左右，才能支撑上述估值。现在这一占比为0.6%。特斯拉目前处于亏损状态，负债110亿美元，其中有30亿美元债务在2020年前到期，这些都是容易引发信心危机的因素。

面对高空走钢丝般的挑战，过去24个月里已有20多名高管离职。与此同时，科技热潮让华尔街卖空者度日维艰，促使他们加大力度攻击特斯拉这个显见的靶子。而特斯拉的市值发出的价格信号也引发了反应。传统汽车公司正涌入电动汽车领域，到2020年将有数十款新车型问世。

但无论如何，马斯克得设法让自己的高难度杂耍继续。他时有疯狂之举，比如在《滚石》杂志的采访中大胆自白，又比如诋毁参与泰国洞穴救援的一位潜水员。但更能说明问题的，是他疯狂寻找能够重塑特斯拉或改变人们对公司看法的计划。2016年，特斯拉收购了能源公司太阳城（Solar City）。今年7月又表示将在中国建立一家大型工厂。马斯克正在给出详细的短期指引（他预计下个季度公司将盈利）。8月7日，他发推文说可能会以每股420美元的价格（前一天的股价为342美元）将特斯拉私有化，而且资金已有保障。稍后他又澄清说，预计有一半外部股东会继续持股，另外沙特阿拉伯的主权财富基金可能出手相助。这也许还不足以支持他的那条推文，据报道美国证券交易委员会已经向特斯拉发出了传票。

私有化听起来有点像是逃离现实的“长假”。目前根本看不出这能解决什么问题。围绕特斯拉的马戏般的纷乱主要因马斯克而起，而非上市公司所受的监管。对忠诚的股东而言，私有化可能意味着他们要为溢价收购少数股东的股票提供一部分资金，并且之后的流动性和透明度都会降低。任何新投资者购入股票的成本都将比5月时高出50%，这样一来，连大手大脚的沙特人也会三思而后行。假如私有化失败，特斯拉面对的很可能是疲软的股价，以及需要长期苦苦提升产能。如果其市值下降，也许最终会被某家大型汽车公司收购或入股。

企业家常要经受艰难困苦——查尔斯·固特异（Charles Goodyear）在1844年获得硫化橡胶专利前被关进了债务人监狱。但马斯克可能无法再忍受更长久的煎熬。在2006年的一份备忘录中，他把经营私人火箭公司SpaceX列为自己的“正职”。特斯拉的处境可能令他失望，但用任何其他标准来衡量都已经是成功。即使这家公司的股价砍半，也已创造了200亿美元的股东财富，其中40亿美元为马斯克拥有。在颠覆的过程中（最早描述这一过程的是经济学家约瑟夫·熊彼特，本专栏以其名字命名），特斯拉的雄心壮志燃起了整个汽车行业的投资热。一定程度上由于马斯克的表率，包括Netflix在内的一批顶尖上市公司现在再度开始大力投资，亚马逊在过去几年里已是如此。现在大多数董事会不再那么执着于“积谷防饥”。马斯克测试了这家上市公司的极限，也提醒了美国其拥有的可能性。■



John Stuart Mill

Against the tyranny of the majority

Why the father of liberalism still matters today

BY THE age of six, John Stuart Mill had written a history of Rome. By seven, he was devouring Plato in Greek. “This looks like bragging,” his father James told a friend when the boy was eight; “John is now an adept in the first six books of Euclid and in Algebra.”

The hot-housing that began at the younger Mill’s birth in 1806 yielded its intended result: a prodigy with a profound faith in the power of reason. He became the leading exponent of the philosophy of liberalism, formulating ideas about economics and democracy that shaped the political debates of the 19th century. His reflections on individual rights and mob rule still resonate today. Especially today.

Mill grew up at a time of revolution. Democracy was on the march. America had broken free from Britain; France had overthrown its monarchy. In 1832 Britain passed the first Reform Act, which extended the franchise to the middle classes. The Industrial Revolution was in full swing. The old social order, in which birth determined social position, was disintegrating. Nobody could be certain what would replace it.

Many today see Mill as an avatar for the ruthless capitalism of his era. Henry Adams, an American historian, referred to Mill as “his Satanic free-trade majesty”. In the few surviving photos of him, he looks somewhat cold and unfeeling.

He wasn’t. True, in his early years Mill was a dyed-in-the-wool utilitarian. His mentor was Jeremy Bentham, who had argued that the principle underlying all social activity ought to be “the greatest happiness of the

greatest number". The aim of political economy, as economics was then known, was to maximise utility. Like Gradgrind in Charles Dickens's "Hard Times", Mill initially followed Bentham in seeing humans as mere calculating machines.

But that was only the young Mill. In his brilliant autobiography, published after his death in 1873, he confided that he grew up "in the absence of love and in the presence of fear". The result was a breakdown in his early 20s. He later came to believe that there must be more to life than what Benthamites term the "felicific calculus"—the accounting of pleasure and pain.

He turned to the poetry of William Wordsworth and Samuel Taylor Coleridge, which taught him about beauty, honour and loyalty. His new aesthetic sense pushed him away from gung-ho reformism and gently towards conservatism. If the societies of the past had produced such good art, he reasoned, they must have something to offer his age.

Mill did not reject utilitarianism as thoroughly as his contemporary Thomas Carlyle, who argued that only pigs would view the seeking of pleasure as the foundation of all ethics. Instead, Mill qualified it. Unlike Bentham, who thought that pushpin, a board game, was "of equal value with...poetry", he maintained that some sorts of pleasure were superior to others. He denied that these nuances meant he was no longer a utilitarian at all. What may at first seem a purely virtuous act that engenders no immediate pleasure—being true to your word, say—may eventually come to seem essential to well-being.

This refinement of utilitarianism demonstrated a pragmatism that is one of Mill's intellectual hallmarks. On many issues it is difficult to pigeonhole his stance, or even to pin down exactly what he believes. Part of what makes him a great thinker is that he qualifies his own arguments. His views evolved over the course of his life, but for most of it he rejected absolutes

and recognised the world's mess and complexity. John Gray, a philosopher, writes that Mill was "an eclectic and transitional thinker whose writings cannot be expected to yield a coherent doctrine."

Above all, though, like all liberals Mill believed in the power of individual thought. His first big work, "A System of Logic", argues that humanity's greatest weakness is its tendency to delude itself as to the veracity of unexamined convictions. He renounced shibboleths, orthodoxies and received wisdom: anything that stopped people thinking for themselves.

He wanted them to be exposed to as wide a range of opinions as possible, and for no idea or practice to remain unchallenged. That was the path to both true happiness and progress. To protect freedom of expression he formulated his "harm principle": "the only purpose for which power can be rightfully exercised over any member of a civilised community, against his will, is to prevent harm to others," he wrote in "On Liberty", his most famous book.

As Richard Reeves's biography makes clear, Mill thought the coming industrial, democratic age could enable human flourishing in some ways, but hinder it in others. Take free trade, for which he was an enthusiast (despite working for a long time for the East India Company, perhaps the world's biggest-ever monopoly). He thought free trade increased productivity: "Whatever causes a greater quantity of anything to be produced in the same place, tends to the general increase of the productive powers of the world," he wrote in "Principles of Political Economy". He criticised the Corn Laws, tariffs which largely benefited holders of agricultural land.

Yet Mill was even more taken by the philosophical argument for free trade. "It is hardly possible to overrate the value, in the present low state of human

improvement, of placing human beings in contact with persons dissimilar to themselves, and with modes of thought and action unlike those with which they are familiar.” This applied to everyone: “there is no nation which does not need to borrow from others.” He practised what he preached, spending a lot of time in France and seeing himself as a sort of interlocutor between the revolutionary passion of French politics and the buttoned-down gradualism of England.

As democracy spread, he anticipated, ideas would clash. He supported the Reform Act of 1832, which, as well as extending the franchise, did away with “rotten boroughs”, constituencies with tiny electorates, often controlled by a single person. He praised France’s move in 1848 to institute universal male suffrage. Each voter’s views would be represented—and each would have reason to be informed. Participation in collective decision-making was for Mill part of the good life.

For the same reason he was an early proponent of votes for women. “I consider [sex] to be as entirely irrelevant to political rights as difference in height or in the colour of the hair,” he wrote in “Considerations on Representative Government”. After becoming an MP in 1865, he presented a petition calling for female suffrage.

Mill believed that society was advancing. But he also foresaw threats. Capitalism had flaws; democracy had an alarming tendency to undermine itself.

Take capitalism first. In 1800-50 average annual real-wage growth in Britain was a pathetic 0.5%. The average working week was 60 hours long. At times life expectancy in some cities dipped below 30. Mill supported trade unions and legislation to improve working conditions.

He worried, though, that capitalism could inflict spiritual damage that

would be harder to fix. The pressure to accumulate wealth could lead to passive acceptance of the world as it was—what Mill’s disciples call the “tyranny of conformity”.

Mill loved the idea of a country founded on liberty, but he feared America had fallen into precisely this trap. Americans displayed “general indifference to those kinds of knowledge and mental culture which cannot be immediately converted into pounds, shillings and pence.” Following Alexis de Tocqueville’s premonitions, Mill saw America as the country where there was less genuine freedom of thought than any other. How else could it live with such a huge inconsistency at its heart: a proclamation of liberty for all which co-existed with the institution of slavery?

Democracy itself threatened the free exchange of ideas in a different way. Mill thought it right that ordinary people were being emancipated. But once free to make their own choices, they were liable to be taken in by prejudice or narrow appeals to self-interest. Give the working classes a vote, and chaos could result.

That in turn might cramp society’s intellectual development, the views of the majority stifling individual creativity and thought. Those who challenged received wisdom—the freethinkers, the cranks, the Mills—might be shunned by “public opinion”. Expertise could be devalued as the “will of the people” reigned supreme.

The upshot was frightening. Paradoxically individual freedom could end up being more restricted under mass democracy than under the despotic sovereigns of yore. Mill famously refers to this as “tyranny of the majority”. But he worries just as much about middle-class “respectable” opinion as working-class ignorance.

He pondered how to counter the tyrannical tendencies inherent in

economic and political liberalism. Experts had a vital role to play, he thought. Progress required people with the time and inclination for serious study—a secular clergy, of sorts, termed the “clerisy” (a word borrowed from Coleridge). The clerisy had a utilitarian justification: its members would devise “rules that would maximise human well-being if we all followed them,” as Alan Ryan, a political theorist, puts it.

One solution was to give educated voters greater power. In this dispensation, people who could not read or write, or who had received the 19th-century equivalent of welfare benefits, would not get a vote. (Mill also thought certain citizens of Britain’s colonies, including Indians, were incapable of self-government.) University graduates might get six votes, unskilled workers one. The aim was to give those who had thought deeply about the world more say. The lower orders would be reminded that they required political and moral guidance, though in time more of them would join the ranks of the educated.

Although that approach looks snobbish, or worse, Mill was enlightened for his time. Indeed, he would have approved many of the social changes in the 21st century, including the universal franchise and women’s rights.

There would be much to concern him, too. Take Brexit. Whether or not Mill would have been a Brexiteer, he would have abhorred the referendum. Why get laymen to decide a matter on which they have little knowledge? He would have watched the rise of President Donald Trump, whose anti-intellectualism he would have loathed, and say: “I told you so.” He might have been surprised that America had taken so long to elect a demagogue.

The intellectual climate on both sides of the Atlantic would have depressed him. “[T]he peculiar evil of silencing the expression of an opinion is, that it is robbing the human race,” Mill wrote in “On Liberty”. “If the opinion is right, they are deprived of the opportunity of exchanging error for truth: if

wrong, they lose, what is almost as great a benefit, the clearer perception and livelier impression of truth, produced by its collision with error." He would not be impressed by no-platforming.

He might well argue that, before 2016, liberal thought had succumbed to a tyranny of conformity. Until recently there was little talk in liberal society about the "left behind" or the losers from free trade. Many liberals had fallen into a decidedly unMillian complacency—assuming that all the big arguments had been settled.

No longer. Mr Trump's victory has prompted liberals to revisit the case for everything from free trade to immigration. Brexit has led to a lively debate about the proper locus of power. And universities have become a battleground over the limits of free speech. Like Mill's, these are disorienting times—urgently requiring the intellectual flexibility and boldness epitomised by the father of liberalism.

LATER IN THIS SERIES: Alexis de Tocqueville; John Maynard Keynes; Schumpeter, Popper and Hayek; Berlin, Rawls and Nozick; Rousseau, Marx and Nietzsche ■



约翰·斯图尔特·密尔

反对多数人的暴政

为什么自由主义之父今天仍然重要

六岁时，约翰·斯图尔特·密尔（John Stuart Mill）写下了一部罗马史。七岁时，他如饥似渴地阅读希腊文版的柏拉图。“这听起来像是吹牛，”在这个男孩八岁时，他的父亲詹姆斯对一位朋友说，“约翰现在已经熟练掌握欧几里德的前六本书和代数了。”

从1806年密尔诞生之日起就开始的超前培养带来了想要的结果：一个深刻信仰理性力量的神童。他成了自由主义哲学的主要代表，创立了影响19世纪政治辩论的经济和民主思想。他对个人权利和暴民统治的思考在今天仍然引发共鸣。特别是在今天。

密尔成长于革命时期。民主思想如火如荼。美国脱离英国独立；法国推翻了君主制。1832年，英国通过了第一部《改革法案》，将选举权扩大至包含中产阶级。工业革命开足马力。由出身决定社会地位的旧社会秩序正在瓦解。没人确切知道取而代之的会是什么。

今天有许多人认为密尔是他那个时代冷酷的资本主义的化身。美国历史学家亨利·亚当斯（Henry Adams）称密尔为“撒旦自由贸易陛下”。在他留存下来的仅有的几张照片中，他看起来有些冷漠无情。

但他不是。的确，早年的密尔是一个彻底的功利主义者。他的导师是杰里米·边沁（Jeremy Bentham），认为所有社会活动的基本原则应该是“最多数人的最大幸福”。政治经济学（经济学在那时的称法）的目标就是效用最大化。就像查尔斯·狄更斯的《艰难时世》中的葛莱恩一样，密尔最初跟随边沁，把人类仅仅看作计算的机器。

但那只是年轻的密尔。在他1873年去世后出版的精彩自传中，他透露自己“在无爱和恐惧中”长大。结果是他在20岁出头时精神崩溃。他后来开始相

信，生命肯定不只是边沁的信徒所说的
calculus) ——对快乐和痛苦的统计。

“幸福计算” (felicific

他开始阅读威廉·华兹华斯 (William Wordsworth) 和塞缪尔·泰勒·柯勒律治 (Samuel Taylor Coleridge) 的诗歌，这些诗歌让他了解了美、荣誉和忠诚。他的新审美意识使他远离了轰轰烈烈的改良主义，逐渐走向保守主义。他认为，如果过去的社会产生了如此美好的艺术，它们肯定能为他的时代带来些什么。

密尔并没有像与他同时代的托马斯·卡莱尔 (Thomas Carlyle) 那样彻底拒绝功利主义，后者认为只有猪才会将寻求快乐视为所有道德的基础。相反，密尔对它做出了修正。与边沁认为图钉棋盘游戏“与……诗歌具有同等价值”不同，密尔认为某些快乐比其他快乐更高级。他不认为有这些细微差别就意味着他完全不再是功利主义者。那些乍看上去似乎是纯粹的善行——比如言出必行——虽不会产生直接的快乐，最终却可能对福祉至关重要。

对功利主义的这种改进体现了实用主义，这是密尔的标志性智慧之一。在许多问题上很难将他的立场归类，甚至难以确定他到底相信什么。他之所以成为伟大的思想家，部分原因在于他会修正自己的观点。他的观点在一生中不断演变，但对于其中的大多数他都拒绝绝对真理，并认识到世界的混乱和复杂性。哲学家约翰·格雷 (John Gray) 写道，密尔是“一个兼收并蓄、博采众长的思想家，不能指望他的作品产生连贯的学说。”

然而最重要的是，和所有自由派一样，密尔相信个人思想的力量。他的第一部重要著作《逻辑体系》 (A System of Logic) 认为，人类最大的弱点在于，他们倾向于欺骗自己那些未经检验的信念是真实的。他宣称摒弃陈词滥调、正统观念和普遍看法——一切阻止人们独立思考的东西。

他希望人们尽可能地接触到各种各样的意见，并且没有任何思想或做法可以不受质疑。这是通往真正的幸福和进步之路。为了保护言论自由，他制定了“伤害原则”：“对文明群体中的任何成员行使违背其自身意愿的权力

的唯一正当理由，是防止对其他人的伤害。”他在他最著名的《论自由》（On Liberty）一书中写道。

理查德·里夫斯（Richard Reeves）所著的传记中说，密尔认为即将到来的工业化民主时代可以在某些方面促进人类的繁荣，但在其他方面会阻碍它。他热情拥护自由贸易（尽管他为东印度公司工作了很长时间，这家公司也许是世界上有史以来最大的垄断企业）。他认为自由贸易提高了生产力：“无论是什么，只要让同一个地方生产出了更多的东西，它往往会使普遍提高世界的生产力。”他在《政治经济学原理》（Principles of Political Economy）中写道。他批评了《玉米法》，该法案中实施的关税主要使农田的持有者受益。

不过，对自由贸易的哲学论证更令密尔着迷。“在如今人类进步的低谷，让人们与不同于自己的人，以及与不同于自己所熟悉的那些思维和行动模式接触，其价值怎么强调都不为过。”这适用于每个人：“没有哪个民族不需要向外界借鉴。”他身体力行，在法国度过了很多时光，并将自己看作是法国政治的革命激情和英格兰的保守渐进主义之间的传话者。

他预计，随着民主的传播，思想会发生冲突。他支持1832年的《改革法案》，该法案除了扩大选举权外，还废除了“腐烂的自治市”——这些选区选民人数较少，通常由一个人把持。他赞扬法国在1848年提出的男性普选权。每个选民的观点都将被代表——每个人都有理由知情。在密尔看来，参与集体决策是美好生活的一部分。

出于同样的原因，他是女性投票权的早期支持者。“我认为[性别]与政治权利完全无关，就像身高或头发颜色的差异。”他在《代议制政府》（Considerations on Representative Government）一书中写道。在于1865年成为国会议员后，他提出了一份号召授予女性普选权的请愿书。

密尔认为社会在发展。但他也预见到了威胁。资本主义有缺陷；民主有一种令人不安的自我破坏的趋势。

首先来说资本主义。在1800年到1850年的英国，年均实际工资增长率仅为可怜的0.5%。平均每周工作60小时。有些时候，某些城市的预期寿命低于30岁。密尔支持工会和立法改善工作条件。

然而，他担心资本主义可能会造成更加难以治愈的精神损害。积累财富的压力可能导致被动地接受世界的现状——密尔的信徒称之为“合群的暴政”（tyranny of conformity）。

密尔很喜欢将国家建基于自由之上的观念，但他担心美国恰恰落入了这个陷阱。美国人表现出“对那些不能立即转化为英镑、先令和便士的知识和精神文化的普遍冷漠”。在亚历克西斯·德·托克维尔（Alexis de Tocqueville）的预警之后，密尔认为美国是一个真正的思想自由比其他任何国家都少的国家。不然它如何能容忍如此巨大的核心矛盾：为所有人宣告自由，却与奴隶制共存？

民主本身会以不同的方式威胁到思想的自由交流。密尔认为普通人确实在获得解放。但是，一旦有了选择的自由，他们就有可能被偏见或狭隘的自身利益诉求所蒙蔽。允许工人阶级投票可能导致混乱。

这继而可能导致多数人的观点扼杀个人的创造力和思想，从而阻碍社会的智力发展。那些挑战普遍看法的人——自由思想者、思想怪人、密尔们——可能会被“公众舆论”所排斥。由于“人民的意志”至高无上，专业知识可能会被轻视。

其结局令人恐惧。看似矛盾的是，比起昔日的专制王权，个人自由在大众民主制度下受到的限制可能更多。密尔将此称为著名的“多数人的暴政”。但和工人阶级的无知一样，他也同样担心中产阶级“可敬的”意见。

他思索如何能够对抗经济和政治自由主义固有的暴君倾向。他认为专家应扮演至关重要的角色。进步需要有时间也愿意认真研究的人——类似于在俗教士的所谓“知识阶层”（从柯勒律治那里借来的一个词）。正如政治理论家艾伦·瑞安（Alan Ryan）所说，这个知识阶层有一个功利主义的理由：它的成员会制定“如果我们所有人都遵循就能带来最大人类福祉的规

则”。

一个解决方案是给受过教育的选民更大的权力。在这个制度下，那些无法读写，或者拿着19世纪版本的救济金的人不能投票。（密尔还认为英国殖民地的某些公民，包括印度人，没有自治的能力。）大学毕业生或许可获得六票，非熟练工人一票。其目的是让那些深入思考世界的人有更大的话语权。较低的阶层会被提醒自己需要政治和道德指引，但随着时间推移，他们中的更多人将加入受过教育者的行列。

虽然这种方式看起来自命不凡甚或更糟，但密尔在他的时代已算开明。实际上，如果活在21世纪他应该会同意这个时代的许多社会变革，包括全民普选和女性权利。

也会有很多事令他担忧。以英国脱欧为例。无论密尔是否会支持脱欧，他都会憎恶公投。为什么让外行决定他们知之甚少的事情呢？他会看着唐纳德·特朗普总统崛起，厌恶他的反智主义，并说：“我早就说过了。”他可能会惊讶于美国经过了这么多年才选出了一个煽动者。

大西洋两岸的知识氛围会让他感到沮丧。“压制一种意见的发表之特殊罪恶在于它是对整个人类的掠夺，”密尔在《论自由》中写道，“假如那意见是对的，那么他们是被剥夺了以谬误换真理的机会；假如那意见是错的，那么他们失掉了一个差不多同样大的利益，那就是从真理与谬误的冲突中，获得对真理更清晰的认识和更生动的印象。”他不会喜欢“不给他们舞台”（no-platforming）运动。

他很可能会说，在2016年之前，自由主义思想已经屈服于一种合群的暴政。直到最近，自由主义社会中几乎没有人谈论自由贸易中的“落后者”或输家。许多自由派无疑陷入了非密尔式的自满——认为所有重大议题都得到了解决。

再不是如此了。特朗普的胜利促使自由派重新审视从自由贸易到移民的所有议题的理据。英国脱欧引发了关于正确的权力中心的激烈辩论。而大学已成为有关言论自由的边界的战场。和密尔的时代一样，如今也是一个迷

失方向的时代，迫切需要以自由主义之父为代表的那种智识的灵活与大胆。

本系列其他篇目：亚历克西斯·德·托克维尔；约翰·梅纳德·凯恩斯；熊彼特、波普尔和哈耶克；柏林、罗尔斯和诺齐克；卢梭、马克思和尼采■



John Maynard Keynes

Was he a liberal?

People should be free to choose. It was their freedom not to choose that troubled John Maynard Keynes

IN 1944 Friedrich Hayek received a letter from a guest of the Claridge Hotel in Atlantic City, New Jersey. It congratulated the Austrian-born economist on his “grand” book, “The Road to Serfdom”, which argued that economic planning posed an insidious threat to freedom. “Morally and philosophically, I find myself”, the letter said, “in a deeply moved agreement.”

Hayek’s correspondent was John Maynard Keynes, on his way to the Bretton Woods conference in New Hampshire, where he would help plan the post-war economic order. The letter’s warmth will surprise those who know Hayek as the intellectual godfather of free-market Thatcherism and Keynes as the patron saint of a heavily guided capitalism.

But Keynes, unlike many of his followers, was not a man of the left. “The Class war will find me on the side of the educated bourgeoisie,” he said in his 1925 essay, “Am I a Liberal?”. He later described trade unionists as “tyrants, whose selfish and sectional pretensions need to be bravely opposed.” He accused the leaders of Britain’s Labour Party of acting like “sectaries of an outworn creed”, “mumbling moss-grown demi-semi-Fabian Marxism”. And he stated that “there is social and psychological justification for significant inequalities of incomes and wealth” (although not for such large gaps as existed in his day).

Why then did Keynes advocate Keynesianism? The obvious answer is the Great Depression, which reached Britain in the 1930s, shattering many people’s faith in unmanaged capitalism. But several of Keynes’s ideas dated

back further.

He belonged to a new breed of liberals who were not in thrall to laissez-faire, the idea that “unfettered private enterprise would promote the greatest good of the whole”. That doctrine, Keynes believed, was never necessarily true in principle and was no longer useful in practice. What the state should leave to individual initiative, and what it should shoulder itself, had to be decided on the merits of each case.

In making those decisions, he and other liberals had to contend with the threats of socialism and nationalism, revolution and reaction. In response to the Labour Party’s growing political clout, a reform-minded Liberal government had introduced compulsory national insurance in 1911, which provided sickness pay, maternity benefits and limited unemployment assistance to the hard-working poor. Liberals of this kind saw unemployed workers as national assets who should not be “pauperised” through no fault of their own.

This cadre of liberals believed in helping those who could not help themselves and accomplishing collectively what could not be achieved individually. Keynes’s thinking belongs within this ambit. He dwelled on entrepreneurs who could not profitably expand operations unless others did the same, and on savers who could not improve their financial standing unless others were willing to borrow. Neither group could succeed through their own efforts alone. And their failure to achieve their purposes hurt everyone else, too.

How so? Economies produce, Keynes said, in response to spending. If spending is weak, production, employment and income will be correspondingly feeble. One vital source of spending is investment: the purchase of new equipment, factories, buildings and the like. But Keynes worried that private entrepreneurs, left to their own devices, would

undertake too little spending of this kind. He once argued, provocatively, that America could spend its way to prosperity. Certainly, countries could underspend their way out of it.

Earlier economists were more sanguine. They believed that, if the willingness to invest was weak and the desire to save was strong, the interest rate would fall to bring the two into alignment. Keynes thought the interest rate had another role. Its task was to persuade people to part with money and hold less-liquid assets instead.

Money's appeal, Keynes understood, was that it allowed people to preserve their purchasing power while deferring any decision about what to do with it. It gave them the freedom not to choose. If people's demand for this kind of freedom was particularly fierce, they would part with money only if other assets seemed irresistibly cheap by comparison. Unfortunately, asset prices that were so very low would also depress capital spending—resulting in diminished production, employment and earnings. Falling incomes would reduce the community's ability to save, squeezing it until it matched the nation's meagre willingness to invest. And there the economy would languish.

The resulting unemployment was not merely unjust, it was also thuddingly inefficient. Labour, Keynes pointed out, does not keep. Although workers themselves do not disappear through disuse, the time they could have spent contributing to the economy is squandered for ever.

Such wastefulness still haunts the world. Since the beginning of 2008, the American workforce has put in 100bn fewer hours than it could have if fully employed, according to the Congressional Budget Office. Keynes was often accused by bean-counting officials of a cavalier disregard for fiscal rectitude. But his penny-foolishness was nothing compared with the extraordinary waste of resources from mass unemployment.

The remedy most often associated with Keynes was simple: if private entrepreneurs would not invest heavily enough to maintain high employment, the government should do so instead. He favoured ambitious programmes of public works, including rebuilding South London from County Hall to Greenwich so that it rivalled St James's. In his letter to Hayek, he admitted that his moral and philosophical agreement with "The Road to Serfdom" did not extend to its economics. Britain almost certainly needed more planning, not less. In the "General Theory" he prescribed "a somewhat comprehensive socialisation of investment".

His worst critics have seized on the illiberal, even totalitarian, implications of that phrase. It is true that Keynesianism is compatible with authoritarianism, as modern China shows. The interesting question is this: if Keynesianism can work well without liberalism, can liberalism prosper without Keynesianism?

Liberal critics of Keynes make a variety of arguments. Some reject his diagnosis. Recessions, they argue, are not the result of a curable shortfall of spending. They are themselves the painful cure for misdirected spending. Slumps thus pose no conflict between liberty and economic stability. The remedy is not less liberalism but more: a freer labour market that would let wages fall quickly when spending flags; and an end to activist central banks, because artificially low interest rates invite the misdirected investment that ends in a bust.

Others say that the cure is worse than the disease. Recessions are not reason enough to infringe on liberty. This stoicism was implicit in Victorian institutions like the gold standard, free trade and balanced budgets, which tied governments' hands, for better or worse. But by 1925, society could no longer tolerate such pain, partly because it no longer believed it had to.

A third line of argument mostly accepts Keynes's diagnosis but quarrels

with his most famous prescription: public mobilisation of investment. Later liberals placed more faith in monetary policy. If the interest rate would not naturally reconcile saving and investment at high levels of income and employment, modern central banks could lower it until it did. This alternative sat more comfortably with liberals than Keynesian fiscal activism. Most of them (although not all) accept that the state has a responsibility for a nation's money. Since the government will need a monetary policy of one kind or another, it might as well choose one that helps the economy realise its full potential.

These three arguments have rebuttals. If an economy has spent badly, surely the solution is to redirect expenditures, not to reduce them. If liberal governments do not fight downturns, voters will turn to illiberal governments that do, jeopardising the very freedoms the government's pious inaction was meant to respect.

Last, Keynes himself thought easy money was helpful. He just doubted it was sufficient. However generously supplied, extra liquidity may not revive spending, especially if people do not expect the generosity to persist. Similar doubts about monetary policy have revived since the financial crisis of 2008. The response of central banks to that disaster was less effective than hoped. It was also more meddlesome than purists would like. Central-bank purchases of assets, including some private securities, inevitably favoured some groups over others. They thus compromised the impartiality in economic affairs that befits a strictly liberal state.

In severe downturns Keynesian fiscal policy may be more effective than monetary measures. And it need not be as heavy-handed as its critics fear. Even a small and unassuming state must carry out some public investment—in infrastructure, for example. Keynes thought these projects should be timed to offset downturns in private spending, when men and

materials would anyway be easier to find.

In promoting investment, he was happy to entertain “all manner of compromises” between public authority and private initiative. The government could, say, underwrite the worst risks of some investments, rather than undertaking them itself.

By the 1920s Britain had progressive taxation and compulsory national insurance, which collected contributions from wage-earners and firms during periods of employment, then shelled out unemployment benefits during spells of joblessness. Although not intended as such, these arrangements served as “automatic stabilisers”, removing purchasing power during booms and restoring it during busts.

This can be taken further. In 1942 Keynes endorsed a proposal to lower national-insurance contributions during bad times and raise them in good. Compared with varying public investment, this approach has advantages: payroll taxes, unlike infrastructure projects, can be adjusted with the stroke of a pen. It also blurs ideological lines. The state is its most Keynesian (judged by stimulus) when it is also at its smallest (measured by its tax take).

Keynesian theory is ultimately agnostic about the size of government. Keynes himself thought that a tax take of 25% of net national income (roughly 23% of GDP) is “about the limit of what is easily borne”. He worried more about the volume of spending than its composition. He was broadly happy to let market forces decide what was purchased, provided enough was. Done right, his policies only distorted spending that would otherwise not have existed at all.

Keynesianism can certainly be carried to excess. If it works too well in reviving spending, it can strain the economy’s resources, yielding chronic inflation (a possibility that also worried Keynes). Planners can miscalculate

or overreach. Their power to mobilise resources can invite vociferous lobbying, which can turn militant, requiring a forcible government response. The totalitarian states Keynes worked so hard to defeat showed that the “central mobilisation of resources” and “the regimentation of the individual” could destroy personal liberty, as he himself once noted.

But Keynes felt that the risk in Britain was remote. The planning he proposed was more modest. And some of the people carrying it out were as worried about creeping socialism as anyone. Moderate planning will be safe, Keynes argued in his letter to Hayek, if those implementing it share Hayek's moral position. The ideal planners are reluctant ones. Keynesianism works best in the hands of Hayekians.

LATER IN THIS SERIES: Schumpeter, Popper and Hayek; Berlin, Rawls and Nozick; Rousseau, Marx and Nietzsche ■



约翰·梅纳德·凯恩斯

他是自由主义者吗？

人们应该有选择的自由。而让凯恩斯烦恼的是他们不选择的自由

一九四四年，出生于奥地利的经济学家弗里德里希·哈耶克（Friedrich Hayek）收到一封信。信是新泽西州大西洋城克拉里奇酒店（Claridge Hotel）的一位客人寄来的，祝贺他写成了一本“伟大的”书——《通往奴役之路》（The Road to Serfdom），这本书认为经济规划对自由暗藏威胁。信中写道：“我发现自己，在道德上和哲学上，都深表赞同。”

给哈耶克写信的是约翰·梅纳德·凯恩斯（John Maynard Keynes），彼时他正前往新罕布什尔州参加布雷顿森林会议，帮助规划战后的经济秩序。在许多人的认知中，哈耶克是自由市场撒切尔主义的思想教父，凯恩斯则是重度规划资本主义的守护神。这封信里洋溢的热情会让他们感到吃惊。

但和他的很多追随者不同，凯恩斯本人并不是左派。他在1925年发表的《我是自由主义者吗？》（Am I a Liberal?）一文中写道：“阶级斗争到来时，我会站在受过教育的资产阶级一边。”他后来形容工商业主义者是“暴君，需要勇于反对他们自私的、群体性的自命不凡”。他指责英国工党领导人表现得像“陈腐教义的信徒”、“咕哝着过时的、打折再打折的费边马克思主义”。他还指出：“收入和财富的显著不平等在社会和心理上有正当理由。”（尽管不是指他那个时代那般巨大的不平等。）

那么，凯恩斯为什么主张凯恩斯主义？显而易见的原因是上世纪30年代波及英国的大萧条，它粉碎了很多人对无管制的资本主义的信心。但是凯恩斯的一些观点可以追溯到更早以前。

凯恩斯属于不受制于自由放任主义的新一代自由主义者。自由放任主义认为“不受约束的私人企业会促进整体利益的最大化”。凯恩斯认为这种学说理论上未必正确，实践中也不再管用。国家必须根据不同的情形，斟酌定夺把哪些事情留给个人自主完成，哪些事情由国家承担。

在做这类决定时，凯恩斯和其他自由主义者不得不与社会主义和民族主义、革命和反革命等各种威胁抗争。迫于工党日益强大的政治势力，致力改革的自由党政府在1911年实施了强制国民保险，为辛勤工作的穷人提供病假工资、生育津贴和有限额的失业救济金。这类自由主义者把失业工人视为国家资产，认为他们不应因并非自身造成的错误“沦为穷人”。

这类自由主义者认为应该帮助不能自助者，共同完成凭一己之力无法完成的事情。凯恩斯的思想属于这一范畴。他反复强调，企业主无法扩大经营赚钱，除非别人也能扩大经营赚钱；储蓄者无法改善自己的财务状况，除非其他人愿意贷款。这些群体靠单打独斗都不能成功。而如果他们达不成目标，也会伤及其他所有人。

为什么会是这样呢？凯恩斯说，消费刺激经济产出。如果消费疲软，生产、就业和收入就会相应衰弱。消费的一个重要来源是投资：购买新设备、建造工厂、楼房等。但是凯恩斯担心，如果任由私人企业主自行其是，他们会在这类消费上投入太少。他曾鼓动性地指出，美国可以通过多消费走向繁荣。当然，各国同样也可以因为消费不足而由兴变衰。

更早期的经济学家比较乐观。他们认为，如果投资意愿不足而储蓄愿望强烈，利率就会下降，使两者保持一致。凯恩斯认为利率还有另一个作用，即让人们放弃现金，转而持有流动性较差的资产。

凯恩斯认为，金钱的吸引力在于它让人们保持购买力的同时，还能推迟人们对金钱用途的任何决定。金钱带给人们不选择的自由。如果人们对这种自由的需求特别强烈，那么只有当其他资产的价格相比之下低到极其诱人的程度之时，他们才会放弃持有现金。不幸的是，如此低的资产价格也会抑制资本支出，导致生产、就业和收入萎缩。收入减少会降低公众的储蓄能力，不断挤压这种能力，直到与整个国家微弱的投资意愿相匹配。这时，经济就会陷入疲软。

由此带来的失业不仅不合理，还是一种扼杀活力的低效。凯恩斯指出，劳动力是无法保存的。虽然工人自身不会因为停工而消失，但他们本可以为

经济做出贡献的时间被永远地浪费掉了。

这种浪费仍旧困扰着世界。美国国会预算办公室的数据显示，自2008年初起，美国劳动力如果充分就业，投入的劳动时间会比现在多出1000亿个小时。精于算小账的官员们经常指责凯恩斯对财政纪律漫不经心。但是，与大规模失业造成巨大资源浪费相比，凯恩斯在小钱上的糊涂微不足道。

最常与凯恩斯联系在一起的解决方法很简单：如果私人企业主的投资不足以维持高就业率，那么政府就该挺身而出。他支持规模宏大的公共工程，包括重建从郡政厅到格林威治的南伦敦地区，使之与圣詹姆斯区相媲美。在写给哈耶克的信中，他承认自己对《通往奴役之路》道德和哲学上的赞同并不适用于此书的经济理论。英国几乎肯定需要更多的、而不是更少的计划经济。在《通论》一书中，他给出的对策是“某种程度的投资全面社会化”。

最恶意的批评者揪住他这句话里隐含的非自由、甚至极权主义的思想。正如现代中国所示，凯恩斯主义的确与威权主义相容。有趣的问题是，假如凯恩斯主义可以不需要自由主义而运作良好，那么自由主义能在没有凯恩斯主义的情况下成功吗？

批评凯恩斯的自由主义者提出各种质疑。一些人拒不接受凯恩斯的诊断。他们提出，经济衰退并不是由可治愈的消费不足造成的，它们本身是对有恙的消费环节的一种痛苦的治愈手段。因此，衰退不会造成自由和经济稳定之间的冲突。解药不是减少而是增加自由主义：一个更加自由的劳动力市场——当消费疲软，这个市场会迅速拉低工资；还要叫停各央行的激进主义做法，因为人为降低利率会误导投资，最终导致破产。

另一些人指出这样的治疗比疾病更糟糕。经济衰退不足以成为侵犯自由的理由。这种对病痛的坚忍隐含在维多利亚时代的制度中，如金本位、自由贸易和平衡预算等。不管结果好坏，它们都束缚了政府的手脚。但到了1925年，社会无法再忍受这种痛苦了，部分原因是它不再认为自己必须忍受。

第三种质疑大体上接受凯恩斯的诊断，却不认同他最著名的处方——调动公共投资。后来的自由主义者更加相信对货币政策的运用。如果利率不能自动协调高收入和高就业水平下的储蓄和投资，那么现代央行就可以降低利率，直到实现这一目标。与凯恩斯主义的财政激进主义相比，这种方式更适合自由主义者。他们中的大多数（尽管不是全部）相信政府对一国货币负有责任。既然政府总会需要某种货币政策，那就不妨选择一种有助于充分发挥经济潜力的政策。

这三种质疑都能被逐一驳斥。如果一个经济体的消费疲软，解决办法无疑是调整开支方向，而不是减少开支。如果自由主义政府不阻击经济衰退，选民们就会求助于能够阻击经济衰退的专制政府，从而危及自由主义政府虔诚的不作为意图尊重的自由。

最后，凯恩斯本人认为宽松的货币政策是有益的。他只是怀疑它是否足够有效。无论货币供应多么充足，额外的流动性可能都无法带动消费复苏，尤其是如果人们不认为这种宽松会持续下去。自2008年金融危机以来，对货币政策的类似质疑重新流行。各国央行应对那场灾难的措施效果不如预期，而且干预也超出了纯粹主义者能接受的程度。央行购买包括一些私人证券在内的资产，难免会在不同群体间厚此薄彼。这种购买行为因此损害了一个严格的自由主义国家在处理经济事务上所应有的公正性。

在严重的经济衰退期，凯恩斯主义的财政政策可能比货币措施更能奏效，且不必像其批评者担心的那样强硬。即使是一个小而低调的国家政府也必须开展一定的公共投资，比如基础设施。凯恩斯认为，这些项目应该被安排在私人消费衰退之时，以作为弥补，而且那时的人力和物力也都比较容易落实。

为了促进投资，凯恩斯乐于考虑公共权力和私人自主活动之间的“各种折衷方案”。比如，政府可以为一些最具风险的投资承保，而不是自己直接来投资。

上世纪20年代，英国出台了累进税制和强制性的国民保险，在用工期内向

工薪族和公司收取各种税费，然后在失业期间支付救济金。尽管不是有意为之，但这些措施起到了“自动稳定器”的作用——在繁荣期消除购买力，在萧条期恢复购买力。

这种方法可被进一步运用。1942年，凯恩斯支持一项提议，在经济困难时降低国民保险费率，在经济景气时提高费率。与各种公共投资相比，这种方法的优势在于，薪资税不同于实施基础设施项目，只要动动笔就可以调整。此外它还模糊了不同思想路线之间的界限。国家在最符合凯恩斯主义之时（从对经济的刺激来衡量），却也恰恰最远离凯恩斯主义（以税收收入来衡量）。

对于政府的规模，凯恩斯理论最终没有给出明确的观点。凯恩斯本人认为，税收占国民净收入的25%（约占GDP的23%）“差不多是易于承受的极限”。相比消费的构成，他更担心消费的规模。总体而言，他乐于让市场力量来决定购买对象，只要买得足够多就行。如果运用得当，他的政策影响的只是原本根本不存在的那部分消费。

凯恩斯主义当然可能被滥用。如果它对消费提振太过，就有可能造成经济资源紧张，导致长期通货膨胀，这也是凯恩斯所担心的。规划者有可能误判或者不自量力。他们调动资源的权力可能引来喧嚣的游说，有时可能演变成武力激进行动，需要政府以暴制暴。凯恩斯力图战胜极权主义国家，正如他本人曾经指出的那样，极权主义国家的案例表明，“集中调动资源”和“对个人的严格组织管理”可能摧毁人身自由。

但是凯恩斯认为这种风险在英国微乎其微。他提出的规划较为温和。而且该规划的一些实施者和所有人一样担心暗中滋生的社会主义。凯恩斯在给哈耶克的信中说，如果规划的实施者与哈耶克的道德立场一致，那么有节制的规划就会是安全的。勉为其难的规划者最为理想。凯恩斯主义政策交给哈耶克派来执行是再好不过了。

本系列后续文章：熊彼特、波普尔和哈耶克；柏林、罗尔斯和诺奇克；卢梭、马克思和尼采■



Alexis de Tocqueville

The French exception

The gloomiest of the great liberals worried that democracy might not be compatible with liberty

HE IS the most unusual member of the liberal pantheon. Liberalism has usually been at its most vigorous among the Anglo-American middle classes. By contrast, Alexis de Tocqueville was a proud member of the French aristocracy. Liberalism tends to be marinated in optimism to such an extent that it sometimes shades into naivety. Tocqueville believed that liberal optimism needs to be served with a side-order of pessimism. Far from being automatic, progress depends on wise government and sensible policy.

He also ranks among the greats. He wrote classic studies of two engines of the emerging liberal order: "Democracy in America" (1835-40) and "The Old Regime and the French Revolution" (1856). He also helped shape French liberalism, both as a political activist and as a thinker. He was a leading participant in the "Great Debate" of the 1820s between liberals and ultra-Royalists about the future direction of France. In 1849 he served briefly as foreign minister (he died a decade later). He broadened the liberal tradition by subjecting the bland pieties of the Anglo-American middle class to a certain aristocratic disdain; and he deepened it by pointing to the growing dangers of bureaucratic centralisation. Better than any other liberal, Tocqueville understood the importance of ensuring that the collective business of society is done as much as possible by the people themselves, through voluntary effort, rather than by the government.

Tocqueville's liberalism was driven by two forces. The first was his fierce commitment to the sanctity of the individual. The purpose of politics was

to protect people's rights (particularly the right to free discussion) and to give them scope to develop their abilities to the full. The second was his unshakable belief that the future lay with "democracy". By that he meant more than just parliamentary democracy with its principle of elections and wide suffrage. He meant a society based on equality.

The old regime was predicated on the belief that society was divided into fixed classes. Some people are born to rule and others to serve. Rulers like Tocqueville's family in Normandy inherited responsibilities as well as privileges. They were morally bound to look after "their people" and serve "their country". Democratic society was based on the idea that all people were born equal. They came into the world as individuals rather than as aristocrats or peasants. Their greatest responsibility was to make the most of their abilities.

Many members of Tocqueville's class thought that democratisation was both an accident and a mistake—an accident because cleverer management of the old regime could have prevented the revolution in 1789, and a mistake because democracy destroyed everything they held most dear. Tocqueville thought that was nonsense—and pitied his fellow blue-bloods who wasted their lives in a doomed attempt to restore aristocratic privilege.

The great question at the heart of Tocqueville's thought is the relationship between liberty and democracy. Tocqueville was certain that it was impossible to have liberty without democracy, but he worried that it was possible to have democracy without liberty. For example, democracy might transfer power from the old aristocracy to an all-powerful central state, thereby reducing individuals to helpless, isolated atoms. Or it might make a mockery of free discussion by manipulating everybody into bowing down before conventional wisdom.

Sir Larry Siedentop, an Oxford academic, points out that Tocqueville's

contribution was to identify a structural flaw in democratic societies. Liberals are so preoccupied by the “contract” between the individual on the one hand and the state on the other that they don’t make enough room for intermediate associations which acted as schools of local politics and buffers between the individual and the state. And, he was the first serious thinker to warn that liberalism could destroy itself. Tocqueville worried that states might use the principle of equality to accumulate power and ride roughshod over local traditions and local communities. Such centralisation might have all sorts of malign consequences. It might reduce the variety of institutions by obliging them to follow a central script. It might reduce individuals to a position of defencelessness before the mighty state, either by forcing them to obey the state’s edicts or making them dependent on the state’s largesse. And it might kill off traditions of self-government. Thus one liberal principle—equal treatment—might end up destroying three rival principles: self-government, pluralism and freedom from coercion.

Tocqueville feared his own country might fall into the grip of just such an illiberal democracy, as it had in the Terror, under Maximilien Robespierre in 1793. The French revolutionaries had been so blinded by their commitment to liberty, equality and fraternity that they crushed dissenters and slaughtered aristocrats, including many members of Tocqueville’s family. His parents were spared, but his father’s hair turned white at 24 and his mother was reduced to a nervous wreck.

He was worried about more than just the bloodshed, which proved to be a passing frenzy. The power of the state also posed a more subtle threat. The monarchy had nurtured an over-mighty state, as French kings sucked power from aristocrats towards the central government. The revolution completed the job, abolishing local autonomy along with aristocratic power and reducing individual citizens to equal servitude beneath the “immense tutelary power” of the state.

By contrast, the United States represented democracy at its finest. Tocqueville's ostensible reason for crossing the Atlantic, in 1831, was to study the American penal system, then seen as one of the most enlightened in the world. His real wish was to understand how America had combined democracy with liberty so successfully. He was impressed by the New England townships, with their robust local governments, but he was equally taken by the raw egalitarianism of the frontier.

Why did the children of the American revolution achieve what the children of the French revolution could not? The most obvious factor was the dispersal of power. The government in Washington was disciplined by checks and balances. Power was exercised at the lowest possible level—not just the states but also cities, townships and voluntary organisations that flourished in America even as they declined in France. The second factor was what he called “manners”. Like most French liberals, Tocqueville was an Anglophile. He thought that America had inherited many of Britain’s best traditions, such as common law and a ruling class that was committed to running local institutions.

America also had the invaluable advantage of freedom of religion. Tocqueville believed that a liberal society depended ultimately on Christian morality. Alone among the world’s religions, Christianity preached the equality of man and the infinite worth of the individual. But the *ancien régime* had robbed Christianity of its true spirit by turning it into an adjunct of the state. America’s decision to make religion a matter of free conscience created a vital alliance between the “spirit of religion” and the “spirit of liberty”. America was a society that “goes along by itself”, as Tocqueville put it, not just because it dispersed power but because it produced self-confident, energetic citizens, capable of organising themselves rather than looking to the government to solve their problems.

He was not blind to the faults of American democracy. He puzzled over the

fact that the world's most liberal society practised slavery, though, like most liberals, he comforted himself with the thought that it was sure to wither. He worried about the cult of the common man. Americans were so appalled by the idea that one person's opinion might be better than another's that they embraced dolts and persecuted gifted heretics. He worried that individualism might shade into egotism. Shorn of bonds with wider society, Americans risked being confined within the solitude of their own hearts. The combination of egalitarianism and individualism might do for Americans what centralisation had done for France—dissolve their defences against governmental power and reduce them to sheep, content to be fed and watered by benevolent bureaucrats.

Tocqueville exercised a powerful influence on those who shared his fears. In his "Autobiography" John Stuart Mill thanked Tocqueville for sharpening his insight that government by the majority might hinder idiosyncratic intellectuals from influencing the debate. In 1867 Robert Lowe, a leading Liberal politician, argued for mass education on the Tocquevillian grounds that "we must educate our masters". Other Liberal politicians argued against extending the franchise on the grounds that liberty could not survive a surfeit of democracy. In the 1950s and 1960s American intellectuals seized on Tocqueville's insight that mass society might weaken liberty by narrowing society's choices.

More recently intellectuals have worried about the rapid growth of the federal government, inaugurated by Lyndon Johnson's Great Society programme. Transferring power from local to the federal government; empowering unaccountable bureaucrats to pursue abstract goods such as "equality of representation" (even if it means riding roughshod over local institutions); and undermining the vitality of civil society tends, they fear, to destroy the building blocks of Tocqueville's America. A recent conference, organised by the Tocqueville Society and held in the family's Normandy manor house, dwelt on the various ways in which democracy is under

assault from within, by speech codes, and from without, by the rise of authoritarian populism, under the general heading of “demo-pessimism”.

It is worth adding that the threat to liberty today does not stem just from big government. It also comes from big companies, particularly tech firms that trade in information, and from the nexus between the two. Gargantuan tech companies enjoy market shares unknown since the Gilded Age. They are intertwined with the government through lobbying and the revolving door that has government officials working for them when they leave office. By providing so much information “free” they are throttling media outfits that invest in gathering the news that informs citizens. By using algorithms based on previous preferences they provide people with information that suits their prejudices—right-wing rage for the right and left-wing rage for the left.

Today’s great rising power is the very opposite of the United States, the great rising power of Tocqueville’s time. China is an example not of democracy allied to liberty but of centralisation allied to authoritarianism. Its state and its pliant tech firms can control the flow of information to an extent never dreamed of. Increasingly, China embodies everything that Tocqueville warned against: power centralised in the hands of the state; citizens reduced to atoms; a collective willingness to sacrifice liberty for a comfortable life.

Before the revolution in France in 1848, Tocqueville warned that the continent was “sleeping on a volcano...A wind of revolution blows, the storm is on the horizon.” Today democracy in America has taken a dangerous turn. Populists are advancing in Europe, Asia and Latin America. Authoritarians are consolidating power. The most pessimistic of great liberal thinkers may not have been pessimistic enough.

LATER IN THIS SERIES: John Maynard Keynes; Schumpeter, Popper and

Hayek; Berlin, Rawls and Nozick; Rousseau, Marx and Nietzsche ■



亚历克西斯·德·托克维尔

例外的法国人

最悲观的伟大自由主义者担心民主与自由有时可能并不相容

他是自由主义万神殿中最不寻常的一尊。自由主义通常在英美中产阶级中最为活跃，而亚历克西斯·德·托克维尔（Alexis de Tocqueville）却自豪于自己是法国贵族的一员。自由主义往往在乐观中腌泡太久，有时渐渐变了味而沦为幼稚。托克维尔相信，自由主义的乐观需要辅以“悲观”这道配菜。进步远非自然而然，而是有赖于英明的政府和明智的政策。

他也位于伟大之列。他撰写了关于新兴的自由主义秩序的两大火车头的经典研究——《论美国的民主》（*Democracy in America*, 1835-1840）和《旧制度与大革命》（*The Old Regime and the French Revolution*, 1856）。他还帮助塑造了法国的自由主义——以政治活动家也以思想家的身份。19世纪20年代，自由派与极端保王派就法国未来走向展开了一场“大辩论”，他是主要参与者之一。1849年，他曾短暂担任法国的外交部长（他在十年后去世）。他令英美中产阶级对自由主义乏味的虔诚受到些许贵族式清高的冲击，从而扩大了自由主义的传统。他指出了日益增长的官僚集权的危险，又令这一传统得以深化。托克维尔比任何自由主义者都更明白一件事的重要性：要确保社会的集体事务尽可能由人民自己通过自发的努力来完成，而非由政府来实施。

托克维尔的自由主义受两股力量驱动。首先是他坚定维护个人权力神圣不可侵犯。政治的目的是保护人民的权利（尤其是言论自由权），并赋予他们空间以充分发展自身的才能。其次是他坚信未来存在于“民主”之中。他所说的民主不仅仅是以选举和广泛投票权为原则的议会民主，而是建立于平等基础上的社会。

旧制度的依据是相信社会被划分为固定的阶级。一些人生来就是要统治他人，而另一些人要为别人服务。像托克维尔在诺曼底的家族这样的统治者

继承了特权也继承了责任。他们在道德上必须照顾“他们的子民”，并为“他们的国家”服务。民主社会则是基于人人生而平等的观念。人是作为个体而非贵族或农民来到这个世界上的。他们最大的责任是充分发挥自己的才能。

托克维尔所在阶层的许多成员都认为民主化是一次意外也是一个错误——说是意外，是因为如果旧制度在管理上更高明些，就可以防止1789年的革命爆发；说是错误，是因为民主摧毁了他们最珍视的一切。托克维尔认为这是无稽之谈，并对在努力恢复贵族特权这一注定失败的企图中虚掷生命的其他贵族深表同情。

托克维尔思想的核心大问题是自由与民主的关系。他确信没有民主就没有自由，但他担心有民主而无自由是可能的。比如，民主可能将权力从旧贵族转移到拥有至上权力的中央政府手中，从而使个人沦为无助又孤立的微尘。或者，它可能会操纵每一个人，让他们谨遵传统观念，而令言论自由沦为空谈。

牛津大学学者拉里·西登多普爵士（Larry Siedentop）指出，托克维尔的贡献在于他发现了民主社会的一个结构性缺陷。自由主义者太过专注个人与国家之间的“契约”，而没有为中介性组织留出足够的空间，这些组织本应充当地方政治派系以及个人与国家之间的缓冲。此外，托克维尔是第一个警告自由主义可能自我摧毁的思想家。他担心国家可能利用平等原则积蓄权力，从而践踏地方传统和地方社区。这种集权可能带来各种恶果。它可以强制各个机构遵循一套中央部署以减少它们的多样性。它可以强迫个人服从国家法令或让他们依赖国家施舍，令个人在强大的国家面前退到毫无招架之力的位置。它可能扼杀自治的传统。因此，自由主义的其中一项原则——平等待遇——最终可能会摧毁它的另外三个竞争性原则：自治、多元化和不受强迫的自由。

托克维尔担心自己的国家可能会陷入这样一种不自由的民主之中，就像它在1793年马克西米连·罗伯斯庇尔（Maximilien Robespierre）领导的恐怖政治时期所经历的那样。法国革命者被他们对自由、平等、博爱的承诺蒙

蔽了双眼，他们镇压异见人士，屠杀贵族，包括托克维尔家族的众多成员。他的父母幸免于难，但父亲在24岁就白了头，母亲精神崩溃。

令他忧心的不仅仅是流血事件——事实证明这是一时的疯狂。国家权力还带来了更微妙的威胁。随着法国的国王们削弱贵族的权力来加强中央统治，君主制孕育了一个过于强大的政府。大革命将此趋势推向了顶峰，在废除贵族权力的同时取消了地方自治，并让个体公民沦为国家“无限监护权”之下平等的受奴役者。

与此相反，美国则代表了最优质的民主。托克维尔于1831年远赴大西洋彼岸，对外宣称的原因是考察美国的刑法制度——在当时被视为世界上最文明的制度之一，而他真正的愿望是了解美国如何能这般成功地将民主与自由结合在一起。他对新英格兰的乡镇和那里富于活力的地方政府印象深刻。但边疆地区原始的平等主义同样让他惊叹。

为何美国独立战争的产物取得了法国大革命的产物未能取得的成就？最明显的原因是权力分散。华盛顿政府受到权力制衡的约束。权力被下放到尽可能低的层面——不仅在国家，还在城市、乡镇和志愿组织中行使。这些地方权力在法国衰落，却在美国蓬勃发展。第二个因素是托克维尔所说的“社会风俗”。和大多数法国自由派一样，托克维尔是亲英派。他认为美国继承了许多英国最好的传统，比如普通法和一个致力于运行地方机构的统治阶级。

美国还拥有宗教自由的可贵优势。托克维尔认为自由的社会从根本上依赖基督教的道德观。在全世界各种宗教中，唯有基督教宣扬人类平等和个人的无限价值。但法国的旧制度剥夺了基督教的核心精神，把它变成了国家的附庸。美国决意把宗教信仰变成一种良心的自由选择，这在“宗教精神”和“自由精神”之间创建了一个至关重要的联盟。正如托克维尔所言，美国是一个“自成一派”的社会，不仅因为它分散了权力，也因为它培育出了自信又充满活力的公民，他们能够自行组织起来，而非依赖政府来解决他们的问题。

他也看到了美国民主的缺陷。这个世界上最自由的社会却实行奴隶制，这让他困惑。虽然，和大多数自由主义者一样，他自我安慰说它必将萎败。他担心一种对普通人的崇拜。美国人对于一个人的观点可能比另一个人的更好这件事谈虎色变，以至于要拥抱愚人，迫害天才的异见者。他担心个人主义可能会演变成自我中心主义。如果被切断了与广泛社会的联系，美国人可能会受困于内心的孤岛。平等主义和个人主义的结合对美国人的影响可能与集权带给法国的一样——解除他们对政府权力的防御，把他们变成温顺的绵羊，满足于由仁慈的官僚机构喂吃喂喝。

托克维尔对那些心怀相同忧虑的人影响重大。约翰·斯图尔特·密尔在他的《自传》中感谢托克维尔让他更深刻地认识到大多数人的政府可能会阻碍见解独特的知识分子影响辩论进程。1867年，重要的自由派政治家罗伯特·罗威（Robert Lowe）从托克维尔的主张“我们必须教育我们的主人”出发，提倡大众教育。其他自由派政客以过度的民主会损害自由为由反对扩大投票权。上世纪五六十年代，美国的知识分子采纳了托克维尔的观点，认同大众社会可能会缩减社会的选择而削弱自由。

更近些时候，知识分子为联邦政府的迅速扩张忧心忡忡，这种扩张始于林登·约翰逊提出的“伟大社会”。他们担心，将权力从地方转移到联邦政府、赋予无从追责的官僚权力来追求“代表权平等”这类抽象的好处（即使这意味着损害地方机构），以及破坏公民社会的活力等变化会破坏托克维尔称颂的美国的基石。最近，在托克维尔家族位于诺曼底的庄园里举行了由托克维尔协会（Tocqueville Society）组织的会议，以“民主悲观主义”为题，探讨了民主制度正在遭遇的从言论准则到威权民粹主义崛起等各种“内忧外患”。

值得一提的是，今天自由所受的威胁不仅仅来自大政府。它也来自大企业——尤其是交易信息的科技公司——以及企业与政府的联结。自镀金时代以来，科技巨头就享有不为人知的市场份额。它们通过游说以及让政府官员在离任后为它们工作的“旋转门”与政府交织在一起。它们提供大量的“免费”信息，扼杀了那些花钱费力来收集新闻以求让公民知情的媒体机

构。它们使用基于既有的偏好得出的算法，为人们提供符合他们固有偏见的信息——给右翼看右翼之忿，给左翼看左翼所憎。

今天正在崛起的大国正好是美国这个托克维尔时代崛起的强国的反面。中国不是民主与自由联盟的例证，而是中央集权与威权主义的结合。其国家政府以及听话的科技公司对信息流的控制可以达到超出想象的程度。中国越来越多地显现出托克维尔警告过的一切：权力集中在国家手中、公民沦为微尘、为了舒适的生活而牺牲自由的集体意愿。

在1848年法国二月革命前夕，托克维尔警告说，欧洲大陆“在火山上沉睡……革命之风吹拂，暴雨即将来袭。”今天，美国的民主已经发生了危险的转变。民粹主义者在欧洲、亚洲和拉美挺进。威权主义者在巩固权力。伟大的自由派思想家中的最悲观者可能还不够悲观。

本系列后续文章：约翰·梅纳德·凯恩斯；熊彼特、波普尔和哈耶克；柏林、罗尔斯和诺齐克；卢梭、马克思和尼采■



Private equity

Barbarians grow up

As private-equity firms mature, the way they buy and sell is changing—as is everything in between

“SELL in May and go away,” say the denizens of Wall Street, and to the usual summer lethargy is added the excuse of a heatwave. But for those working in private equity, there is no let-up. The “shops”, as private-equity funds like to call themselves, are stuffed with money and raising more: \$1.1trn in “dry powder” ready to spend around the world, according to Preqin, a consultancy, with another \$950bn being raised by 3,050 firms.

So hot is the market that there are rumours of money being turned away. Even the firms themselves, which receive fees linked to assets under management, cannot fathom how to use all that may come their way. It is not for want of trying. The year to date has seen nearly 1,000 acquisitions (see chart 1). Health care has been particularly vibrant (see next article).

Even more noteworthy than the volume of money pouring into private equity is the way the business is maturing. Banks are reconfiguring their operations to serve such a transaction-heavy clientele. Limited partners—the public-pension schemes, sovereign-wealth funds, endowments and family offices that provide the bulk of private-equity investment—are playing more active roles. It all adds up to a stealthy, but significant, reshaping of the financial ecosystem.

Data on returns are patchy. Odd measures are often used to gauge performance and disclosure is intermittent. But there is plenty of reason to believe that private-equity funds have done well in the past decade. Low interest rates have favoured their debt-heavy business model. Rising asset

prices have made it easy to sell for large gains.

And some recent clouds on the horizon have dissipated. Mooted tax reforms would have stopped private-equity firms from deducting the interest they pay on debt from their taxable income and forced their managers to pay the personal-tax rate on their investment profits (or “carried interest”), rather than the lower capital-gains rate. In the event, however, the new rules brought in last year did not touch carried interest at all and only slightly reduced the benefits of debt.

Another fear had been that regulations would become less supportive. Jay Clayton, who took over at the Securities and Exchange Commission (SEC) last year, made it clear that he wanted to see a shift towards public markets. He noted that the loss of companies to private equity had denied opportunities to small investors. A flurry of public offerings followed his appointment, including sales by private-equity firms. But the burdens of being listed remain heavy. These include onerous filing requirements and the knowledge that routine business decisions may become the subject of caustic public debate.

The result is that the value of public companies being taken private continues to rise (see chart 2). The figures understate the trend, since they omit the growing number of large companies selling off divisions to private-equity firms. These deals attract little attention—which is partly the point. Headquarters do not move; senior executives keep their jobs. Recent examples include the decision by J.M. Smucker, a food company, to sell its baking business to Brynwood Partners and GE’s move to sell its industrial-engines division to Advent International. Similarly unremarked is the rising number of transactions in which one private-equity firm sells to another, rather than listing an asset on the public markets.

Private equity's growing heft has knock-on effects throughout the financial sector. Goldman Sachs has 25 merger bankers assigned to private-equity firms, working on deals alongside colleagues who focus on specific industries. Its analysts monitor 5,500 private-equity holdings—50% more than the number of listings on the American public markets. The other big institutional banks, such as Morgan Stanley and JPMorgan Chase, are just as attentive to private equity.

The most significant change may be in private equity's investor base. In the past two years the number of limited partners with more than \$1bn invested has grown from 304 to 359. Together they account for \$1.5trn—half of all private-equity money, according to Preqin. And this statistic does not fully capture their growing activism. As well as placing cash in private-equity funds, they increasingly "co-invest"—ie, take direct stakes in a buy-out.

The advantage for limited partners is that they avoid management fees—often 2% annually, plus 20% of profits. Private-equity funds gain from being less reliant on each other. Not long ago, large deals often required several funds to collaborate. The purchase of Nielsen Media in 2006, for example, involved seven. That alarmed antitrust regulators, complicated management and made it hard to exit from investments, since many potential buyers were already co-owners. The value of deals done by more than one private-equity firm has fallen by half since the Nielsen deal. Even when firms work together, the average number involved is smaller than it was.

For the biggest deals, private-equity firms are today making acquisitions solo and then syndicating large stakes through co-investments to limited partners. Notable among numerous recent examples are Blackstone's purchase of Thomson Reuters' finance and risk division in January for \$20bn, and Carlyle's of the specialty-chemicals division of Akzo Nobel, a Dutch multinational, in March for \$12bn. The process often begins with a

phone call by a private-equity firm to big, sophisticated investors such as GIC, Singapore's sovereign-wealth fund, or CPP Investment Board, a giant Canadian pension fund. They can quickly put together teams to analyse transactions. Smaller limited partners are brought in later if needed, along with select outsiders, notably family offices.

This trend does not just reduce risk for private-equity managers. It also underlines a change in financial markets. Why should companies accept the costs and scrutiny that come with selling shares to the general public when there is a sophisticated, rich, private alternative? And when the time comes for one private-equity owner to sell, another private-equity fund can put together such a network to buy. Brokers and exchanges developed a century ago to help companies tap money where it lay—in individual pockets. Today that capital increasingly lies elsewhere. ■



私募股权

野蛮人成长记

随着私募股权公司走向成熟，其买卖方式随之改变，其他的方方面面也在变

华尔街的人常说：“五月清仓，完事离场。”加上热浪来袭的借口，夏季通常都是一片慵懒怠惰。但那些在私募股权公司工作的人却松懈不得。各家“店”（私募股权基金喜欢这样自称）积攒了大量资金，而且还在不断增加。据咨询公司Preqin的数据，除了1.1万亿美元的“干火药”可随时投向世界各地，3050家私募股权公司正在另外筹集9500亿美元。

市场如此火爆，传言称有些资金都不得其门而入。私募股权公司对自己管理的资产收取管理费，连它们也不知道该怎么利用所有这些一拥而入的资金。它们做出的尝试并不少。今年迄今已有近1000宗收购交易（见图表1）。医疗保健市场尤其活跃。

相比涌入私募股权市场的资金量，更值得留意的是这项业务正在走向成熟。银行正在重新调整业务，以便为这个业务繁忙的客户群提供服务。作为私募股权投资资金的主要来源，公共养老金计划、主权财富基金、捐赠基金和家族财富管理办公室等有限合伙人正在发挥更积极的作用。这一切正在悄然却显著地重塑金融生态系统。

收益方面的数据零散不全。衡量业绩的手段往往稀奇古怪，信息披露时有时无。但有充分理由相信私募股权基金在过去十年里表现不俗。低利率有利于其高债务的商业模式。资产价格节节攀升，可轻易出售获取厚利。

不久前浮现的一些阴霾也已消散。之前酝酿的税制改革本来要阻止私募股权公司从其应税收入中扣除所支付的债务利息，并迫使基金经理们就其投资利润（又称“附带权益”）按个人所得税税率而非较低的资本利得税率缴税。然而到头来，去年提出的新规则并未触及附带权益的问题，只是略微调低了债务税盾。

之前另一个引人担忧的因素是监管支持力度会减弱。去年接任美国证券交易委员会（SEC）主席的杰伊·克莱顿（Jay Clayton）明确表示希望企业回流公开市场。他指出，企业投奔私募股权，剥夺了小投资者的投资机会。在他上任后，连串公开上市随之而来，包括私募股权公司出售的公司股权。但企业上市的负担仍然很重，包括要应对繁琐的申报要求，而且日常业务决策都可能引起激烈的公共争论。

结果是上市公司被私有化的规模持续上升（见图表2）。图中数字并未充分反映这一趋势，因为其中没有考虑越来越多的大公司将旗下部门出售给私募股权公司这一情况。这些交易很少受到关注——但在一定程度上，要的就是这样的效果。总部不变，高管留任。最近的例子包括食品公司斯味可（J.M. Smucker）决定将其烘焙业务出售给私募股权Brynwood Partners，以及GE将其工业发动机部门出售给安宏资本（Advent International）。另外，同样不受注意的是，私募股权公司更多地把资产出售给其他私募股权公司，而不是公开上市。

私募股权公司的势力与日俱增，在整个金融领域产生了连锁效应。高盛有25位合并交易银行专家被派驻到私募股权公司内，与专注特定行业的同事一起推动交易。高盛的分析师监控着5500项私募股权资产的动态，这比在美国公开市场上市的股票数量还多50%。其他大型机构银行，如摩根士丹利和摩根大通，也对私募股权投资关注有加。

最重要的变化可能发生在私募股权的投资者群体上。过去两年，投资额超过10亿美元的有限合伙人数量已从304增至359个。根据Preqin的数据，这些合伙人的私募股权投资总额达1.5万亿美元，占到所有私募股权资金的一半。而这一统计数据并未完全反映出他们日益积极的投资活动。除了将资金投入私募股权基金外，他们还越来越多地“共同投资”，即在并购交易中直接购入股份。

有限合伙人的优势在于可免除管理费（通常为每年2%），另外还有20%的利润。私募股权基金之间已经减少了对彼此的依赖，这对它们自身有

利。不久以前，大宗交易往往需要多个基金合作完成。例如，2006年尼尔森媒体（Nielsen Media）的收购案就涉及七家基金。这既引来了反垄断监管机构的关注，也令管理变得复杂，还让退出投资变得困难，因为许多潜在买家已经是共同所有者了。自尼尔森收购案以来，多于一家私募股权公司参与的并购的交易总额下跌了一半。即使私募股权公司合作，参与一宗并购的私募公司的平均数也少于以往。

对于最大型的交易，私募股权公司如今会独自收购，然后通过共同投资向有限合伙人分别出售大量股权。近期众多例子中较突出的包括黑石集团（Blackstone）在1月以200亿美元的价格收购了汤森路透的金融和风险部门，以及凯雷集团（Carlyle）在3月以120亿美元收购了荷兰跨国公司阿克苏诺贝尔（Akzo Nobel）的特种化学品部门。这一过程通常始于私募股权公司致电大型资深机构投资者，如新加坡主权财富基金新加坡政府投资公司（GIC），或加拿大大型养老基金CPP投资委员会（CPP Investment Board）。这些机构可以快速组建团队来分析交易。之后，如有需要，私募股权公司会引入较小型的有限合伙人，以及精选的外部机构——主要是家族理财办公室。

这一趋势不仅降低了私募股权基金经理的风险，还突显了金融市场的一个变化。既然有资金充裕而又成熟的私募渠道，企业为何还要公开募股并接受伴随而来的成本及审查限制？而且，等私募股权的所有者要出售手中股权时，另一个私募股权基金也可组建这样一个私募网络来购入。一个世纪以前，股票经纪和交易所发展起来，帮助企业募集资金——当时是从个人的口袋里。如今，越来越多的资本聚集于别处。 ■



Health care

Sun, sea and surgery

More people are going under the knife abroad

IN THE tiny Croatian town of Zabok patients arrive in their thousands each year from across Europe and the Middle East, seeking replacement hips or knees at the St Catherine hospital, which specialises in orthopaedic work. Some come for treatment they cannot get at home, others to escape long waiting-lists for public health care or high prices for private operations. Croatia is one of a number of treatment hotspots in the medical-tourism industry. Babies are made in Barbados, sexes are changed in Bangkok, teeth are replaced in Hungary or Mexico and hair is transplanted in Turkey (see map).

Precise numbers are hard to pin down, partly because of differences between countries in what is counted as medical tourism. Some national statistics include a mere spa visit or a tourist who falls sick. Allied Market Research, a research firm, puts the industry's value at \$61bn in 2016. Keith Pollard, head of LaingBuisson, a health-care research outfit that specialises in medical-tourism data, reckons it is much smaller, at around \$10bn-15bn.

Rising numbers of middle-class patients in Asian and African countries mean more people willing to spend if they cannot find what they need at home. And consumers are incentivised to travel by substantial price differences across borders for the same treatment. The average heart-valve replacement, for example, costs €30,000 (\$35,000) in Germany but only €15,000 next door in Austria, with little or no drop in quality. A hip operation can be had for €12,000 in Britain, €10,000 in Turkey and only €4,725 in Poland.

Governments are responding to rising demand. South Korea, Malaysia and Dubai have all invested heavily in creating regional centres of medical expertise to attract foreign patients. The Dubai Healthcare City seeks to attract patients from Gulf nations who have in the past been sent further afield by their health systems, to Europe or America. Some niche areas are showing particularly strong growth. Mr Pollard says that international travel for in vitro fertilisation (IVF) is increasing rapidly because many wealthy countries have restricted access to free treatment. A number of European countries, such as Germany, offer only three rounds of IVF and limit access to those with medical conditions or to younger women.

Medical tourism is still hampered, however, by a lack of detailed, reliable information on the quality of hospitals and clinics and of their doctors and surgeons, notes Valorie Crooks, a professor of geography at Simon Fraser University in British Columbia. International hospitals are often verified by the Joint Commission, a non-profit organisation that awards accreditation to medical-services providers. These aside, patients have had to rely solely on reputation or on intermediaries that grease the wheels of medical travel. Patients often do not realise that these “facilitators” may be working exclusively with certain clinics; some receive undisclosed commissions. If things go wrong, patients may have little recourse to help. Doctors have long complained about people who return from treatment abroad with complications.

Two newish online firms, Qunomedical and Medigo, both based in Berlin, hope to improve matters. They allow patients to search for medical treatments from a large selection of providers, offering clear information about pricing and the quality of staff and services. Both take fees from the hospitals and clinics that they list, as disclosed on their websites; Medigo also earns money from patients and corporate customers in the form of fees. Patients write reviews, and human advisers are available to help with choosing where to receive treatment. Such information should make

foreign medical treatments more appealing.

But making money out of medical tourism can still be hard. Variations in exchange rates can instantly make a destination less appealing. The market for “scalpel safaris” in South Africa has proved volatile, say people in the business, due to currency fluctuations. Sometimes demand fails to materialise. When work first started on a 2,000-bed hospital called Health City Cayman Islands, the \$2bn project was expected to attract more than 17,000 foreign patients annually, mostly from America. But when the first wing of the hospital opened in 2014, the *International Medical Travel Journal* reported that fewer than 1,000 overseas patients arrived in its first year. One reason was that its backers based projections of customer numbers on a flawed study, according to a subsequent investigation by a government public-accounts committee. Fewer American patients came than expected partly because health insurers were not interested in sending people overseas.

In time, health-care providers are likely themselves to travel to serve patients. Vikram Kapur, a partner at Bain & Company, says that China has in the past been an exporter of patients but now American hospitals, such as Johns Hopkins, the Cleveland Clinic and the University of Pittsburgh Medical Center, are undertaking joint ventures with local Chinese hospitals to deliver services to patients closer to their homes. One way or another, health care is becoming more footloose. ■



医疗保健

阳光、大海和手术

越来越多的人在海外开刀

在克罗地亚小镇扎博克（Zabok），每年都有成千上万欧洲和中东的患者来到这里，希望在擅长矫形外科的圣凯瑟琳医院（St Catherine hospital）接受髋关节或膝关节置换手术。有些人是为国内无法获得的治疗而来，其他人是不想在公立医院排长队或在私人诊所花大钱。克罗地亚是医疗旅游业的一批治疗热点之一。做试管婴儿去巴巴多斯，变性去曼谷，做假牙去匈牙利或墨西哥，植发去土耳其（见地图）。

精确的医疗旅游人数很难确定，原因之一是各国对医疗旅游的界定不同。有些国家的统计数据把仅仅去了下水疗中心或在当地生了病的游客都算在内。联合市场研究公司（Allied Market Research）估算，2016年医疗旅游行业的价值为610亿美元。专门研究医疗旅游数据的医疗保健研究机构LaingBuisson的负责人基思·波拉德（Keith Pollard）估计的市场规模要小得多，约为100亿到150亿美元。

亚洲和非洲国家中产阶级患者数量不断增加，如果他们无法在国内得到所需的治疗，就会愿意花钱出国解决问题。而且相同的治疗在不同国家价格差异巨大，也让消费者有动力出国治疗。例如在德国，心脏瓣膜置换费用平均为3万欧元（3.5万美元），而邻国奥地利仅需1.5万欧元，质量无甚差别。英国的髋关节手术要1.2万欧元，土耳其要1万欧元，而波兰只需4725欧元。

各国政府正在回应增长的需求。韩国、马来西亚和迪拜都投入巨资创建区域专科医疗中心以吸引外国患者。迪拜医疗城（Dubai Healthcare City）想要吸引海湾国家的患者，过去这些国家的医疗系统会把本国的一些病人送到更远的欧洲或美国去接受治疗。一些利基领域的增长尤为强劲。波拉德表示，以做试管婴儿（IVF）为目的的国际旅行正在迅速增加，因为许

多富裕国家已经对免费IVF做出限制。德国等一些欧洲国家只可以免费做三次，而且对患病或较年轻的女性都有限制。

但是，由于缺乏有关医院、诊所及其内外科医生质量的详细、可靠的信息，医疗旅游业的发展还是受到了阻碍，加拿大不列颠哥伦比亚省的西蒙弗雷泽大学（Simon Fraser University）的地理学教授瓦莱丽·克鲁克斯（Valorie Crooks）指出。国际医院常获得国际医疗卫生机构认证联合委员会（Joint Commission）这一非营利组织的资质认证。但除此之外，患者只能完全依赖医院和医生的声誉或促成医疗旅游的中介机构。患者通常不知道这些“辅助机构”可能和某些诊所独家合作，有些还会悄悄收取佣金。如果出现问题，他们可能求助无门。长期以来，医生们一直对人们去国外治疗回来后出现并发症的情况怨声载道。

柏林两家成立不久的网络公司Qunomedical和Medigo希望能改进现状。它们提供了有关定价和医护人员及服务质量的明确信息，让患者能在大量医疗服务机构中查找自己需要的治疗。两家公司都向自己罗列的医院和诊所收取费用——这一点它们都在网站上写明；Medigo还会向患者和企业客户收取费用。患者在网站上撰写评价，人工顾问协助选择医疗机构。这些信息应该会让海外医疗更具吸引力。

但要靠医疗旅游赚钱可能仍然很难。汇率的变化可以让一个旅游目的地瞬间失去吸引力。业内人士表示，由于汇率的波动，南非“手术刀探险之旅”的市场变化无常。有时需求无法实现。当拥有2000张病床、名为开曼群岛健康城（Health City Cayman Islands）的医院开建之时，这个20亿美元的项目预计每年将吸引超过1.7万名外国患者，主要来自美国。但据《国际医疗旅游杂志》（International Medical Travel Journal）报道，当医院的一区于2014年建成开业时，第一年前来就医的海外患者还不到1000人。一个政府公共账目委员会随后的调查显示，原因之一是项目投资者对海外病患数量的预测是基于一项有缺陷的研究。美国患者人数少于预期的部分原因是医疗保险公司对把病人送到海外治疗不感兴趣。

未来，医疗机构很可能自己“出国游”以服务当地病患。贝恩咨询公司的合

伙人维克拉姆·卡普尔（Vikram Kapur）表示，中国过去一直是患者出口国，但现在约翰霍普金斯医院、克利夫兰诊所和匹兹堡大学医学中心等美国医院正在和中国本土医院建立合资机构，把医疗服务送到中国患者的家门口。不管怎样，医疗服务正变得越来越不受地域的限制。■



Technology and law firms

Diligence disrupted

Magic-circle law firms climb aboard the artificial-intelligence wagon

LONG hours have been the bane of the legal profession for ages; few of them involve thrilling courtroom antics. As a junior corporate lawyer at Davis Polk & Wardwell, a law firm in New York, John Bick remembers spending most of his waking hours poring over contracts looking for clauses that could complicate or kill off a deal. Even once he became a partner he still had to pitch in on due diligence for large transactions. In 2015 nearly a third of British lawyers were looking to leave the profession, according to the job searches of more than 1,000 of them by Life Productions, a career-change consultancy, perhaps because of the drudgery.

Such dissatisfaction may recede in future. Now on his firm's management committee, Mr Bick is drafting in artificial intelligence (AI) to do the gruntwork—like many others at top law firms in New York and London. The shift could transform lawyers' work and slash costs for clients.

Prestigious firms make their money by throwing large numbers of bodies at huge stacks of paperwork. During discovery, a pre-trial procedure in America, for example, both sides exchange heaps of documents that must be combed through for evidence. Junior lawyers dig up and compare judges' decisions on similar cases, or arguments previously made by opposing counsel, to prepare for litigation.

A growing number of legal startups now apply machine-learning techniques to these tasks. The algorithms can process much more paperwork than humans in a fraction of the time. They recognise clauses and point out anomalies. They might highlight contracts where liability is

unlimited rather than limited. They can even point out contracts where key clauses are absent. The latter is something that humans do not always reliably do, says Noah Waisberg, a former corporate lawyer who founded Kira Systems, a software tool that uses machine learning to review contracts.

The potential gains are large. Due diligence can be so time-consuming that it typically accounts for as much as half of the fees that lawyers charge for advising on deals. Many firms, including Davis Polk, as well as Freshfields and Clifford Chance in London, use Kira to help with document review. The firm's software is trained on a set of documents to recognise more than 450 clauses, such as "change-of-control" provisions which specify the termination of a contract in the event one of the parties is taken over. Lawyers can then tinker with it further to recognise more obscure clauses, or even those in different languages. Other software firms that use AI to review documents include Luminance and RAVN, both of which are based in London and count big law firms as customers.

Machine learning can also help prepare for trial. It speeds up discovery, and assists lawyers in drawing up a litigating strategy. Lex Machina, a Silicon Valley startup now owned by Lexis Nexis, a legal-information provider, uses court documents from previous cases to make predictions about a particular case, such as its time to trial, its likelihood of success in various jurisdictions, and the damages it could win.

Some tech firms are aiming at full disintermediation, developing "robot lawyers" to deal with certain tasks. LISA, a British AI tool, helps people draw up non-disclosure agreements, removing the need for expensive human lawyers to be apprised of confidential (and perhaps embarrassing) details. Others aim to help people appeal against parking tickets or draw up rental leases without incurring legal expenses.

The savings from using machine-learning software are often hard to predict. It is early days and every case is different, says Isabel Parker, chief legal innovation officer at Freshfields. But the time spent on document review can fall by as much as 80%, which is likely to translate into lower fees for clients.

Will legal employment eventually shrink? The jury is still out. Some firms expect to employ fewer graduates. But others argue that cheaper services could encourage clients to consult their lawyers more. And although some tasks are automatable, many others rely on human judgment. AI might pinpoint atypical clauses in contracts, for example, but it cannot decide if the anomaly is a deal-breaker. In any event, lawyers should start to find their work more interesting. ■



技术和律所

轻松尽职

顶尖律所开始利用人工智能

长久以来，法律行业的一大弊端是工作时间太长。很少有律师真的会到法庭上展开激动人心的唇枪舌战。约翰·比克（John Bick）曾是纽约达维律师事务所（Davis Polk & Wardwell）的初级企业律师，他记得那会儿自己醒着的大部分时间都在看合同，寻找那些可能会影响交易变得复杂甚至失败的条款。即使在成为合伙人之后，他还是要花大力气为大额交易做尽职调查。2015年，转业咨询公司Life Productions为1000多名英国律师物色新工作，据它称，近三分之一的英国律师都希望离开这个行业，原因或许正是那些单调又繁重的工作内容。

这种不满未来可能会减轻。目前，比克正在达维的管理委员会里起草方案，让人工智能（AI）担负那些繁重的基础工作。在纽约和伦敦的顶级律师事务所里，许多人都在干这件事。这种变化可能会改变律师的工作，并大幅削减客户的成本。

顶级律所都是靠投入大批人力处理大量文书来赚钱。例如，在美国的“证据开示”（discovery）这个审前阶段，控辩双方须交换大量文件来查找证据。初级律师要挖掘并比对法官对类似案件的判决，或研究对方律师过去的辩词，为诉讼做准备。

越来越多法律创业公司正在把机器学习技术应用到这类任务上。相比人工，算法只需要一点点时间就能处理多得多的文书。它们辨别条款并指出异常。它们可能会划出那些导致无限责任而非有限责任的合同。它们甚至会指出哪些合同缺少关键条款——律师们有时候也发现不了，诺厄·魏斯伯格（Noah Waisberg）说。他曾是一名企业律师，后来创建了Kira Systems，一种使用机器学习来审查合同的软件工具。

潜在的收益很大。尽职调查非常耗时，在交易咨询中通常要占到律师收费

的一半。许多公司，包括达维以及伦敦的富而德（Freshfields）和高伟绅（Clifford Chance），都用Kira来帮助审查文件。该软件用一套文件来训练，可识别450多种条款，例如规定在一方被接管时终止合同的“控制权变更”条款。而后律师可以进一步打磨软件，以识别那些更模糊的条款，甚至是其他语言的条款。其他使用AI审查文件的软件公司包括Luminance和RAVN，这两家公司的总部都位于伦敦，客户中有不少大律所。

机器学习也可以帮助准备庭审。它加速了证据开示环节，并协助律师制定诉讼策略。法律信息供应商Lexis Nexis旗下的硅谷创业公司Lex Machina利用旧案件的法庭文件来为某个案子做预测，比如进入庭审的时间、在不同司法辖区胜诉的几率，以及可能拿到的赔偿金额。

一些科技公司的目标是完全摒弃中介，开发出“机器人律师”来处理某些任务。英国的AI工具LISA帮助人们制定保密协议，不再需要让那些昂贵的律师了解机密（或许还是令人尴尬的）细节。其他科技公司想要帮助人们对停车罚单提出申诉或起草租赁合同而不产生法律费用。

使用机器学习软件能帮助人们省多少钱通常难以预测。富而德的首席法律创新官伊莎贝尔·帕克（Isabel Parker）说，这类应用现在还处于早期阶段，每个案例都不同。不过，花在审查文件上的时间可能会减少八成之多，而这很可能也会降低客户支付的费用。

法律职位最终会减少吗？这还不好说。一些公司估计自己雇用的毕业生人數会减少。但另一些人认为，更便宜的服务会鼓励客户更多地咨询律师。虽然有些任务是可以自动化的，但其他许多任务仍然依赖人类的判断。例如，AI可能会精确指出合同中的非典型条款，但它无法判断这个异常是否会毁了这项交易。无论如何，律师们应该会开始发现自己的工作变得更有趣了。■



Aerospace

A breath of fresh air

Meet Zephyr, a high-flying drone that can do the work of a satellite

ON AUGUST 6th a flimsy-looking pilotless aircraft, the Zephyr S, came slowly in to land at an undisclosed location in Arizona, and was caught by a group of people jogging along beside it. The reception committee was needed because the craft, which weighs less than 75kg, lacks an undercarriage—or, indeed, anything else that would add unnecessary weight. The touchdown meant the Zephyr S had set a new flight-endurance record for a drone, of 25 days, 23 hours and 57 minutes. The point of doing so was to show that solar-powered aircraft of this sort can compete with satellites in the markets for Earth observation and telecommunications. This has led some people to dub them “pseudo-satellites”. The idea is that eventually they will stay aloft for months.

The previous endurance record for drones, of just over 14 days, was set in 2010 by the Zephyr 7, an earlier version of this aircraft. The Zephyr 7 was developed by QinetiQ, a British defence company. In 2013 QinetiQ sold the Zephyr programme to Airbus, a European aerospace firm. Airbus has now built, at Farnborough, in Britain, a factory to make them. The model S, with a wingspan of 25 metres, will soon be joined by a bigger, more advanced version, the model T.

Zephrys fly in the stratosphere. During daylight hours they cruise at an altitude of about 21km. At night, when solar energy is unavailable and they must rely solely on their batteries, they make a slow but powered and controlled descent to 16.7km. That, though, is still well above troublesome weather, and also clear of commercial aircraft.

They are powered by a pair of propellers driven by electric motors. Airbus says the craft are fitted with batteries which use an “advanced chemistry” and are recharged by “novel” solar cells that cover their wings. But it will provide no other details for fear of tipping off rivals, of whom there are several. (Though one potential competitor, Facebook, closed its own high-altitude-solar-powered-drone operation earlier this year with a view to using drones built by others to provide internet access in remote regions.) At the opening of the Farnborough factory, in July, the wings of the three Zephrys then on the production line were carefully covered, in order to avoid prying eyes.

Rather than selling the craft outright, Airbus plans to use them to conduct particular jobs for particular customers, says Nigel Chandler, head of sales for the operation. A craft thus leased out might engage in Earth-observation tasks such as maritime surveillance or detecting forest fires—or it might, by travelling in small circles, act as an internet node or as a platform for mobile telephony. Moreover it could, if required, be moved around in mid mission, for example to act as an observation platform for a disaster area. That would both be much simpler than repositioning a satellite and cheaper to operate.

Airbus will run its Zephyr service from a base at Wyndham, Western Australia, that will open later this year. This is surrounded by a large area of unrestricted airspace and has reliable weather for landings and take-offs (like landings, these also involve people giving the craft a helping hand). Depending on conditions, a Zephyr on the move can travel between 1,000km and 2,000km a day, so in principle only this one base is needed to serve the world. Airbus will, though, offer a portable ground-station and launching services in other parts of the world, for those customers who do not wish to wait for a craft to arrive under its own (or, rather, the sun’s) power from Australia. ■



航空

一股新风

来见识下“和风号”，一架可以充当卫星的高空无人机

八月六日，一架看起来很轻巧的无人机“和风S号”（Zephyr S）缓缓降落在亚利桑那州的一个秘密地点，被一群在旁边慢慢跟着它跑的人接住。之所以需要接机队伍，是因为这架重量不到75公斤的飞机没有起落架——实际上它没有任何会增加不必要的重量的部件。这次着陆意味着“和风S号”创造了新的无人机飞行滞空纪录：25天23小时57分钟。此次飞行是为了证明这种太阳能驱动的飞机可以在地球观测和通信市场上与卫星竞争。已经有一些人称它们为“伪卫星”。研发目标是让它们最终能在空中停留几个月。

此前无人机的滞空纪录为14天多一点，是由“和风7号”（Zephyr 7，该系列的早期型号）在2010年创下的。“和风7号”由英国防务公司QinetiQ开发。2013年，QinetiQ将“和风”项目卖给了欧洲航空航天公司空客。现在空客已经在英国的法恩伯勒（Farnborough）建造了一家制造这种飞机的工厂。在翼展为25米的S型之后，很快会推出更大更先进的T型机。

“和风号”在平流层飞行。白天它们在约21,000米的高度巡航。在夜间，当太阳能不可用、必须完全依靠电池的时候，它们会缓慢下降到16,700米的高度，这个下降的过程仍有动力驱动并受控制。在此高度依然不会受地面复杂气候的影响，也不会遭遇商用飞机。

它们由电动机驱动的一对螺旋桨提供动力。空客称这架飞机安装了使用“先进化学物质”的电池，并用覆盖机翼的“新型”太阳能电池充电。但公司不会提供其他细节，以免向几家竞争对手泄露信息。（不过，潜在竞争对手之一的Facebook今年早些时候停止了它的高空太阳能无人机项目，而计划使用别人制造的无人机在偏远地区提供互联网接入。）7月，在法恩伯勒工厂的开工典礼上，当时生产线上的三种和风机型的机翼都被小心地盖住，免得被人窥探。

空客主管该项目销售业务的奈杰尔·钱德勒（Nigel Chandler）表示，公司计划用这些无人机为特定客户执行特定任务，而不是直接销售飞机。这样租借出去的飞机可能会参与地球观测任务，如海事监视或森林火灾探测，也可能小范围绕圈飞行，充当互联网节点或移动通信平台。此外，如果有需要，它可以在任务中途随意变更路线，例如充当灾区的观测平台。这比重新定位卫星要简单得多，操作成本也更低。

空客将在西澳大利亚的温德姆（Wyndham）的一个基地运营“和风”服务，该基地将于今年晚些时候开放。该地周围有大片不受限制的空域，也有可靠的天气条件，方便飞机着陆和起飞（像着陆一样，它们起飞也需要人力帮助）。在不同情况下，升空的“和风号”每天可以飞行1000至2000公里，所以原则上只需要这一个基地就可以服务全球。不过，空客将在世界其他地区开设流动式地面站和发射服务，为那些不愿等待飞机靠自己的（或者更确切地说，太阳的）能量从澳大利亚飞抵的客户提供服务。■



Business and demography

Silver linings

Japanese firms get better at selling to the country's legions of elderly

A BRANCH of Renaissance, a Japanese chain of fitness centres, would not seem the likeliest place to find crowds of the elderly, but they abound. Older women chat as they leave the facilities with wet hair; a couple of seniors sit in the lounge reading books and sipping coffee. The lounge is something the chain introduced with the grey-haired in mind. “Our older clients like community and hospitality,” says Naoki Takazaka of Renaissance. All staff must make time to chat with them.

Japan’s population is ageing more rapidly than any other country’s. Those over 65 years of age make up 28% of the population, a proportion expected to rise to 40% by 2065. Any business that wants to prosper has to cater to their needs. It is an opportunity rather than a problem, says Masahiko Uotani, chief executive of Shiseido Group, a cosmetics behemoth: older people live longer, are active for longer than past generations and are relatively rich. “But you have to take the time to find out what they actually want since it is often not what you expect,” he says.

The obvious opportunities are in care of the elderly and end-of-life services such as funerals. Big companies such as Kobe Steel and Hitachi, two industrial heavyweights, sell private housing to seniors. Several providers of nursery schools have also started care homes for the more numerous people at the other end of life. Robotics firms are developing tools to help old people live independently for longer. Manufacturers of walking sticks and adult nappies are faring well.

Unexpected avenues of business are also opening up. Renaissance realised

earlier than other companies that older people want to stay fit and started to offer discounted memberships for those over 60. By 2016, 30% of its customers were over 60 compared to just over 3% in 1994. People in this age group are much less likely than younger members to give up their membership, which is good for business, says Mr Takazaka.

Many retirees simply want the same things as those a decade younger, slightly tweaked. O-net, Rakuten's matchmaking arm, in 2013 launched a dating service for seniors which is growing. Shiseido beauticians go into care homes to teach old people how to do their make-up, at a cost (to the care home) of ¥10,000-20,000 (\$88-177) per visit; a process with therapeutic benefits. Since older people often spend longer in a shop, making them more likely to spend, some convenience-store chains have tried to become places to socialise by adding dining facilities or having personnel make coffee rather than offering it from a machine, says Ming Li of Lawson, a chain of convenience stores.

Companies have also noticed how, in Japan too, elderly folk are reluctant to shop online. Lawson is rolling out stocks of books in some shops while it and other convenience-store chains (so ubiquitous that older people can often walk to them) are competing with supermarkets by stocking more food, cleaning products and over-the-counter medicines.

Despite the plethora of initiatives, businesses are only in the early days of working out how to target older consumers, says Hiroyuki Murata, who heads the Centre for Studies on Ageing Societies and advises firms on targeting the silver-haired. Few companies have yet started opening early, for example, when old people say they like to get out and about. Most stores have yet to improve access for the infirm with, say, handrails (public facilities have brought in features such as slow escalator speeds).

Marketing to older people is another area that needs work. They want to

be subtly targeted, says Mr Uotani, rather than being reminded of their age through, say, adverts using someone advanced in years or with wrinkles. "I'm 64 and I am not old!" he says. His firm seems to have pulled this off; sales of Shiseido's Prior range of cosmetics aimed at those over 50, with simple packaging and instructions on how to use the products in a large font, have risen by 120% per year in the two years since its launch in 2015.

Another sizeable opportunity may lie in what firms can then export in terms of know-how as other countries follow Japan's demographic trajectory. Last year Shiseido started to run its care-home cosmetics lessons in Taiwan. Renaissance has developed Synapsology, a programme of simple but ever-changing exercises for the brain, and now makes money both taking the programme into care homes and certifying people to run the course. It has struck a deal for a South Korean company to host it locally. That fits nicely with another priority of which Japanese firms often talk: becoming more global-minded. ■



商业与人口构成

银边闪亮

日本企业在开发本国大批老年客户上经验提升

日本连锁健身俱乐部Renaissance的分店看起来不像是老年人会扎堆出现的地方，然而这里老人比比皆是。头发湿漉漉的年长妇女聊着天离开健身房；几个老人坐在休息区里啜着咖啡看书。这家健身房在设计休息区时考虑到了银发会员的需求。“我们的年长客户喜欢社区氛围和热情接待。”公司的高阪直树（Naoki Takazaka）说。所有员工都必须抽出时间与他们聊天。

日本人口老龄化的速度超过其他任何国家。65岁以上人口占总人口的28%，预计到2065年这一比例将上升到40%。任何想要成功的企业都必须迎合老年群体的需求。化妆品巨头资生堂集团（Shiseido Group）首席执行官鱼谷雅彦（Masahiko Uotani）表示，这是机遇而不是麻烦：老年人的寿命更长了，活跃的时间也比过去的老人更长久，并且相对富裕。“但你必须花时间找出他们真正想要的东西，因为这往往和你想的不一样。”他说。

显而易见的机遇自然是老年护理和葬礼等临终服务。工业巨头神钢集团（Kobe Steel）和日立等大公司向老年人出售私有住房。一些开办托儿所的机构开始为走到生命另一端、人数更多的老年人开设护理院。机器人公司正在开发工具，帮助老年人延长独立生活的时间。手杖和成人尿布的制造商生意都很不错。

一些预想之外的商机也在浮现。Renaissance先于其他公司意识到老年人也想要保持健康，为60岁以上的人推出了折扣会员价。截至2016年，60岁以上客户的占比达30%，而1994年时才刚刚超过3%。高阪表示，这个年龄段的人放弃会员资格的可能性远低于年轻会员，这对业务有利。

许多退休人士想要的与比他们小十岁的人相同——只需稍做调整。2013

年，乐天（Rakuten）的婚介业务O-net推出了针对老年人的约会服务，这项业务正不断增长。资生堂的美容师进入养老院教老人化妆，每次授课收费一至两万日元（88至177美元），由养老院支付。这个过程还有让老人们放松身心的效果。连锁便利店罗森（Lawson）的李明（Ming Li，音译）说，老人逛商店的时间通常会更长，也就更有可能消费，因此一些便利店尝试增设用餐设施或请人工而非机器煮咖啡，好让便利店成为社交场所。

企业还注意到，和其他地方的老年人一样，日本的老年人也不大愿意上网购物。罗森已开始在一些分店出售书籍，而它和其他连锁便利店（这类便利店在日本无处不在，老年人经常可以步行前往）还通过提供更多种类的食品、清洁用品和非处方药来与超市竞争。

老龄社会研究中心（Centre for Studies on Ageing Societies）的负责人村田池内（Hiroyuki Murata）向企业提供开发银发客户方面的建议。他说尽管目前举措众多，但在制定针对老年消费者的策略上仍处于早期阶段。例如，尽管老人们说他们喜欢更早外出活动，鲜有公司已经提前了营业时间。大多数商店尚未针对年迈体弱者改进设施，例如安装扶手（公共设施已经引入了诸如慢速扶梯等功能）。

针对老年人的营销是另一个需要改进的领域。鱼谷说，老年人希望企业在向他们卖东西时不要那么露骨，不要提醒他们自己有多老，比如用年事已高或满脸皱纹的人来做广告。“我64岁，但我不老！”鱼谷说。他的公司在这一方面似乎做得很成功：资生堂针对50岁以上人士的系列化妆品包装简洁，使用说明用了大号字体，自2015年推出后的两年里销售额每年增长120%。

随着其他国家也像日本那样进入深度老龄化社会，另一个可观的机会是企业可以出口专门知识。去年，资生堂开始在台湾开设养老院化妆课程。Renaissance开发了一个简单但不断变化的大脑训练课程Synapsology，目前正在通过将课程引入养老院和认证课程老师盈利。Renaissance已与一家韩国公司达成协议，由其在当地做该项目的代理。这很符合日本企业经常

谈论的另一个发展重点：提升全球意识。 ■



Agriculture

News from the underground

A cheap way to save rice plants from the effects of pollution

ACID rain damages crops. In particular, it damages rice, because many rice-growing countries, which are predominantly in Asia, do not have in place the pollution-control mechanisms that are now routine in the wheat-growing continents of Europe and North America. A rice crop soaked by acid rain can be saved if it is rinsed with clean water. But it is not always obvious when that needs doing, for rainfall varies in its acidity and is not always acidic enough to cause harm.

What is needed is a cheap and reliable way of finding out whether a particular set of plants have actually been stressed by a fall of acid rain. And Wang Xin of Nankai University, in Tianjin, China, thinks he has one. It relies on the reaction of soil bacteria to molecules secreted by plant roots.

Dr Wang knew from the botanical literature that most plants secrete from their roots a mixture of carbohydrates, amino acids and fatty acids that are food for microbes. He also knew, from previous experiments, that some of these microbes generate a weak electric current while they are feeding, and that monitoring this current reveals their level of activity. With all of this in mind, he theorised that acid rain would disrupt metabolic activity in leaves, decrease the flow of organic compounds from the leaves to the roots, and thereby alter the behaviour of soil microbes enough to generate a signal that could warn farmers that their crops were in need of a rinse.

Tests proved him right. Spraying experimental rice plants with artificial acid rain immediately cut their release into the soil of three relevant bacterial foodstuffs—fumaric acid, galactose and glucose. The bacteria responded as

expected. The electric current they generated dropped by an average of 300 microamps within two minutes of the plants being sprayed.

That, as Dr Wang describes in *ACS Sensors*, is a change easily measurable using cheap electrodes. And by wiring those electrodes to a transmitter, the plants' cries of distress can be texted instantly to the farmer tending them, who can then arrange for a second shower, this time of clean water, to restore them to health before any permanent damage occurs. ■



农业

来自地下的消息

一种让水稻免受污染影响的低成本方法

酸雨会危害农作物。水稻受害尤其严重，因为在水稻的主产地亚洲，很多水稻种植国还没建立起污染控制机制，而在种植小麦的欧洲和北美，这种机制已是常规做法。被酸雨浸湿的水稻如果用清水冲洗还是可以挽救回来。但有时是不是需要这样做不好判断，因为雨水的酸度各异，有时酸度并不足以造成危害。

人们需要找到一种既经济又可靠的方法来确定一批作物是否确实遭到一场酸雨的侵害。天津南开大学的王鑫认为自己已经找到解决之道。他的方法依据的是土壤细菌对作物根系分泌物的反应。

王鑫从植物学相关文献中了解到，多数植物的根系会分泌一种由碳水化合物、氨基酸和脂肪酸组成的混合物，这些都是微生物的食物。他还从前期实验中了解到，有些微生物在进食过程中会产生微弱的电流，监测这种电流便可获知微生物的活跃度。在这些认识的基础上，王鑫提出一种理论，认为酸雨会破坏叶子的代谢活动，减少叶子向根部输送的有机化合物，从而改变土壤微生物的活动，并因此释放信号，提醒农民作物需要冲洗。

试验证明他的猜想是正确的。用人工酸雨喷洒试验水稻植株，根系马上会减少向土壤释放三种主要的细菌食物——富马酸、半乳糖和葡萄糖。细菌的反应一如所料。在植株被喷洒酸雨的两分钟内，细菌产生的电流平均降低了300微安。

按王鑫在学术期刊《ACS Sensors》中的说法，使用低成本的电极就能轻易检测到这种变化。将这些电极连接到一个信号传送器上，植株的呼救声就能即时发送到照料它们的农民那里，之后农民就会用清水对植株进行二次淋浴，好让它们恢复健康，避免了永久性损害。■



Biometrics

Love the way you walk

Footsteps can be used to identify people, and monitor their health

LISTEN carefully to the footsteps in the family home, especially if it has wooden floors unmuffled by carpets, and you can probably work out who it is that is walking about. The features most commonly used to identify people are faces, voices, finger prints and retinal scans. But their “behavioural biometrics”, such as the way they walk, are also giveaways.

Researchers have, for several years, used video cameras and computers to analyse people's gaits, and are now quite good at it. But translating such knowledge into a practical identification system can be tricky—especially if that system is supposed to be covert. Cameras are often visible, are fiddly to set up, require good lighting and may have their view obscured by other people. So a team led by Krikor Ozanyan of the University of Manchester, in England and Patricia Scully of the National University of Ireland, in Galway have been looking for a better way to recognise gait. Their answer: pressure-sensitive mats.

In themselves, such mats are nothing new. They have been part of security systems for donkeys' years. But Dr Ozanyan and Dr Scully use a sophisticated version that can record the amount of pressure applied in different places as someone walks across it. These measurements form a pattern unique to the walker. Dr Ozanyan and Dr Scully therefore turned, as is now commonplace for anything to do with pattern recognition, to an artificial-intelligence system that uses machine learning to disentangle and recognise such patterns.

It seems to work. In a study published earlier this year the two researchers

tested their system on a database of footsteps trodden by 127 different people. They found that its error rate in identifying who was who was a mere 0.7%. And Dr Scully says that even without a database of footsteps to work with the system can determine someone's sex (women and men, with wide and narrow pelvises respectively, walk in different ways) and guess, with reasonable accuracy, a subject's age.

A mat-based gait-recognition system has the advantage that it would work in any lighting conditions—even pitch-darkness. And though it might fail to identify someone if, say, she was wearing stilettos and had been entered into the database while wearing trainers, it would be very hard to fool it by mimicking the gait of an individual who was allowed admission to a particular place.

The latest phase of Dr Ozanyan's and Dr Scully's project is a redesign of the mat. The old mats contained arrays of individual pressure sensors. The new ones contain grids of optical fibres. Light-emitting diodes distributed along two adjoining edges of a mat transmit light into the fibres. Sensors on the opposite edges (and thus the opposite ends of the optical fibres) measure how much of that light is received. Any pressure applied to part of the mat causes a distortion in the fibres and a consequent change in the amount of light transmitted. Both the location and amount of change can be plotted and analysed by the machine-learning system.

Dr Ozanyan says that the team have built a demonstration fibre-optic mat, two metres long and a metre wide, using materials that cost £100 (\$130). They are now talking to companies about commercialising it. One application might be in health care, particularly for the elderly. A fibre-optic mat installed in a nursing home or an old person's own residence could monitor changes in an individual's gait that presage certain illnesses. That would provide early warning of someone being at greater risk of falling over,

say, or of their cognition becoming impaired.

Gait analysis might also be used as a security measure in the workplace, monitoring access to restricted areas, such as parts of military bases, server farms or laboratories dealing with hazardous materials. In these cases, employees would need to agree to their gaits being scanned, just as they would agree to the scanning of their faces or retinas for optical security systems.

Perhaps the most intriguing use of gait-recognition mats, though, would be in public places, such as airports. For that to work, the footsteps of those to be recognised would need to have been stored in a database, which would be harder to arrange than the collection of mugshots and fingerprints that existing airport security systems rely on. Some people, however, might volunteer for it. Many aircrew or preregistered frequent flyers would welcome anything that speeded up one of the most tiresome parts of modern travel. ■



生物识别技术

迷恋你的步伐

可利用步态识别身份和监控健康

仔细听家里的脚步声，特别是家里铺的是木地板而又没有地毯消声的话，你大概可以辨认出是谁在走动。最常用于身份识别的体征是面容、声音、指纹和视网膜扫描。但步态等“生物行为特征”也是可循之迹。

近年来，研究人员一直在用摄像机和计算机分析人的步态，目前技术已经相当成熟。但要将这些知识转化为实用的识别系统并不容易，尤其是还需要实现隐蔽性。摄像机往往容易被看到，安装也较为繁琐，又需要有足够的光线，而且镜头还可能被他人遮挡。因此，英国曼彻斯特大学的克里科尔·奥贊扬（Krikor Ozanyan）和爱尔兰国立大学戈尔韦的帕特丽夏·斯高莉（Patricia Scully）带领的团队一直在探索更好的识别步态的方法。他们的解决方案是使用压敏垫。

压敏垫本身并不是什么新发明，长久以来一直是安保系统的一部分。但奥贊扬和斯高莉使用的是更精密的压敏垫，可以在有人走过时记录步伐在不同位置产生的压力值。这些测量数据构成了步行者独有的步态模式。于是，两位研究人员按照如今识别模式的普遍做法，把数据输入一套人工智能系统，运用机器学习来梳理并识别这些模式。

这看来行得通。在今年早前发表的一项研究中，两位研究人员运用127人的足迹数据测试了该系统。他们发现，系统识别身份的错误率仅为0.7%。斯高莉说，即使不搭配使用足迹数据库，系统也能确定受试者的性别（女性骨盆宽，男性骨盆窄，因而行走方式不同），并可以还算准确地估计出其年龄。

压敏垫步态识别系统的优点是可以在任何光照条件下工作，即使一片漆黑也没问题。如果数据库之前输入的是某人穿运动鞋时的步态，当她换成穿

高跟鞋走路时，系统可能就无法识别了。但是，如果想模仿某人的步态来欺骗系统以获准进入特定地点会非常困难。

奥赞扬和斯高莉的研究项目的最新进展是经过重新设计的压敏垫。原来的垫子包含由单个压力传感器组成的阵列。新的垫子则包含多组光纤网格。分布在垫子相邻两条边上的发光二极管将光传输到光纤中。安装在对面两条边上（也就是光纤的另一端）的传感器测量接收到的光量。施加到垫子上某处的任何压力都会引起光纤变形，进而导致传输光量的变化。机器学习系统可以识别并分析变化发生的位置和变化的量。

奥赞扬说，该团队已制成了一块两米长、一米宽的演示用光纤垫，材料成本为100英镑（130美元）。他们正与多家公司洽谈，希望将其商业化。医疗保健或许会是应用领域之一，特别是在照护老年人方面。将光纤垫安装在养老院或老人自己家中，可以监测一个人步态的变化，预测某些疾病。这将提供早期预警，例如提醒某人较有可能摔倒或出现认知受损。

步态分析也可作为工作场所的安保措施，用于监控限制区域的人员进出，例如军事基地、服务器农场，或处理危险品的实验室。在这些情况下，员工需要同意系统扫描自己的步态，就像同意光学安保系统扫描自己的面部或视网膜那样。

不过，步态识别垫最吸引人的用途可能在公共场所，例如机场。要实现这一点，被识别者的步态资料需要被提前存储到数据库中，而这会比机场现有安全系统所倚赖的面部照片和指纹更难收集。但有些人可能会自愿提供。任何革新，若能加速安检这一现代出行中最烦人的环节之一，许多空勤人员或预先登记的飞行常客都会欢迎它。 ■



Economic and financial indicators

World's biggest banks

*ICBC held the top spot for the sixth year running in terms of Tier-1 capital, according to an annual league table from *The Banker**

For the first time Chinese banks rank as the biggest four in the world in terms of Tier-1 capital, according to an annual league table from *The Banker*, a trade publication. ICBC held the top spot for the sixth year running; its capital grew by \$43bn in 2017. The gap between American banks, whose capital did not budge much, and Chinese ones continued to widen. European banks notched up some rare good news last year—their share of global profits grew from 13% to 20%. The Italian and British banking sectors were among those to enjoy strong rises in profits. India's banks had a much grimmer time of it, posting a \$9.2bn loss, the world's biggest. ■



经济与金融指标

全球最大银行

《银行家》年度排名显示，按一级资本，中国工商银行连续第六年居首

行业刊物《银行家》（*The Banker*）的年度排名显示，按一级资本排序，全球最大银行前四席首次由中国的银行包揽。中国工商银行连续第六年居首位，2017年该行一级资本增加了430亿美元。美国各大银行一级资本未显著增长，中美两国银行间的差距继续扩大。欧洲各家银行去年难得迎来若干好消息——它们在全球银行业利润中所占的份额从13%增长至20%。意大利和英国等国的银行业实现了利润强劲增长。印度的银行则经历了大为惨淡的一段时光，亏损额达92亿美元，为全球之最。■



Cities and development

Build, baby, build

A flourishing west-coast city wants to avoid becoming another San Francisco

FOR the third consecutive year, Seattle has the most cranes in operation of any city in America—three times as many as New York. Long a placid, drizzly company town, the place is booming. Since 2010 Seattle has grown more quickly than any other large American city, thanks in part to the success of Amazon and Microsoft, two local technology firms. Entrepreneurs are flocking there, repelled by the obscene costs of San Francisco.

But the pathologies of the Bay Area may not be far behind. Rents have shot up and homelessness is common. “We are not a welcoming city in the way Seattle has historically been,” says Mike McGinn, the former mayor. The boom shows little sign of abating, meaning that Seattle has only a few years before it contracts a case of full-blown San Francisco. Either the city will cleverly manage its growing prosperity, or it will become inaccessible to ordinary people. The Emerald City would be turned into a gilded fortress.

A single-family residence now rents for \$2,600 per month, on average—25% more in real terms than five years ago, according to data from Zillow, a property website. That is less than the peak price of \$2,870 reached in September 2017. In fact, it is the largest drop in rents seen in any of America’s 100 largest cities. Much of the decline is owing to the frantic pace of building visible in parts of the city. Seattle added 8,750 units of housing last year, nearly double San Francisco’s count. Another 22,000 units have been approved.

Better than other highly successful cities, Seattle grasps the fact that property prices are driven by supply and demand. Americans can move

freely, and demand for urban living is enormous. Yet supply remains tightly constrained by local zoning rules and limits on building heights and density. The resulting artificial scarcity, enforced by the government, inflates prices, benefiting homeowners. The overall costs to society are staggering. Research by two economists, Chang-Tai Hsieh and Enrico Moretti, estimates that removing excessive regulations in just three cities—New York, San Francisco and San Jose—could boost America's GDP by 9% because more people could move to them.

In Seattle, as in other cities facing similar problems, three camps have emerged. The first contains urbanists and developers who want to build more homes. In the second camp are homeowners, who fear that new housing will depress property values. If new building is to happen, these NIMBYs would prefer it to happen elsewhere. The third camp is occupied by the urban left. Its members are keen on public housing but suspicious of unfettered private building, which they see as a handout to developers.

In California socialists and affordable-housing activists called PHIMBYs—which stands for “public housing in my backyard”—joined NIMBYs to oppose legislation that would have greatly expanded market-rate development in San Francisco. “In Seattle the NIMBYist-Trotskyite alliance is the default political alignment,” says Alan Durning, executive director of the Sightline Institute, a local think-tank.

Seattle's proposed solution to this deadlock, unveiled in 2015, is known as the “grand bargain”. It would reduce restrictions and unleash building on big patches of city. In exchange, developers would have to reserve a few units for renting below the market rate or pay into an affordable-housing fund. Such schemes, known as “inclusionary zoning”, are increasingly common in progressive American cities. They can lead to more mixed districts and placate left-wing critics. But they are not without problems.

By reducing future earnings, inclusionary zoning acts as a tax on new development. If the affordability requirements are set too high, many new projects will not be built. Bill de Blasio, New York City's progressive mayor, championed requirements that at least one-fifth of new units should be offered below the prevailing market rate. San Francisco sets the threshold as high as 30% and imposes a clutch of added "impact fees". Developers complain that these fees suffocate all but the most lucrative projects—which then invite criticism as "luxury high-rises".

Seattle has negotiated a more reasonable route by requiring between 5% and 11% of new units to be rented at below-market rates. Progressives think that too little. "It's not in any way a substitute for a serious programme of affordability. We need rent control, social housing on a mass scale, and a full bill of renters' rights," says Kshama Sawant, a socialist member of the city council. "It's all been led by what developers want, and by what corporate Seattle wants," adds Tammy Morales, a community organiser in southern Seattle, who says the city is doing little about the displacement of poorer residents.

Any remaining goodwill towards Seattle's building plan has also diminished after Amazon made a rare intervention in local politics. On May 14th the city council passed a "head tax" of \$275 per employee for firms with more than \$20m in annual revenue, in order to fund services for homeless people. Amazon, which employs more than 40,000 people in Seattle, promptly halted construction on one office tower and suggested it would sub-let another. A month later the city council tucked tail and repealed the tax. Progressives were furious. Ms Sawant, who (along with one other holdout) voted to keep the tax, called it a "serious betrayal".

The perception that Seattle is becoming Amazon-town will make neighbourhood change, never easy, a harder sell. Implementation of the city plan, despite four years of consultation, has been slow. Restrictions

are loosened in urban centres, leading to a building boom and a trickle of affordable housing. But only 6% of single-family neighbourhoods would be profoundly affected by the plan. And homeowners are digging in even against that. Mr Durning likens it to trench warfare.

For more than 50 years NIMBYs have swayed American city politics. They attend council meetings in droves and vote in low-turnout local elections. They explain why strange pockets of low-rise suburbia, frozen in time, can be found in the heart of many cities facing sharply rising rents, such as San Francisco's Noe Valley, Seattle's Queen Anne and Northwest Washington. Upsetting the entrenched power structure of cities is an exasperating, thankless task. But if they are to remain truly open to all, it will be necessary. ■



城市与发展

造啊造啊造房子

繁荣发展的西海岸城市西雅图想避免成为下一个旧金山

西雅图作业中的起重机数量已经连续三年位列全美城市之首，是纽约的三倍。这个一直以来平和宁静、细雨霏霏的“公司城镇”正驶在发展的快车道上。自2010年以来，西雅图的发展速度超过了美国其他所有大城市，这在一定程度上得益于当地两家成功的科技公司——亚马逊和微软。旧金山离谱的高成本让企业家们望而却步，纷纷涌进西雅图。

但是西雅图离旧金山湾区的病态可能并不遥远。房租已经飞涨，无家可归者随处可见。前市长迈克·麦克金（Mike McGinn）表示：“我们已经不再是过去那个宜人的城市。”迅猛发展的势头毫无减弱的迹象，也就是说，只消几年，西雅图就会变成另一个充分发展的旧金山。西雅图必须明智地处理这种繁荣趋势，否则就会将普通人拒之门外，翡翠之城将变成镀金堡垒。

房地产网站Zillow的数据显示，目前西雅图独栋住宅的平均月租金为2600美元，扣除物价因素后比五年前实际高出25%。这低于2017年9月最高峰时的2870美元。事实上，这一跌幅是美国100个最大城市里最大的，很大程度上是缘于城中四处可见的建设热潮。去年西雅图新增8750个住房单位，几乎是旧金山的两倍。此外还有2.2万个住房单位已获准兴建。

相比其他大获成功的城市，西雅图更清楚地认识到房地产价格由供需关系驱动。美国人可以自由迁居，对城市住房需求巨大。但住房供应仍旧受地方区域规划法规、楼宇高度和密度等因素的严格限制。这种由政府强加的人为住房稀缺抬高了房价，让房主受益。社会为此付出的总体代价十分惊人。经济学家谢长泰和恩里科·莫雷蒂（Enrico Moretti）的研究估计，仅仅是在纽约、旧金山和圣何塞这三个城市取消过度监管，让更多人移居进来，就可能将美国的GDP提升9%。

与其他面对类似问题的城市一样，在西雅图出现了三个阵营。第一个阵营包括想建造更多住宅的城市规划专家和开发商。第二个阵营是房主，他们担心新房会压低现有房产的价格。如果非要盖新房，这些邻避者

（NIMBY, not in my back yard的缩写）希望它们是建在别处。第三个阵营是城市左派人士，他们热衷于公共住房，但对不加约束的私人住房建设持怀疑态度，视之为向开发商派钱。

在加州，社会主义者和公共住房倡导者（PHIMBY, public housing in my backyard的缩写）加入了邻避者的队伍，共同反对会让旧金山大幅扩展商业住宅的立法。“在西雅图，邻避主义者与托洛茨基派结成了天然的政治联盟。”当地智库Sightline Institute的执行董事艾伦·德宁（Alan Durning）表示。

为应对这一僵局，西雅图在2015年出台了名为“大交易”的解决方案。该计划将减少限制措施，放开在城市中进行大面积开发建设。作为交换，开发商必须留出一些住房单位以低于市场价的价格出租，或者支付经济适用房基金。这类被称为“包容性区域规划”的方案在美国崇尚革新的城市越来越普遍。它们可能会造就更多的混合居住区，并安抚左翼批评人士。但它们并非没有问题。

由于减少了未来的收益，包容性区域规划相当于对新建住宅区征税。如果对配套的可负担住房的门槛设置过高，许多新项目将无法实施。纽约改革派市长白思豪（Bill de Blasio）曾力挺拿出至少20%的新建住房单位以低于现有市场价出租。而旧金山设定的门槛高达30%，并强加了一系列额外的“影响费用”。开发商抱怨道，除了最赚钱的项目，这些费用让其他项目陷入绝境。而那些赚钱的项目又会被批是“奢华的摩天大厦”。

西雅图经谈判达成了一项较为合理的方案，要求5%到11%的新建住房单位以低于市场价出租。革新派人士认为该比例太低。身为市议会议员的社会主义者卡萨玛·萨万特（Kshama Sawant）表示：“不管怎么说，这都算不上是正儿八经的保障型住房方案。我们要的是租金管制、大规模的社会保障房以及一个完整的租房者权益法案。”西雅图南部的社区组织者塔米·莫

拉莱斯（Tammy Morales）认为西雅图在贫困居民流离失所的问题上几乎无所作为，她补充道：“一切都是由开发商和西雅图企业界的意愿主导。”

在亚马逊罕见地干预了地方政治之后，人们对西雅图建设计划仅存的一点好感也已变淡。5月14日，市议会通过了一项针对年收入超过2000万美元的公司的“人头税”，征税金额为每名员工275美元，用于资助服务无家可归者的项目。在西雅图雇用了四万多名员工的亚马逊迅速叫停了一座办公楼的建设，并暗示要将另一座办公楼转租出去。一个月后，市议会灰溜溜地废除了这项税收。革新派人士义愤填膺。萨万特与另一位拒不退让者一起投票支持保留这项税收，她称议会的做法是“重大的背叛”。

认为西雅图正在变成“亚马逊城”的观点将让从来就不易推行的社区改造难上加难。尽管已经商讨了四年，城市规划的落实一直进展缓慢。对中心城区的限制有所放宽，引发了一轮建设热潮，也带来了少量的保障住房。而实际上这项规划只会对6%的独栋居住区带来深刻影响。但房主们还是严阵以待。德宁把这比作阵地战。

半个多世纪以来，邻避者左右着美国的城市政治。他们成群结队地参加市议会的会议，在低投票率的地方选举中投票。正是由于他们的存在，在旧金山的诺伊谷、西雅图的安妮皇后区以及华盛顿西北区等许多面临房租暴涨的城市核心区，还能找到一些与众不同的郊区式低层建筑群，让人有时光凝固之感。扭转城市根深蒂固的权力结构是件伤神动气、吃力不讨好的事。但是如果城市要真正对所有人开放，就必须这么做。■



The new geography of innovation

Peak Valley

The Bay Area's primacy as a technology hub is on the wane. Don't celebrate

“LIKE Florence in the Renaissance.” That is a common description of what it is like to live in Silicon Valley. America’s technology capital has an outsize influence on the world’s economy, stockmarkets and culture. This small portion of land running from San Jose to San Francisco is home to three of the world’s five most valuable companies. Giants such as Apple, Facebook, Google and Netflix all claim Silicon Valley as their birthplace and home, as do trailblazers such as Airbnb, Tesla and Uber. The Bay Area has the 19th-largest economy in the world, ranking above Switzerland and Saudi Arabia.

The Valley is not just a place. It is also an idea. Ever since Bill Hewlett and David Packard set up in a garage nearly 80 years ago, it has been a byword for innovation and ingenuity. It has been at the centre of several cycles of Schumpeterian destruction and regeneration, in silicon chips, personal computers, software and internet services. Some of its inventions have been ludicrous: internet-connected teapots, or an app that sold people coins to use at laundromats. But others are world-beaters: microprocessor chips, databases and smartphones all trace their lineage to the Valley.

Its combination of engineering expertise, thriving business networks, deep pools of capital, strong universities and a risk-taking culture have made the Valley impossible to clone, despite many attempts to do so. There is no credible rival for its position as the world’s pre-eminent innovation hub. But there are signs that the Valley’s influence is peaking (see Briefing). If that were simply a symptom of much greater innovation elsewhere, it would be cause for cheer. The truth is unhappier.

First, the evidence that something is changing. Last year more Americans left the county of San Francisco than arrived. According to a recent survey, 46% of respondents say they plan to leave the Bay Area in the next few years, up from 34% in 2016. So many startups are branching out into new places that the trend has a name, “Off Silicon Valleying”. Peter Thiel, perhaps the Valley’s most high-profile venture capitalist, is among those upping sticks. Those who stay have broader horizons: in 2013 Silicon Valley investors put half their money into startups outside the Bay Area; now it is closer to two-thirds.

The reasons for this shift are manifold, but chief among them is the sheer expense of the Valley. The cost of living is among the highest in the world. One founder reckons young startups pay at least four times more to operate in the Bay Area than in most other American cities. New technologies, from quantum computing to synthetic biology, offer lower margins than internet services, making it more important for startups in these emerging fields to husband their cash. All this is before taking into account the nastier features of Bay Area life: clogged traffic, discarded syringes and shocking inequality.

Other cities are rising in relative importance as a result. The Kauffman Foundation, a non-profit group that tracks entrepreneurship, now ranks the Miami-Fort Lauderdale area first for startup activity in America, based on the density of startups and new entrepreneurs. Mr Thiel is moving to Los Angeles, which has a vibrant tech scene. Phoenix and Pittsburgh have become hubs for autonomous vehicles; New York for media startups; London for fintech; Shenzhen for hardware. None of these places can match the Valley on its own; between them, they point to a world in which innovation is more distributed.

If great ideas can bubble up in more places, that has to be welcome. There are some reasons to think the playing-field for innovation is indeed being levelled up. Capital is becoming more widely available to bright sparks

everywhere: tech investors increasingly trawl the world, not just California, for hot ideas. There is less reason than ever for a single region to be the epicentre of technology. Thanks to the tools that the Valley's own firms have produced, from smartphones to video calls to messaging apps, teams can work effectively from different offices and places. A more even distribution of wealth may be one result, greater diversity of thought another. The Valley does many things remarkably well, but it comes dangerously close to being a monoculture of white male nerds. Companies founded by women received just 2% of the funding doled out by venture capitalists last year.

The problem is that the wider playing-field for innovation is also being levelled down. One issue is the dominance of the tech giants. Startups, particularly those in the consumer-internet business, increasingly struggle to attract capital in the shadow of Alphabet, Apple, Facebook et al. In 2017 the number of first financing rounds in America was down by around 22% from 2012. Alphabet and Facebook pay their employees so generously that startups can struggle to attract talent (the median salary at Facebook is \$240,000). When the chances of startup success are even less certain and the payoffs not so very different from a steady job at one of the giants, dynamism suffers—and not just in the Valley. It is a similar story in China, where Alibaba, Baidu and Tencent are responsible for close to half of all domestic venture-capital investment, giving the giants a big say in the future of potential rivals.

The second way in which innovation is being levelled down is by increasingly unfriendly policies in the West. Rising anti-immigrant sentiment and tighter visa regimes of the sort introduced by President Donald Trump have economy-wide effects: foreign entrepreneurs create around 25% of new companies in America. Silicon Valley first bloomed, in large part, because of government largesse. But state spending on public universities throughout America and Europe has fallen since the financial crisis of 2007-08. Funding for basic research is inadequate—America's

federal-government spending on R&D was 0.6% of GDP in 2015, a third of what it was in 1964—and heading in the wrong direction.

If Silicon Valley's relative decline heralded the rise of a global web of thriving, rival tech hubs, that would be worth celebrating. Unfortunately, the Valley's peak looks more like a warning that innovation everywhere is becoming harder. ■



创新新地貌

硅谷“触顶”

湾区的科技中心地位正在衰退。且慢庆祝

“就像文艺复兴时期的佛罗伦萨。”说到在硅谷生活的感受，人们常常会这样描述。美国这一科技之都对世界经济、股市和文化影响巨大。在这片从圣何塞到旧金山的小小区域里聚集了全球市值最高的五大公司中的三家。苹果、Facebook、谷歌和Netflix等巨头都把硅谷称为自己的诞生地和总部，爱彼迎、特斯拉和优步这些开创性企业也一样。湾区可列作全球第19大经济体，排在瑞士和沙特阿拉伯之上。

硅谷不仅是一个地区，还是一种理念。自从约80年前比尔·休利特（Bill Hewlett）和戴维·帕卡德（David Packard）在车库里创业以来，硅谷一直是创新和创造的代名词。在硅芯片、个人计算机、软件和互联网服务的数轮熊彼特式创造性破坏与再生周期中，这里一直是核心所在。有些发明是闹着玩，比如联网的茶壶，或是出售硬币供人们在自助洗衣店使用的应用。另一些却举世无双——微处理器芯片、数据库和智能手机都源自硅谷。

硅谷集合了专业工程技术、蓬勃的商业网络、深厚的资本池、科研能力强大的高校和冒险文化，令其他地方一再尝试也无法复制。作为世界首屈一指的创新中心，硅谷并没有有力的竞争对手。但有迹象表明，硅谷的影响力渐已触顶。如果这是因为其他地方出现了更大规模的创新，那我们该欢欣鼓舞。但事实并不如此乐观。

首先，说一说事情正在变化的迹象。去年，离开旧金山的美国人比来到这里的美国人更多。根据近期一项调查，46%的受访者表示计划在未来几年离开湾区，而2016年时这一数字为34%。众多创业公司纷纷向其他地方拓展，这一潮流甚至有个名字——“逃离硅谷”（Off Silicon Valleying）。堪称硅谷最知名风投家的彼得·泰尔（Peter Thiel）就是搬家大军中的一员。留

下来的投资者也放宽了视野：2013年时，硅谷的投资者把一半资金投给湾区以外的创业公司，而现在这一比例接近三分之二。

这种转变的原因是多方面的，但其中最主要的是硅谷高昂的开支。这里的生活成本在全球最高之列。一位企业创始人认为，年轻的创业公司在湾区的经营成本至少是在美国其他大多数城市的四倍。相比互联网服务，从量子计算到合成生物学等新技术的利润率较低，这些新兴领域的创业公司因而必须精打细算。除此以外，在湾区生活还有些更令人不悦的地方：交通堵塞、吸毒用的针筒随处丢弃、不平等的程度令人震惊。

结果是其他城市的相对重要性正在提升。追踪创业趋势的非营利组织考夫曼基金会（Kauffman Foundation）根据创业公司和新企业家的密度，把迈阿密-劳德代尔堡地区列为目前美国创业活动最活跃的地区。泰尔正准备搬往洛杉矶，那里的科技圈生机勃勃。凤凰城和匹兹堡已成为无人驾驶汽车的研发中心；纽约有媒体创业公司扎堆；伦敦为金融科技重镇；深圳是硬件制造基地。单独来看，这些地方都无法匹敌硅谷，但整体而言，它们指向的是一个创新更为分散的世界。

如果伟大创想能在更多地方涌现，当然值得欢迎。有一些理由让我们相信创新的竞技场确实在升级。由于科技投资者日益放眼全球，而非只盯着加州，如今世界各地的出色创意都更有机会获得资本支持。相比以往任何时候，技术创新都不必以单一地区为中心。得益于硅谷自己的企业创造出来的工具，包括智能手机、视频通话以至消息应用，工作团队可以在不同的办公室和地点有效地合作。带来的结果一方面可能是财富分配更加均匀，另一方面是思想更多元化。硅谷在许多事情上出类拔萃，但却有“白人理工男”一统天下之虞。去年，风投资金中只有2%投向了女性创办的公司。

问题在于，从更全面的角度看，创新的竞争环境却在变糟。一则是因为科技巨头的霸主地位。在Alphabet、苹果、Facebook等巨头的阴影下，创业公司，特别是从事消费互联网业务的公司，越来越难以吸引资金。2017年，在美国，获得第一轮融资的项目数量比2012年减少了约22%。Alphabet和Facebook的员工薪酬优厚，令创业公司难以吸引到人才

（Facebook的年薪中位数为24万美元）。创业成功的机会愈发小，再加上回报和在某家巨头公司里打工并无太大差别，创新的活力就受到了影响，而这不仅仅发生在硅谷。在中国，阿里巴巴、百度和腾讯提供了国内近半的风险投资，令这些巨头对潜在竞争对手的命运有着很大的话语权。

创新受压的第二个原因是西方国家日益不友好开放的政策。反移民情绪高涨，特朗普收紧了签证政策。鉴于美国约25%的新公司是由外国企业家创立的，这对经济的方方面面都造成影响。硅谷最初的兴盛在很大程度上得益于政府的慷慨支持。但自2007年至2008年的金融危机以来，美国和欧洲政府对公立大学的经费支出普遍下降。政府对基础研究的资助不足（2015年美国联邦政府在研发方面的支出占GDP的0.6%，是1964年比例的三分之一），而且正朝着错误的方向行进。

如果硅谷的相对衰退预示着全球将有一系列与之竞争的科技中心蓬勃崛起，那是值得庆祝的。不幸的是，硅谷“触顶”看起来更像是一种警示：无论在何处，创新变得越来越难。 ■



Schumpeter

French connection

Forget McKinsey. A Gallic intellectual is the key to controlling how businesses are perceived

NOT many businesspeople study post-war French philosophy, but they could certainly learn from it. Michel Foucault, who died in 1984, argued that how you structure information is a source of power. A few of America's most celebrated bosses, including Jeff Bezos and Warren Buffett, understand this implicitly, adroitly manipulating how outsiders see their firms. It is one of the most important but least understood skills in business.

Foucault was obsessed with taxonomies, or how humans split the world into arbitrary mental categories in order "to tame the wild profusion of existing things". When we flip these around, "we apprehend in one great leap...the exotic charm of another system of thought". Imagine, for example, a supermarket organised by products' vintage. Lettuces, haddock, custard and the *New York Times* would be grouped in an aisle called "items produced yesterday". Scotch, string, cans of dog food and the discounted Celine Dion DVDs would be in the "made in 2008" aisle.

Most industries have established taxonomies that hide their flaws. Wall Street firms disguise their risky proprietary-trading profits by lumping them together with the more stable fees paid by clients. India's IT outsourcing giants split their sales into bland categories such as "solutions" and "application development", which sound better than "work outsourced by American clients to our lowly paid staff in Mumbai and Bangalore". Mining firms are organised by commodity type—copper, say, or iron ore. A geographic taxonomy would reveal that their production is often in unstable countries and that they rely on one big customer: China.

A few astute bosses know how to remould taxonomies, bending the perceptions of investors, counterparties and staff. A dazzling case is Mr Bezos at Amazon. In early 2015 investors were worrying that it was a low low-margin retail business and were losing their nerve. Mr Bezos changed its taxonomy by “breaking out” AWS, its cloud-hosting business, which was producing the holy grail of high, consistent and fast-growing cashflow. This move has been central to Amazon’s resurgent stock price.

The AWS technique is being adopted by younger, loss-making, tech firms that want to go public. Uber, for example, encourages outsiders to split it up by cities and vintage. In the places where it has brokered rides for longest its margins are positive, suggesting that it is just a matter of time before the entire firm makes money. WeWork, a trendy office-rental firm, revealed in April a new profit measure, “community-adjusted-Ebitda”. The label was moronic, but not the concept, meaning “the gross profits of offices that have been open for a while”. Like Uber, WeWork wants to show that it has a profitable core that can be scaled up.

Some firms have the opposite problem and need to show that, as well as being steady cash cows, they have new thrills up their sleeve. For instance, Google still relies on search ads for its profits. But in 2015 it changed its name to Alphabet, which became a holding firm split into two divisions, Google and “other bets”, which contains its new projects such as driverless cars. It hired Ruth Porat from Morgan Stanley to become its finance chief. The changes were meant to show that it has a serious framework for investing in new ventures. Investors have lapped it up.

Stodgy Western banks keen to prove they can do fintech would be well advised to study DBS, a Singaporean bank with a market value of \$51bn. Piyush Gupta, its boss, wanted to showcase the digital initiatives taking place at the firm. DBS tagged each customer as “digital” or “traditional” based on whether they primarily used digital products or not, and allocated

costs to both groups. The bank can now divide itself into two businesses and show that the digital one is more profitable and is a rising share of the total. The exercise helps explain a soaring share price.

The most accomplished corporate taxonomists play a still grander game; controlling not only how the firm is subdivided, but also whether it is viewed as a company at all. This is at the heart of Warren Buffett's accomplishment at Berkshire Hathaway, which he insists is neither a conglomerate nor an investment vehicle, but a one-off that can only be analysed using a special set of rules that he has provided in an "owners' manual". This has shielded Berkshire from scrutiny and criticism over the past decade, even as it has underperformed the stockmarket.

Masayoshi Son, the boss of SoftBank, a Japanese telecoms and tech conglomerate, has just executed a similarly mind-bending classification leap. The firm has long been criticised for its weak cashflow and high debt, so starting in 2017 Mr Son began to describe it as a venture-capital (VC) operation, to be assessed using the VC measure of internal-rate-of-return, which is both flattering and unverifiable. He has since completed the shift by setting up the Vision Fund, a giant \$100bn affiliated investment vehicle.

But it is Elon Musk who has taken recategorisation to its logical end point. Tesla, his car firm, he infers, cannot be judged in the present, but only the future, which he predicts using long-term production and market-value targets. So far it has worked. Even as Tesla has struggled to produce a modest volume of cars, Wall Street forecasts of its sales in 2023—a total guess—have been eerily stable at \$60bn, supported only by the intensity of his vision.

Taxonomies are not alchemy. If firms do not succeed, eventually there is nowhere to hide, as Tesla may discover. General Electric (GE) and IBM have tried to classify parts of their empires as especially "high tech", but since overall profits have been falling investors are not fooled—indeed, GE has

just lost its spot in the elite Dow Jones index. Nonetheless, by controlling how their firms are classified and subdivided, managers can often change perceptions, and in turn reality, lowering the cost of capital and intimidating competitors. Foucault had no interest in business. But if he had he might have split companies into two categories: those that understand the power of taxonomies and those that don't. ■



熊彼特

向法国哲学家取经

别指望麦肯锡了。要控制外界对企业的看法，关键得向一位法国知识分子取经

研究战后法国哲学的商界人士不多，但他们无疑能从中学到东西。1984年去世的米歇尔·福柯（Michel Foucault）指出，一个人组织信息的方式是一种力量之源。美国一些最知名的老板，包括杰夫·贝索斯和沃伦·巴菲特在内，无疑深谙其中的道理，因而能游刃有余地操控外界对自己公司的看法。在商界，这是最重要的技能之一，却也是人们理解最不充分的一个。

福柯对分类学很沉迷。这门学问研究人们如何专断地将世界分为一个个认知范畴，以“驯服世间万物之杂乱无章”。而当我们将其打乱重组，“我们霎时领会觉得……另一种思想体系异乎寻常的魅力”。例如，想象一家超市根据生产时间来安排商品的摆放位置。生菜、黑线鳕、奶黄酱和《纽约时报》会被放置在“昨日生产的商品”的货架处；苏格兰威士忌、线绳、狗罐头和席琳·迪翁的打折DVD会摆放在“2008年产”的货架上。

多数行业都建立起了可掩盖自身缺陷的分类法。华尔街的自营交易利润存在风险，为掩盖这一点，这些公司将之与更加稳定的客户支付费用归并在一起。印度的IT外包巨头将自己的销售分割成平淡无奇的“解决方案”或“应用开发”等类别，听起来比“美国客户外包给我们孟买或班加罗尔的低薪员工的工作”要体面些。矿业公司的分类是根据所经营的大宗商品的种类，像是铜或者铁矿石。如果按地理因素分类，就会暴露出这些公司的生产地往往都是在政局不稳的国家，而且还仰赖一个大客户：中国。

一些精明的老板知道如何改造分类法来扭曲投资者、交易方以及员工对公司的认知。亚马逊的贝索斯就是一个亮眼的例子。2015年初，投资者担心这家零售企业利润过低而紧张不安。贝索斯改变了公司的分类法，让云托管业务AWS“突围”，而那时的AWS提供了高水平、稳定又快速增长的现金流的“圣杯”。亚马逊的股价得以复苏，这一招是关键。

那些更年轻、尚在亏损且希望上市的科技公司也开始采用“AWS手法”。例如，优步鼓励外界按照城市和它在各地推出服务的时间对它分而视之。它在最早推出服务的那些城市里利润为正，显示出公司整体实现盈利只是时间问题。时髦的办公空间租赁公司WeWork在4月推出了一个衡量利润的新标准：“根据社群调整后的息税折旧摊销前利润”。这个名称听着傻气，但背后的理念则不然，指的是“那些已运营了一段时间的办公室的毛利”。和优步一样，WeWork也想显示自己的核心业务能够盈利并实现规模化。

一些公司存在相反的问题：它们需要证明自己不仅是稳定的现金牛，而且还有其他令人兴奋的潜力项目。例如，谷歌仍旧依赖搜索广告贡献利润，但2015年它更名为Alphabet，变身为一个控股公司，并分为两大部门：谷歌和“其他投资”——后者包含了无人驾驶汽车等新项目。它从摩根士丹利请来露丝·波拉特（Ruth Porat）担任首席财务官。谷歌有意借这些变化表明自己有非常认真的投资新事业的计划。投资者们对此照单全收。

西方那些急切想证明自己也做得来金融科技的“老古董”银行不妨研究下星展银行（DBS）。这家新加坡银行的市值达到510亿美元。此前，其老板高博德（Piyush Gupta）想要展示该银行开展的数字创新项目。它根据用户是否主要使用数字产品而将其标记为“数字型”或“传统型”，并在这两组客户中分配成本。星展银行如今已可以将自己分割成两大业务部门，并证明数字业务的利润更高，在利润总额中的占比也不断上升。这一操作是这家银行股价飙升的原因之一。

成就最为卓著的企业分类学家使用的招数还要高明。他们不仅控制着如何对公司再细分，甚至还能左右它是否被视作一家公司。巴菲特在伯克希尔·哈撒韦取得的成就的核心便在于此。他坚称伯克希尔既非企业集团也非投资载体，而是一个独一无二的事物，只能用他在“股东手册”中给出的一套特别的规则来分析。这让伯克希尔在过去十年里躲过了外界审视及批评的影响，即便其股价表现逊于大盘。

日本通信及科技企业集团软银的老板孙正义也刚刚完成了一个大动作，为自己的公司重新归类，同样颠覆了人们的认知。一直以来，现金流疲弱及

债务高企令软银备受批评，因此自2017年起，孙正义开始将其描述成一家风投公司（VC），在做评估时也就要采用VC行业的内部收益率这一衡量标准。这既让结果得以美化，又无从证实。之后他成立了规模达1000亿美元的巨大的附属投资工具愿景基金，完成了公司的角色转变。

但是把重新分类的招数运用到极致的还是伊隆·马斯克。他暗示自己的汽车公司特斯拉不能在现在被评判，而只能在未来——他使用长期生产和市值目标来预测的未来。目前来看这一招奏效了。即便特斯拉连小规模量产都难以实现，华尔街对其2023年销售额的预测——完全是猜测——还是匪夷所思地稳定在600亿美元，依据仅仅是马斯克无比坚定的构想。

分类学不是炼金术。企业如果不成功，终究无法掩人耳目。特斯拉也许也会发现这一点。通用电气和IBM已尝试将其企业帝国的部分业务特别归类为“高科技”，但整体利润水平一直在下降，因而骗不了投资者。实际上，通用电气已被踢出了追踪精英企业的道琼斯指数。然而，通过控制自己公司的分类和再分割，管理者往往可以改变人们的认知，进而改变现实——降低资本成本并威吓竞争对手。福柯对商业不感兴趣，但如果他感兴趣，他可能会将公司分为两类：对分类学的威力了然于心的，和对此一无所知的。 ■



Danone and the rise of B Corporations

Choosing plan B

The boss of Danone, a food-and-drink giant, rethinks the purpose of the company

THE food industry is going nowhere. Pretty pictures on food packets mislead. Big companies have disconnected people from their sustenance. Consumers, especially millennials, are sceptics about industrial-scale food production. Even sellers of healthy products, such as mineral water, spread harm—just look at billions of their plastic bottles that choke the oceans.

Such views are commonly heard among food activists, radical bloggers or anti-capitalists. Yet these come from Emmanuel Faber, who runs Danone, a large French food company. Mr Faber (pictured) frequently sounds like a doomsayer about his own industry—and about capitalism more broadly. “A revolution” and the end of globalisation are nigh, he says.

Danone is well-placed to spot such changes. With its headquarters in Paris, the company sells to over 130 countries and made nearly €25bn (\$28bn) in revenues last year. Mostly it sells dairy goods such as Activia yogurt, mineral water (in plastic bottles) such as Evian or Volvic, and baby food. Mr Faber sees change driven mostly by the new habits of consumers in rich countries. “People are walking out of brands that they’ve been consuming for decades,” he says. Millennials in particular do not think their food system works and are shopping locally, favouring smaller producers and buying organic, plant-based or GM-free products.

Danone’s answer is to rethink the motivating idea of the company. That means rejecting the Anglo-Saxon idea that a firm exists primarily to maximise the welfare of its owners, the shareholders. Danone is pursuing what Mr Faber sees as a more meaningful goal. The “purpose of this firm

is not to create shareholder value”, he says. Instead it is to get healthy food to as many mouths as possible, benefiting everyone from suppliers to consumers to owners.

In part, this serves as savvy marketing; Mr Faber, a wiry rock-climber, is living the brand. The approach is also consistent with Danone’s history going back well over a century. In a speech in Marseille in 1972 a former boss, Antoine Riboud, launched the idea of the company having a “dual project”, meaning it should pursue both economic and social benefits. That speech, influenced by his Socialist leanings and anti-capitalist protests and social upheaval from 1968 onwards, is still dutifully cited by senior management.

The firm does put its money where its mouth is. It has sold subsidiaries that produced biscuits, chocolate and beer, for example. Evian, its high-end mineral water brand, which accounts for roughly 3% of revenues, is trying to become carbon neutral. Danone is working on a way to make recycled plastic, which is often grey, appealing to drink from. Danone also runs large-scale, non-profit “social businesses”, such as one in co-operation with Muhammad Yunus, a Nobel laureate, which provides high-quality and nutritious yogurt cheaply to Bangladeshi children. Mr Faber previously led this part of the company.

The latest effort is to win certification as a “B Corporation”, a label meant to reflect a firm’s ethical, social, environmental practices. Smaller outfits, such as Patagonia, a clothing firm, or Ben and Jerry’s ice-cream (now part of Unilever) were early B Corps. Some 2,500 have been certified in the past decade or so. Athleta, an “athleisure” firm owned by the Gap clothing chain, became a B Corp in March. Firms scrutinise each other, along with independent monitors.

So far around 30% of Danone's various subsidiaries are thus certified. The goal is to do them all within a few years, at least by 2030. In April Danone North America, encompassing WhiteWave, an organic-food firm that Danone bought in 2017 for \$12.5bn, became the world's biggest B Corp. The idea is that the label will help to win back trust from consumers.

Relatively few people, at least outside America, have heard of B Corps, although Walmart, Danone's biggest single customer, is an enthusiastic promoter and pushes B-Corp goods in its stores. In America B Corps are associated with (but different from) Benefit Corporations, a legal status for firms that lets them seek goals other than maximising shareholder welfare.

B Corps are certified by an independent movement called B Lab, founded by Jay Coen Gilbert. Like Mr Faber, he talks of a pressing need to rethink the philosophy of the company, saying "we need to correct an error in the source code of capitalism: shareholder primacy". B Corps, he says, promote better governance and better serve the interests of workers, suppliers and wider society, in addition to investors. He notes that Larry Fink, chairman of BlackRock, the world's biggest asset manager, said much the same in a letter to companies in January.

Does Danone's radical approach hold water? Other consumer giants, such as Unilever, emphasise that giant firms should lead on environmental, social and governance topics. But Danone's virtue-signalling goes further, analysts agree. All the same, Martin Deboo, of Jefferies International, a bank, notes that Danone has a mixed reputation among European investors. The firm had been trying to up its returns, but its high-priced purchase of WhiteWave, which has low returns, was disappointing, he says. Danone's returns of around 8% on invested capital are relatively low compared to its peers. After rumours in the summer of 2017 that an activist investor was circling, the firm's share price leapt, suggesting buyers hoped new management could lift its performance.

Over time, Danone's approach may become more appealing to mainstream investors. Long-term asset managers, banks, and other financial partners say they feel social and environmental obligations getting stronger. Yngve Slyngstad, the head of Norway's pension fund, says he is obliged to consider how investment decisions today might affect future generations and ask how firms might influence society, say, over climate change. The fund owns nearly \$1bn of Danone stock (1.7% of the total).

Danone points to other financial benefits of its approach. It trumpets, for example, a deal announced in February with 12 creditors. Cecile Cabanis, its chief financial officer, describes a syndicated credit facility of €2bn that is tied to Danone's B-Corp status plus other environmental, social and governance goals. As more of Danone is certified, she says, the margin payable on the credit will gradually fall. Mr Faber does concede that ultimately, he himself will be judged by Danone's share price. The proof of the pudding will be in the eating. ■



达能和B型公司的崛起

选择B计划

食品和饮料巨头达能的老板反思公司的宗旨

食品工业已经迷失了方向。食品包装上的漂亮图片误导了民众。大公司切断了人与食物之间的关系。消费者，特别是千禧一代，对工业级食品生产充满怀疑。即使是矿泉水等健康产品的销售商也会传播危害——看看那数十亿只令海洋“窒息”的塑料瓶吧。

这类观点在食品活动家、激进博主或反资本主义者当中十分常见。然而，以上言论却是出自法国大型食品公司达能的首席执行官范易谋（Emmanuel Faber）。范易谋（下图）很多时候听起来都像是对他自己所在行业的末日预言家——对更广泛的资本主义也一样。他说，“一场革命”和全球化的终结即将到来。

达能在行业里的地位让它易于察觉这种变化。该公司总部位于巴黎，产品销往130多个国家，去年收入近250亿欧元（280亿美元）。达能主要销售碧悠酸奶等乳制品、依云或富维克（Volvic）等（塑料瓶装）矿泉水以及婴儿食品。范易谋认为行业变化主要是受富裕国家消费者新习惯的推动。“人们正在放弃他们已经消费了几十年的品牌。”他说。千禧一代尤其不认为他们的食品系统运作有效，并且开始购买本地食品，偏爱小型生产商，也更愿意购买有机、植物基或非转基因产品。

达能的应对方法是反思公司的经营动机。这就意味着拒绝盎格鲁-撒克逊式的观点，即企业的存在主要是为了让所有者也就是股东的利益最大化。达能正在追求一个在范易谋看来更有意义的目标。“这家公司的目的不是创造股东价值。”他说。相反，它是为了让尽可能多的人获得健康的食品，让从供应商到消费者再到企业所有者的每个人都从中受益。

在某种程度上，这是一种精明的营销手段。精瘦结实的攀岩爱好者范易谋

本人就在实践这一品牌理念。这种理念也与达能一个多世纪以来的历史一脉相承。1972年在马赛的一次演讲中，达能前老板安托万·里布（Antoine Riboud）提出了公司拥有“双重目标”的理念，即应该同时追求经济和社会效益。这一讲话受到了他本人社会主义倾向和1968年以来反资本主义抗议以及社会动荡的影响，至今仍被达能的高层忠实地引述。

达能公司的确说到做到。比如它已经卖掉了生产饼干、巧克力和啤酒的子公司。占其总收入约3%的高端矿泉水品牌依云正在努力实现碳中和。达能正在研究再生塑料的制造方法，这种塑料通常是很吸引人的灰色。达能还经营着大规模的非营利性“社会企业”，例如与诺贝尔奖得主穆罕默德·尤努斯（Muhammad Yunus）合作的企业，为孟加拉国儿童提供质优价廉、营养丰富的酸奶。范易谋此前曾领导这一业务。

达能最新的努力是赢得“B型公司”的认证，这个标签反映了一家公司在道德、社会和环境方面的良好实践。服装公司巴塔哥尼亚（Patagonia）和本杰瑞冰淇淋（Ben and Jerry's，现在属于联合利华）等较小型企业都是较早获得认证的B型公司。过去十年左右的时间里，约有2500家公司获得了这项认证。服装连锁企业Gap旗下的“运动休闲”服装公司Athleta在3月也成为了B型公司。除了受独立监察员审查外，B型公司之间也要互相监督。

到目前为止，达能约30%的子公司都获得了这项认证。达能的目标是在几年内完成所有子公司的认证，最晚是在2030年前。4月，达能北美公司（Danone North America）成为了全球最大的B型公司。这家子公司包含了达能于2017年以125亿美元收购的有机食品公司白波食品（WhiteWave）。达能之所以做出这番努力，是因为相信B型公司的标签有助于赢回消费者的信任。

听说过B型公司的人不多，至少在美国以外是如此。不过，达能最大的单一客户沃尔玛是B型公司的积极倡导者，在其超市里大力推销这类公司的产品。在美国，B型公司与共益公司（Benefit Corporation）有关联（但并不相同）。共益公司是企业的一种法律地位，让它们可以追求最大化股东

利益以外的目标。

B型公司由名为B型实验室（B Lab）的独立机构认证，该实验室由杰·科恩·吉尔伯特（Jay Coen Gilbert）创立。和范易谋一样，吉尔伯特认为迫切需要反思公司的理念。他说：“我们需要纠正资本主义源代码中的一项错误：股东至上。”他还说，除了考虑对投资者的回报，B型公司还能促进更好的治理、更好地为员工、供应商和更广泛的社会的利益服务。他指出，全球最大的资产管理公司贝莱德（BlackRock）的董事长拉里·芬克（Larry Fink）在1月份给企业的一封信中说了差不多相同的一番话。

达能激进的做法是否明智？联合利华等其他消费品巨头强调巨型企业应当引领ESG（环境、社会与公司治理）议题的发展。但分析师一致认为，达能的美德展示走得更远。尽管如此，投行杰富瑞国际（Jefferies International）的马丁·德布（Martin Deboo）指出，欧洲投资者对达能的看法毁誉参半。他说，达能一直在努力提高回报率，但高价购买低回报的白波食品令人失望。达能的投资回报率约为8%，相对低于同行。2017年夏天有传言称维权投资者盯上了达能，之后公司股价大涨，表明买家希望新的管理层能够提升业绩。

随着时间的推移，达能的方式对主流投资者的吸引力可能会增加。长期资产管理公司、银行和其他金融合作伙伴表示，他们认为企业的社会和环境责任越来越重要。挪威养老基金负责人尤恩戈夫·史林斯塔德（Yngve Slyngstad）表示，他有义务考虑今天的投资决策会如何影响后代，并追问企业它们可能会如何影响社会——比如在气候变化方面。该基金拥有近10亿美元的达能股票（占达能总股本的1.7%）。

达能已经显现出这套做法的其他经济效益。例如，它高调宣传了在2月与12家信贷机构宣布达成的一项协议。达能的首席财务官塞西尔·卡巴尼斯（Cecile Cabanis）描述了一项20亿欧元的银团信贷便利，它与达能的B型公司地位以及其他环境、社会和治理目标挂钩。她表示，随着更多达能子公司获得认证，应付信贷保证金将逐渐减少。范易谋确实承认，他本人的

成绩最终还是以达能的股价来评判。一切有待实践检验。 ■



Litigation finance

Appealing returns

Third-party funding for lawsuits attracts investors and lawyers alike

CONTINGENT fees, in which clients pay lawyers only if a case is won, have long been a feature of America's legal system. Many other countries used to bar them, wary of importing America's ambulance-chasing culture. But a belated acceptance of their benefits means they are now widely allowed. "No-win, no-fee" arrangements help shift risks from parties to a suit to their lawyers, and make it less likely that a would-be plaintiff decides not to press a strong case for fear of a big financial loss.

Around a decade ago, some lawyers took the principle of risk-shifting further. They accepted money from third parties to fund cases in exchange for some of the winnings. Litigation finance has since taken off. Fortune 500 companies and New York's elite law firms increasingly tap outside capital when pursuing multi-million-dollar suits.

Funds that invest in litigation are on the rise. In the past 18 months some 30 have launched; over \$2bn has been raised. Last year Burford Capital, an industry heavyweight, put \$1.3bn into cases—more than triple the amount it deployed in 2016. Lee Drucker of Lake Whillans, a firm that funds lawsuits, says he gets calls weekly from institutional investors seeking an asset uncorrelated with the rest of the market—payouts from lawsuits bear no relation to interest-rate rises or stockmarket swings.

Such outside funding does not just enable plaintiffs to pursue potentially lucrative cases. It also allows law firms to hedge risk. Some clients, worried about the misaligned incentives caused by law firms' sky-high hourly rates, insist on partial or full contingency-payment schemes. Outside funding lets

firms recoup some revenue even if they do not win a case. “Firms that lose are still going to take a bath,” says Nicholas Kajon of Stevens & Lee. “But the write-off won’t be quite as bad.”

Returns are usually a multiple of the investment or a percentage of the settlement, or some combination of the two. Funders of a winning suit can expect to double, triple or quadruple their money. Cases that are up for appeal, where the timespan is short—usually 18-24 months—and the chance of a loss slimmer, offer lower returns. New cases that are expected to take years offer higher potential payouts.

A maturing market means more sophisticated offerings. To spread risk, funders are bundling cases into portfolios and taking a share of the proceeds. Last year Burford ploughed \$726m into portfolio deals, compared with \$72m into stand-alone suits.

As funders compete for high-quality investments, opportunities in new markets arise. Bentham IMF, a litigation funder based in New York, has joined Kobre & Kim, a law firm, to set up a \$30m fund for Israeli startups to pursue claims against multinationals—for example, over trade-secret violations. A burgeoning secondary market is likely to develop further, allowing investors to cash out before long-running suits are closed. Burford recently sold its stake in an arbitration case concerning two Argentine airlines for a return of 736%. Such mouth-watering profits should keep luring capital into the courtroom. ■



诉讼融资

诱人的回报

投资者和律师都为第三方诉讼融资所吸引

只有在胜诉后才需要向律师付费的“风险代理收费制”一直是美国法律体系的一个特色。其他许多国家曾禁止这种操作，担心将美国的讼棍文化“引狼入室”。但这种收费制的好处终于得到迟来的认可，如今已被广泛采用。有了“不赢不收钱”的协定，风险就从诉讼各方转移到了他们的律师身上，也就不大会发生原本颇有些胜算，却因为害怕白白烧钱而放弃打官司的情况。

大约十年前，一些律师把这种转移风险的原则再往前推进了一步。他们接受第三方的资金来支付诉讼开支，作为交换，向对方支付部分诉讼赔偿所得。自那之后，诉讼融资业务蓬勃发展起来。《财富》世界500强公司和纽约的精英律师事务所在打数百万美元的官司时，越来越多地利用外部资本。

投资于诉讼案件的基金逐步增多。过去18个月里成立了约30只这样的基金，融资超过20亿美元。去年，业界“大腕”伯福德资本（Burford Capital）为资助诉讼案件投入了13亿美元，是2016年投入金额的三倍多。诉讼资助公司Lake Whillans的李·德鲁克（Lee Drucker）说他每周都会接到机构投资者的电话，他们想寻觅一种与市场其余部分不相关的资产——诉讼赔偿金与利率上涨或股市起伏没有任何关联。

这样的外部资金不仅能让原告方发起有可能会带来大笔赔偿金的诉讼，还能让律师事务所对冲风险。一些委托人担心律师事务所按小时收取的天价费用会造成不当激励，因而坚持部分或全部采用风险代理付费方案。有了外部资金，律师事务所就算没能赢得诉讼也能挽回部分收入。“输了官司，律所还是会亏一大笔钱，”Stevens & Lee律师事务所的尼古拉斯·卡永（Nicholas Kajon）说，“但会少亏一些。”

诉讼投资的收益通常为投资额的一个倍数或赔偿金的一定比例，或者两者兼有。胜诉案件的资助者所获收益可能会是其出资金额的二到四倍。准备上诉的案子审理时间短——通常在18到24个月之间，败诉的可能性相对较低，投资回报也较低。那些预计将耗时多年的新案子可能会带来更高的回报。

市场日渐成熟，出现了更复杂的投资方式。为了分散风险，诉讼融资机构将案件打包成投资组合，从中抽取一部分收益。伯福德去年投入了7.26亿美元用于组合投资各类案件，而在单个案件上的投入为7200万美元。

随着诉讼融资公司争相抢夺高质量的投资项目，在新市场中也出现了机会。总部设在纽约的诉讼融资公司Bentham IMF与高博金律师事务所（Kobre & Kim）共同设立了一个规模达3000万美元的基金，专门支持以色列的创业公司向跨国公司索赔——例如在侵害商业机密方面。一个新兴的二级市场看来会进一步发展，让投资者得以先一步套现离场，而不用等待一宗旷日持久的诉讼案尘埃落定。伯福德近期出售了自己在一个涉及两家阿根廷航空公司的仲裁案中的股份，回报率达736%。如此令人垂涎的利润水平应该会吸引资本源源不断地流向法庭。 ■



Start Today

Suits you

A Japanese firm is shaking up the business of selling clothes online

ONE problem plagues the business of selling clothes online—predicting how a garment will fit without trying it on. Behemoths such as ASOS, a British internet platform that sells its own and others' apparel, try to overcome this by allowing people to buy several sizes to try on at home and return items free of charge—at huge cost to them. Enter the body-measurement suit from Start Today, a Japanese firm that runs the “Zozotown” platform in Japan on which clothing companies from around the world sell their wares, as well as its own private label, Zozo.

In the past three months Start Today has distributed to just over 1m Japanese customers, free of charge, its “Zozosuit”, a skin-tight, full-body suit covered in around 350 fiducial markers, small objects that can be used as a point of reference for measurements. Shoppers slip on the suit and slowly rotate as their smartphone takes photos.

The firm uses the images to create a 3D scan of their body, which it can use to offer a range of customised services. Among these are made-to-measure business suits for men from its Zozo brand, which are selling strongly, and jeans and T-shirts that fit most snugly from tens of thousands of pre-cut patterns, also from Zozo. At the most basic level, when customers choose an item from one of the 6,400 brands listed on Zozotown—the core of Start Today’s business—the platform uses the Zozosuit data to recommend the right size.

A first, more high-tech version of the suit proved too expensive (it had capacitors holding an electric charge that measured body shape by how

much the suit stretched). But its latest version costs the company only ¥1,000 (\$9) a piece. Masahiro Ito, a board member who oversees engineering at the firm, says the fashion industry has not yet adapted to meet the needs of a generation accustomed to buying everything online, to their specifications and at their convenience. “We offer exactly that,” he says. Other companies are watching closely. Fast Retailing, a giant which owns the UNIQLO brand, is one firm looking at ways to measure the body using smartphones.

How the suit fares is crucial for Start Today’s future. The Zozotown platform is the undisputed giant of online fashion retail in Japan. It created and dominates the market for online clothing sales; the second biggest platform, Marui Web Channel, makes only a tenth of its sales. It takes lucrative cuts of up to around 35% from brands it hosts; its founder and boss, Yusaku Maezawa, is now Japan’s 18th-richest person.

But analysts reckon it may be reaching saturation point. The company counts 6% of the country’s population as active users (meaning those who have bought something in the past 12 months). Its share price dipped sharply in July after growth slowed slightly. Bespoke services could attract more customers, especially men, who make up only around 30% of active users, reckons Osamu Yamada, an independent retail analyst.

Observers are more circumspect about whether the suit can help Start Today on its other path to growth: expanding abroad. Since July customers in 72 countries have been able to request a body-measurement suit to help them buy clothes from the Zozo label. An attempt a few years ago to take the Zozotown platform into China, Hong Kong and South Korea (before it came up with the body-measurement suit) failed. Mr Ito notes that Zozotown could not compete then with existing companies offering more or less the same products; for now at least, the suit is a unique service. But the company will still have to work harder than it does at home to persuade

people to squeeze into it. ■



Start Today公司

适合你的衣服

一家日本公司正在撼动网上服装销售业务

有个问题一直困扰着网上服装销售业务：顾客要在无法试穿的情况下预测一件衣服是否合身。有些业内巨头尝试让人们买下多个尺码在家试穿，然后免费退货来解决这个问题，比如ASOS这家销售自有品牌和其他品牌服装的英国在线平台就是这么做的。但这种方法成本巨大。现在，日本公司Start Today拿出了它的办法：量体服。这家公司在本国经营Zozotown平台，销售来自世界各地的服装公司的产品以及它的自有品牌Zozo。

过去三个月里，这家公司向总数一百万出头的日本消费者免费提供了Zozosuit。这是一件连体紧身衣，上面覆盖着大约350个基准标记物，这些小部件是测量的参考点。顾客套上衣服后，慢慢转动身体，并由智能手机拍下照片。

公司用所得的照片创建顾客身体的3D影像，利用它来提供一系列定制服务。其中包括其旗下Zozo品牌的男士定制商务套装，目前销售强劲；还有从Zozo的数万种预制款式中找出最合身的牛仔裤和T恤。在最基本的层面上，当客户要从Zozotown（Start Today的核心业务）上销售的6400个品牌中选择一件商品时，平台会根据Zozosuit的数据推荐合适的尺码。

一开始研发的量体衣版本科技含量更高，但太过昂贵（配有带电荷的电容器，通过衣服拉伸的程度来测量体型）。最新版的成本仅为每件1000日元（9美元）。公司负责工程事务的董事伊藤正裕（Masahiro Ito）说，时尚业还没能适应习惯网购的一代人的需求，这代人按自身特点、以自由方便的方式网购一切。“我们提供的正是这样的服务。”他说。其他公司正密切关注这项进展。拥有优衣库品牌的巨头迅销也在研究用智能手机测量体型的方法。

量体衣的功效如何对Start Today的未来至关重要。Zozotown平台是日本无可争议的在线时尚零售巨头。它创造并主导了网上服装销售市场。第二大平台丸井网上购物（Marui Web Channel）的销售额仅是它的十分之一。它对平台上销售的品牌抽成最高达35%左右。其创始人兼老板前泽友作（Yusaku Maezawa）目前位列日本富豪榜第18位。

但分析人士认为它可能即将达到饱和点。该公司的活跃用户（即过去12个月里在它平台上买过东西的人）占日本人口的6%。在增长略有放缓后，公司股价在7月份大幅下跌。独立零售分析师山田修（Osamu Yamada，音译）认为，定制服务可以吸引更多的顾客，尤其是男性，他们只占活跃用户的30%左右。

至于这件量体衣能否帮助Start Today走上另一条增长之路——海外扩张，观察人士的态度就更谨慎了。自7月以来，已有72个国家的顾客可以申请这件量体衣来帮助他们购买Zozo品牌的衣服。几年前，Zozotown平台进军中国大陆、香港和韩国的尝试失败了（那时还没有推出量体衣）。伊藤认为Zozotown当时无法与当地提供差不多产品的既有公司竞争；但至少到目前为止，量体衣是公司的独家服务。不过，要说服那些地方的人也把自己塞进这件紧身衣里，它一样还得花比在国内更多的力气。■



Economic and financial indicators

Household income

Household income can provide a better picture of people's material well-being

Growth in GDP is the most common measure of economic performance. But household income can provide a better picture of people's material well-being. That is because some of the income that counts towards GDP goes to non-residents, firms and governments. Over the past eight years GDP growth has outpaced that of household income in the OECD, a mostly rich-country club. The gap is big in Britain, where household incomes fell in real terms at the start of the decade, even as GDP expanded. In America growth in household income per person has outpaced GDP per person by 3.4 percentage points since the first quarter of 2010, in part because of low household taxes. ■



经济与金融指标

家庭收入

家庭收入可以更好地反映人们的物质生活水平

GDP增速是最常用来衡量经济表现的指标。但家庭收入能够更好地反应人们的物质生活水平。这是因为有些被计入GDP的收入是归非本地居民、企业以及政府所有。过去八年里，成员主要为富裕国家的经合组织的GDP增速已经超过了家庭收入增速。两个指标的差距在英国非常突出，该国的家庭收入实际值自2010年起下降，而与此同时GDP却在增长。在美国，自2010年第一季度，家庭人均收入增速超过人均GDP增速3.4个百分点，一定程度上是因为家庭税务支出较低。 ■



Education policy

Copying allowed

What other countries should learn from Singapore's schools

WHEN the island of Singapore became an independent country in 1965, it had few friends and even fewer natural resources. How did it become one of the world's great trading and financial centres? The strategy, explained Lee Kuan Yew, its first prime minister, was "to develop Singapore's only available natural resource: its people".

Today Singapore's education system is considered the best in the world. The country consistently ranks at the top of the OECD's Programme for International Student Assessment (PISA), a triennial test of 15-year-olds in dozens of countries, in the main three categories of maths, reading and science. Singaporean pupils are roughly three years ahead of their American peers in maths. Singapore does similarly well in exams of younger children, and the graduates of its best schools can be found scattered around the world's finest universities.

The island-state has much to teach the world. But other countries are reluctant pupils. One reason is that Singapore favours traditional pedagogy, with teachers leading the class. That contrasts with many reformers' preference for looser, more "progressive" teaching intended to encourage children to learn for themselves. Although international studies suggest that direct instruction is indeed a good way of conveying knowledge, critics contend that Singapore has a "drill and kill" model that produces uncreative, miserable maths whizzes. Parents worry about the stress the system puts on their children (and on them, even as they ferry kids to extra classes).

Yet Singapore shows that academic brilliance need not come at the expense

of personal skills. In 2015 Singaporean students also came first in a new PISA ranking designed to look at collaborative problem-solving, scoring even better than they did in reading and science. They also reported themselves to be happy—more so than children in Finland, for instance, a country that educationalists regard as an example of how to achieve exceptional results with cuddlier methods of teaching. Not content with its achievements, Singapore is now introducing reforms to improve creativity and reduce stress (see Asia section). This is not a sign of failure, but rather of a gradual, evidence-led approach to education reform—the first of three lessons that Singapore offers the rest of the world.

Where other countries often enact piecemeal and uncoordinated reforms, Singapore tries to look at the system as a whole. It invests heavily in education research. All reforms are tested, with the outcomes diligently monitored, before being rolled out. Close attention is paid to how new ideas and results should be applied in schools. Carefully developed textbooks, worksheets and worked examples—practices often seen as outdated in the West—are used to inject expertise into the classroom. The result is good alignment between assessments, accountability and teaching styles.

The second lesson is to embrace Singapore's distinctive approach to teaching, notably of mathematics—as America and England are already doing to some extent. It emphasises a narrower but deeper curriculum, and seeks to ensure that a whole class progresses through the syllabus. Struggling pupils get compulsory extra sessions to help them keep up; even the less-able do comparatively well. An analysis in 2016 in England found that the Singaporean approach boosted results, though it was somewhat watered down in transition.

The third and most important lesson is to focus on developing excellent teachers. In Singapore, they get 100 hours of training a year to keep up to date with the latest techniques. The government pays them well, too.

It accepts the need for larger classes (the average is 36 pupils, compared with 24 across the OECD). Better, so the thinking goes, to have big classes taught by excellent teachers than smaller ones taught by mediocre ones. Teachers who want more kudos but not the bureaucratic burden of running schools can become “master teachers”, with responsibility for training their peers. The best teachers get postings to the ministry of education and hefty bonuses: overall, teachers are paid about the same as their peers in private-sector professions. Teachers are also subject to rigorous annual performance assessments.

The system is hardly faultless. Other countries might wish to avoid Singapore’s dividing of high- and low-achievers into separate schools from the age of 12. The benefits of doing so are unproven, and it contributes to stress about exams. Singapore’s size, moreover, allows for an unusual degree of centralisation. The director-general of the ministry of education says he knows more than 80% of head teachers by name, which makes it easier to keep tabs on what is going on. Other trade-offs would be unpalatable elsewhere. In most countries, teachers’ unions and parents are resistant to big classes, for instance. That is a shame. Education would be much better if more countries copied Singapore’s homework. ■



教育政策

该抄就抄

其他国家应该向新加坡的学校学什么

岛国新加坡在1965年独立时，它几乎没有朋友，更没有自然资源。它是如何成为世界上最大的贸易和金融中心之一的？新加坡首任总理李光耀解释说，新加坡的战略是“开发新加坡唯一的自然资源：人才”。

今天，新加坡的教育系统被认为在全球首屈一指。经合组织（OECD）的国际学生评估项目（PISA）每三年对几十个国家的15岁学生开展数学、阅读和科学三大科目的测试，新加坡一直名列前茅。新加坡学生的数学成绩比美国学生领先大概三年。在对更年幼学生的测试中，该国表现同样出色。这里最好的学校的毕业生遍布于全球顶尖大学中。

这个岛国有很多地方可供全世界借鉴。但其他国家并不情愿向它学习。原因之一是新加坡偏爱传统教学法，由老师主导课堂。与之形成鲜明对比的是，许多改革者倾向于更宽松、更“进步”的教学方式，鼓励孩子们自学。尽管国际研究表明，直接教学法确实是一种传授知识的好方法，但批评人士认为，新加坡的模式是“死读书”，培养出的是缺乏创造力、一味苦学的数学能手。父母们担心这个系统给他们的孩子带来压力（还有对自己的压力，虽然他们一边这样担忧一边还在送孩子上课外班）。

然而，新加坡的情况表明，优异的学业成绩不需要以牺牲个人能力为代价。2015年，新加坡学生在PISA的一项新排名中也拿下了第一，该排名考察的是协作解决问题的能力。他们在这一项上的得分甚至比阅读和科学的分数还要高。他们还表示自己很快乐，比芬兰孩子更快乐，而芬兰被教育学家奉为用更具亲和力的教学方法获得优异成绩的范例。新加坡并不满足于它的成就。现在，它正在通过改革提升创造力、减轻压力。这不是失败的表现，而是一种循序渐进、以证据为导向的教育改革。这是新加坡带给世界其他地区的三堂课中的第一课。

其他国家的教育改革常常零散而缺乏协调，新加坡却努力从整体上审视这个体系。它重金投资教育研究。所有的改革都经过试点，在进一步推行它们之前一丝不苟地监测成效。它密切关注应当如何在学校中应用新思想和新成果。它精心编制教科书、练习题和例题——这在西方常被视为过时——以求让课堂教学变得更加专业。其结果是评估、问责和教学风格协调运作。

第二课是拥抱新加坡独特的教学方法，尤其是数学。美国和英国在一定程度上已经这么做了。这种方法强调范围更窄但更深入的课程内容，并且力保整个班级按照教学大纲取得进步。学校有强制补课帮助有困难的学生跟上进度；即使是学习能力较差的学生也表现得相对较好。2016年英国的一项分析发现，采用新加坡的方法帮助提高了成绩，虽然在转变方式的过程中功效打了些折扣。

第三课是最重要的一课：专注于培养优秀的教师。在新加坡，教师每年接受100小时的培训以跟上最新的教学方法。政府提供的薪酬也很优厚。新加坡满足了扩大班级规模的需求（平均每个班36名学生，而经合组织成员国只有24名）。新加坡的观点是，由优秀的老师来上大课，要比由平庸的老师上小课好。那些希望获得更高威望、但又不想承担学校行政管理工作的教师，可以努力成为“主任教师”，兼有培训其他教师的职责。最好的老师会被派驻到教育部短期任职，并得到丰厚的奖金。总的来说，教师的薪水和私营部门同等资历的人差不多。教师还必须接受严格的年度绩效评估。

这一体系并非无懈可击。其他国家可能希望避免像新加坡那样，从12岁起将成绩好和成绩差的学生分校。这样做的好处尚未证实，而且会增加考试的压力。此外，新加坡国土面积小，能达到不同寻常的集中。教育部提学司表示，他能叫出80%以上校长的名字，这让大家更容易跟进当下的情况。其他方面的权衡取舍在其他地区难以实施。比如，在大多数国家，教师工会和家长都抵制大班授课。这很遗憾。如果有更多国家抄新加坡的作业，教育会好得多。 ■



Free exchange

Made from concentrate

Central bankers grapple with the changing nature of competition

RECENT visitors to Jackson Hole, a resort in the Teton Mountain range in Wyoming, were denied the usual scenic views by a shroud of smoke from recent forest fires. Disappointing, no doubt, for the tourists among them—but oddly fitting for the economic panjandums attending the Federal Reserve Bank of Kansas City's annual symposium on August 23rd-25th. Not only are economic policymakers used to making choices in a fog of uncertainty, but this year's theme of market structures generated its own haze. Though the nature of competition in America's economy is changing, it is unclear how worried they should be.

Jerome Powell, the chairman of the Federal Reserve, highlighted slow wage growth in recent decades. America seems stuck in a “low-productivity mode”, he said. Others pointed to sluggish investment, despite cheap capital, and a fall in workers' share of national income. Could these ills share some common causes, namely rising market concentration and crimped competition?

As evidence, Alan Krueger of Princeton University pointed to nominal wage growth that is 1-1.5 percentage points lower than would normally be expected with inflation and unemployment as low as they are now. He laid some blame on employers' growing power, as no-poaching agreements and non-compete restrictions proliferate, on sickly union membership and on the falling real value of the federal minimum wage.

Antoinette Schoar of the Massachusetts Institute of Technology (MIT) remarked that a banking shakeup by fintech upstarts, long predicted, has

not fully materialised. Rather than turning new firms into viable competitors, venture capital seems to have nurtured them only for incumbents to gobble them up. As markets have become more concentrated, observed John van Reenen, also of MIT, the gap in productivity between the biggest and smallest companies has widened. If something is stopping substandard firms from closing the gap, that could be sapping the economy's dynamism.

These concerns fit into a dark story, of an economy weakened by behemoths abusing their market power. But there is a competing narrative. Consider the Jackson Hole conference itself, stuffed with star academics and policymakers. Is it an incumbent monopolist, resting on its reputation as the year's hottest macroeconomic event? Or is it a shining example of the power of network effects, convening great minds to produce ideas jointly that surpass anything they could dream up separately?

Rising market concentration, Mr van Reenen pointed out, might reflect not a decline in competition, but a change in its nature. Platforms such as Google, Uber and Airbnb match buyers and sellers, and thus make outsize gains as they grow. In such winner-takes-most competition, a slight advantage can tip the entire market in a company's favour. Mr van Reenen finds that America's rising economic concentration is mostly caused by big, productive companies gaining market share. Far from growing complacent and fat, they seem impressively muscular.

Other observations chimed with this narrative. Alberto Carvallo of Harvard University showed that the prices of goods sold in brick-and-mortar shops vary less by location and are updated more often if they are also sold by online rivals. Prices of shops' products were much more likely to reflect changes in exchange rates if the same items were sold on Amazon. Such cost-sensitivity is hard to square with the idea that competition is lacking.

The differences between these rival narratives matter for economic policymakers. In one version nefarious market forces are constricting productivity, holding down investment and wages. If so, that would make the trade-off between inflation and unemployment harder to manage. In the other, restrained investment and wages are signs of structural changes that boost productive potential—in which case, there would be fewer ill-effects from running the economy hot.

Unsurprisingly, given the number of economists assembled, the only point of agreement was on the need for more evidence. Part of the difficulty is that the two narratives are not as distinct as they appear. As Janice Eberly and Nicolas Crouzet of Northwestern University pointed out, the same forces could be creating both competition-harming barriers to entry and rising productivity associated with economies of scale. They find a correlation between a company's market share and its investment in patents, algorithms and other intangible capital.

Moreover, the impact on competition seems to vary by industry. In retail and manufacturing, although concentration and intangible investment have risen, the researchers' measure of price markups has stayed low. By contrast, in the high-tech and health-care industries, they find an association between intangible investments and markups. Even as sophisticated logistical algorithms sharpen the battle between the likes of Amazon and Walmart in retailing, in other words, a proliferation of patented devices and databases full of customer insights could be enabling market leaders in pharmaceuticals and finance to shut rivals out.

Raghuram Rajan of the University of Chicago offered another reason to wait before declaring increased economic concentration either good or bad for the economy overall. Even if superstar companies are passing efficiency gains on to consumers now, they may not keep doing so indefinitely. If they continue to be boosted by the trends behind economic concentration,

from stellar returns to amassing troves of customer data and the increasing sophistication of proprietary software, their pricing forbearance may not last. Once their dominance is secure, they could turn predatory, milking consumers and squeezing innovative potential from the broader business environment. The economy has changed a lot in recent years—and there is no reason why it cannot keep changing. ■



自由交流

集中的后果

央行官员设法理解竞争特性的变化意味着什么

最近来到怀俄明州提顿山脉（Teton Mountain）杰克逊霍尔（Jackson Hole）度假区的人未能一睹这里往日的如画美景。在他们眼前是一大片森林大火延烧后弥漫的烟雾。这无疑令游客们失望。不过，对于8月23日至25日在这里参加由堪萨斯城联储举办的全球央行年会的一众经济官员来说，这番景象倒是奇异地映衬了主题。经济政策的制定者常常都是在不确定的迷雾中做选择，而今年的会议主题“市场结构”更是自带阴霾。虽然美国经济中竞争的特性正在改变，这一点多值得忧虑却并不明朗。

美联储主席杰罗姆·鲍威尔（Jerome Powell）强调近几十年来工资增长缓慢。他说，美国似乎陷入了一种“低生产率模式”。其他人指出，尽管资本成本低廉，投资依然低迷，而且工资占国民收入的比重在下降。这些弊病的背后是否有着共同的原因，即市场更加集中，竞争受到抑制？

普林斯顿大学的艾伦·克鲁格（Alan Krueger）提出了证据：相较于在目前这种低通胀和失业率水平下通常会有的预期，名义工资增长低了1至1.5个百分点。他将责任部分归咎于互不挖角协议及竞业限制协议激增令雇主的权力增强、工会力量疲弱，以及联邦最低工资的实际价值下降。

麻省理工学院的安托瓦内特·肖尔（Antoinette Schoar）表示，金融科技新贵早被预言将重塑银行业，但这并没有完全实现。风险资本培育了这些新企业，但它们最终并没有变成既有企业的有力竞争对手，而是被既有企业吞并。该校的约翰·范雷南（John van Reenen）发现，随着市场变得更加集中，最大和最小企业在生产率上的差距扩大了。如果某些因素正在阻碍小公司缩小这一差距，那么整个经济的活力都将受损。

这些担忧契合了一个暗黑故事——巨头滥用市场支配力，削弱了经济整体。但还有另一种与之对立的叙事。以杰克逊霍尔会议自身为例，与会者

尽是明星学者和政策制定者。它是一个既有垄断者吗？一个倚赖“宏观经济界年度最吸睛盛事”这一响亮名号的垄断者？还是说，它是网络效应的光辉典范，让伟大的头脑聚集在一起，碰撞出它们凭一己之力无法企及的创意？

范雷南指出，市场集中度上升反应的也许不是竞争程度的下降，而是竞争特性的改变。谷歌、优步、爱彼迎等平台匹配买家和卖家，因而它们一旦扩张速度会非常快。在这样赢家拿大头的竞争中，轻微的优势便可使整个市场倒向一家公司。范雷南发现，美国经济集中度上升主要是由于高效的大企业抢占市场份额。它们全然没有变得自满和臃肿，反而显得极其强健。

其他观察结果与这套论述相符。哈佛大学的阿尔贝托·卡瓦洛

(Alberto Carvallo) 表示，实体店商品假如同时也在竞争的网店出售，其价格的地区差异会减少，价格变动则会更频繁。如果实体店商品同时在亚马逊上有售，其价格反映汇率变化的可能性就大幅增加。这样的成本敏感性与市场缺乏竞争的说法相抵触。

对经济政策制定者而言，这些对立的论述之间的差异很重要。一种说法认为邪恶的市场力量正在束缚生产率，抑制投资和工资。如果真是这样，那么通胀与失业率之间的权衡将更难把握。另一种说法认为投资和工资受抑制是结构性变化的迹象，这些变化可以提高生产潜力。如果是这种情况，那么即使让经济运行得热一些，负面效应也会较少。

经济学家云集，不出所料，唯一能达成的共识是证据还有待充实。部分困难在于这两种论述并不像表面上那样泾渭分明。正如美国西北大学的贾尼丝·艾伯利 (Janice Eberly) 和尼古拉斯·克鲁泽 (Nicolas Crouzet) 指出的那样，同样的力量可能一方面构成市场准入障碍，损害竞争，另一方面却造就规模经济，提高生产率。他们发现公司的市场份额与其在专利、算法和其他无形资本上的投资存在相关性。

而且，这类投资对竞争的影响似乎因行业而异。在零售和制造业，虽然市

场集中度和无形资产投资有所增加，但据研究人员统计，价格增幅仍然较低。相比之下，在高科技和医疗行业，他们发现无形投资和加价存在关联。换言之，尽管复杂的物流算法加剧了亚马逊和沃尔玛等零售企业之间的竞争，专利设备以及充满客户洞见的数据库的激增可能令制药和金融业里的龙头企业得以将竞争对手赶尽杀绝。

经济集中度上升对整体经济究竟是好是坏？芝加哥大学的拉古拉姆·拉詹（Raghuram Rajan）提出了又一个让大家且慢断言的理由。即便超级巨头现在把效率增益让渡给了消费者，它们可能也不会永远都这样做。如果它们持续得益于经济集中背后的趋势——获得丰厚回报、积累庞大的客户数据、拥有日益精良的专有软件——可能就不会在定价上持续保持克制。一旦霸主地位得以巩固，它们可能就会开始凶残杀戮，压榨消费者，并在更广泛的商业环境中挤压创新潜力。近年来经济的变化巨大，没有理由认为它不会继续变下去。 ■



Space flight

Munching into orbit

A rocket that devours itself may soon take off

IT TAKES a lot of oomph to launch a satellite into space. Typically, the payload represents only about 5% of the mass of a rocket as it leaves the launch pad. The rocket's motors account for some of the rest, but the bulk of it consists of the propellants (the fuel and oxidant that react to produce the thrust required to reach orbit) and the gubbins needed to handle these propellants (tanks, pumps, valves, piping and the bodywork that contains them). The gubbins are not only expensive in themselves, but their mass also requires extra fuel to lift. Things would be more efficient if the gubbins could be dispensed with and a rocket designed that consists of only payload, motor and propellants.

This is exactly what those behind what they call the “autophagy” rocket hope to achieve. This team, a group of researchers led by Patrick Harkness of Glasgow University, in Britain, and Vitaly Yemets of Oles Honchar Dnipro National University, in Ukraine, is designing a rocket that has a body made of a rigid cylinder of fuel and oxidant. At launch, the engine will sit at the base of this cylinder, but by the time the craft reaches orbit, it will have gobbled its way up towards the top, consuming the rocket’s structure on the way. That will save on launch weight, and thus on fuel. And, as they report in the *Journal of Spacecraft and Rockets*, Dr Harkness and Dr Yemets have now carried out the first static test-firing of such a rocket’s motor.

Self-evidently, the design they propose requires both fuel and oxidant to be solid. Solid-fuelled rockets are common in military applications, such as intercontinental ballistic missiles, but are less frequently employed for launching satellites because their thrust is hard to regulate. Like firework

rockets (themselves solid-fuelled), once the metaphorical blue touchpaper has been lit, the fuel burns as it will. Liquid-fuelled rockets are preferred as satellite launchers because their thrust can be tuned by changing the flow of propellant to the motor. That makes it easier to position a payload into orbit correctly. But Dr Harkness and Dr Yemets think that their self-consuming design can overcome this difficulty, too.

The fuel for the motor is a hollow cylinder made from polypropylene, a plastic hard and strong enough to form a rocket's outer casing. The middle of the cylinder is filled with a powdered mixture of ammonium perchlorate and ammonium nitrate, the oxidants. For their test firing, the researchers used a hydraulic ram to drive the cylinder into a preheated engine. Here, it made contact with a specially designed vaporisation surface, heated in order to turn both fuel and oxidants into gases and pierced by holes designed to collect the gases separately and channel them into a combustion chamber, where they mixed and burnt. To start the process, the vaporization surface had to be warmed to its operating temperature by a gas burner (this would be done electrically in an operational model), but once the system was up and running, vaporisation and combustion became self sustaining. And, by varying the rate at which the propellant tube entered the engine, it was possible to control the amount of thrust developed.

A real rocket would, of course, have no ram to feed in the fuel. But Dr Harkness hopes Newton's laws of motion will deal with that. Though the prototype under test is not yet powerful enough to make this work properly, the idea is that the acceleration of the motor will push constantly against the inertia of the propellant cylinder, forcing the cylinder against the vaporisation surface and causing it to be consumed. That process, moreover, is capable of regulation by using some sort of throttle to slow the cylinder's feed-in speed, permitting control of the amount of thrust developed in a way not possible for a normal solid-fuelled rocket, in which

the fuel burns *in situ*.

The autophage design Dr Harkness and Dr Yemets have come up with is not, in truth, likely to worry those who use large liquid-fuelled rockets to launch heavy satellites. The way rockets scale up means that freedom from gubbins is more valuable for small craft than big ones. But a small solid-fuel rocket fitted with an autophage engine might prove an ideal launcher for the growing number of small satellites being sent into space. Dr Harkness thinks such a vehicle could even be designed to launch an individual CubeSat, a type of satellite that has a volume of a litre and a maximum weight of 1.33kg.

At present, most CubeSats are taken up in batches alongside other payloads on big, liquid-fuelled rockets, and even Rocket Lab, a firm that has recently started offering dedicated CubeSat launches, uses liquid propulsion. A solid-fuel rocket would, though, be easier to handle than one full of liquid so, though a working autophage rocket is still several years from production, a launch vehicle that eats its way into space looks an attractive idea. ■



航天飞行

吃进轨道

一种会吞噬自己的火箭可能很快要升空

把卫星送进太空要费很大力气。一般来说，火箭的有效载荷只占起飞重量的5%左右。余下的载荷中，发动机占了一部分，但大部分是火箭推进剂（相互反应以产生进入轨道所需推力的燃料和氧化剂）以及处理这些推进剂所需的部件（储箱、泵、阀门、管道和容纳它们的箭体）。这些部件不仅成本高昂，本身的质量也需要额外的燃料来推进。如果可以不用这些部件，设计出仅由有效载荷、发动机和推进剂组成的火箭，就能提高效率。

这正是一个研发团队希望实现的目标。他们把自己的设计叫做“自噬”火箭。该团队由英国格拉斯哥大学（Glasgow University）的帕特里克·哈克尼斯（Patrick Harkness）和乌克兰第聂伯彼得罗夫斯克国立大学（Oles Honchar Dnipro National University）的维塔利·叶梅茨（Vitaly Yemets）领导。这种火箭的箭体是一个由燃料和氧化剂构成的坚固圆柱体。发射时，发动机位于这个圆柱的底部。但在火箭到达轨道的过程中，发动机会一路向顶部吞噬燃料，消耗掉火箭的结构。这将减少发射重量，从而节省燃料。哈克尼斯和叶梅茨在刊载于《航天器与火箭杂志》（Journal of Spacecraft and Rockets）的文章中说，他们现在已经对这种火箭发动机进行了第一次地面试车。

不消说，他们提出的设计需要用到固体的燃料和氧化剂。固体火箭常见于军事应用，例如洲际弹道导弹，但由于其推力很难控制，因而不太常用于发射卫星。就像窜天猴（它们本身使用的就是固体燃料）一旦点着引线，燃料的燃烧就无法控制了。液体火箭是卫星发射的首选，因为它们的推力可以通过改变推进剂到发动机的流速来调整，也就更容易将有效载荷准确地送进轨道。但哈克尼斯和叶梅茨认为他们的自我消耗设计也可以克服这个难题。

他们设计的发动机燃料是一个由聚丙烯制成的空心圆柱体，这种塑料的硬度和强度足以用作火箭外壳。圆柱体中间填充的是两种氧化剂高氯酸铵和硝酸铵的粉末混合物。在发动机试车时，研究人员使用液压顶将药柱推进已预热的发动机中，在这里和一个经专门设计的汽化表面接触。这个表面需要被加热以令燃料和氧化剂汽化，表面上的穿孔将分别收集两种气体并将它们导入燃烧室，在那里混合燃烧。要启动这个过程，汽化表面必须首先被一台燃气燃烧器加热到工作温度（在经营模式中将用电力加热）。但是一旦系统启动并运行，汽化和燃烧就开始自行维持。而且，通过改变药柱进入发动机的速度，就可以控制所产生的推力大小。

当然，真正的火箭是没有液压顶来输送燃料的。但哈克尼斯希望牛顿运动定律能够解决这个问题。虽然测试原型的动力还不足以验证这一设计理念，但他们的想法是发动机的加速度将能不断克服药柱的惯性，迫使药柱抵靠汽化表面并使其消耗。此外还可以对这一过程加以调节，方法是使用某种节流阀来减缓向发动机输送药柱的速度，从而实现对推力大小的控制。相比之下，燃料“在原位”燃烧的普通固体火箭就无法用这种方式控制推力。

事实上，哈克尼斯和叶梅茨提出的自噬设计不大可能令那些使用大型液体火箭发射重型卫星的机构感到担忧。火箭运力提升的原理意味着，减少部件的拖累对小火箭比大火箭更有价值。但对于越来越多被送入太空的小型卫星来说，装有自噬发动机的小型固体火箭可能会成为理想的发射装置。哈克尼斯认为，这种火箭甚至可以用于发射单个的立方体卫星（CubeSat），这是一种体积为1升、最大重量为1.33公斤的卫星。

目前，大多数立方体卫星都是被成批地装载在大型液体火箭上，和其他有效载荷一起发射的。就连最近开始提供立方体卫星单独发射的公司火箭实验室（Rocket Lab）也使用液体火箭。然而，固体火箭比装满液体燃料的火箭更易于操控。因此，尽管可发射的自噬火箭仍需数年才能投产，但是一路“吃”进太空的运载火箭似乎仍是一个颇有吸引力的想法。■



Schumpeter

iSupply

The global smartphone supply chain is a modern marvel. But it will have to reinvent itself

FEW monuments to globalisation rival the smartphone industrial complex. This year 1.5bn devices will be made by millions of workers at hundreds of firms in dozens of countries. When you tap your screen you are touching an object just as miraculous as Javanese spices seemed to 16th-century European nobs. In commercial terms the system is too important to fail. But this cosmopolitan wonder faces twin threats: the fading of the smartphone boom and the end of globalisation's golden era. To assess these risks, Schumpeter has "stress-tested" the supply chain's financial strength. Overall it is in reasonable shape, but a long tail of weak firms provokes concern.

For decades most consumer-electronics companies produced their wares close to home. Nokia hit the big time while churning out handsets from the small town of Salo in Finland. Then in the 1990s a few pioneers, including Cisco, and later Dell, outsourced manufacturing to a network of factories, mostly in Asia. That so impressed Steve Jobs at Apple that in 1998 he hired Tim Cook, a supply-chain expert. Mr Cook created a global archipelago of contract manufacturers and suppliers, which today has hundreds of key sites around the world.

The four other big smartphone firms each add their own twist. Samsung makes more of its devices in-house, but has huge factories in Vietnam and sells semiconductors and displays to its rivals. Huawei, based in Shenzhen, prefers to make components internally. Xiaomi and OPPO, both Chinese, are even leaner than Apple, using outsourced production at home and abroad.

These intricate networks have a vast economic footprint, as a recent IMF study shows. At the peak in October 2017, smartphone components accounted for over 33% of exports from Taiwan, 17% of those from Malaysia and 16% from Singapore. Smartphones comprise 6% of Chinese exports. Memory chips flow from South Korea and Vietnam; system chips from Malaysia, Taiwan and elsewhere; and displays from Japan and South Korea. Rich-world firms, such as Qualcomm, sell licences to use their intellectual property (IP). The parts are then assembled, mainly by armies of Chinese workers. The machine cranks up ahead of the launch of each new model—Apple may reveal its latest on September 12th—and spews out millions of devices.

The first threat to this system is that the number of new smartphones sold fell by 0.3% last year as China reached saturation and Western users upgraded less often. Yet despite this, total revenues increased by 10% for all suppliers of hardware and services to smartphone firms. Firms that sell games and services are booming; the sales of developers through Apple's App Store rose by over 30% last year, to \$27bn. New phones are stuffed with pricier chips and displays. The total value of the parts inside the iPhone X and Samsung Galaxy S9 is 28% and 13% more, respectively, than in their predecessor models, according to IHS Markit.

The system's chief weakness is its long tail of puny firms. Many observers worry about labour conditions in the supply chain; the typical poorly paid assembly worker in China handles 1,700 phones a day. But life has been hard for some capitalists, too. One way to show this is to examine the finances of 42 big Apple suppliers. (These figures are estimates, using data from Bloomberg, IHS and Morgan Stanley; the 42 firms cover about three-quarters of Apple's suppliers' total gross profits and we weight each firm for the share of its business with Apple.)

Apple and 13 of its chip suppliers earn over 90% of the total pool of profits from the Apple system. Meanwhile the tail of other firms doing more basic activities must pay for most workers, inventories and fixed assets (see chart). So they have in aggregate a weak return on equity, of 9%, and a net profit margin of just 2%. Their earnings have not risen for five years. They include assemblers such as Taiwan's Hon Hai and niche component makers, some of which are visibly struggling. On August 22nd AAC Technologies, a specialist in making phones vibrate, said its second-quarter profits fell by 39% compared with the previous year.

The typical supplier is secretive, battle-hardened, controlled by its founder and accustomed to volatility. If you take a broader sample of 132 suppliers to Apple, Samsung and Xiaomi, typically a third of them are shrinking in any given year. Their tight finances leave them exposed to trade tensions, which are the industry's second big problem. In April America imposed sanctions on ZTE, a Chinese electronics firm that makes some handsets (they were lifted in July). So far America and China have refrained from messing with any other firms. Yet if tensions escalate, they could be in the firing line.

Apple, Samsung and most semiconductor makers could ride out such tensions, with their high margins and cash-laden balance-sheets. But the long chain of other suppliers could not, given their razor-thin margins, big working-capital balances and fixed costs. Tariffs could push them into the red. Of the 132 firms, 52% would be loss-making if costs rose by just 5%. And a ZTE-style cessation of trade would be disastrous. If revenues dried up and the 132 firms continued to pay their own suppliers, short-term debts and wages, 28% of them would run out of cash within 100 days.

Choking the smartphone complex would be madness: consumers would be upset, millions of jobs would be at risk in Asia, and stockmarkets in America and East Asia would suffer. But even if governments avoid a shock, over time they are likely to push for a greater share of the profits, jobs and IP. America

wants more plants at home. China is suing several foreign memory-chip firms for price-fixing and wants to build an indigenous semiconductor capability. If you are running a big firm in the smartphone complex, you should be reimagining things in preparation for a less open world. In a decade, on its current trajectory, the industry will be smaller, with suppliers forced to consolidate and to automate production. It may also be organised in national silos, with production, IP, profits and jobs distributed more evenly around the world. Firms will need to adapt—or be swiped away. ■



熊彼特

iSupply

全球智能手机供应链是一大现代奇迹，但它的自我重塑在所难免

要说全球化的功绩，智能手机产业体系可谓一座罕有匹敌的丰碑。今年，几十个国家的数百家企业的数百万名工人将制造出15亿台手机。当你点击手机屏幕，你触摸的这件东西就如同16世纪欧洲贵族眼中的爪哇香料一般神奇。从商业方面看，智能手机产业至关重要，不容有失。但这一全球化奇迹正面临双重威胁：智能手机热潮的消退和全球化黄金时代的结束。为评估这些风险，本专栏对智能手机供应链的财务实力做了“压力测试”。总体而言，这条供应链目前的状态良好，但其中大量弱小公司构成的“长尾”令人担忧。

曾有几十年的时间，大多数消费电子企业都选择在本土生产设备。诺基亚在它大红大紫的时代就是在芬兰小镇萨洛（Salo）大批量生产出自己的手机。到了上世纪90年代，思科以及稍后的戴尔等公司率先将制造流程外包给主要位于亚洲的工厂网络。苹果公司的乔布斯深受启发，遂在1998年聘请了供应链专家库克。库克在全球建立了星罗棋布的合同制造商及供应商网络，如今在世界各地拥有数百个重要工厂。

其他四家大型智能手机公司在此基础上各有变化。三星如今主要在自己公司内部生产设备，但在越南拥有大型工厂，并向竞争对手销售半导体和显示屏。总部位于深圳的华为倾向在公司内部生产组件。同为中国品牌的小米和OPPO则比苹果更精简，采用外包形式在国内外生产产品。

正如国际货币基金组织最近一项研究显示，这些错综复杂的网络产生了广泛的经济影响。在2017年10月的巅峰期，智能手机组件占台湾出口的33%以上、马来西亚的17%、新加坡的16%。智能手机占到中国出口的6%。韩国和越南大量出口内存芯片；系统芯片主要来自马来西亚、台湾等地；显示屏来自日本和韩国。像高通（Qualcomm）这样的富裕国家的公司会出

售使用其知识产权的许可证。之后，再由主要由中国工人组成的制造大军组装产品。每款新机型推出前（苹果预计会在9月12日发布新产品），这台“供应链机器”就会开动起来，源源不断地输出数百万台设备。

这个系统面临的第一个威胁是市场萎缩。随着中国市场饱和，西方用户升级换机的频率降低，去年售出的新智能手机数量下降了0.3%。尽管如此，所有智能手机公司的硬件和服务供应商的总收入仍增长了10%。销售游戏和服务的公司正蓬勃发展——苹果App Store的应用开发者的销售额去年上升超过30%，达到270亿美元。新款手机采用的芯片和显示屏价格也愈加昂贵。据全球信息提供商IHS Markit的数据，iPhone X和三星Galaxy S9采用的部件总值分别比各自的上一代机型高出28%和13%。

这个系统的主要弱点是由弱小公司构成的“长尾”。许多观察人士为供应链中工人的劳动条件感到担忧——中国的低收入装配工人通常每人每天要经手1700台手机。但一些资本家也度日艰难。从苹果的42家大型供应商的财务状况可见一斑。（这些数字是根据彭博、IHS和摩根士丹利的数据估算而来；这42家公司的总利润约占苹果供应商总利润的四分之三，我们按每家公司与苹果业务的份额作加权。）

苹果公司及其13家芯片供应商拿走了苹果体系中超过90%的总利润。而负责完成较基本工作的其他“长尾”公司必须支付大部分工人的工资、存货和固定资产（见图表）。因此，它们作为一个总体的股本回报率较低，为9%，净利润率仅为2%。这些公司的营收已五年未见起色。这之中包括台湾的鸿海等组装工厂以及一些小型组件制造商，其中部分公司显然处境艰难。8月22日，主营手机震动部件的瑞声科技表示，其第二季度利润比去年同期下降了39%。

典型的供应商都低调隐秘，久经沙场，由创始人控制，见惯市场风浪。如果把样本扩大至苹果、三星和小米的132家供应商，那么任何一年里通常都有三分之一的供应商在萎缩。财务紧拙令这些公司容易受到贸易摩擦的冲击，这是该行业的第二大问题。今年4月，美国对拥有手机生产业务的

中国电子公司中兴通讯实施制裁（已于7月解除）。目前为止，美国和中国都还保持克制，未对其他任何公司动手。然而，如果贸易战升级，这些公司就可能遭到打击。

苹果、三星和大多数半导体制造商可凭借高利润和资产负债表上充裕的现金捱过这种紧张局面。但长链上的其他供应商由于利润微薄、营运资金余额和固定成本高，情况不容乐观。关税可能令其陷入亏损。只要成本上涨5%，这132家公司中就有52%将出现亏损。中兴式的贸易禁令将是灾难性的。如果收入枯竭，而这132家公司继续偿付自己的供应商、短期债务和工资，其中28%将在100天内耗尽所有现金。

扼杀智能手机产业体系将是疯狂之举：消费者会失望，亚洲的数百万个工作岗位将岌岌可危，美国和东亚的股票市场也将受挫。但即使两国政府此次避免了这样的冲击，长期来看它们很可能还是要为本国争取更大份额的利润、就业岗位和知识产权。美国希望企业更多在美国设厂。中国正在状告几家外国内存芯片公司涉嫌价格垄断，同时希望在本土发展半导体产能。如果你在智能手机产业体系中经营着一家大公司，那就得重做打算，准备适应一个不那么开放的世界。按目前的发展趋势，十年后，这个产业的规模将缩小，供应商被迫整合并实现生产自动化。它也可能要在各个国家的内部组织，令生产、知识产权、利润和就业机会在世界各地更均匀分布。企业将需要调整适应，否则就会被淘汰出局。■



Universities abroad

Dreaming of new spires

British universities are increasingly setting up shop overseas

JOHOR BAHRU, a sprawling, gritty city in Malaysia, would once have been an unusual home for a British university. But just off one of the main roads out of town, past signs to Legoland, sits EduCity, a development which is home to three British institutions, each a humid five-minute stroll from the other. The University of Reading is filled with greenery and gleams in the sun. Newcastle transplants the architecture of the university's Tyneside home to Malaysia. Southampton completes the unlikely trio.

These outposts are part of a broader trend. Britain's 136 universities now have 39 foreign campuses abroad, educating 26,000 students, from Middlesex University's site in Mauritius to Glasgow Caledonian's branch in Bangladesh (see map). Only Australia, which has a much smaller higher-education system, can boast a similar ratio of home to overseas campuses.

In addition, there are many more students taking British degrees taught by foreign institutions. In these arrangements British universities provide a curriculum, and sometimes teaching staff, training and support, in return for a juicy fee. In all, in 2015-16 there were 703,000 students studying for a British higher-education qualification overseas. Including international students in Britain, British universities have 1.1m foreign students on their books, a number fast catching up with the 1.9m British students they are educating.

The universities' overseas footprint began to grow fast in the 2000s, as they rushed to meet demand in growing economies, mostly in Asia. "Like in any other industry, universities dipped their toes in the water, then took

the plunge,” says Vangelis Tsiligiris of Nottingham Business School. High-ranking universities were the most likely to set up campuses, in the hope of attracting better staff and more students, both of which would help them up the international rankings. In the early days, less-fancy universities were happier letting local colleges teach their qualifications. Increasingly, the more prestigious universities prefer this approach too. All universities wax lyrical about the benefits of fostering international research links; in some cases it might even be true.

The attraction for students is clear. A British degree holds a promise of quality, explains Mark, a local undergraduate at Sunway University, a Malaysian institution just outside Kuala Lumpur. Studying at home allows students to avoid Britain’s increasingly strict visa regime. It is also much cheaper. A joint Lancaster-Sunway degree costs around 28,000 ringgit (£5,300, or \$6,820) a year, compared with £9,250 for a Lancaster degree in Britain—which would also involve hefty travel and living costs. In the past five years, Sunway’s student numbers have trebled, to 7,500. The offer of British qualifications has been crucial, says Graeme Wilkinson, its vice-chancellor—although, he adds, having a water park next door did no harm.

For countries like Malaysia, importing foreign universities offers a way to build institutional expertise quickly. Two decades ago, Malaysia began to position itself as a hub for higher education, seeking to attract students from around the region, as well as from farther-away Muslim countries, explains Sarah Deverall, head of the Malaysian branch of the British Council, which promotes British culture abroad. Malaysia now has more students studying for a British qualification than any country bar Britain itself. Other places have courted foreign universities for different reasons. Dubai, for instance, encouraged them to set up shop to cater to the children of its large expat population.

Despite support from host governments, dealing with a foreign higher-

education system is hard work. Sam Weston, who works for the University of Reading in EduCity, admits that recruitment has been slower than hoped. “It’s early days,” she explains. “We’re still getting the word out.” Both Wolverhampton and Aberystwyth have closed campuses in Mauritius, after failing to attract students. Last year Warwick scrapped plans to build a campus in California, following difficulties in navigating local regulation. Others relied too heavily on the enthusiasm of individual university officials in Britain, and floundered when those people moved on.

Universities also have to adapt, sometimes uncomfortably, to local politics. In July an academic was removed from the management board of Nottingham’s Ningbo campus—a joint venture with the Chinese government—after writing an essay critical of the 19th Party Congress, a meeting of government bigwigs. Restrictions in Malaysia mean there are no student unions on the British campuses there.

Partly as a result of these difficulties, most British universities selling their qualifications abroad prefer to get a local institution to do the teaching. But this arm’s length approach is not entirely trouble-free. Some worry that the quality of education is not always up to scratch. The Quality Assurance Agency, which helps regulate British universities (including their overseas empires) says that malpractice is rare. But some university officials privately doubt that teaching is always equal to that found in Britain, as is meant to be the case.

All of this means universities are beginning to tread more carefully. There has been a move away from the “hands-off model”, in which universities provide certificates and little else, to more genuine partnerships, says Janet Ilieva, a higher-education consultant based in Britain.

A number of governments in big markets are also growing more cautious. Two years ago, Malaysia banned any new links with universities not in

the top 5% of a global ranking. At the same time, China reportedly halted approvals of new joint-venture campuses. Expansion is also kept in check by the fact that universities are reluctant to do anything that might water down their British character. David Willetts, a former higher-education minister, has complained that he was unable to convince any university to create a vehicle to list on the stock market to promote a global higher-education brand.

Last year growth in the number of students studying for British degrees overseas slowed, to just 1%. But university officials don't expect the lull to last long. Some British universities are considering setting up continental campuses after Brexit, in order to sidestep expected restrictions on immigration. A looming demographic dip in the number of British 18-year-olds, and threats by politicians to cut tuition fees at home, are also making universities look abroad. As demand for degrees grows around the world, it is likely that British universities will become ever more international. ■



海外办学

梦想新塔尖

英国大学不断扩大海外业务

马来西亚的新山市（Johor Bahru）扩张无序，砂砾遍地，在过去不大会是英国大学安家的地方。但就在城外一条主要道路的旁边、过了通往乐高乐园的路标之后，坐落着新山国际教育城（EduCity）——三个英国高等学府的分校所在地。在湿热的空气里，从一所学校溜达到另一所只要五分钟。雷丁大学的校园绿意葱茏，在阳光下熠熠生辉。纽卡斯尔大学把在英国泰恩（Tyneside）本部的建筑风格移植到了马来西亚。再加上南安普顿大学，构成了一个意想不到的组合。

这些海外分校是更广泛趋势的一部分。从毛里求斯的密德萨斯大学（Middlesex University）分校，到孟加拉国的格拉斯哥卡利多尼安大学（Glasgow Caledonian）分校，英国的136所大学目前在海外设有39所分校，共2.6万名学生（见地图）。只有高等教育体系规模比英国小得多的澳大利亚才有类似的本部分校比。

此外，还有数量多得多的学生在英国以外的其他高校攻读英国学位。在这些合作项目中，英国大学提供课程，有时还提供教学人员、培训和支持，以收取一笔丰厚的费用。两部分加起来，2015至2016年间总计共有70.3万名学生在海外攻读英国高等教育学位。包括在英国的国际学生在内，英国大学共有110万名注册外国学生，这个数字正在迅速追赶上目前在这些大学就读的190万英国学生。

进入21世纪后，英国大学的海外扩张之旅开始提速，因为它们急于满足发展中经济体的需求——主要是在亚洲。诺丁汉商学院（Nottingham Business School）的范吉利斯·兹力吉利斯（Vangelis Tsiligiris）表示：“和其他任何行业一样，大学试了一下水，然后一头扎了进去。”排名靠前的大学最有可能建立分校，希望能以此吸引更优秀的教工和更多的学生，这

两者都有助于它们提升国际排名。在早期，不那么有名的大学更乐意让当地的大学教授它们的学位课程，如今越来越多的知名大学也开始倾向于使用这种方法。所有大学都在高谈促进国际研究合作的益处，在某些情况下这甚至可能是真的。

这类扩张对学生的吸引力是很明显的。在紧邻马来西亚吉隆坡的双威大学（Sunway University），来自本地的本科生马克解释说，英国学位是高质量的保证。在本地学习可以让学生绕过英国日趋严格的签证制度，而且花费也便宜得多。兰卡斯特-双威联合学位项目的费用约为每年2.8万林吉特（合5300英镑或6820美元），而在兰卡斯特大学英国本部攻读学位的费用为一年9250英镑，此外还有高额的交通和生活费用。在过去五年里，双威大学的学生人数增加了两倍，达到7500人。副校长格雷姆·威尔金森（Graeme Wilkinson）说，英国的学位项目发挥了至关重要的作用，虽然——他补充说——隔壁的水上乐园也有一定的吸引力。

对于像马来西亚这样的国家来说，引进外国大学有助于快速获得打造高等院校的能力。负责在海外推广英国文化的英国文化协会（British Council）的马来西亚办事处负责人戴思薇（Sarah Deverall）解释说，20年前马来西亚开始将自己定位为高等教育中心，以吸引来自该地区以及更远的穆斯林国家的学生。除英国本国以外，马来西亚现在是拥有最多攻读英国学位的学生的国家。其他国家则出于其他原因引进外国大学。例如，迪拜鼓励它们开设分校是为了满足这里庞大的外派人士子女的教育需求。

尽管有东道国政府的支持，与外国的高等教育体系打交道仍是件难事。在新山国际教育城雷丁大学工作的山姆·维斯顿（Sam Weston）承认，招生工作的进度比大家期望的要慢。“现在还是项目初期，”她解释说，“我们还在大力宣传。”由于未能吸引到足够的学生，胡弗汉顿大学（Wolverhampton）和亚伯大学（Aberystwyth）都关闭了在毛里求斯的分校。去年，由于在应对当地监管方面遇到困难，华威大学（Warwick）取消了在美国加州建立分校的计划。其他项目都过分依赖在英国的个别大学官员的热情，在这些人转移注意力之后项目就陷入困境。

大学也必须适应地方政治环境，有时这个过程并不愉快。7月，与中国政府合作开办的诺丁汉大学宁波校区的一名学者著文批评了十九大，之后被免除管理委员会职务。马来西亚的限制条件则意味着那里的英国校园不能成立学生会。

一定程度上由于这些困难，大多数在海外销售学位项目的英国大学更愿意让本地大学承担教学工作。但这种保持距离的方法并非完全没有问题。有些人担心教育质量并不总能达标。帮助规范英国大学（包括其海外分校）的英国高等教育质量保证委员会（Quality Assurance Agency）表示，敷衍了事的情况很少见。但是一些大学官员私下怀疑分校的教学水平并不总是与英国的相当，而办分校的初衷就是要保持一致的水准。

这促使大学开始更小心地行事。常驻英国的高等教育顾问珍妮特·伊利亚娃（Janet Ilieva）表示，合作办学已经从英国大学仅提供证书而其他基本不管的“放手模式”转变成更有实质内容的合作伙伴关系。

一些拥有庞大教育市场的国家的政府也变得更加谨慎。两年前，马来西亚禁止与不在全球排名前5%的大学创建任何新的合作办学项目。与此同时，据报道中国已经暂停了对新合办分校的审批。此外，大学不大愿意做任何可能消减自身英国特色的事情，这也限制了它们的扩张。前高等教育大臣戴维·威利茨（David Willetts）抱怨说，他无法说服任何一所大学成立机构上市，以推广一个全球高等教育品牌。

去年，在海外攻读英国学位的学生数量增长放缓，增幅仅为1%。但大学官员并不认为这种情况会持续很久。一些英国大学正考虑在英国脱欧后设立欧洲大陆校区，以避开预期中的对移民的限制。英国18岁人口的数量即将下降，加上政客们威胁要在国内削减学费，都促使大学将目光投向海外。随着全世界对学位的需求不断增长，英国大学可能会变得越来越国际化。 ■



Ten years after Lehman

Has finance been fixed?

The system is safer. But the right lessons have not all been learned

WHEN historians gaze back at the early 21st century, they will identify two seismic shocks. The first was the terrorist attacks of September 11th 2001, the second the global financial crisis, which boiled over ten years ago this month with the collapse of Lehman Brothers. September 11th led to wars, Lehman's bankruptcy to an economic and political reckoning. Just as the fighting continues, so the reckoning is far from over.

Lehman failed after losing money on toxic loans and securities linked to America's property market. Its bankruptcy unleashed chaos. Trade fell in every country on which the World Trade Organisation reports. Credit supplied to the real economy fell, by perhaps \$2trn in America alone. To limit their indebtedness, governments resorted to austerity. Having exhausted the scope to cut interest rates, central bankers turned to quantitative easing (creating money to buy bonds).

Just as the causes of the financial crisis were many and varied, so were its consequences. It turbocharged today's populist surge, raising questions about income inequality, job insecurity and globalisation. But it also changed the financial system (see Briefing). The question is: did it change it enough?

One way—the wrong way—to judge progress would be to expect an end to financial crises. Systemic banking meltdowns are a feature of human history. The IMF has counted 124 of them between 1970 and 2007. There is no question that they will occur again, if only because good times breed complacency. Consider that the Trump administration is deregulating

finance during an economic boom and that the Federal Reserve has not yet raised counter-cyclical capital requirements. Even when prudence prevails, no regulator is a perfect judge of risk.

A better test is whether the likelihood and size of crises can be reduced. On that, the news is both good and bad.

First, the good. Banks must now fund themselves with more equity and less debt. They depend less on trading to make money and on short-term wholesale borrowing to finance their activities. Even in Europe, where few banks make large profits, the system as a whole is stronger than it was. Regulators have beefed up their oversight, especially of the largest institutions that are too big to fail. On both sides of the Atlantic banks are subject to regular stress tests and must submit plans for their own orderly demise. Derivatives markets of the type that felled AIG, an insurer, are smaller and safer. Revamped pay policies should prevent a repeat of the injustice of bankers taking public money while pocketing huge pay-packets—in 2009 staff at the five biggest banks trousered \$114bn.

Yet many lessons have gone unlearned. Take, for example, policymakers' mistakes in the aftermath of the crisis. The state had no choice but to stand behind failing banks, but it took the ill-judged decision to all but abandon insolvent households. Perhaps 9m Americans lost their homes in the recession; unemployment rose by over 8m. While households paid down debt, consumer spending was ravaged.

It has taken fully ten years for the countervailing economic stimulus to restore America's economy to health. Many of Europe's economies still suffer from weak aggregate demand. Fiscal and monetary policy could have done more, sooner, to bring about recovery. They were held back by mostly misplaced concerns about government debt and inflation. The fact that this failing is not more widely acknowledged augurs badly for the policy

response next time (see Free exchange).

Stagnation has, inevitably, fed populism. And, by looking for scapegoats and simplistic solutions that punish them, populism has made it harder to confront the real long-term problems that the crisis exposed. Three stand out: housing, offshore dollar finance and the euro.

The precise shape of the next financial crisis is unclear—otherwise it would surely be avoided. But, in one way or another, it is likely to involve property. Rich-world governments have never properly reconciled a desire to boost home ownership with the need to avoid dangerous booms in household credit, as in the mid-2000s. In America the reluctance to confront this means that the taxpayer underwrites 70% of all new mortgage lending. Everywhere, regulations encourage banks to lend against property rather than make loans to businesses. The risk will be mitigated only when politicians embrace fundamental reforms, such as reducing household borrowing, with risk-sharing mortgages or permanent constraints on loan-to-value ratios. In America taxpayers should get out of the rotten business of guaranteeing mortgage debt. Sadly, populists are hardly likely to take on homeowners.

Next, the greenback. The crisis spread across borders because European banks ran out of the dollars they needed to pay back their dollar-denominated borrowing. The Fed acted as lender of last resort to the world, offering foreigners \$1trn of liquidity. Since then, offshore dollar debts have roughly doubled. In the next crisis, America's political system is unlikely to let the Fed act as the backstop to this vast system, even after Donald Trump leaves the White House. Finding ways to make offshore dollar finance safe, such as pooling dollar reserves among emerging-market countries, relies on international co-operation of the type that is fast falling out of fashion.

The rise of nationalism also hinders Europe from solving the euro's

structural problems. The crisis showed how a country's banks and its government are intertwined: the state struggles to borrow enough to support the banks, which are dragged down by the falling value of government debt. This "doom loop" remains mostly intact. Until Europe shares more risks across national borders—whether through financial markets, deposit guarantees or fiscal policy—the future of the single currency will remain in doubt. A chaotic collapse of the euro would make the crisis of 2008 look like a picnic.

Policymakers have made the economy safer, but they still have plenty of lessons to learn. And fracturing geopolitics make globalised finance even harder to deal with. A decade after Lehman failed, finance has a worrying amount to fix. ■



雷曼破产十年后

金融系统修好了吗？

金融体系已变得更加安全，但没有充分吸取教训

在回顾21世纪初时，历史学家会指出两个重大冲击性事件。一是发生在2001年9月11日的恐怖袭击事件，二是爆发于十年前这个月、以雷曼兄弟倒闭为标志的全球金融危机。“9·11”事件导致了战争，雷曼兄弟破产则导致了经济和政治上的大清算。战争仍在继续，清算也远未结束。

雷曼因与美国房地产市场挂钩的不良贷款和证券的亏损而倒台。它的破产引发了混乱。世贸组织报告的所有国家的贸易额都下降了。仅在美国，提供给实体经济的贷款就下降了2万亿美元。为了限制债务，各国政府采取紧缩措施。由于利率已降无可降，央行官员们转而采取量化宽松政策（加印货币来购买债券）。

金融危机的后果和其原因一样繁多。它助长了今天的民粹主义浪潮，引发了有关收入不平等、职位不稳定以及全球化的质疑。但它也改变了金融体系。问题是，改变得彻底吗？

有一种评判进步的视角是期待金融危机从此终结，但这是错误的。银行业出现系统性崩溃是人类历史的一个特征。据国际货币基金组织统计，这样的崩溃在1970年至2007年间共发生过124次。毫无疑问，未来它必将再次发生，哪怕只是因为好日子过久了而滋生自满。看看特朗普政府在经济繁荣时期放松对金融的管制，以及美联储尚未启动逆周期资本缓冲要求，就能知晓一二。即使监管机构普遍谨慎，也没有哪家能够完美地判断风险。

更好的检验进步的方法是看危机再次发生的可能性和规模是否可以减小。在这方面，喜忧参半。

先来说喜。现在银行在资本结构上必须增加股本、减少债务。它们降低了对靠交易盈利和靠短期批发贷款融资的依赖。即使在没什么银行实现大笔

盈利的欧洲，整个银行业体系也比以前更为强健。监管机构加强了监管，特别是对那些大到不能倒的金融机构。大西洋两岸的银行都要定期接受压力测试，并且必须提交有序破产计划。曾经压倒了保险公司美国国际集团（AIG）的衍生品市场如今规模更小、更安全。改革后的薪酬政策应该可以杜绝银行家一边花着公共资金，一边领取巨额薪水的不公现象——2009年五家最大银行的员工共捞走了1140亿美元。

然而，许多教训未被汲取。比如决策者在危机后犯下的错误。银行陷入困境，政府别无选择，只能出手相救，但同时基本舍弃了无力偿债的家庭，这样的决定极不明智。可能有900万美国人在经济衰退中失去了自己的房子，失业人数增加了800多万。家庭要偿还债务，消费支出遭到扼杀。

用来与危机抗衡的经济刺激措施足足用了十年时间才让美国经济恢复健康。许多欧洲经济体仍然受到总需求疲软的影响。本来可以更快地出台更多的财政和货币政策来实现经济复苏。但这些措施迟迟未出台，主要是因为对政府债务和通胀的错误担忧。这一过失并未得到更广泛的认识，预示着下次危机爆发时的应对政策仍然很可能失当。

经济停滞不可避免地助长了民粹主义。而且，民粹主义一力寻找替罪羊以及惩罚替罪羊的简单粗暴的解决方案，这妨碍了人们正视危机暴露出的真正的长期问题。其中有三个问题十分显著：住房、离岸美元金融和欧元。

下一次金融危机的确切形态尚不清楚——否则肯定就能避免。但不论如何，它很可能都会涉及房地产。富裕国家的政府从来没能正确地协调它们推高住房自有率的愿望和避免危险的家庭信贷泡沫的需要，就像在2005年前后发生的那样。在美国，缺乏解决这一问题的意愿导致纳税人借走了所有新增抵押贷款的70%。各地的法规都鼓励银行发放房地产抵押贷款，而不是向企业放贷。政治家必须采取一些根本性的改革才能减轻风险，比如增加风险分担抵押贷款，或对贷款价值比率实行永久限制，以减少家庭借贷。在美国，纳税人应该从担保抵押贷款的泥潭中抽身。可惜，民粹主义者几乎不可能去挑战置业民众。

第二个问题是美元。当时的欧洲银行缺乏足够的美元来偿还以美元计价的贷款，这场危机因而跨境蔓延开来。美联储起到了全球最后贷款机构的作用，向外国人提供了1万亿美元的流动性。从那时起，离岸美元债务大致翻了一番。在下一次危机中，即使特朗普离开了白宫，美国的政治体系也不太可能让美联储成为这个庞大体系的后盾。要寻找保证离岸美元金融安全的方法——诸如在新兴市场国家之中汇集美元储备——有赖于国际合作，但这种合作正在迅速过时。

民族主义的兴起也阻碍了欧洲解决欧元的结构性问题。上一次金融危机显示了一国银行与其政府之间紧密交织的关系——政府难以进行足够的借款来支持银行，而银行又受到政府债务价值下跌的拖累。这种“厄运循环”基本没变。除非欧洲能跨境分担更多风险——无论是通过金融市场、存款担保还是财政政策——否则欧元的未来仍将存疑。欧元一旦出现混乱并崩溃，2008年的危机看起来将只是小儿科。

政策制定者已使经济更加安全，但他们仍需要吸取大量的经验教训。而由于分裂的地缘政治，应对全球化金融更是难上加难。雷曼轰然倒塌十年之后，金融业仍有大量问题要解决，令人担忧。■



Economic and financial indicators

Economic outlook

The Economist's latest poll of forecasters, September



经济与金融指标

经济前景

《经济学人》9月对各家预测机构的最新调查



Machine learning

Head full of brains, shoes full of feet

A sense of curiosity is helpful for artificial intelligence

SOFTWARE that can learn is changing the world, but it needs supervision. Humans provide such oversight in two ways. The first is to show machine-learning algorithms large sets of data that describe the task at hand. Labelled pictures of cats and dogs, for instance, allow an algorithm to learn to discriminate between the two. The other form of supervision is to set a specific goal within a highly structured environment, such as achieving a high score in a video game, and then let the algorithm try out lots of possibilities until it finds one that achieves the objective.

These two approaches to “supervised learning” have led to breakthroughs in artificial intelligence. In 2012 a group of researchers from the University of Toronto used the first method to build AlexNet, a piece of software that in a competition recognised one in ten more images than its closest competitors. In 2015 researchers at DeepMind, a British AI firm owned by Alphabet, used the second method to teach an algorithm to play Atari video games at superhuman levels, an advance that led to later triumphs at Go, a board game.

Such breakthroughs underpin much of the excitement in AI today. But supervised learning has weaknesses. Human guidance is expensive, involving manual tasks such as labelling data or designing virtual environments. Once complete, that guidance cannot be used for other lessons. Nor is supervised learning very realistic. The real world does not often label things or provide explicit signals about the progress that a learner is making. Both AlexNet and DeepMind’s game-playing agents require millions or billions of examples or simulations to work on—and

powerful computers that use lots of electricity. “If you are going to do this with every new [training] task, you are going to need dozens of nuclear power plants doing nothing else,” says Pierre-Yves Oudeyer, an AI researcher at Inria, the French national institute for computer science in Paris.

If AI is going to really take off, then something more is needed. Dr Oudeyer says that requirement is driving interest in one of the fundamental mechanisms used by humans to learn about the world: curiosity. Instead of training algorithms with functions created by humans, Dr Oudeyer and others have spent the past 20 years developing artificial agents that use their own intrinsic reward systems to inspect the world around them and gather data. Such work is starting to come into its own.

The first generation of curious AI used “prediction error” to motivate the agent. The software would explore the environment it was required to study, whether physical or virtual, looking for things that deviated significantly from what it predicted it would find. In other words, it searched for novel data. Using prediction error worked, but it had a big flaw. An agent looking at passing cars, for instance, might become obsessed with the sequence of the colours of each car, because its prediction about what colour would come next is almost always wrong. That serves no useful purpose. Nor would a curious robot repeatedly throwing itself down the stairs for the sheer informatic thrill of it, rather than learning to walk its way down.

This problem is fixed by concentrating on the rate at which an agent’s prediction error changes, rather than on the error itself. Using this process, a robot watching the sun rise and set will see its prediction errors start high but decrease over time, as it learns about the actual properties of a physical system. Using the rate of change in a prediction-error system as a signal for the agent to move on to something else is equivalent to giving it a boredom threshold. If the robot trying to work out the pattern of colours of passing cars were to use such a system it would make errors at a steady rate, and get

bored.

Dr Oudeyer has tried out his curiosity algorithms in practical pursuits. In June his group tested one on 600 primary schoolchildren at a number of public and private schools in the Aquitaine region of France. The idea was to model each child's learning in mathematics and present each pupil with exercises in a way that optimises their learning. The system, called KidLearn, treats each child as its own curious agent, and adapts the learning content to suit that child's level of understanding and progress. Unlike other software, KidLearn does not rely on data gathered from other children as its guide but is tuned primarily by a child's curiosity. Dr Oudeyer's researchers will shortly report on how well their system performs.

Researchers in Silicon Valley have been embracing curiosity, too. In a recent paper Deepak Pathak and his colleagues at the University of California, Berkeley and OpenAI, a non-profit research firm backed by Elon Musk, showed that curiosity-driven learning works well across a range of virtual environments, despite the fact that their agent was told nothing about the video games it was playing, nor given any signal when it died in the game or reached a higher level.

The curious agent displayed some interesting behaviour. It learned to achieve higher scores in Breakout, a block-breaking game, because the higher the score the more complicated the pattern of blocks becomes, and the more the agent's curiosity was satisfied. When two curious agents played Pong they learned to rally so long that they crashed the game because they found rallying was more interesting than winning. Dying is also boring. "The agent avoids dying in the games since that brings it back to the beginning of the game, an area it has already seen many times and where it can predict the dynamics well," the researchers said in a recent paper.

There are other ways to bestow machines with the urge to explore. Kenneth

Stanley, a researcher at Uber's AI lab in San Francisco, mimics evolution. His system starts with a set of random algorithms, chooses the one that looks good for the task at hand, then generates a set of algorithms derived from it. Eventually it arrives at an algorithm that is most suited for the job. Evolution, Mr Stanley notes, can yield serendipitous results that goal-driven optimisation cannot. Biological evolution was not explicitly curious about flying, and yet it still managed to come up with birds.

All this suggests that a more complete set of learning algorithms is emerging. Artificial agents that are driven by curiosity or evolution could look after the earlier stages of learning. They are also more suited to sparse environments devoid of much data. Once something interesting has been found, supervised learning could take over to ensure particular features are learned exactly. In August, in a video-game competition in Vancouver, AI agents created by OpenAI, using the most advanced supervised-learning techniques available, were crushed by humans in DOTA 2, a strategy game. More curious modes of learning might have helped AI play the long-term parts of the game, in which there are few reward signals and no changes in score.

"I'd hate to die twice. It's so boring," were the death-bed words of Richard Feynman, an American theoretical physicist. His last salute to curiosity followed a lifetime probing the inner workings of the universe, finding new things to model and to understand. That very human inclination can motivate machines as well as man. ■



机器学习

才智满脑，足下生风

好奇心有助于人工智能的发展

会学习的软件正在改变世界，但需要监督。人类以两种方式监督它们。一是向机器学习算法展示描述当下任务的大量数据。例如有标记的猫和狗的图片，让算法学习区分两者。另一种监督是在高度结构化的环境中设定一个特定目标，例如在某款电子游戏中获得高分，再让算法尝试众多可能性，直到找到能实现目标的那个。

这两种“监督学习”的方法已经在人工智能（AI）领域带来了突破。2012年，多伦多大学的一组研究人员用第一种方法构建了AlexNet，这个软件在一项竞赛中识别出的图像比其最接近的竞争对手多了十分之一。2015年，Alphabet旗下的英国人工智能公司DeepMind的研究人员用第二种方法教一个算法玩电子游戏雅达利（Atari），水平超过人类。后来在围棋上取得的胜利正源自这一成果。

这些突破为今天AI很多令人兴奋的发展奠定了基础。但监督学习也存在缺陷。人工指导涉及标记数据或设计虚拟环境等人工作业，成本高昂。指导完成后还不能用于其他学习。监督学习也不大现实。现实世界通常不会标记事物或为学习进展提供明确的信号。AlexNet和DeepMind的游戏智能体都需要几百万至几十亿个示例或模拟，以及消耗大量电力的强大计算机。位于巴黎的法国国家信息与自动化研究所（Inria）的AI研究员皮埃尔-伊夫·乌迪耶（Pierre-Yves Oudeyer）说：“如果你打算在每次新的[训练]任务中都这样做，那么就需要几十个核电站专门为你服务。”

因此，AI若要真正腾飞，还需要些别的东西。乌迪耶说，这推动研究人员开始探索人类了解世界的基本机制之一：好奇心。乌迪耶和其他人不再使用由人类创建的函数来训练算法，而是在过去20年里开发人工智能体，用它们自己内在的奖励系统来检视周围的世界并收集数据。这样的工作正开

始获得成功。

第一代“好奇心AI”使用“预测错误”来激励智能体。该软件会探索它需要研究的实体或虚拟环境，寻找与它的预期差异很大的东西。换句话说，它是在搜索新奇数据。这种方法行得通，但有一个很大的缺陷。例如，观察过往车辆的智能体可能会沉迷于经过车辆的颜色顺序，因为它对下一部车的颜色做出的预测几乎总是错误的。但这样做没有实际用处。一个好奇的机器人如果不学习怎么走下楼梯，而是为了寻求信息的刺激反复从楼梯上滚下去，同样也没有意义。

解决这个问题的方法是把注意力放在智能体的预测错误变化率而不是错误本身上。使用这种方法，机器人在刚开始观察日出日落时预测错误会很多，但随着它对一个物理系统实际属性的认识加深，错误逐渐减少。将预测错误系统的变化率用作智能体进入下一个任务的信号等于给它设了一个无聊阈值。如果一个要搞清过往车辆颜色规律的机器人使用这样一个系统，它会保持稳定的错误率，进而感到无聊。

乌迪耶在实际研究中尝试了他的好奇心算法。今年6月，他的研究小组在法国阿基坦地区（Aquitaine）的一些公立和私立学校对600名小学生开展了测试。他的构想是为每个孩子的数学学习过程建模，提供因人而异的优化练习。该系统名为KidLearn，它把每个孩子都视为自己的好奇智能体，调整学习内容以适应孩子的理解水平和学习进度。与其他软件不同，KidLearn不依赖从其他儿童那里收集到的数据作为引导，而主要是根据孩子的好奇心来调整。乌迪耶的研究人员很快将会公布这一系统的表现。

硅谷的研究人员也一直在研究好奇心。在最近的一篇论文中，来自加州大学伯克利分校和伊隆·马斯克资助的非营利性研究公司OpenAI的迪帕克·帕沙克（Deepak Pathak）及其同事表明，尽管他们的智能体在玩电子游戏时没有得到任何输入，也没有在被打败或过关时得到任何信号，好奇心驱动的学习仍然在一系列虚拟环境中运作良好。

好奇智能体展示了一些有趣的行为。它学会了在打砖块游戏Breakout中获

得更高的分数，因为得分越高，砖块模式越复杂，智能体的好奇心就越能得到满足。两个好奇智能体在玩乒乓球游戏Pong时学会了没完没了地来回击球而不得分，一直打到游戏崩溃，因为它们发现这比获胜更有趣。死掉也很没意思。研究人员在最近发表的一篇论文中说：“智能体会避免在游戏中死掉，因为这会让游戏重头开始，而开始阶段它已经玩过很多次，也已经能很好地预测走向。”

还有其他方法可以赋予机器探索的冲动。旧金山优步AI实验室的研究员肯尼斯·斯坦利（Kenneth Stanley）模仿了进化过程。他的系统从一组随机算法开始运作，从中选出一个看起来适合手头任务的算法，由此派生出一组算法，最终演变出一个最适合这项工作的算法。斯坦利指出，进化可以产生目标驱动的优化所无法产生的偶然结果。生物进化对飞行没有明显的好奇，但仍然演化出了鸟类。

所有这些都表明，一套更完整的学习算法正在出现。由好奇心或进化驱动的人工智能体可应用于学习的早期阶段，也更适合缺乏大量数据的零散的环境。一旦找到有趣的东西，就可以接着进行监督学习，以确保能准确学到特定的功能。8月，在温哥华举行的电子游戏大赛中，OpenAI用目前最先进的监督学习技术创建的AI智能体在战略游戏DOTA 2中惨败给了人类。更好奇的学习模式可能有助于AI玩转游戏中的长期战略部分，因为其中很少有奖励信号，也没什么得分变化。

“我不想死两回，这可太无趣了。”美国理论物理学家理查德·费曼（Richard Feynman）临终前这样说道。这是他最后一次向好奇心致敬。他终生都在探索宇宙的内在运作方式，寻找新的事物来建模和理解。人类的这种倾向性不仅能激励人，也能驱动机器。 ■



Bartleby

Get with the program

How an algorithm may decide your career

WANT a job with a successful multinational? You will face lots of competition. Two years ago Goldman Sachs received a quarter of a million applications from students and graduates. Those are not just daunting odds for jobhunters; they are a practical problem for companies. If a team of five Goldman human-resources staff, working 12 hours every day, including weekends, spent five minutes on each application, they would take nearly a year to complete the task of sifting through the pile.

Little wonder that most large firms use a computer program, or algorithm, when it comes to screening candidates seeking junior jobs. And that means applicants would benefit from knowing exactly what the algorithms are looking for.

Victoria McLean is a former banking headhunter and recruitment manager who set up a business called City CV, which helps job candidates with applications. She says the applicant-tracking systems (ATS) reject up to 75% of CVs, or résumés, before a human sees them. Such systems are hunting for keywords that meet the employer's criteria. One tip is to study the language used in the job advertisement; if the initials PM are used for project management, then make sure PM appears in your CV.

This means that a generic CV may fall at the first hurdle. Ms McLean had a client who had been a senior member of the armed forces. His experience pointed to potential jobs in training and education, procurement or defence sales. The best strategy was to create three different CVs using different sets of keywords. And jobhunters also need to make sure that their LinkedIn

profile and their CV reinforce each other; the vast majority of recruiters will use the website to check the qualifications of candidates, she says.

Passing the ATS stage may not be the jobhunter's only technological barrier. Many companies, including Vodafone and Intel, use a video-interview service called HireVue. Candidates are quizzed while an artificial-intelligence (AI) program analyses their facial expressions (maintaining eye contact with the camera is advisable) and language patterns (sounding confident is the trick). People who wave their arms about or slouch in their seat are likely to fail. Only if they pass that test will the applicants meet some humans.

You might expect AI programs to be able to avoid some of the biases of conventional recruitment methods—particularly the tendency for interviewers to favour candidates who resemble the interviewer. Yet discrimination can show up in unexpected ways. Anja Lambrecht and Catherine Tucker, two economists, placed adverts promoting jobs in science, technology, engineering and maths on Facebook. They found that the ads were less likely to be shown to women than to men.

This was not due to a conscious bias on the part of the Facebook algorithm. Rather, young women are a more valuable demographic group on Facebook (because they control a high share of household spending) and thus ads targeting them are more expensive. The algorithms naturally targeted pages where the return on investment is highest: for men, not women.

In their book* on artificial intelligence, Ajay Agrawal, Joshua Gans and Avi Goldfarb of Toronto's Rotman School of Management say that companies cannot simply dismiss such results as an unfortunate side-effect of the “black box” nature of algorithms. If they discover that the output of an AI system is discriminatory, they need to work out why, and then adjust the algorithm until the effect disappears.

Worries about potential bias in AI systems have emerged in a wide range of areas, from criminal justice to insurance. In recruitment, too, companies will face a legal and reputational risk if their hiring methods turn out to be unfair. But they also need to consider whether the programs do more than just simplify the process. For instance, do successful candidates have long and productive careers? Staff churn, after all, is one of the biggest recruitment costs that firms face.

There may also be an arms race as candidates learn how to adjust their CVs to pass the initial AI test, and algorithms adapt to screen out more candidates. This creates scope for another potential bias: candidates from better-off households (and from particular groups) may be quicker to update their CVs. In turn, this may require companies to adjust their algorithms again to avoid discrimination. The price of artificial intelligence seems likely to be eternal vigilance.

*Prediction Machines: The Simple Economics of Artificial Intelligence ■



巴托比

跟着算法走

算法可能会决定你的职业生涯

想在一家成功的跨国公司谋个职位？那你要面对很多竞争。两年前高盛从在读学生和毕业生那儿收到了25万份求职申请。这不仅使得求职者成功机会渺茫，也给公司带来了现实的麻烦。假设高盛人力资源部的五名员工组成一个团队，全周无休地每天工作12个小时，在每份申请上花5分钟，也得花近一年才能筛选完这堆积如山的申请。

难怪大部分大公司在筛选低阶职位的求职者时都会用到一种计算机程序，也就是算法。这意味着求职者要是能确切知道算法在找什么，就能从中受益。

维多利亚·麦克莱恩（Victoria McLean）曾是一名银行业猎头和招聘经理，她创办了一家名叫City CV的公司，帮助求职者制作申请。她说，在由人处理简历前，应聘者追踪系统（ATS）会拒掉其中多达75%的申请。这些系统会搜寻符合雇主标准的关键字。一个小建议是研究招聘广告中使用的语言，如果文中是用首字母PM指代项目管理，那么就确保你的简历中有PM的字眼。

这意味着一份没有针对性的简历可能连第一关都过不去。麦克莱恩有个客户曾是高级军官。从他的履历来看，他在培训和教育、采购或军备销售方面可能有工作机会。她说，最佳策略是用三套不同的关键词，做三份不同的简历。求职者还要保证他们在领英上的个人资料能和自己的简历呼应——绝大多数招聘人员会用这个网站来查证求职者的资质。

ATS可能还不是求职者面临的唯一技术关卡。包括沃达丰和英特尔在内的许多公司都采用了名为HireVue的视频面试服务。应聘者在回答视频提问时，AI程序会分析其面部表情（建议与摄像机保持眼神交流）和语言模式（听上去自信是要诀）。手臂乱挥或坐姿慵懒的人很可能会失败。只有通

过了这个测试，求职者才会和一些面试人员面谈。

也许你以为AI程序能够避免传统招聘方法中存在的某些偏见，尤其是面试官倾向于选择与自己相似的求职者这一点。然而歧视会以意想不到的方式出现。安雅·兰布雷希特（Anja Lambrecht）和凯瑟琳·塔克（Catherine Tucker）这两位经济学家在Facebook上发布了宣传科学、技术、工程和数学领域工作机会的广告。她们发现这些广告被推送给男性的可能性比女性大。

这并不是Facebook算法有意识的偏见造成的。相反，年轻女性在Facebook上是一个更有价值的群体（因为她们控制着很大一部分家庭支出），因此针对她们的广告价格更高。这些算法自然而然就瞄准了投资回报最高的页面：男性，而非女性。

多伦多大学罗特曼管理学院（Rotman School of Management）的阿杰伊·阿格拉沃尔（Ajay Agrawal）、约书亚·甘斯（Joshua Gans）和阿维·戈德法布（Avi Goldfarb）在他们关于人工智能的合著*中写道，公司不能把这类结果视作算法的“黑盒子”特性带来的令人遗憾的副作用，就简单打发了。如果它们发现一个AI系统的输出带有歧视性，就要找出原因，然后调整算法直到影响消失。

从刑事司法到保险，AI系统可能带来的偏见已在众多领域引发担忧。人事招聘也一样，如果公司的招聘手段有违公平，那它们将面临法律和声誉上的风险。但它们也要考虑，除了简化招聘流程，这些程序能否发挥更多作用。例如，成功受聘的求职者能否长期且富有成效地在公司工作？毕竟员工流失是公司面临的最大招聘成本之一。

候选人渐渐学会调整简历以通过最初的AI测试，而算法也会相应改进，好筛掉更多的求职者，这可能会引发一场军备竞赛。这又为另一个潜在的偏见创造了空间：来自富裕家庭（以及特定群体）的求职者也许能更及时地更新简历。反过来，公司可能就需要再次调整算法，以避免歧视。运用人工智能的代价似乎是要永远保持警惕。

* 《预测机器：人工智能的简单经济学》 ■



Emerging markets

Lessons from Lusaka

Zambia's looming debt crisis is a warning for the rest of Africa

DEBT stalks Africa once again. Over the past six years sub-Saharan governments have issued \$81bn in dollar bonds to investors hungry for yield. Piled on top of this are murkier syndicated loans and bilateral debts, many to China and tied to big construction projects. Public debt has climbed above 50% of GDP in half the countries in sub-Saharan Africa. The risk of a crisis is growing. Consider Zambia. In 2012 this southern African country could borrow more cheaply than Spain. Now bond yields have jumped above 16%, suggesting that investors fear that it will default (see Middle East and Africa section). This fall from grace offers several lessons.

The first relates to the “moral hazard” of debt write-offs. Zambia, along with 29 other African countries, had many of its debts wiped clean since 2005 under the IMF’s “heavily indebted poor countries” (HIPC) scheme. Sceptics such as William Easterly, an economist, warned at the time that debt relief would simply encourage more reckless borrowing by crooked governments unless it was accompanied by reforms to speed up economic growth and improve governance.

To be fair, the scheme did a lot of good by freeing up money for schools and clinics. But Mr Easterly’s warning was prescient. Zambia took barely a decade to run up fresh debt worth 59% of GDP. The government blames a fall in copper prices from 2011. But the real reason is that Zambia is run by an inept and venal elite who used easy credit to line their own pockets. Much of the money Zambia borrowed was squandered or stolen. Bigwigs skimmed from worthy-sounding contracts. When the country bought bright new fire-engines their price somehow ballooned by 70%, to more than \$1m each. Its

new roads mysteriously cost twice as much per kilometre as its neighbours'. Its new airport terminal was designed to accommodate an improbable ten-fold jump in traffic. A slide into authoritarianism made corruption harder to check. Zambia's main independent paper, which used to squeal about graft, was shut down.

The second lesson is that an increasing number of creditors are willing to encourage irresponsible borrowing. By 2016, when it was clear that Zambia was hurtling towards a crisis, the IMF urged it to put a brake on new borrowing. A spike in interest rates in the bond market provided some discipline. Yet governments, particularly China's, were happy to fill the gap. China now holds perhaps a quarter to a third of Zambia's external debt. (No one knows how much—itself a cause for concern.) The regime has also asked for loans from Turkey, which has ambitions in Africa. That leads to the third lesson. The rules for how to handle Africa's debt crises are changing. In the past much of the money was owed to the World Bank, IMF and Paris Club, an informal group of Western government creditors. This gave the fund the power to demand prudent economic reforms as a condition for help. Now China's influence has risen—and it puts much less emphasis on good governance. The IMF's clout has diminished. When the fund's representative irked Zambia's president, Edgar Lungu, the regime demanded his removal. Amazingly, the fund complied.

Because so many competing interests are involved, Zambia's latest debt mess will be much harder to unscramble. Western creditors and the IMF want the government to stop wasting money on overpriced infrastructure. But the Chinese banks that finance infrastructure projects are also large creditors whose short-term loans to Zambia need to be restructured. If projects are cancelled, they may refuse to roll over existing loans. Or they may demand to be given, say, Zambia's state power utility as compensation. A crisis will be inevitable unless all creditors, China included, give the IMF the backing it needs to chivvy Zambia into getting its finances in order and

its economy back on track. Alas, that seems all too unlikely. ■



新兴市场

卢萨卡的经验教训

赞比亚债务危机迫在眉睫，非洲其他地区应引以为戒

债务阴影再次笼罩非洲。过去六年，撒哈拉以南非洲各国政府向渴求回报的投资者共发行了810亿美元的债券。此外还有更加晦暗不明的银团贷款和双边债务，其中许多是由中国借出，涉及大型建设项目。撒哈拉以南非洲有一半国家的公共债务占GDP比例已超过50%。爆发危机的风险正在加大。以赞比亚为例，2012年，这个非洲南部国家的借贷成本甚至低于西班牙。而现在其债券收益率已升至超过16%，表明投资者担心出现违约。这种糟糕的局面提供了几个教训。

第一个教训涉及债务冲销的“道德风险”。在国际货币基金组织（IMF）的“重债穷国”（HIPC）倡议下，自2005年以来，赞比亚和其他29个非洲国家的许多债务被一笔勾销。当时，经济学家威廉·伊斯特利（William Easterly）等对此持怀疑态度的人警告，除非同时施以改革，加速经济增长并改善治理，否则减免债务只会让不正直的政府变本加厉，无所顾忌地大肆举债。

说句公道话，HIPC有助于释放资金投入到学校和诊所里，的确造福不少。但伊斯特利的警告颇有先见之明。不到十年，赞比亚又一次债台高筑，新积累的债务占到GDP的59%。政府将此归咎于自2011年以来铜价的下跌。但真正的原因是，赞比亚由一群腐败无能的精英阶层管治，他们利用宽松的信贷中饱私囊。赞比亚借来的钱多被挥霍盗用。但凡合同有利可图，就有权贵从中捞取油水。赞比亚购买了崭新的消防车，购入价格不知怎的猛涨70%，每辆价格超过100万美元。新建道路每公里建造成本高得蹊跷，是邻国的两倍。机场客运量离奇地“暴增十倍”，因而需要设计建造新航站楼。国家陷入威权统治，让腐败更难被遏制。一家常常曝光贪污问题的主要独立报纸已被政府关停。

第二个教训是越来越多债权人愿意鼓励不负责任的借贷。到2016年，危机显然已迅速逼近赞比亚，IMF遂敦促该国停止借新债。债券市场利率急升在一定程度上抑制了贷款。然而一些政府，特别是中国政府，却乐于填补放贷空白。中国目前可能持有四分之一到三分之一的赞比亚外债（具体数字无人知晓，这本身就令人担忧）。赞比亚政府还向土耳其寻求贷款，后者对非洲怀有野心。这引出了第三个教训。处理非洲债务危机的规则正在改变。过去，大多数债务的贷方是世界银行、IMF和巴黎俱乐部（由西方政府债权人组成的非正式组织）。这使得IMF有权要求借方做出审慎的经济改革，作为换取援助的条件。如今中国的影响力已经上升，而它对借款国的治理没有太多要求。IMF的影响力已然减弱。之前IMF的代表惹恼了赞比亚总统埃德加·伦古（Edgar Lungu），该国政府直接要求将此人解职。令人吃惊的是，IMF真的照办了。

由于涉及大量利益角力，要理清赞比亚最近的债务乱局，难度将大大增加。西方债权人和IMF希望该国政府停止在造价过高的基建项目上浪费资金。但为基建项目融资的中资银行同时也是赞比亚的大债权人，它们对该国的短期贷款需要重组。如果基建项目叫停，这些银行可能会拒绝对现有贷款展期，或者会要求控制像赞比亚国家电力公司这样的企业作为补偿。危机爆发将在所难免，除非包括中国在内的所有债权人给予IMF所需的支持，让它能够督促赞比亚重建财政秩序，把经济带回正轨。唉，这似乎是痴人说梦了。■



Vladivostok

Brother enemy

Russia's far east is close to China but far from making good use of that fact

MUSIC was blasting, rockets were flying and pancakes were frying in Russia's far east on September 9th. A vast screen placed on the embankment in Vladivostok, a port city on the shores of the Pacific, juxtaposed a North Korean military choir singing patriotic songs with images of burning American flags and rockets hitting Capitol Hill. A few hundred miles to the north-west, Russian, Chinese and Mongolian troops were readying for their joint war games, timed to coincide with the Eastern Economic Forum, a three-day annual gathering organised by Vladimir Putin.

On Russky Island, linked to Vladivostok by a shiny new bridge, Mr Putin and China's president, Xi Jinping, ate caviar and toasted each other with vodka. Russian youth danced to old Soviet pop songs among eastern-style pavilions. All this symbolised Russia's new improved friendship with China, energised by the Western sanctions that followed the annexation of Crimea in 2014, and China's trade war with America.

Russia's pivot to Asia, so Mr Putin has repeatedly promised, would transform the fortunes of the sparsely populated Russian far east. So far, however, the words have not been matched by actions. The two leaders' personal relationship may be flourishing, but the partnership rests largely on military co-operation and political alignment. The only significant economic deal announced during the forum was an agreement by Alibaba, a Chinese e-commerce giant, to team up with Russia's sovereign wealth fund and a Kremlin-friendly oligarch, Alisher Usmanov, who controls the country's rival to Facebook, to create a joint platform. The deal, yet to be finalised, shows that Russia is looking to China for technology, not just

money.

The main beneficiaries of Russia's turn towards China are Mr Putin's cronies and state firms such as Gazprom and Rosneft, the state gas and oil giants. China's investment in Russia overall is relatively modest. The figures are murky, since many Chinese firms invest in Russia via offshore hubs such as Singapore, but it is estimated that China has invested \$40bn in Russia since 1991, half of it in the past six years, a number that is dwarfed by Europe's investment in Russia and China's investment in Europe. Only a tiny part of that Chinese money goes to the Russian far east, and the Chinese presence there is mostly limited to small manufacturers and farmers. Private business is cautious, lacking in incentives and success stories.

China still sees Russia primarily as a source of energy and raw materials. Its trade war with America will increase demand for this. China is particularly keen on Russian soya beans, and Russian officials are promising to give Chinese investors 1m hectares of land to grow them. But research by Ivan Zuenko, a China expert in Vladivostok, shows that the region does not have much available land, and its soya production is already reaching its peak. Such promises, he argues, are "an imitation of activity". The result will be inflated expectations and inevitable disappointment.

Some Russian firms complain that China puts up trade barriers to their products, while flooding the Russian market with goods that often circumvent Russian customs by going via poor Central Asian countries, such as Kyrgyzstan, which are part of Russia's customs union.

For all the talk of closer ties, Russia's border crossings to China are pitiful and often look like sheds rather than gateways. Two planned bridges to China that were supposed to symbolise an improvement have become symbols of the wide gap between expectations and reality.

One, a railway bridge that was proposed more than a decade ago to cut the distance required to shift Russian iron ore to China quite literally hangs in the air. The Chinese long ago completed their part of the bridge to the line in the Amur river that forms the frontier, but Russia has barely started on its much shorter bit. Having missed many deadlines, Russia now promises to complete it next summer, along with a two-lane bridge for cars that will link Blagoveshchensk, little changed since Soviet times, with Heihe, which has grown from a village into a metropolis of 1.6m people and numerous skyscrapers.

One of the main barriers to better relations is Russia's security apparatus, which still views China (and ordinary Russians, for that matter) with great suspicion. In contrast, local people see China as an underexploited opportunity rather than a threat, and are frustrated by Moscow's colonial attitude towards the region. According to Viktor Larin, a scholar of the area, a third of the population in Russia's far east say Moscow's policy towards them is one of the top three security threats, along with international terrorism. Tax breaks have not done much to change this attitude.

Frustration at all this showed up in recent regional elections, where Kremlin-backed candidates fared poorly, and were forced into run-offs, considered a slap in the face for the central government. While ideologues try to persuade Russian people that their destiny lies with authoritarian China, people in the far east seem as keen on Western lifestyle and institutions—such as property and human rights—as are the Chinese. The irony is that Russia's confrontation with the West, as well as its weak property rights, is making it less attractive to China, whose banks are reluctant to do business with people and institutions under sanctions. North Korean choirs, vodka and rockets will not remedy that. ■



符拉迪沃斯托克

兄弟阋墙

俄罗斯的远东地区毗邻中国，但远未充分利用这一点

本月9日，俄罗斯远东地区音乐震彻天空，火箭弹划过天际，煎饼锅里热气腾腾。在太平洋之滨的港口城市符拉迪沃斯托克（Vladivostok），堤岸上的一块巨幅屏幕上同时播放着一个朝鲜军队合唱团高唱爱国歌曲、美国国旗被焚烧和火箭弹袭击国会山的画面。往西北方向数百英里处，俄罗斯、中国和蒙古的军队正在为参加联合作战演习做准备。此次演习与普京组织的一年一度、为期三天的东方经济论坛的举办时间完全重叠。

一座闪亮的新桥连接了符拉迪沃斯托克和俄罗斯岛（Russky Island），普京和习近平在岛上品尝鱼子酱，互敬伏特加。俄罗斯青年在充满东方风情的帐篷外伴着苏联老歌翩翩起舞。所有这些都象征着俄罗斯与中国新近加深了友谊。这友谊因为2014年俄罗斯吞并克里米亚后受到的西方制裁以及中美贸易战而注入了活力。

普京一再承诺俄罗斯的重心将转向亚洲，这将改变人口稀少的俄罗斯远东地区的命运。然而到目前为止，还没有出现与这些承诺匹配的行动。中俄两国领导人的私交可能正在加深，但这种伙伴关系在很大程度上有赖于军事合作和政治联盟。论坛期间宣布达成的唯一的重要经济协议是中国电子商务巨头阿里巴巴同意与俄罗斯主权财富基金以及亲克里姆林宫的寡头阿利舍尔·乌斯马诺夫（Alisher Usmanov）创建一个联合平台。乌斯马诺夫控制着Facebook在俄罗斯的竞争对手。这项尚待最终敲定的协议表明，俄罗斯向中国寻求的不仅仅是资金，还有技术。

俄罗斯将目光转向中国，主要受益者是普京的亲信，还有俄罗斯天然气工业股份公司（Gazprom）和俄罗斯国家石油公司（Rosneft）等国有企业。中国对俄罗斯的投资总额相对来说并不多。许多中国公司都是通过新加坡等离岸中心投资俄罗斯，因此具体数额并不清楚。但据估计，中国自

1991年以来已在俄罗斯投资400亿美元，其中一半是在过去六年中投下的。不过，比起欧洲对俄罗斯的投资额，以及中国对欧洲的投资额，这个数字还是相形见绌。只有一小部分中国资金流向了俄罗斯远东地区，中国在那里的投资主要局限于小型制造商和种植业者。私营企业缺乏动力和成功案例，态度谨慎。

中国主要还是将俄罗斯视为能源和原材料的来源地。中美贸易战将增加这方面的需求。中国对俄罗斯大豆特别感兴趣，俄罗斯官员目前承诺向中国投资者提供100万公顷的土地用于种植大豆。但符拉迪沃斯托克的中国问题专家伊万·祖恩科（Ivan Zuenko）的研究表明，该地区已没有多少可用土地，其大豆生产行将触顶。他认为，这种承诺是“口惠”，结果是推高期望和不可避免的失望。

一些俄罗斯企业抱怨中国对它们的产品设置了贸易壁垒，而俄罗斯市场上却充斥着中国商品，这些货物通常是经由吉尔吉斯斯坦等属于俄罗斯关税同盟的中亚穷国，绕过俄罗斯海关进入市场。

尽管加强两国关系的高谈阔论不少，俄中边境口岸却让人不敢恭维，看起来往往像一个个棚屋而不是门户通道。计划建设的与中国相连的两座桥梁本应成为改善的标志，结果却成了期望与现实之间巨大鸿沟的象征。

其中一座铁路桥是十多年前就提出修建的，目的是要缩短将俄罗斯铁矿石运到中国的路途，但至今尚未完工，当真是“悬而未决”。中国人在很久以前就完成了阿穆尔河这条跨界河上的铁路桥的中方段，俄罗斯段要短得多，却几乎还没开工。多次逾期后，俄罗斯现在承诺于明年夏天完工。同时要完工的还有一条连接布拉戈维申斯克（Blagoveshchensk）与黑河的双车道公路桥。布拉戈维申斯克自苏联时代以来几乎没有变化，而黑河已从一个小村庄发展成拥有160万人口、高楼林立的大城市了。

改善中俄关系的一大主要障碍是俄罗斯的安全机构，它们仍然对中国（对普通俄罗斯人也一样）疑心重重。相比之下，当地民众则认为中国是一个未被充分利用的机会，而非威胁，并对莫斯科对该地区的殖民心态非常失

望。根据远东地区的学者维克多·拉林（Viktor Larin）的说法，该地区三分之一的人口表示，莫斯科对他们采取的政策和国际恐怖主义并列该地区三大安全威胁之一。减税也没怎么改变这种看法。

这些失望情绪在最近的地方选举中显露了出来，克里姆林宫支持的候选人表现不佳，不得不进入第二轮选举，被视为是给中央政府的一记耳光。虽然一些意识形态的信奉者试图说服俄罗斯人民，他们的命运与威权主义的中国息息相关，但远东地区的人们似乎和中国人一样热衷于西方的生活方式以及财产权和人权等制度。讽刺的是，俄罗斯与西方的对抗以及其薄弱的产权制度令它对中国的吸引力降低，中国的银行不大愿意与受制裁的人和机构做生意。朝鲜合唱团、伏特加和火箭弹也无法补救这一点。■



Alibaba

Ma where he came from?

No entrepreneur has defined China's transformation like Jack Ma. His success will be hard to repeat

THE most recognisable face of Chinese capitalism belongs to Jack Ma, the founder of Alibaba, an e-commerce juggernaut matched in size only by Amazon. Mr Ma, who launched Alibaba from a small apartment in Hangzhou in 1999, is an emblem of China's extraordinary economic transformation. Last week's announcement that he will step down as the firm's chairman a year from now, to concentrate on philanthropy, was greeted with comparative calm by investors. He stopped being chief executive in 2013; Alibaba's share price has more than doubled since its initial public offering, the world's largest-ever, in 2014 (see Business section). But one question presents itself: could China produce another story to match his? The answer is almost certainly not.

There are some very good reasons for that. China's own rise is an unrepeatable one. When Mr Ma, then an English-language teacher, launched Alibaba, the country was still gearing up to join the World Trade Organisation. Its GDP per head, in terms of purchasing-power parity, stood at under \$3,000; it is now more than six times higher. The internet was still young, too. Less than 1% of Chinese had access to the web back then, compared with some 36% of Americans. As incomes grew and connections proliferated, Mr Ma took full advantage.

Thousands of small businesses have since flourished on Alibaba's platforms. About 1m merchants trade in its virtual emporiums. Its services have helped push China's economy towards consumption-led growth. Last year it boasted sales of \$25bn on Singles' Day, China's equivalent of Black

Friday (when Americans spent a measly \$5bn). It has transformed logistics and finance, as well as retailing. Last year Alibaba delivered an average of 55m packages a day; its financial offshoot, Ant Financial, accounts for more than half of China's vast mobile-payments market. Its reach is so great that many startups decide to work with Alibaba rather than strike out alone.

But more has changed than the structure of China's economy and the clout of digital giants like Alibaba. Politics has changed, too. Alibaba thrived partly thanks to Mr Ma's skilful dealings with China's ruling Communist Party, with which he cultivated both closeness and stand-offishness ("Love them, don't marry them," he once said of the government). Under the leadership of President Xi Jinping, however, China's political system has grown hostile to private businesses that become too big or too disruptive. Officials have constrained bosses' freedom to make splashy deals. Bytedance, a brash technology firm set up in 2012, has been reined in, and forced to withdraw one of its apps. Its founder issued a grovelling public apology after being chastised by the government. Ant, meanwhile, has seen its aspirations to compete with state-owned banks held back by regulators (see Finance section).

China is putting its corporate champions at the service of its ambitions to compete globally in high-tech industries. Alibaba's task is to use artificial intelligence to improve cities. Through state-backed venture-capital funds, the government is pouring money into industries that were once the preserve of the private sector. Rumours occasionally surface that it plans to take stakes and board seats in big tech firms. All this has fed growing international suspicion of China, especially in America. Mr Ma was one of the first out of the blocks to congratulate President Donald Trump on his election victory; this year America prevented Ant's purchase of MoneyGram, a money-transfer firm, on national-security grounds. The reality was always more complicated, but Mr Ma embodies an idea of China as market-driven and open. That idea has faded.

None of this is to say that enterprise is fizzling in China. Indeed one of Mr Ma's legacies is a shift to a culture that values startups more than ever. His charisma and folksy advice have earned him cult-like status among the country's entrepreneurs. Venture capitalists are lavishing money on hundreds of newcomers, in industries from biotech to electric vehicles. Small private firms will continue to flourish.

But it is harder to be as disruptive today as Mr Ma was 20 years ago. That is partly because his own creation is so dominant. Increasingly, however, the greatest obstacle to disruption is China's rulers. The party is intent on having a say much earlier in the development of industries that it considers important. As a result, China is unlikely to see new business leaders with the boldness and brio to match Mr Ma. ■



阿里巴巴

后无来者

没有哪个企业家像马云那样定义了中国的转型。他的成功难以复制

中式资本主义最知名的面孔当属阿里巴巴创始人马云。只有亚马逊可在规模上与他创立的电子商务巨头比肩。1999年，马云在杭州一间小公寓里成立了阿里巴巴，他本人象征了中国非凡的经济转型。上周他宣布将在一年后辞去集团董事局主席的职务，专注慈善。投资者对此反应较为平静。马云自2013年起就不再担任首席执行官；阿里巴巴于2014年上市时，融资规模为史上最大，至今股价已翻了一倍多。那么问题来了：中国还能上演一个可与他比拟的故事吗？答案是几乎肯定不能。

这么说有几个非常充分的理由。中国的崛起本身就不可重复。曾是英语老师的马云推出阿里巴巴时，中国还在为入世做准备。按购买力平价计算，当时的人均GDP不到3000美元，现在则高出六倍多。互联网那时也才刚起步。当时只有不到1%的中国人可以上网，而美国人约为36%。人们收入逐步增长、互联网迅速普及，马云充分利用了这样的有利条件。

从那时开始，成千上万的小企业在阿里巴巴的平台上蓬勃发展。约有100万商家在其虚拟集市中开展交易。阿里巴巴提供的服务帮助推动中国经济走上了消费型增长之路。去年“双十一”当天其平台的销售额高达250亿美元（美国人在“黑色星期五”当天才花了50亿美元）。除了零售业，阿里巴巴还改变了物流和金融业。去年，阿里巴巴平均每天递送5500万个包裹；其金融业务部门蚂蚁金服在中国庞大的移动支付市场中占据了过半江山。阿里巴巴影响力巨大，许多创业公司因此决定与它合作，而不是单枪匹马出征。

然而，发生了变化的不只是中国的经济结构和阿里巴巴等数字巨头的影响力。政治也已不同往日。阿里巴巴蓬勃发展的原因之一是马云善于经营与中国执政党的关系——他们之间既亲密又保持距离（他曾说：“要跟政府

恋爱，但别跟政府结婚。”）然而，在习近平的领导下，中国的政治体制对规模过大或太具颠覆性的私营企业越来越不友好。官员们已经限制了企业老板们做大手笔交易的自由。成立于2012年、鲁莽张扬的科技公司字节跳动已受到约束，并被迫关闭了一个应用。在受到政府严厉批评之后，其创始人公开道歉，言辞卑谦。与此同时，蚂蚁金服与国有银行竞争的壮志也受到了监管机构的压制。

中国正在利用领军企业为自己在全球高科技产业中竞争的雄心服务。阿里巴巴的任务是利用人工智能改善城市。通过国家支持的风投基金，政府正在向曾经专属于私营部门的行业投入资金。时有传言说中国政府计划在大型科技公司中持股并获取董事会席位。所有这些都让其他国家对中国疑心渐重，特别是美国。马云是首批祝贺特朗普当选总统的人之一。今年，美国以国家安全为由阻止了蚂蚁金服收购汇款公司速汇金（MoneyGram）。现实总是更为复杂，但马云代表的是市场驱动和开放的中国。而这个形象已逐渐失色。

这并不是说企业经营在中国正趋于衰落。事实上，马云的遗产之一就是带领人们转向一种比以往任何时候都更重视创业公司的文化。他的魅力和接地气的建议让他在中国企业家中享有神一般的地位。从生物技术到电动汽车等行业，风险资本家正在向各个领域里的成百上千家新企业投入大量资金。小型私营企业还将继续蓬勃发展。

但是比起20年前，今天更难产生像马云当年那样的颠覆性影响。部分原因是他的创新成果如今占据了如此显赫的市场地位。然而，中国的统治者正日益成为颠覆的最大绊脚石。共产党打定主意要在它认为重要的行业的发展过程中一早就确立话语权。因此，中国不太可能再出现胆识与活力堪比马云的新商业领袖。 ■



Air pollution

A poisoned mind

Older men are more prone to cognitive impairment from dirty air

LIVING under thick layers of smog is known to cause illness and reduce life expectancy. The degree to which pollution harms the mind is less clear. In theory some of the toxins that get inhaled could damage the nervous system and hamper intellect, but few studies have looked into this. One just has, however, and the results are worrying, particularly for older men.

The new study was jointly conducted by Xiaobo Zhang, of Peking University, Xin Zhang, now of Beijing Normal University, and Xi Chen, of Yale University. When Dr Zhang returned to China in 2012, after teaching in America, he found it difficult to concentrate during days when the air in Beijing was heavily polluted. He knew from previous research conducted by another lab that young students living in polluted areas performed more poorly in exams, but there was no exploration of whether this held true for a broader population and, if it did, what specific effects the toxins were having on cognitive function.

To find out, the team looked at tests carried out as part of the China Family Panel Studies (CFPS), a survey by Peking University. In 2010 and 2014 the same group of around 20,000 people were tested in standardised mathematics and given a verbal test in word recognition. Crucially, the CFPS logged precise information about the date and location of each test.

Putting this information together allowed the researchers to match test scores at each location with the local air quality as reported by the air-pollution index, a measure that rates pollution levels in different cities across China based on daily readings of sulphur dioxide, nitrogen dioxide

and tiny bits of particulate matter. The index ranges from zero to 500, signifying the highest level of pollution.

As they report in *Proceedings of the National Academy of Sciences*, the researchers showed that chronic exposure to pollution lowered the scores on the verbal tests, and that the higher the pollution levels were the more the scores dropped. On average, an increase of 13.23 units (one standard deviation) in the pollution index over the course of three years resulted in a reduction of 1.36 points for men and 0.91 points for women, on the 34-point verbal exam. In contrast, mathematics scores were hardly altered by pollution exposure.

The effects were particularly dramatic in older men who had no education beyond primary school. The data showed that these men lost an average of 9.18 points on the verbal exam if they were exposed to an increase of 13.23 units of pollution over three years. For men who had attended middle school at least, this loss was reduced to just 1.88 points.

Precisely why the mathematics scores barely changed, and why men were harmed most, remains unclear. Dr Zhang speculates that pollutant damage is probably accumulating in the white matter of the brain, which people depend upon more heavily for verbal tasks; and men have less white matter than women. It is possible, too, that men with a poor education may work outside, and are thus more exposed to air pollution. Whatever the reasons, the results ought to be food for thought in polluted cities everywhere. ■



空气污染

头脑中毒

年长男性更容易因污浊空气损伤认知能力

众所周知，生活在重重雾霾之下会导致疾病并降低预期寿命。相比之下，污染对智力的伤害如何就不那么清楚了。理论上，吸入的某些有毒物质可能会损伤神经系统，导致智力下降，但罕有这方面的研究。不过，刚刚有人完成了一项相关研究，结果令人担忧，特别是对年长的男性而言。

这项新研究由北京大学的张晓波、目前在北京师范大学任职的张欣，以及耶鲁大学的陈希共同完成。张晓波曾在美国任教，2012年回国后他发现，在北京空气污染严重的日子里他很难集中注意力。他从另一个实验室以前做过的一项研究中得知，生活在受污染地区的年轻学生考试成绩更差。但并没有其他研究显示空气污染是否对更广泛的人群有同样的影响，以及如果有的话，有毒物质对认知功能的具体影响又是什么。

为寻找答案，研究团队查阅了由北京大学开展的中国家庭追踪调查（CFPS）中包含的测试。在2010年和2014年，同一批约两万人接受了标准化数学测试和识字语言测试。至关重要的是，CFPS准确记录了每次测试的日期和地点。

将这些信息汇总后，研究人员就可将每个地点的测试得分与空气污染指数所报告的当地空气质量相匹配。该指数根据每日二氧化硫、二氧化氮和细颗粒物的读数对中国不同城市的污染水平做评级。指数范围在0到500之间，500表示污染最严重。

发表在《美国国家科学院院刊》上的研究论文显示，长期暴露在空气污染中导致语言测试的得分降低，污染程度越高，得分下跌越多。三年平均的空气污染指数上升一个标准差（相当于13.23个单位）会使男性在总分为34分的字词测试中得分减少1.36，女性减少0.91。相比之下，污染对数学测

试的得分几乎没有影响。

这种影响在初中以下文化程度的年长男性身上尤为显著。数据显示，三年平均的空气污染指数上升13.23个单位会使他们在识字测试中的成绩平均降低9.18分。而在至少上过初中的男性中，这一降幅仅为1.88分。

究竟为何数学成绩几乎没有变化、为何男性受到的伤害更大，原因仍不清楚。张晓波推测，污染物造成的损害可能会在更多执行语言任务的脑白质中积累，而男性的脑白质比女性少。另一个可能的原因是受教育水平较低的人可能更多在户外工作，因此更容易受到空气污染的影响。无论原因是什么，这个研究结果应该引起世界各地受污染城市的深思。■



Economic and financial indicators

Education spending

Private sector is playing an increasingly important role in education spending

OECD countries spent an average of 5% of GDP on education in 2015. Between 2010 and 2015 total spending fell in more than two-thirds of countries surveyed, as belts tightened after the financial crisis. The private sector is playing an increasingly important role: its share of education spending rose by 11% across all OECD countries in that period. The private sector is particularly important to tertiary-level education—especially in America, where almost two-thirds of spending is accounted for by households and private institutions. Things are different in Scandinavia. In Norway, 1% of total tertiary-education spending, or under 0.1% of GDP, came from private sources. ■



经济与金融指标

教育支出

私营部门在教育支出上的作用日益重要

经合组织国家2015年在教育上的支出平均占到GDP的5%。2010年到2015年间，受调研的国家中超过三分之二在教育上的总支出下降，原因是金融危机后各国勒紧了裤腰带。私营部门在教育中的作用越来越重要：上述时期内，私营部门在所有经合组织国家教育支出中的占比上升了11%。私营部门在高等教育中的作用尤其重要，特别是在美国。该国近三分之二的教育支出来自家庭和私人机构。斯堪的纳维亚半岛情形则不同。在挪威，高等教育总支出中仅有1%（不到GDP的0.1%）来自私人资本。■



Free exchange

Upsetting the Apple cart

The Trump administration's trade war is forcing hard choices on American companies

YOU might think a company worth \$1trn would gain a sympathetic hearing in the White House. Not, it seems, when the subject is China. On September 7th, as President Donald Trump prepared a new salvo of tariffs on Chinese imports, Apple released a letter pleading with the administration to change tack lest it harm American consumers. “Make your products in the United States instead of China,” Mr Trump tweeted back. “Start building new plants now. Exciting!” The response reflects a view within his administration that in a trade showdown with China, America cannot lose.

Mr Trump’s officials are finalising a list of Chinese imports, of \$200bn in value, which will be subject to new tariffs. If and when they come, they would be in addition to tariffs previously levied on \$50bn of Chinese goods. The president has expressed himself willing to put tariffs on all Chinese imports. China, for its part, is unbowed. At a summit on September 11th Xi Jinping, the Chinese president, and Vladimir Putin, Russia’s leader, agreed to strengthen economic ties and resist American protectionism.

In a sense, America’s aggression is a less conventional, more belligerent version of a trade war many advanced economies have been itching to declare. Although China is a member of the World Trade Organisation (WTO), it engages in dubious growth-boosting measures that skirt the rules, such as pressing foreign manufacturers to share proprietary technologies as a condition of market access. Many countries would applaud if America got China to stop such practices. Tariffs of 25% on low-margin Chinese goods like clothing could hit sales in America, and can be seen as a way of cudgelling China into making concessions. But that is not the only light

in which to view them. For the Trump administration may not even care whether China yields.

Apple, and firms like it, are the reason why. Stiff tariffs on high-end imported electronics are unlikely to reduce sales as much as those on cheaper items. Apple makes vast margins on its products. An analysis in 2011 concluded that it captured a staggering 58% of the iPhone's retail price, which helps explain its towering market value. Although the planned tariffs will spare the iPhone, other Apple products that will be included, such as the Watch, are thought to enjoy similarly extravagant margins. Apple's ability to charge so much above cost suggests that rival products are imperfect substitutes, and that it therefore enjoys pricing power in the market. Its bosses can choose whether to sacrifice sales or absorb the tariffs and accept thinner margins. Where high-end electronics are concerned, in other words, tariffs foist hard choices on domestic firms rather than China's government.

That might be to Trump officials' liking. Two decades ago, technology firms began outsourcing production. Asia became the dominant hub for electronics. Roughly 1.5bn smartphones were sold in 2016. At peak output, according to the IMF, smartphone components accounted for more than 33% of exports from Taiwan, and 15% of those from Singapore and South Korea. Finished smartphones accounted for 5% of Chinese exports. Although Asia captures only a modest share of the income generated by such sales, it takes much more of the associated employment—which Mr Trump covets. When Foxconn, which assembles Apple products in China, broke ground on a production plant for LCD screens in Wisconsin in June, he gleefully claimed credit.

But reclaiming portions of a supply chain is tricky. "Factory Asia" enjoys considerable efficiencies of scale. Because parts suppliers and final assembly are relatively close together, it is flexible and responsive; a trans-

Pacific supply chain would be slower and less efficient. And China's mammoth smartphone industry hoovers up skilled workers and engineers, creating demand for labour that coaxes a corresponding supply into existence. Filling such jobs in America would be hard, at least in the short run.

But hard is not the same as impossible. Officials at Apple no doubt recognise the vulnerability created by their dependence on China. When tech executives complain about China's abuses, China hawks sympathetic to Mr Trump respond that they have only themselves to blame. As difficult as reshoring large parts of the electronics supply chain would be, the prospect of a protracted trade war may persuade some American firms to opt for the costlier, but less uncertain, option of disentangling themselves from China. And though other parts of Asia may look appealing, they might decide that reshoring to America makes most sense, given Mr Trump's protectionist bent.

To an economic nationalist, the tariffs are a win-win proposition. Either China abandons elements of its industrial policy deemed to be unfair, or America's tech titans reshore production, reverse the dramatic shifts in global trade of the past two decades, and rebuild a top-to-bottom domestic high-tech industry.

The decline in manufacturing employment since 2000 has been felt keenly in many parts of America. But reshoring electronics production will not mean reshoring anything like the number of jobs that were lost in the first place, thanks to relatively high labour costs and better labour-saving technology. To the extent that firms with pricing power charge more, it will hurt consumers. And it will cause a potentially irreparable tear in the geopolitical fabric joining America and China. The norm that trade differences should be settled in a peaceful and orderly manner will have been sacrificed to no advantage for most Americans.

The harm may already have been done. Analyses of China's accession to the WTO suggest that the reduction in uncertainty about tariff rates, rather than falling tariffs themselves, accounted for more than a third of subsequent growth in exports. Times are once more uncertain. Even if the Trump administration suddenly declares that the trade war is over, America's tech titans will surely rethink their reliance on China. But to what purpose? ■



自由交流

打翻苹果摊

特朗普政府的贸易战迫使美国公司做艰难抉择

你可能觉得，市值万亿美元的企业向政府进言，白宫总该用心听一听吧。但当议题关系到中国时，情况似乎并非如此。9月7日，正当美国总统特朗普准备对中国进口产品再次加征关税之际，苹果公司发表了一封公开信，恳请政府改变方针，以免损害美国消费者的利益。“在美国生产，别到中国去，”特朗普在推特上回应，“现在就开始建新工厂吧。多让人兴奋！”他的回答反映出其政府内部的一种观点：与中国的贸易对决，美国许胜不许败。

特朗普的官员们正在最后确定一份征税清单，对价值2000亿美元的中国进口产品加征关税。如果真的实施，这将是继先前对500亿美元中国商品征税后的又一次行动。特朗普表示他本人愿意对所有中国进口产品征收关税。中国也不屈服。在9月11日举行的一场峰会上，中国国家主席习近平和俄罗斯领导人普京一致同意加强经济联系，抵制美国的贸易保护主义。

在某种程度上，许多发达经济体一直渴望开打类似的贸易战，只不过美国此番进攻更出格、更强硬。虽然中国是世贸组织（WTO）的成员国，但却为刺激经济增长而采取了一些有争议的手段来规避世贸规则，例如迫使外国制造商分享专有技术作为市场准入条件。美国如果能让中国停止这种做法，许多国家都会拍手叫好。对服装等低利润的中国商品征收25%的关税可能会影响这些商品在美国的销售，可理解为逼迫中国让步的一种手段。但这并非看待这番举措的唯一角度。因为特朗普政府甚至可能并不在乎中国是否让步。

苹果以及与之类似的公司是原因所在。与低价商品不同，高端进口电子产品的销售受高关税的影响没那么大。苹果从其产品中获取丰厚的利润。2011年的一项分析推断，苹果将iPhone零售价的58%都收入囊中，比例高

得惊人，这也成就了它的超高市值。虽然计划中的关税将豁免iPhone，但被纳入征税范围的其他苹果产品（如苹果手表）也被认为具有同样高的利润率。苹果的定价能远高于成本，表明其产品难以被竞争对手的产品完美替代，因此在市场上享有定价权。苹果的高层可以选择是牺牲销量还是自己承担关税而接受利润减少。换言之，就高端电子产品而言，受关税影响而要被迫做出艰难决策的是美国企业，而非中国政府。

这也许正中特朗普政府官员下怀。20年前，科技公司开始将生产外包。亚洲成为电子产业的绝对中心。2016年全球智能手机销量约为15亿台。根据国际货币基金组织的数据，在高峰期，智能手机零部件占台湾出口的33%以上，占新加坡和韩国出口的15%。智能手机成品占中国出口的5%。虽然亚洲从这些销售中获取的收入份额不算高，但在因此产生的就业机会中分走的比例却要高得多，而这是特朗普所觊觎的。今年6月，苹果的中国代工厂富士康在美国威斯康星州动工建设液晶显示屏工厂，特朗普欢欣不已，以此居功。

但要夺回部分供应链并不容易。“亚洲工厂”享有高度的规模效率。由于零件供应商和最后组装地距离相对接近，因此相当灵活，反应快速；如果换成跨太平洋的供应链，反应速度将变慢，效率将变低。此外，中国庞大的智能手机产业吸收了大量熟练工人和工程师，所创造的劳动力需求也催生了相应的人才供应。在美国，要填补此类职位空缺并非易事，至少短期内是这样。

但不容易不等于不可能。苹果的高层无疑知道依赖中国而导致的弱点。当科技企业高管抱怨遭到中国不公对待时，支持特朗普的对华鹰派回应说，他们是咎由自取。要把电子产品供应链大部分搬回国内虽说困难，但眼看贸易战可能旷日持久，这也许会说服一些美国公司选择从中国抽身。虽说这样一来成本会提高，但不确定因素也会减少。亚洲其他地区看起来虽然很有吸引力，但考虑到特朗普的保护主义倾向，美国公司可能还是认为回归美国是最明智的。

在经济民族主义者看来，加征关税是双赢的主张。要么中国放弃产业政策

中被视为不公平的部分，要么美国科技巨头把生产转回国内，扭转过去20年全球贸易的巨变，在美国国内重建完整的、自成一体的高科技产业。

自2000年以来，美国国内许多地方的制造业就业人数显著减少。但由于劳动力成本相对较高，而且出现了更先进的节省劳动力的技术，电子产品生产的回归并不意味当初流失的就业岗位也会恢复。而且考虑到拥有定价权的公司可能会抬高价格，这将对消费者造成损害。这一过程还将导致中美间的地缘政治联系出现无法挽回的裂痕。贸易分歧本应以和平有序的方式解决，美国不惜打破这一常规，却不会给大多数美国人带来好处。

伤害可能已然造成。对中国入世的分析表明，后来的出口增长有三分之一是源于关税不确定性的降低，而非关税本身的下降。不确定的时代再次来临。即使特朗普政府突然宣布贸易战结束，美国的科技巨头也一定会重新思考自身对中国的依赖。然而，意义何在？ ■



Schumpeter

An empire of the mind

American firms and security chiefs want tight control of the global flow of ideas. Good luck

ONE of the quirks of LinkedIn, a career-oriented networking site with over 562m users, is that strangers wish you a happy birthday even when your mum has forgotten. If this happens to you, don't respond: it could be a Chinese spy. According to Reuters, American counter-intelligence chiefs think that China is running a “super-aggressive” campaign on LinkedIn to recruit experts in health care, green energy and technology. Other agencies are nervous, too. The FBI complains of an “unparalleled” level of economic espionage. The National Security Agency says America is being “pummelled”.

The spooks' warnings are part of a wave of anger in the West about ideas leaking across borders. On June 1st the European Union complained to the World Trade Organisation (WTO) that China prevents European firms from getting a fair price for their intellectual property (IP). A 215-page White House report on China's trading practices published in March was filled with accusations of IP violations, including outright theft and the forced transfer of IP to joint-venture partners in China. On August 1st Congress approved a law that gives the government sweeping powers to police cross-border deals involving “critical technologies”.

For American firms the stakes are high. They derive 80% of their market value from intangible assets such as patents and brands, as opposed to physical ones. They own half of the world's IP. At the biggest 50 multinationals, 65% of foreign profits come from IP-intensive businesses such as tech and drugs. The latest star firms rely on selling intangibles

across borders. Netflix has 73m users outside of Uncle Sam. NVIDIA, which designs artificial-intelligence (AI) chips, makes 87% of its sales abroad.

Yet in the eyes of many American bosses and security types the global IP regime is broken. The Economic Espionage Act of 1996 is intended to police IP theft by governments and firms but has led to few prosecutions; WTO rules on safeguarding IP abroad have little bite. What is required now, many believe, is tough, unilateral action by America to enforce its rights abroad. Companies want stronger control of IP, allowing them to maximise their profits. The IP Commission, a lobbying group in Washington, reckons that they are being robbed of up to \$600bn a year.

Politicians and the security establishment have a grander aim: regulating the flow of ideas to preserve American technological supremacy. History is not encouraging. At any point in time an elite group of firms in a particular country are on the frontier of innovation. Businesses and governments in poorer places try to catch up, because that is the best way to get rich. According to the IMF, the absorption of foreign IP explains 40% of the growth in labour productivity in emerging economies between 2004 and 2014. The incentives for such countries are so powerful that hoarding ideas away from them is like clutching a wet bar of soap.

Thus in the Anglo-French wars of the 1700s France recruited British defectors to unlock the secrets of coal technologies. In the subsequent century America stole British designs for looms and trains. Japan mimicked the West during the Meiji Restoration. South Korea, Taiwan and Singapore industrialised by buying and stealing Western ideas on everything from ships to chips. Cries of foul play from the global hegemon are to be expected. In the case of Britain, it passed an act against economic espionage in 1719. In the 1980s Caspar Weinberger, America's defence secretary, fretted about the haemorrhaging of high-tech ideas to the Soviet Union, which had a wishlist for its spies called the Red Book.

Despite this, the Soviets did less for computers than Steve Wozniak in the Jobs family's garage. To take off, after all, foreign ideas need to be absorbed and commercialised by firms and entrepreneurs. One channel is contractual relationships, such as foreign direct investment or licensing. Another is persistent theft. But often there is a grey area that includes reverse-engineering products, tips from suppliers and headhunting experts from rivals. Globalisation and the web have deepened all these channels. Companies' IP is more scattered owing to global production chains. A global jobs market exists for technical experts and armies of students learn abroad.

How might America control the flow of ideas? During the cold war it ran a Western embargo of the Soviet Union for military goods and some high-tech ones, through a secretive body known as COCOM. Today it would need an even more intrusive and coercive approach to assert its IP rights unilaterally. Establishing an extraterritorial deterrent would require crippling punishments for firms that violated IP, such as banning them from using the dollar-based banking system. A Big Brother regime would be needed at home. There are 67,000 AI experts working in America who are ethnic Chinese, according to an analysis of LinkedIn by Bernstein, a research firm. They can hardly all be suspects.

Even then, China and other countries might balk at paying a bigger tribute to America's IP supremacy. If USA Inc charged the world \$600bn more, and this hit was absorbed by all foreign companies, it would cut total profits outside America by about a tenth. The return on equity of American multinationals abroad (excluding financial firms) would soar from 8% to 14%. Europe and emerging countries are already uneasy about the large and lightly taxed rents that American firms extract abroad, from the drugs industry to the big tech companies.

America's economy is shifting further towards intangibles. The administration and bosses are right that China has misbehaved. But ideas

are harder to police than gearboxes and coils of steel. The solution is a global regime that permits the flow of ideas, prohibits theft, offers a framework for pricing IP and sees that rules are enforced. A next-generation global trade treaty, in other words. Sadly, this is exactly the multilateral approach to trade that America has rejected. Not one of its best ideas. ■



熊彼特

思想的帝国

美国企业和安全部门负责人想要从严控制创意的全球流动。祝他们好运

用户超过5.62亿的职业社交网站领英时有诡异之处，其中一桩是有陌生人祝你生日快乐——即使连你妈妈都把这一天忘了。如果碰到这种事，不要回复，因为这可能是中国间谍干的。据路透社报道，美国反间谍部门负责人认为，中国正在领英上发起一场“来势汹汹”的行动，积极招揽医疗保健、清洁能源和科技领域的专家。其他机构也如临大敌。美国联邦调查局（FBI）抱怨经济间谍活动达到了“前所未有”的地步。国家安全局（NSA）称美国正被“连续暴击”。

西方世界正在掀起一股不满创意跨境外泄的怒潮，这些情报机构的警告便是其中的一部分。6月1日，欧盟向世贸组织（以下简称WTO）投诉，称中国阻止欧洲公司以公正的价格出售知识产权。3月，白宫就中国的贸易操作发布了一份长达215页的报告，其中充斥着对侵犯知识产权的指控，包括公然窃取以及强迫向中方合资伙伴转让知识产权。8月1日，美国国会通过一项法案，赋予政府广泛权力来监管涉及“关键技术”的跨国交易。

这样的举措对美国企业来说风险很大。它们80%的市值源于专利和品牌等无形资产，而非实物资产。它们拥有世界一半的知识产权。在全球最大的50家跨国公司中，65%的国外利润来自科技、制药等知识产权密集型企业。一批最新的明星企业的壮大有赖于向国外出售无形资产。Netflix的海外用户多达7300万。设计人工智能芯片的英伟达87%的销售额来自国外。

然而，在很多美国老板和安全人士看来，全球知识产权体系已经崩溃。

《1996年经济间谍法》（Economic Espionage Act of 1996）旨在监管政府和企业窃取知识产权的行为，但却很少提起诉讼；WTO有关保护海外知识产权的规则作用甚微。很多人认为，如今美国需要采取强硬的单边行动来行使其在海外的权利。企业希望加强对知识产权的控制，实现利润最大

化。华盛顿的游说组织知识产权委员会（IP Commission）估计，美国企业因知识产权被窃所受的损失每年高达6000亿美元。

政客和安全机构有更雄心勃勃的目标：限制创意的流动，以维持美国的科技霸主地位。从历史来看，前景并不乐观。任何时候都是某个国家的一批精英企业处于创新的前沿，而较贫穷地区的企业和政府试图迎头赶上，因为这是致富的最佳途径。根据国际货币基金组织（IMF）的报告，2004年至2014年间，新兴经济体40%的劳动生产率增长得益于对国外知识产权的利用。这些国家如饥似渴。要将创意背着它们藏起来，犹如握紧流沙。

正因如此，18世纪的英法战争期间，法国招募英国叛逃者来揭开煤炭技术的秘密。在随后的一个世纪里，美国从英国那里偷走了织布机和火车的设计。日本在明治维新时期效仿西方。韩国、台湾和新加坡通过购买和偷窃从船舶到芯片等各方面的创意，实现了工业化。全球霸主大呼“犯规”不足为奇。比如英国，它在1719年通过了一项反对经济间谍活动的法案。上世纪80年代，美国国防部长卡斯珀·温伯格（Caspar Weinberger）担心高科创意会向苏联大量流失——苏联为它的经济间谍准备了一份叫作“红皮书”的目标清单。

尽管如此，苏联人在计算机方面的成就还比不上在乔布斯家的车库里工作的史蒂夫·沃兹尼亚克（Steve Wozniak）。毕竟，要想成功，从国外获取的创意还需要被公司和企业家吸收并商业化。一个途径是合同关系，比如外国直接投资或授权。另一个途径是不断窃取。但通常存在着一个灰色地带，包括对产品进行逆向工程、供应商透露的“风声”，以及从竞争对手处挖走专家。全球化和互联网深化了所有这些渠道。由于生产链的全球化，企业的知识产权更加分散。如今技术专家的就业市场是全球性的。大批学生在海外留学。

美国可能会如何控制创意的流动？冷战时期，以美国为首的西方国家通过一个名为巴黎统筹委员会（COCOM）的秘密机构对苏联实行军用物资和一些高科技产品的禁运。如今，要单方面维护自己的知识产权，美国需要一种更具侵扰性和强制性的方法。要形成境外的震慑力需要对侵犯知识产

权的公司加以严惩，比如禁止其使用以美元清算的银行业务系统。而在国内，则需要一个“老大哥”式的监控机制。根据研究公司盛博（Bernstein）对领英的分析，在美国工作的人工智能专家中，有6.7万人是华裔。他们不可能个个都是嫌疑犯。

即便到了那时，中国和其他国家可能也不愿意向美国知识产权的霸主地位进献更多贡金。假设美国公司向全世界多收取6000亿美元的费用，这笔费用由所有外国公司分担，那么美国以外企业的利润总额将会削减大约十分之一。而美国自己的海外跨国公司（不包括金融公司）的股本回报率将从8%飙升到14%。从制药企业到大型科技公司，美国公司在海外收取的数额庞大且缴税不多的知识产权费用早已令欧洲和新兴国家感到不安。

美国经济正进一步向无形资产转移。美国政府和企业老板有理由认为中国行为不端。但是，相比变速箱和钢卷，创意更难被监管。解决方案是一个全球性机制，它允许创意流动，禁止盗窃，提供知识产权的定价框架，并确保所有规则得以执行。换句话说，也就是新一代的全球贸易条约。遗憾的是，这正是美国拒绝的多边贸易模式。这可算不上它最好的创意。■



Free exchange

A savings account

America's long-lived recovery breeds complacency about lingering macroeconomic risks

FIVE years after the darkest days of the financial crisis, Lawrence Summers took the dais at an IMF forum to offer a few thoughts on America's recovery. It was lousy. Growth showed no signs of making up ground lost during a deep recession. The unemployment rate had only just fallen back below 7%. It was common to attribute this lousiness to the after-effects of a monumentally nasty downturn. But Mr Summers suggested that his listeners consider another possibility: that America was stuck in a pattern of slumps punctuated by bubbles, and had been since well before the banking system seized up in August 2007. It is fashionable now, a decade after Lehman Brothers collapsed, to say that the "secular stagnation" hypothesis Mr Summers put forward is no longer relevant. America's economy grew at an annual pace of 4.2% in the most recent quarter, and unemployment is at 3.9%. But there is little reason to think the world has escaped from the macroeconomic pattern that made the crisis possible.

Mr Summers began by pointing out that the weak recovery was not the only macroeconomic oddity that needed explaining. It seems obvious that before the crisis America had been indulging in a wild bout of economic excess (hence the crash). But there were few signs of excess where economists might normally have looked for them. Neither inflation nor wage growth were signalling that the economy had run up against its productive capacity. Indeed, much the same could be said about the late 1990s before the dotcom bust. Despite an explosive investment and stock boom, there was no sign of the sort of overheating that had driven inflation into double figures in the 1970s and 1980s. America seemed to have entered a novel realm in which

even wild booms did not generate excess demand; indeed, one in which growth in demand was chronically weak in the absence of wild booms.

Slumps happen when spending is too low to prevent some of an economy's capacity from falling idle. Spending drops when the desire to save increases suddenly across an economy, as people seek to pinch pennies in the face of economic anxiety. Because one person's spending is another's income, a rise in saving leads to a slump, unless it is offset by increased borrowing elsewhere. But normally, when an economy has too much saving, interest rates fall (or are manipulated downward by central banks) until borrowers come out of the woodwork and savers become less interested in hoarding their income. Real trouble starts when interest rates get stuck at zero before saving and borrowing are brought into balance, leaving the economy stuck. This could be the result of a severe financial crisis, as in America in the 1930s or Japan in the early 1990s. But Mr Summers, borrowing from the ideas of former Keynesians, suggested that such conditions could become a near-permanent feature of the economy.

That could happen for several reasons. Perhaps ageing populations and a slowdown in technological progress were permanently depressing investment. Perhaps inequality, by concentrating resources in the hands of the rich, who are more likely than others to save, was to blame. Whatever the cause, the upshot was a world in which the real rate of interest necessary to keep capacity from falling idle had dropped below zero. In such a situation governments have three options: to accept a permanent slump, to hope low rates spark an asset-price boom that temporarily rouses the economy, or to borrow to soak up the excess saving. It could be, Mr Summers has mused, that the economy needs fiscal stimulus all the time, rather than only in times of depression.

But is such secular stagnation a real phenomenon? Not only has growth picked up, but, perhaps more important, interest rates in America have risen

above zero. Surely, if the Federal Reserve can raise its benchmark rate to 1.75% without derailing the economy, something in the secular-stagnation story is awry.

Or perhaps not. The consolidation of America's recovery roughly coincides with the end of post-crisis deleveraging, and the resumption of growth in total indebtedness as a share of GDP (see chart). Whether intentionally or not, America's government has embraced permanent fiscal stimulus. Faster growth in 2018 is occurring alongside a widening of the federal-budget deficit, from 3.5% of GDP to 4%. And in his most recent speech Jerome Powell, the chairman of the Federal Reserve, expressed frustration at the economy's failure to behave as it should. "Inflation may no longer be the first or best indicator of a tight labour market and rising pressures on resource utilisation," he said. According to him, the Fed should look instead to financial markets for signs of excess.

It is possible, as Mr Powell suggests, that too much money chasing too few workers and goods may no longer bid up the prices of those workers and goods, but instead lead people to bid up the prices of homes and stocks. A better explanation may be that prices for workers and goods are subdued because the economy is not actually at capacity, and that, but for rising asset prices and indebtedness, growth would still be weak. Yes, unemployment is low, but labour-force participation by prime-age adults remains below the pre-crisis level, and wage growth is weak.

If the problem really is a long-run imbalance between desired rates of saving and borrowing, current policy is a mess. For now, financial excess is the means by which spending power flows to those who are eager to use it. Choking it off by raising interest rates further will simply bring back the slump. Government deficits could provide a sustainable long-term solution, if money were directed to growth-boosting public goods, such as

infrastructure, and to poorer people. It is they who are most likely to spend additional income and therefore to add to demand. They would also benefit most from additional spending. But politicians struggle to reshape public spending along such lines.

The strange position in which the economy found itself before the crisis, and which complicated the recovery, continues. One of the oddest legacies of the crisis is that governments accept this, and the risks it entails, rather than try for something better. ■



自由交流

储蓄账户

美国经济的持久复苏让人们安于现状，对宏观经济中挥之不去的风险掉以轻心

金融危机最黑暗的日子过去后第五年，劳伦斯·萨默斯（Lawrence Summers）登上国际货币基金组织某次论坛的讲台，分享了一些有关美国经济复苏的见解。这场复苏乏善可陈。因严重经济衰退而受挫的增长率并没有显示出收复失地的迹象。失业率只勉强回落到7%以下。人们常把这种糟糕局面归因于一场极其恶劣的经济衰退留下的后遗症。但萨默斯建议台下的听众思考另外一种可能性：美国经济已陷入一种衰退夹杂泡沫的模式，而且在2007年银行体系失灵之前很久就已如此。雷曼兄弟垮台十年后的今天，一种流行的说法是萨默斯提出的“长期停滞”假说已不再契合当下。美国最近一个季度的年经济增长率为4.2%，失业率为3.9%。但几乎没有理由认为，世界已经摆脱了使那场危机成为可能的宏观经济模式。

萨默斯首先指出，复苏乏力并不是唯一需要解释的宏观经济怪象。金融危机爆发之前，美国似乎明显陷入了一轮严重的经济过热（由此引发了崩溃）。但在经济学家通常会去寻找过热的地方，却少有过热的迹象。通胀和工资增长都未显示经济已遭遇产能局限。事实上，上世纪90年代末互联网泡沫破灭之前大体也是如此。尽管投资激增、股市繁荣，并没有迹象显示经济会过热到将通胀推高至七八十年代时两位数的水平。美国似乎进入了一个全新的境地——即便高度的繁荣也没有带来需求过度；更确切地说，需求增长长期疲弱，且并没有出现高度繁荣。

当消费水平过低，无法阻止部分产能闲置时，就会发生衰退。当人们对自己的经济前景感到焦虑，想紧紧攥住手中的钞票，进而造成整个经济突然出现储蓄意愿增强的情形，消费支出就会下降。由于一个人的消费支出就是另一个人的收入，储蓄上升会导致衰退，除非别处借贷增加，抵消了上升的储蓄。但通常情况下，当一个经济体中储蓄过多，利率就会下降（或者由央行刻意压低），直到借款人闻风出动，储蓄者也不再那么有兴趣囤

积收入所得。如果储蓄和借贷尚未被调节至平衡状态，利率就已经卡在了零的位置，真正的麻烦就开始了，经济“卡壳”了。这可能是一场严重的金融危机造成的，类似上世纪30年代的美国或90年代初的日本发生过的那种。但萨默斯借鉴了之前凯恩斯主义者的观点，指出这样的情形可能会成为经济中一个近乎永久的特性。

造成这种局面可能有几种原因。也许人口老龄化和科技进步放慢长久压制了投资。也许不平等是症结所在，因为它令资源聚集在富人手中，而这些人比其他人更可能存钱。不管诱因是哪个，结局都是实际利率已跌到零以下，而要防止产能闲置，实际利率需要保持在一定水平。在这种情况下，政府有三种选择：接受长期衰退的局面；寄希望于低利率刺激资产价格暴涨，暂时提振经济；通过借贷来吸收过剩的储蓄。萨默斯思忖，经济可能一直都需要财政刺激，而不是只有在萧条期才需要。

但这种长期停滞确有其事吗？在美国，不仅经济增长已经提速，也许更重要的一点是利率也已升至零以上。如果美联储可以将基准利率调高至1.75%而不破坏经济，想必长期停滞这套理论就有问题了。

但也许不是这样。美国经济复苏的巩固差不多与危机后去杠杆进程终结、总债务占GDP比重恢复增长同时发生（见图表）。不管是有意为之，美国政府已经积极采取长期财政刺激政策。2018年经济增长的提速伴随联邦预算赤字扩大而发生，后者占GDP的比重从3.5%升至4%。而美联储主席杰罗姆·鲍威尔（Jerome Powell）在最近一次演讲中沮丧地表示，美国经济表现不如预期。“通胀也许不再是劳动力市场吃紧、资源利用压力上升的首要或最佳指标了。”他说。在他看来，美联储应该到金融市场去寻找过度的征兆。

鲍威尔表示，一种可能的原因是，太多的钱追逐着太少的劳动力和商品这种情形也许不再会推高工资水平和商品价格，而是促使人们去推高房屋和股票的价格。一个更好的解释也许是，工资和商品价格之所以疲弱，是因为经济实际上并未满负荷运转。或者说，除了资产价格及债务水平有所升

高，经济增长仍然乏力。是的，失业率确实处于低位，但青壮年劳动力参与率仍旧低于危机前水平，工资增长也呈现疲态。

如果问题真的是理想的储蓄率与借贷率之间长期失衡，那么现行的政策可谓一团糟。就眼下来说，让购买力流向迫切想使用购买力的人手中靠的是金融过度。如果为了压制金融过度而进一步提升利率，只会让衰退复现。政府赤字也许可提供一种可持续的长期解决方案，如果资金被导向基建这类能促进增长的公共产品或用在较贫困的人身上。这些人最有可能将增加的收入用于消费，进而促进需求增长，而从消费增长中获益最多的也会是他们。但政客很难按这样的方针来改变公共开支结构。

美国经济在金融危机前陷入了奇怪的境地，这种境地令危机后的复苏也变得更复杂，而它仍在继续。那场危机遗留下来的最古怪问题之一就是政府接受了这样的局面，以及它引致的种种风险，却不去做一些更好的尝试。





Trade

Hunker down

America's tariffs on China have several goals—some of them unachievable

IN HIS trade war with China, President Donald Trump appears to have the upper hand. The new tariffs his administration unveiled last week, which will raise the share of Chinese imports subject to levies to at least 44%, are unlikely to dampen America's sizzling economy, or to boost inflation by much. Though some firms will be disrupted, most Americans will not notice the damage (see Finance section). China, however, is under pressure. Its growth seems to be slowing and its stockmarket is down almost a quarter from its peak in January. China's government has announced retaliatory tariffs against American goods, but it is fast running out of imports to tax.

During conflict, an imbalance in strength should lead to a swift resolution. Here the side with the advantage may prolong the war. That is because America has several goals, some of them unachievable.

The official justification for the tariffs is rooted in anger about Chinese mercantilism—anger which is shared across the rich world. China gives vast and opaque subsidies to its state-owned firms. It requires exporters to hand over intellectual property as a condition of access to its market. The world's consumers benefit from the artificially cheap imports that result. But trade of this sort is unsustainable, politically and economically. America is right to demand that China play fair.

That is not the limit of Mr Trump's ambition, however. He also wants to eliminate America's trade deficit with China, which he mistakenly sees as a transfer of wealth. He has broadcast his desire to force manufacturing supply chains back to America. And his administration has identified China

as a strategic competitor. Some of the president's advisers seem to relish the chance to do it economic harm.

The White House may argue that China's abuse of the rules, the trade deficit and the decline of American industry are one and the same. They are not. Even without subsidies, China, like most other emerging markets, would enjoy a substantial cost advantage over America. The trade deficit, meanwhile, is tied to the difference between domestic saving and investment. Tariffs might cut the bilateral deficit with China, but America would find it nearly impossible to shrink its overall deficit without engineering a domestic recession.

The goal of rolling back decades of American deindustrialisation is a pipe-dream. Should America succeed in forcing supply chains back onshore, it will find that many fewer jobs are attached, because of rapid automation and productivity growth. American manufacturing's share of GDP has fallen only by a fifth since 2000, while its share of employment is down by a third. Besides, the lowest-skilled jobs would not go to America, but to low-wage Asian countries, like Vietnam.

There is a faint hope that Mr Trump's advisers and allies will play good cop to his bad cop, using tariffs as a bargaining chip in rewriting global trading rules to constrain China's mercantilism—a legitimate goal. More probably, the bad cop—who is, after all, in charge—will refuse to be stood down, because of his obsession with trade deficits and jobs and because Chinese leaders seem unwilling or unable to contemplate reforms that would strengthen moderate voices in Team Trump.

The prospects for any truce with China look grim. Recent history suggests that trade disputes are hard to settle. Tariffs imposed on Chinese tyres in 2009 under President Barack Obama, a free-trader, lasted three years. Mr Trump's recent trade agreement with Mexico does not include an end to

levies on its steel and aluminium. America's latest escalation against China is no more likely to be speedily reversed. ■



贸易

拒不停战

美国对华加征关税有多个目标，但其中一些无法实现

在与中国开打的贸易战中，特朗普似乎正占据上风。其政府上周公布了新一轮关税方案，入美中国商品被征税的比例将至少提高到44%，这不太可能挫伤美国当前火热的经济或大幅推高通胀。虽然有些公司会受影响，但大多数美国人不会感觉到损害。中国则在承受压力。其增长似乎正在放缓，股市相比1月份的峰值下跌了近四分之一。中国政府已宣布对美国商品实施报复性关税，但可征税的美国进口商品数量不断减少，很快将征无可征。

在一般冲突中，双方势力不均的结果本应是速战速决。但在这场贸易战里，占优势的一方可能会延长战事。那是因为美国有几个目标，而其中一些是无法实现的。

美国加征关税的官方理由植根于对中国重商主义的愤怒，其他富裕国家对此也是怒火中烧。中国向本国国有企业提供大量不透明补贴，又要求别国出口商交出知识产权作为进入中国市场的条件。这些人为干预使得中国出口商品价格低廉，全球消费者从中受惠。但这种贸易在政治和经济上都不可持续。美国要求中国公平竞争无可厚非。

然而，特朗普的野心不尽于此。他还想消除美国对华贸易逆差，他误以为这是一种财富转移。他意欲迫使制造业供应链回岸美国的心愿已是广昭天下。此外，其政府已认定中国为战略竞争对手。特朗普的一些顾问似乎乐见中国经济受挫。

白宫可能会辩解说，中国践踏规则、美国对华贸易逆差以及美国工业的衰落都是一回事。但事实并非如此。即使没有补贴，中国也和其他大多数新兴市场一样，相较于美国具有相当大的成本优势。同时，贸易逆差与国内储蓄和投资之差存在紧密联系。加征关税也许会缩减美国对华双边贸易

赤字，但美国会发现，除非设计一场国内衰退，否则缩减整体赤字近乎不可能。

要逆转美国数十年的去工业化进程如同白日做梦。即便美国成功迫使供应链回迁，由于快速自动化和生产率提高，一同带回的就业机会将大大减少。自2000年以来，美国制造业产出占GDP的比例仅下降了五分之一，但占总就业比例却下降了三分之一。此外，那些技能要求最低的工作不会流向美国，而是流向低工资的亚洲国家，如越南。

尚存的一线希望是在特朗普唱黑脸时，他的顾问和盟友会唱白脸，以关税为筹码来改写全球贸易规则，制约中国的重商主义——一个正当合理的目标。但掌权的毕竟是唱黑脸的那位，所以更可能出现的情形是特朗普拒绝让步，执着于扳回贸易逆差，夺回就业岗位，而且中国领导人似乎不愿意或无法考虑推行改革措施来壮大特朗普阵营中温和派的声音。

与中国休战的希望渺茫。近年历史表明，贸易争端难以解决。主张自由贸易的美国前总统奥巴马在2009年对中国轮胎征收关税，持续了三年。特朗普最近与墨西哥达成的贸易协议并未包括停止对其钢铁和铝材征税。美国新近对中国贸易制裁措施的升级同样不太可能迅速逆转。■



The economy

Life in a slower lane

Is the world's biggest infrastructure boom past its peak?

CHINA does not do infrastructure by half measures. It has the world's longest networks of motorway and high-speed rail (which Hong Kong joins on September 23rd, see next story). It has the tallest bridge as well as the longest. It is building nearly ten airports a year, more than any other country. It has the most powerful hydroelectric dam, the biggest wind farm and as much coal power as the rest of the world combined.

But the infrastructure boom has lost steam this year. After expanding at a double-digit pace for much of the past three decades, investment in it has slowed sharply. Since May spending on projects ranging from railways to power plants has fallen compared with a year earlier, the longest weak patch on record.

The question is whether this is a blip or a fundamental change. Some analysts argue that the decline in spending is only short-term, related to the government's efforts to rein in debt. As the trade war with America rumbles on (see Finance), they expect that China will try to boost the economy with another burst of infrastructure-building. But many others believe that even if this were to be attempted, it would not work. Their argument is not that investment should stop. China still usefully spends more in two months on such things as building roads and ports and laying cables than India manages in an entire year. Rather, they say, building at an even greater rate would risk outstripping demand. It is time to find other ways of fuelling growth.

The recent infrastructure-spending slump certainly relates to efforts to curb

the country's massive build-up of local-government debt. Many cities had been borrowing heavily, often using murky channels, to build flashy transport systems. A crackdown on shadow banking has left them short of funds. The central government has also targeted spendthrifts. Last year it ordered a halt to the construction of a subway in Baotou, a city in Inner Mongolia, a northern province where government debts are sky high.

But the slowdown is not just because of a short-term squeeze. Chinese officials are also becoming more conservative in their planning. In July the government decreed tough new standards for subway systems. Cities must have a population of at least 3m to qualify for one. They must also have their debts under control, and cover at least 40% of building costs from their own revenues.

In recent weeks big cities with much healthier economies than Baotou's have scaled back their subway plans, too. One example is Chengdu, the booming capital of Sichuan province, which has produced a revised blueprint for its transport system. It features six fewer subway lines than had previously been planned.

Nantong, a city about 150km north of Shanghai, demonstrates both China's prowess in infrastructure and what seems to be a newfound restraint. Builders are close to completing a cable-stayed bridge (pictured) that will be the longest of its type in the world. Yet at the same time Nantong has tempered its ambitions. Its urban centre is home to 2m people, spread over an area larger than London, below the required population for a subway system. It was already building its first line when the rules came into effect, and was allowed to continue with that and a second one.

But even without the new edict, Nantong had been having second thoughts. The city's traffic already flows well. Zhong Qingwen says she is typical in getting from her home to her office, at a medical-testing company, in less

than 20 minutes by bus. The city had been planning eight urban-rail lines. Their combined length of 330km would have surpassed that of Tokyo's subway. Now the government is moving more slowly. The first line will not be finished until 2022, four years later than the original target. Beyond the second one, further expansion is off the table for now.

One reason why many cities had such big dreams was because they expected a white-hot economy and a rapid influx of migrants from the countryside. Rising demand had seemed more or less assured. But both economic growth and the pace of urbanisation are tailing off. Spending on infrastructure still accounts for a fifth of China's annual output, far above the level of most other countries. Liu Shijin, a member of the central bank's monetary policy committee, said at a conference this month that the economic benefits of this were waning fast. Instead, he suggested, the government should spend more on health care and welfare.

Mr Liu may well be right. China's stock of government-invested fixed assets—a proxy for infrastructure—is already about the same per person as Germany's or Britain's, according to IMF data that use exchange rates adjusted for purchasing power. The stock is much greater than in other countries at China's income level. It is well behind America's, but it would have caught up within a decade had China continued spending on infrastructure at its previous feverish rate (see chart). Even the rosiest projections of China's infrastructure needs suggest that demand will slacken. Julian Evans-Pritchard of Capital Economics, a London-based research firm, says investment growth will slow to low single digits.

Yet the current slowdown has gone too far for the government. After a meeting on September 18th China's cabinet called for more "efficient" investment. Having slammed on the brakes to control debt, the central government is now making it easier for fiscally responsible localities to

spend on infrastructure. It has resumed approvals of some large projects. It has also encouraged banks to buy local-government bonds, including ones earmarked for infrastructure spending.

As a result, the flow of money into subways, bridges and the like may increase slightly, says Yao Wei of Société Générale, a French bank. But Ms Yao reckons that the voices for prudence will win out, even if the trade war with America begins to take a bigger toll on the economy. Unlike in the past, China will, she predicts, play it safe on debt and let growth slide.

One dividend from China's past infrastructure-building sprees has been the expertise it has gained in construction work. In Nantong a site managed by the China Railway Group, a state-owned company, is immaculate. Workers stand in front of a body-length mirror to check their safety gear. Cranes lay down a latticework of metal poles nearby to reinforce the terrain. A sign declares that it is a "100-year project"—a subway that should long serve the city. After a mad rush to build, China is also learning to live within its means. ■



经济

慢车道生活

世界上规模最大的基础设施建设热潮是否已经过了高峰期？

中国兴建基础设施绝不小打小闹。它拥有世界上里程最长的高速公路和高速铁路网络（香港于9月23日接入）。它有世界最高和最长的桥梁。它目前每年建造近十个机场，比其他任何国家都多。它有全球最大的水电站大坝和最大的风力发电场，火电厂的发电量与世界其他地区的总和相当。

但今年，基建热潮已经降温。过去30年里，基建投资在大多数年头都以两位数的速度增长，如今已急剧缩减。5月以来，涵盖从铁路到发电厂的项目开支较去年同期下跌，是有记录以来最长的投资低潮。

问题在于这一变化是暂时的还是根本性的。一些分析人士认为，基建支出下降只是短期现象，与政府努力控制债务有关。由于中美贸易战仍在继续，他们预计中国将尝试通过又一轮基础设施建设大潮来推动经济发展。但也有很多人认为，即使中国真要做这样的尝试，也是行不通的。他们并非认为应该停止投资。中国在两个月里花在修路、建港口和铺电缆等方面的有效投资比印度一整年投入的金额还要多。他们的意思是，以更快的速度开展基础设施建设有可能导致供大于求。中国是时候寻找其他方式来促进增长了。

近期基建开支的下滑当然与中国努力遏制地方政府累积庞大债务有关。许多城市一直在为建造华而不实的交通系统大量举债，往往使用灰色渠道。对影子银行的打击导致它们资金匮乏。中央政府还在打击挥霍浪费。去年，中央喊停了内蒙古包头市的地铁建设项目，内蒙古自治区政府已经债台高筑。

但基建速度放缓不仅仅是因为短期资金紧张。中国官员在做规划时也愈发保守。7月，政府新颁布了申建地铁的严格标准。城区人口在300万以上的城市才有资格建地铁。地方政府还必须控制自己的债务水平，项目总投资

中财政资金投入不得少于40%。

最近几周，经济状况远比包头健康的大城市也缩减了它们的地铁规划。蓬勃发展的四川省省会成都就是其中一例，它确定了最新的交通系统规划，地铁线路比之前的计划少了六条。

位于上海以北约150公里的南通市既展示了中国在基础设施方面的高超实力，又显现出一种似乎前所未有的克制。一座斜拉桥即将完工（见图），这将是世界上最长的斜拉桥。但与此同时，南通的雄心壮志已经有所收敛。它的城区面积比伦敦还要大，人口200万，未达到修建地铁系统的标准。新规定生效时，南通已经在修建地铁一号线，并获准继续完成一号线以及修建二号线。

但即使没有出台新法令，南通也已开始重新考虑其地铁计划。这个城市的交通已经很顺畅。钟庆文（音译）在一家医疗检测公司上班，她说自己乘坐公交车不到20分钟就能抵达办公室，而城里大部分人都是如此。南通之前一直在规划八条地铁线路，总长330公里，将超过东京的地铁总长。如今该市政府放慢了步伐。一号线要到2022年才完工，比最初的目标晚四年。二号线之后的其他线路目前都暂不做考虑。

之前许多城市都有宏大的基建梦，一个原因是它们预计经济将白热化发展，而农村人口将迅速涌入城市。那时，需求继续上涨这一点看起来差不多是板上钉钉的事，但如今经济增长和城市化进程都在减速。基建开支仍占中国每年总产出的五分之一，远高于大多数国家的水平。央行货币政策委员会委员刘世锦本月在一次会议上指出，基础建设带来的经济效益正在迅速减弱。他建议，政府应在医疗和福利上投入更多资金。

他很可能是对的。根据国际货币基金组织的数据（采用按购买力平价调整的汇率），在中国，政府投资的固定资产存量（即基础设施的度量指标）的人均水平已与德国或英国大致相同，远高于其他与中国收入水平相当的国家。中国的数字还远落后于美国，但如果继续以前的狂热劲头投资基建，十年之内就能赶上（见图表）。即使是对中国基础设施需求最乐观的

预测也表明需求将会放缓。总部位于伦敦的研究公司凯投宏观（Capital Economics）的朱利安·伊万斯-普理查德（Julian Evans-Pritchard）表示，投资增长将跌至很小的个位数。

然而目前的放缓对政府来说已是难以接受。9月18日召开常务会议之后，国务院呼吁扩大“有效”投资。在急踩刹车控制债务之后，中央政府现在已有所放松，方便财政审慎的地方政府投入基础设施。它已经重新放行了一些大型项目，还鼓励银行购买地方政府债券，包括专门用于基建开支的债券。

法国兴业银行的姚炜表示，投向地铁、桥梁等项目的资金可能会因此而略有增加。但她认为，即使与美国的贸易战开始对经济造成更大的影响，呼吁谨慎的声音最终还是会胜出。她预测，与过去不同，中国将在债务问题上求稳，并允许经济增长下滑。

中国从过去的基建热潮中获得的一个红利就是练就了一身建筑本领。在南通，由国企中国中铁管理的一个地铁工地无可挑剔。工人站在全身镜前检查身上的安全装备。起重机在附近铺设了钢筋网来加固地面。一条横幅宣称这条地铁是“百年工程”，将长长久久地服务南通。疯狂的建设潮过后，中国也在学习如何量入为出。 ■



In praise of air-conditioning

Rebirth of the cool

How to spread the benefits of air-conditioning—without frying the planet

WHAT is the single most effective way to reduce greenhouse-gas emissions? Go vegetarian? Replant the Amazon? Cycle to work? None of the above. The answer is: make air-conditioners radically better. On one calculation, replacing refrigerants that damage the atmosphere would reduce total greenhouse gases by the equivalent of 90bn tonnes of CO₂ by 2050. Making the units more energy-efficient could double that. By contrast, if half the world's population were to give up meat, it would save 66bn tonnes of CO₂. Replanting two-thirds of degraded tropical forests would save 61bn tonnes. A one-third increase in global bicycle journeys would save just 2.3bn tonnes.

Air-conditioning is one of the world's great overlooked industries. Automobiles and air-conditioners were invented at roughly the same time, and both have had a huge impact on where people live and work. Unlike cars, though, air-conditioners have drawn little criticism for their social impact, emissions or energy efficiency. Most hot countries do not have rules to govern their energy use. There is not even a common English word for "coolt" (the opposite of warmth).

Yet air-conditioning has done more than most things to benefit humankind. Lee Kuan Yew, the first prime minister of Singapore, called it "perhaps one of the signal inventions of history". It has transformed productivity in the tropics and helped turn southern China into the workshop of the world. In Europe, its spread has pushed down heat-related deaths by a factor of ten since 2003, when 70,000 more people than usual, most of them elderly, died in a heatwave. For children, air-conditioned classrooms and dormitories are associated with better grades at school (see International section).

Environmentalists who call air-conditioning “a luxury we cannot afford” have half a point, however. In the next ten years, as many air-conditioners will be installed around the world as were put in between 1902 (when air-conditioning was invented) and 2005. Until energy can be produced without carbon emissions, these extra machines will warm the world. At the moment, therefore, air-conditioners create a vicious cycle. The more the Earth warms, the more people need them. But the more there are, the warmer the world will be.

Cutting the impact of cooling requires three things (beyond turning up the thermostat to make rooms less Arctic). First, air-conditioners must become much more efficient. The most energy-efficient models on the market today consume only about one-third as much electricity as average ones. Minimum energy-performance standards need to be raised, or introduced in countries that lack them altogether, to push the average unit's performance closer to the standard of the best.

Next, manufacturers should stop using damaging refrigerants. One category of these, hydrofluorocarbons, is over 1,000 times worse than carbon dioxide when it comes to trapping heat in the atmosphere. An international deal to phase out these pollutants, called the Kigali amendment, will come into force in 2019. Foot-draggers should ratify and implement it; America is one country that has not done so.

Last, more could be done to design offices, malls and even cities so they do not need as many air-conditioners in the first place. More buildings should be built with overhanging roofs or balconies for shade, or with natural ventilation. Simply painting roofs white can help keep temperatures down.

Better machines are necessary. But cooling as an overall system needs to be improved if air-conditioning is to fulfil its promise to make people healthier, wealthier and wiser, without too high an environmental cost.

Providing indoor sanctuaries of air-conditioned comfort need not come at the expense of an overheating world. ■



空调赞歌

酷爽再生

如何普及空调的好处，同时又不让地球升温

要减少温室气体排放，单个最有效的方法是什么？都去吃素？恢复亚马逊的雨林？骑车上班？都不是。答案是：彻底改造空调。一项计算发现，到2050年，替换掉破坏大气层的制冷剂将能减少相当于900亿吨二氧化碳的温室气体。提高空调的能效还能让这个数字再翻一倍。相比之下，如果全球一半人口放弃吃肉，将能减少660亿吨二氧化碳排放；恢复三分之二已退化的热带雨林能减少610亿吨；全球骑车通勤的人数增加三分之一只能减少23亿吨。

空调是世界上最受忽视的产业之一。汽车和空调差不多在同一时间发明，两者都对人们生活和工作的选址产生了巨大的影响。然而与汽车不同的是，空调在社会影响、排放或能源效率方面没有受过什么批评。大多数气候炎热的国家没有管理空调能耗的法规。英文中甚至没有一个和“warmth”相对，表示气温凉爽的常用词【译注：“coolth”一词极少被使用】。

然而，空调带给人类的好处比大多数发明都多。新加坡第一任总理李光耀称空调“可能是历史上最重要的发明之一”。它改变了热带地区的生产力，帮助华南成为世界工厂。在欧洲，自2003年以来，由于空调的普及，与高温相关的死亡人数减少到原来的十分之一。2003年的那次热浪造成的死亡人数比以往多七万，其中大部分是老人。对于儿童而言，他们成绩的提高与教室和宿舍安装空调相关。

然而，将空调称为“我们负担不起的奢侈品”的环保主义者也有其道理。在接下来的十年中，全世界安装的空调数量将相当于1902年（发明空调的时候）至2005年之间安装的总数。除非我们生产的能源不再有碳排放，否则这些新增的机器将让地球变暖。因此，眼下空调造成了一个恶性循环。地球越暖，人们越需要空调，但是空调装得越多，地球就越暖。

要降低空调的影响需要做到三点（除了把冷气的温度调高些，别让房间冷得跟北极似的之外）。首先必须大幅提升空调的效率。目前市场上最节能的空调的能耗大约仅为普通空调的三分之一。需要提高最低能效标准，或者在完全没有这些标准的国家引入标准，以使普通空调的能效更接近最佳标准。

其次，制造商应该停止使用有害的制冷剂。其中一类是氢氟烃，它在大气中的捕热能力比二氧化碳高1000多倍。根据一项将于2019年生效的国际协议《基加利修正案》（Kigali amendment），这些污染物将逐步被淘汰。迟迟未通过该修正案的国家应该批准并实施它，美国是其中之一。

最后，可以在办公室、购物中心、甚至城市的设计上做更多尝试，让它们不需要那么多的空调。更多的建筑物应该建有悬挑屋顶或阳台用于遮阳，或者能自然通风。只要将屋顶涂成白色就有助于降温。

我们需要更好的空调。但是，如果空调要实现让人们更健康、更富裕和更明智的承诺，而不带来过高的环境成本，那么整个制冷系统都需要改进。提供有空调的舒适的室内庇护所不必以世界变暖为代价。■



Economic and financial indicators

Human Development Index

Between 2012 and 2017 Congo made the greatest strides in human development

Between 2012 and 2017 Congo made the greatest strides in human development, according to the UN's Human Development Index. In 2017 people in the central African country lived for over two years longer, and could expect to spend almost one year more in school, than they did five years before. Average income per person was also 20% higher than in 2012. The three countries that performed worst over that period are war-torn. In Syria incomes have fallen by almost half since the war began in 2012. The UN also calculates an adjusted index that takes inequality into account. On average, this reduces countries' scores by 20%; Congo's falls by over 30%. ■



经济与金融指标

人类发展指数

2012年至2017年间，刚果在人类发展方面取得的进步最大

联合国人类发展指数显示，2012年至2017年间，刚果在人类发展方面取得了最大的进步。相较于五年前，2017年这个中非国家居民的预期寿命延长了两年多，在校受教育的时间有望增长近一年，人均收入增长了20%。同期表现最差的是三个饱受战争蹂躏的国家。叙利亚自2012年爆发战争以来，国民收入几乎跌去一半。联合国还另外计算了一个经调整的指数，将不平等状况考虑在内。在这个指数中，各国的分数平均下降了20%，刚果的得分降幅超过30%。 ■



Blockchains

Nailing it

What blockchains may be able to do for your business, and what they can't

WEPOWER IS a Lithuanian startup that aims to change the way renewable-electricity projects are paid for. The government-guaranteed prices that have propelled growth in wind and solar energy around the world are being cut back, says Nick Martyniuk, WePower's founder. So his firm wants to help developers of renewables raise money by selling the rights to the electricity their plants will produce once built. Customers will buy a smart contract now, running on Ethereum's blockchain, that will provide them with power later.

Using a blockchain offers several advantages, says Mr Martyniuk, who used to work as an energy trader. Big energy users such as foundries and aluminium smelters already negotiate such contracts with power stations, but they are often complex and time-consuming. Contracts on a blockchain could be offered off the shelf, allowing smaller companies—and perhaps, one day, individuals—to use them too. Such contracts would be as easily tradable as any other crypto-asset, creating a secondary market in power agreements.

The blockchains that run cryptocurrencies (see diagram) could have far wider applications than tracking the transaction history of electronic cash. Investors have taken note. Crunchbase, a business-information firm, reckons that in the first five months of 2018 blockchain startups raised more than \$1.3bn from venture-capital firms, compared with around \$950m in the whole of 2017. Cloud-computing platforms from Amazon, IBM, Microsoft, Oracle and others let users experiment with using blockchains in their businesses. Professional-services firms such as Accenture and

PricewaterhouseCoopers are lining up to advise clients on the new technology.

The idea is that, because blockchains use distributed rather than centralised records and are more tamper-proof than other databases, they can be applied to tasks from streamlining medical record-keeping or trade finance to ensuring that diamonds and other minerals are ethically sourced. Santander, a bank, has said that adopting blockchains could save the finance industry \$20bn a year in back-office costs. Creative minds are already turning to exotic applications. LegalThings, a Dutch firm, announced in April that it wanted to put sexual consent on a blockchain; lovers would sign an unalterable electronic contract before taking things further and send copies to thousands of strangers for safekeeping.

The obvious way to think about blockchains is as a kind of database, though a more exact definition that commands general agreement is hard to come by. The original blockchain, invented to power bitcoin, was designed to solve a specific problem, says Richard Brown, chief technology officer at r3, a blockchain firm: “How can I build a system of electronic cash that is resistant to official censorship and confiscation?” Bitcoin does the job passably well but extremely inefficiently.

The feature that most business blockchains share with the bitcoin original is that the information stored in a blockchain is kept by the system’s users, not by a central authority, and that each entry is cryptographically linked to the ones before and after it. But businesses do not share the ideological motivations of bitcoin’s creators, so they can throw out parts of bitcoin’s technology they do not need. For example, both the bitcoin and the Ethereum blockchains are public and open for anyone to inspect, so they need a formal verification process for all transactions. But few businesses are keen to lay their back-office functions bare to the world, so most

enterprise blockchains are both private and “permissioned”, meaning that access is restricted to trusted users. Corda, a finance-focused blockchain developed by r3, a consortium of banks, and Hyperledger Fabric, originally developed by IBM and a firm called Digital Asset, work this way. Allowing only trusted participants removes the need for the wasteful proof-of-work systems that many cryptocurrencies use to update their records.

Other vendors weaken the cryptography that makes bitcoin transactions immutable. One reason is that European data-protection law gives individuals the right to ask for their data to be removed from a company's servers and imposes big penalties for non-compliance. Similar rules apply to medical data in America. But entries in a standard blockchain, once created, cannot be altered. Accenture has developed a mutable blockchain in which the content of individual blocks can be modified, leaving a digital “scar” to indicate that they have been changed.

Some business users prefer not to use the term “blockchain” at all, perhaps because they want to dissociate themselves from cryptocurrencies and their sometimes shady reputation. Corda, Digital Asset and a number of other firms like to call it “distributed-ledger technology”. But whatever the name of the game, there is no shortage of proposed uses.

A common one is to smooth business transactions by allowing the different entities involved to draw on the same records. Simon Whitehouse, managing director of financial services at Accenture, reckons that blockchains could help streamline supply chains by allowing records to be shared by suppliers, shipping companies, import agents, customs officials and so on. This would also make dispute resolution easier where supply chains cross international borders, he says. At present all those involved in a supply chain use their own proprietary systems to track consignments, so the same data are being used in different formats and different places and have to shuttle from one database to another. Replacing all that with a single

distributed database for everyone's use could offer big savings. Accenture is already piloting such a scheme with a big technology company.

The finance industry is experimenting with the technology, too. Fusion LenderComm, developed by a firm called Finastra, is running on r3's blockchain. It aims to streamline the syndicated-lending business, in which groups of banks jointly provide large loans for infrastructure projects and the like, by replacing an individual bank's systems with a piece of common infrastructure that any lender can use.

The Bank of Canada and the Monetary Authority of Singapore are collaborating to investigate blockchains as a way of improving international payments. Banks in different countries often run computer systems that cannot easily talk to each other, which makes payments slow and expensive. A single shared ledger could relieve much of the administrative burden. Santander has launched a smartphone app called One Pay FX that lets customers send international payments in a matter of seconds and tells them when they will arrive. Instead of the standard international financial plumbing, One Pay FX uses a closed, permissioned, quasi-blockchain system operated by Ripple, an American firm.

The cryptography that protects entries in a blockchain from tampering could also be used to build robust registers of everything from property deeds to company accounts. Several countries, most famously Honduras, have flirted with the idea of putting their land registries on blockchains to guard against fraud. DHL, a big logistics firm, is testing whether the technology could be applied to shipments of medicines. Everledger, which raised \$10.4m of funding in March, aims, among other things, to use blockchains to track the provenance of diamonds, from the mine to the wearer's finger.

For all the technology's potential, though, most attempts to use it remain

tentative. Honduras's property blockchain, originally announced in 2015, was eventually abandoned in the face of official indifference. And some supposed successes turn out to be wildly exaggerated. A rash of reports earlier this year that Sierra Leone had run the world's first blockchain-powered election, using software from a Swiss startup called Agora, had to be corrected on Twitter by the country's National Electoral Commission. It pointed out that the election had been tallied on to its own database, which "does not use Blockchain in any way". Agora, it appeared, had merely been observing the election, and its blockchain tallies did not match the official ones.

The advantages of blockchains are often oversold. Because of the overheads involved in shuffling data between all participants, blockchains are less efficient than centralised databases, a problem that gets worse as the number of users rises. When the Bank of Canada tried using blockchains to process domestic payments, which are already quite efficient, it found they offered no benefit. Stripe, a big digital-payments firm, has abandoned its blockchain experiments after three years of trying, describing the technology as "slow and overhyped".

Talk about blockchains as "truth machines" is particularly unhelpful, says Kai Stinchcombe, who runs True Link, a financial-services firm for retired people. Many products, such as diamonds or luxury handbags, already come with certificates of authenticity. A blockchain could reassure buyers that those certificates have not been tampered with. But that is not the same as proving they are true. "If you put garbage onto a blockchain, all you get is distributed, encrypted garbage," he points out.

Verisart, a firm that hopes to reduce art fraud by providing blockchain-powered certificates of an artwork's provenance, is a case in point. Armed with a picture from Wikipedia and an impish sense of humour, Terence Eden, a developer at Britain's Government Digital Service, convinced the

firm that he had painted a work called “La Gioconda”. That information was added to Verisart’s blockchain, where it was widely distributed and cryptographically secured. But that did not make it right. The painting is better known as the “Mona Lisa”, created by Leonardo da Vinci in 1503. In the same vein, says Mr Stinchcombe, a blockchain may make it easier to verify the paperwork that claims to show that a diamond is ethically sourced, but it cannot stop mine operators falsely claiming that their products are legitimate.

Enthusiasts are also beginning to realise that even when a blockchain might be a suitable tool for the job at hand, they will still need to resolve the same sorts of problems as for any other big IT project. Proposing a new standard is the easy part. The point is to get everyone, including competitors with little love for each other, to agree on important details such as who will be in charge, how the system will be built, how data formats will work and what happens if someone wants to leave. As David Gerard, a blockchain sceptic who works at the *British Medical Journal*, puts it: “Blockchains don’t solve the underlying problem of agreeing on what you want to do and how.” Applying blockchains to highly regulated industries such as finance, says Mr Brown at r3, means reassuring regulators that the systems can operate as planned, and that systemic risks can be minimised.

Computer scientists point out that the ideas underlying blockchains are hardly new. For example, the cryptographic linkages that secure entries in a block, known as Merkle trees, were first proposed in 1979. Still, the impression of novelty may serve a useful purpose. Sam Chadwick of the Thomson Reuters Foundation notes that the word “blockchain” can help spark interest among senior managers in the kind of back-office improvements that they would normally consider dull. And once competitors are sitting round a table, they find it easier to put aside their differences and work out more efficient ways of doing business. Mike Pisa of the Centre for Global Development, a charity, has been studying possible

uses of blockchains in poor countries and finds that “it’s a word that can attract attention to things we could have done before. That’s a positive.”

Tim Swanson, at Post Oak Labs, thinks blockchains are entering the “trough of disappointment” in the “hype cycle” proposed by Gartner, a technology consultancy. At this point, after an initial surge of excitement, reality reasserts itself as the limits of a technology become apparent. The key to making blockchains useful will be to manage expectations. And sometimes it is best to concede defeat. When Ujo Music tried to blockchainify the notoriously messy business of arranging payments to artists in the music industry, it did not succeed. The musicians were fazed by the technobabble; the technologists who had been called in did not understand the industry they were promising to revolutionise. They concluded: “We are but a few bright-eyed technologists with a special hammer, looking for the right nail.” ■



区块链

想搞定

区块链能为你的业务做什么，不能做什么

立陶宛的创业公司WePower想要改变可再生能源发电项目的融资方式。其创始人尼克·马蒂纽克（Nick Martyniuk）说，受政府担保的低价在世界各地推动了风力和太阳能发电的增长，但这种资助正在削减。因此他的公司想要帮助可再生能源的开发商融资，方法是预售发电厂建成后所生成电力的所有权。客户现在购买在以太坊区块链上运行的智能合约，日后会按这份合约获得供电。

曾是能源交易员的马蒂纽克说，使用区块链有几个好处。铸造厂和炼铝厂等大型能源用户已与发电站谈判此类合同，但它们通常复杂又耗时。区块链上的合同却可以是“现成的”，小企业也能使用，甚至于有朝一日个人也能用。这类合同还可以像任何其他加密资产那样方便地交易，创造一个供电协议的二级市场。

运行加密货币的区块链（见图）的应用可能远远超出跟踪电子现金交易的范畴。投资者已经注意到了这一点。商业资讯公司Crunchbase估计，2018年前五个月，区块链创业公司从风险投资公司那里筹集到超过13亿美元，而2017年全年的筹资额约为9.5亿美元。亚马逊、IBM、微软、甲骨文等公司的云计算平台让用户尝试在自己的业务中使用区块链。埃森哲和普华永道等专业服务公司正在争相为客户提供有关这项新技术的咨询。

人们相信，由于区块链使用的是分布式而非集中式的记录，且比其他数据库更能防篡改，它们可被应用于各种任务，从简化医疗记录或贸易金融，到确保钻石和其他矿产的出产过程符合道德标准等。桑坦德银行表示，采用区块链每年可为金融业节省200亿美元的后台成本。创新人士已经在开发稀奇古怪的应用。荷兰公司LegalThings4月宣称自己想把性行为协议放上区块链。在将彼此关系向前推进之前，恋人们会签署一份不可更改的电

子协议，并将其副本发送给成千上万陌生人以妥善保管。

关于区块链，一种显然的理解是它是一种数据库，但要找到一个能获得普遍共识的更精确的定义却不容易。区块链公司r3的首席技术官理查德·布朗（Richard Brown）说，最初区块链是为支持比特币而发明，其设计是为解决一个特定问题，“如何能建立一个能不被官方审查和没收的电子现金系统？”比特币算是完成了这项任务，但效率极低。

大多数商业区块链与比特币区块链所共有的特征，是区块链上存储的信息由系统的用户而非某个中央机构保存，且每个条目都以加密的方式与它前后的条目链接在一起。但企业并没有比特币创造者那种意识形态上的动机，因此它们可以抛弃自己不需要的那部分比特币技术。例如，比特币和以太坊区块链都是公开的，任何人都可以查看，因而它们需要对所有交易执行一个正式的验证过程。但很少有企业会喜欢把自己的后台功能暴露给全世界看，因此大多数企业区块链都是私密和“受权限保护的”，只有受信任的用户可以访问。由银行联盟r3开发的专注财务用途的Corda，以及最初由IBM和“数字资产”公司（Digital Asset）联合开发的Hyperledger Fabric就是以这种方式运作的。只允许受信任的参与者访问后，企业就不再需要像许多加密货币那样，用“工作证明”这种不经济的系统来更新记录了。

其他商家则削弱了令比特币交易不可更改的加密技术。原因之一是欧洲的数据保护法赋予个人要求从公司服务器中删除其数据的权利，并严惩拒不遵循者。美国对于医疗数据也有类似的规定。但是，在标准化区块链中，条目一旦创建就无法更改。埃森哲开发了一种可变区块链，单个区块中的内容可被修改，并留下一条数字“疤痕”以表明它们曾被修改过。

一些商业用户不想使用“区块链”这个名称。这可能是因为他们想和加密货币以及它们的某些不良声誉划清界限。Corda和“数字资产”等一批公司喜欢称之为“分布式分类账技术”。但无论用的是什么名字，人们提出的用途确实不少。

一个常见的用途是让参与商业交易的不同实体能够使用相同的交易记录，

让交易过程变得更流畅便捷。埃森哲金融服务部门主管西蒙·怀特豪斯（Simon Whitehouse）认为，区块链可以让供应商、航运公司、进口代理商、海关官员等各方共享记录，从而简化供应链。他说，这也会让涉及跨国供应链的争端更易解决。目前，供应链中所有各方都使用自己专有的系统来跟踪货物，因此相同的数据在不同的地方有不同的格式，而且不得不在多个数据库之间来回传输。用一个人人可用的单一分布式数据库替换所有这些数据库可以节省大量的成本。埃森哲已经在和一家大型科技公司试行这种方案。

金融业也在试验区块链技术。r3的区块链正在运行由Finastra公司开发的Fusion LenderComm。当多家银行联合为基础设施等项目提供大额贷款时，它用任何贷款方都可使用的通用基础设施取代银行自有系统，让这种银团贷款业务变得更加高效。

加拿大银行和新加坡金融管理局（MAS）正在合作研究用区块链改善国际支付。不同国家的银行所运行的计算机系统往往不能便捷地互动，这使得跨境支付缓慢又昂贵。一个单一的共享分类帐能够大幅减轻行政管理负担。桑坦德银行推出了一款名为One Pay FX的智能手机应用，可让客户在几秒钟内发送国际付款，还会告知客户账款将于何时到达。该应用绕过了标准国际金融系统，使用由美国公司瑞波（Ripple）运营的一个封闭的、有权限的准区块链系统。

保护区块链中的条目免受篡改的加密技术也可用于构建从房契到企业账户的各种稳妥的记录。有几个国家已尝试将土地登记放到区块链上以防欺诈，其中最著名的是洪都拉斯。大型物流公司DHL正在测试该技术是否可用于药品运输。Everledger在3月融资1040万美元，其目标之一是用区块链追踪钻石从矿山一路到某个人的手指上的过程。

不过，虽然区块链技术有这样那样的潜力，大多数尝试仍是实验性的。洪都拉斯最初于2015年宣布推出房产区块链，最终却因官方对此漫不经心而放弃。而一些所谓的成功实则夸大得不着边际。今年早些时候，媒体大量报道塞拉利昂使用瑞士创业公司Agora的软件完成了全球首个“区块链上的

大选”。但稍后该国的全国选举委员会在Twitter上辟了谣。它称计票是在该委员会自己的数据库上完成，“完全没有用到区块链”。看起来，Agora只是从旁观察了选举，而它区块链上的计票结果与官方不符。

区块链的好处常被夸大。鉴于在所有参与者之间更新数据所需耗费的成本，区块链比集中式数据库效率低，且随着用户数量的增加这个问题会愈发凸显。加拿大银行曾尝试使用区块链来处理本已颇为高效的国内支付，但发现它们没能带来任何好处。大型数字支付公司Stripe经过三年尝试后放弃了区块链实验，称这项技术“缓慢、名不副实”。

将区块链奉为“真相的机器”尤其无济于事，“真实连结”公司（True Link）的老板卡伊·斯廷科姆（Kai Stinchcombe）指出。这家公司为退休人士提供金融服务。许多产品，比如钻石或名贵手袋，本身已经附有真品证书。区块链可以向买家保证这些证书未被篡改过。但这与证明它们本身是真品并不是一回事。“如果你把垃圾放到区块链上，你得到的也就是分散的、加密的垃圾。”他说。

Verisart公司就是一个例子。这家公司希望用区块链支持的艺术品出处证书减少欺诈。英国政府下属数字服务部（Government Digital Service）的开发人员特伦斯·艾登（Terence Eden）开了个调皮的玩笑，用维基百科上的一张图说服了Verisart自己画了一幅名为《La Gioconda》的作品。这则信息被添加到Verisart的区块链上广为散播，并加密以确保安全。但这么做并不能确保真相。这幅画更为人熟知的名称是“蒙娜丽莎”（Mona Lisa，译注：La Gioconda是这幅画的意大利语名称），由达芬奇创作于1503年。同样，斯廷科姆说，区块链让人们更容易验证那些声称某颗钻石出产过程符合道德的文书，但无法阻止矿山经营者谎称他们的产品是合法的。

热衷区块链的人们也开始意识到，即使区块链可能是适用于手头任务的工具，他们仍然需要解决任何其他大型IT项目都会遇到的那类问题。提出新标准只是简单的一步。难点在于让每个人——包括对彼此“无爱”的竞争对手——就重要细节达成一致，例如由谁负责、如何构建系统、数据格式如何运作，以及如果有人想离开时怎么办。正如任职于《英国医学期刊

刊》(British Medical Journal) 的区块链怀疑论者大卫·杰拉德 (David Gerard) 所言：“区块链无法解决一个根本问题：就你们想做什么和如何做达成一致意见。”r3的布朗说，将区块链应用于像金融这样被高度监管的行业意味着要向监管机构确保系统会按计划运行，且系统风险会降至最低。

计算机科学家指出，区块链背后的创意并不新鲜。例如，保护区块中条目安全性的加密链接被称为“默克尔树”，最初于1979年提出。不过，作为新鲜事物的印象可能会有用。汤森路透基金会 (Thomson Reuters Foundation) 的山姆·查德威克 (Sam Chadwick) 指出，“区块链”这个词有助于激发高级管理人员对改进后台系统的兴趣，往常他们总觉得这一块很乏味。而一旦竞争对手都坐到了同一张桌子边，他们会发现自己更容易搁置差异，一起找出更高效的经营方式。慈善机构全球发展中心 (Centre for Global Development) 的迈克·比萨 (Mike Pisa) 一直在研究贫困国家利用区块链的可能性，他发现“这个词可以引发对那些我们以前就可以做的事情的关注。这是好事。”

星毛栎实验室 (Post Oak Labs) 的蒂姆·斯旺森 (Tim Swanson) 认为，在技术咨询公司高德纳 (Gartner) 提出的“光环曲线”中，区块链正在进入“失望的低谷”。在这一转折点上，最初的兴奋期已过，技术的局限显现，现实替代了想象。要让区块链真正产生用处，关键将是对预期的管理，而且有时最好承认失败。创业公司Ujo Music试图把向艺术家支付版权费这个环节搬上区块链，以理清这个音乐行业中出了名混乱的环节。但它没能成功。音乐家们被技术术语弄得云山雾罩。请来的技术专家同样不了解自己承诺要革新的这个行业。他们总结说：“我们不过是一些兴致勃勃的技术人员，手举一把特别的锤子，寻找适合它的钉子。”■



Bitcoin

Riding the rollercoaster

The best-known cryptocurrency has been a failure as a means of payment, but thrilling for speculators

THE PRICE chart at CoinDesk, a cryptocurrency news site, begins on July 18th 2010, when a bitcoin could be had for \$0.09. By November 2013 it had reached \$1,124. In the summer of 2017 it started to take off, reaching over \$19,000 in December. By end-March 2018 it was back down below \$7,000 and in late August it was hovering between \$6,400 and \$6,500 (see chart). That has made a few people very rich (just 100 accounts own 19% of all existing bitcoin), encouraged others to play for quick gains and left some nursing substantial losses.

Bitcoin was never meant to be an object of speculation. When the pseudonymous Satoshi Nakamoto published a short paper outlining his plan for bitcoin a decade ago, it was as a political project. Bitcoin's roots lie in the "cypherpunk" movement, a philosophy that combines an anarchic dislike of governments and large companies with the techno-Utopian belief that computers and cryptography can liberate and protect people. Much of the early development of the internet was informed by similar ideas.

Bitcoin was intended as a computerised version of cash or gold, a "censorship-resistant" alternative to online payment systems run by companies such as Visa and PayPal. If trust in a central authority could be replaced with trust in computer code and mathematics, users could cut out the middleman and deal directly with each other, rugged individualist to rugged individualist.

Electronic cash is not a new idea. In a paper published in 1982 David Chaum,

a computer scientist, had suggested using cryptography to create electronic cash, and the cypherpunks had been kicking such ideas around since the late 1990s. What made Mr Nakamoto's invention stand out was that he had found a solution to one of the biggest problems with computerised money—how to keep users from spending the same digital coin repeatedly without relying on a trusted authority to check every transaction.

With a physical currency, this problem mostly takes care of itself. Once a coin or note has been handed over, its original owner can no longer spend it. But digital currencies are just wisps of information on a computer, and computers are designed to move and copy information easily. Mr Nakamoto solved the problem by handing the job of policing the system to its users. Bitcoin is designed to generate a permanent, constantly growing list of every transaction ever performed with the currency—the “blockchain”. Since all users have a copy of the system's records, they would spot attempts to spend the same bitcoin twice.

A centralised institution like a bank can simply update its internal records every time its customers perform a transaction. Since bitcoin is decentralised, though, all transactions must be broadcast to everyone on the network so that they can update their local copies of the blockchain. When two parties want to make a transaction, they alert everyone else of their intention. Those proposed transactions are bundled into blocks by a subset of users called “miners”, whose job is to maintain the records and ensure their integrity. Every block is connected to its predecessor by a chain of cryptographic links, which makes it next to impossible to alter records once finalised.

In order to prevent malicious miners from subverting that process, bitcoin requires something called “proof of work”, in which miners demonstrate their commitment by competing to crack mathematical problems that are hard to solve but whose solutions are easy to check. Only the winner of each

competition is allowed to add a block to the chain. The network aims for an average block-generation rate of one every ten minutes. If blocks come in faster than this, mining is made harder to slow things down.

All that computation takes a lot of electricity, and hence money, so each new block earns its miner a reward, starting off at 50 bitcoin in 2009 and programmed to halve every four years. It is currently 12.5 bitcoin, or around \$80,000. These block rewards are the only source of new bitcoin in the system. Mr Nakamoto argued that central banks cannot be trusted not to debase their currencies by printing money, so he set a hard limit of 21m for the number of bitcoin that could ever be mined.

All this may sound complicated, but the system generally works. Bitcoin can be used to make payments between any two users of the software, and though the experience is not exactly like using cash, it is a reasonable electronic analogue. Even so, bitcoin has failed to become an established currency, let alone—as its more ideological supporters had hoped—to flourish as an alternative to the traditional financial system.

One reason is that it is still not user-friendly. All participants have to download specialist software, and getting traditional money into and out of bitcoin’s ecosystem is fiddly. Moreover, although the lack of a central authority makes the system resilient to attempts at coercion, it also means that if something goes wrong, there is no one who can fix it.

The original idea was that bitcoin users would “be their own banks”, responsible for the security of their own funds, says David Gerard, a cryptocurrency-watcher and systems administrator. But that is harder than it sounds. If you lose access to your stash of bitcoin—say, by mislaying a USB stick or accidentally overwriting a hard drive—it can be impossible to recover. Many users therefore store their bitcoin on exchanges (companies that let users trade ordinary currency for the cryptographic sort). But many

exchanges are amateurish operations and have an unenviable record of being hacked. And when bitcoins are stolen, there is no insurance scheme to make the owners whole. Nor are there any other protections of the sort that modern consumers take for granted. Mr Nakamoto's original paper proudly points out that with bitcoin, chargebacks (used when a credit-card holder disputes a transaction) are impossible.

There are structural problems, too. The size of an individual block of transactions is fixed, and the network enforces an average block-generation rate of one every ten minutes. In practice, that limits bitcoin's throughput to around seven transactions per second. (Visa's payment network can manage tens of thousands.) So when demand for bitcoin transactions is high, the system clogs up. Users have to accept that their transactions may be delayed or not go through at all, or offer miners extra fees as an incentive to prioritise their payments. Mr Nakamoto had hoped that bitcoin's transaction fees would settle at fractions of a cent, but at the height of the boom in late 2017 they briefly reached \$55. They have since come down to about \$0.65.

Bitcoin's developers have tried various tweaks and workarounds to ease the jam. A scheme called SegWit, first introduced in August 2017, has provided a little extra wiggle room. A more ambitious proposal, called the Lightning Network, hopes to take the bulk of transactions off the ponderous blockchain system and getting users to trade directly with each other, but after a couple of years in development it remains plagued by reliability problems. One recent evaluation by Diar, the cryptocurrency-research firm, found that Lightning transactions became increasingly less likely to be completed successfully as they got bigger.

Volatility, insecurity and occasional congestion make for a poor currency, so bitcoin has done best on the economic fringes. One use is for buying drugs and other dodgy items from online black markets, where buyers and

sellers are prepared to put up with the downsides because they want to cover their tracks. It can help citizens of countries with currency controls get around them, says Alistair Milne, a financial economist at the University of Loughborough. And some cyber-criminals have turned to it for ransom demands.

Legitimate businesses, with a few exceptions, have proved more cautious. A report from JPMorgan published in 2017 found that, of the top 500 online retailers, only three accepted bitcoin, down from five the year before. Among those that have stopped supporting it are Expedia, a travel agency, and Valve, which runs Steam, an online video-games shop (which cited “high fees and volatility” as the reasons). Chainalysis, a research firm based in New York that tracks data from 17 different bitcoin merchant-payment processors, found that monthly transactions peaked in September 2017 at \$411m, and had declined to \$60m by May this year.

The volatility that makes bitcoin unattractive as a currency also makes it an exciting target for speculation. “If we’re being honest,” says Tim Swanson, the founder of Post Oak Labs, a firm that provides technology advice, “the majority of people are buying [cryptocurrencies] because they hope the price will go up, rather than for any great philosophical reason.”

Condemnation from prominent figures has only added to the currency’s allure. Warren Buffett, a wealthy American investor, has called bitcoin “rat poison”. Jamie Dimon, the boss of JPMorgan—the sort of financial institution that bitcoin fans dislike—has described it as “a fraud”. A research note from Goldman Sachs, a bank, published in July, describes cryptocurrencies as “a mania” and concludes that they “garner far more...attention than is warranted”. Still, back in May the same bank announced its intention to open a cryptocurrency trading desk, citing demand from its customers. Autonomous Next, a financial-research firm, reckons that 175 cryptocurrency funds were set up in 2017, up from just 20

the year before.

Would-be punters will need a strong stomach. Bitcoin is thinly traded and barely regulated, and rumours of large-scale price manipulation have been supported by unusual trading patterns on exchanges. A paper published by two researchers at the University of Texas at Austin asks whether Tether, another cryptocurrency, is being used to prop up the price of bitcoin.

Governments are beginning to take notice. In May South Korean regulators raided Upbit, that country's largest cryptocurrency exchange. In the same month America's justice department began a criminal investigation into manipulation of bitcoin's price.

Official scrutiny, and the recent drop in prices, have spooked many investors. Goldman Sachs argues that bitcoin remains overvalued. But for every bear there is a bull. Tim Draper, a venture capitalist who made his fortune backing technology companies, has forecast that by 2022 a bitcoin will be worth \$250,000. ■



比特币

乘上过山车

最著名的加密货币是一种失败的支付手段，但却让投机者兴奋不已

加密货币新闻网站CoinDesk的价格图表于2010年7月18日推出，当时一个比特币只要0.09美元。2013年11月，它已达到1124美元。2017年夏天它的价格开始飙升，12月突破19,000美元。到2018年3月底，它已回落至7000美元以下，到了8月底徘徊在6400美元至6500美元之间（见图表）。这让一些人变得非常富有（仅仅100个账户就拥有所有现有比特币的19%），吸引其他人来赚一笔快钱，并给一些人带来巨大损失。

比特币从未打算成为投机的对象。当署名“中本聪”的人于十年前发表一篇简短的论文，概述了他的比特币计划时，它是一个政治项目。比特币源于“密码朋克”（cypherpunk）运动，这一运动把无政府主义者对政府和大公司的厌恶，与认为计算机和密码学可以解放和保护人们的技术乌托邦信念结合了起来。互联网的早期发展大多来自类似的想法。

比特币本想成为现金或黄金的计算机化版本，是维萨和贝宝等公司运营的在线支付系统的“防审查”替代品。如果对中央权威的信任可以被对计算机代码和数学的信任所取代，那么用户就可以绕开中间人直接交易——一位坚定的个人主义者面对另一位坚定的个人主义者。

电子现金并不是一个新想法。在1982年发表的一篇论文中，计算机科学家大卫·查姆（David Chaum）曾建议使用加密技术来创造电子现金，自上世纪90年代末以来，密码朋克们一直在泛泛地讨论这些想法。中本聪的发明之所以能脱颖而出，是因为他为计算机化的货币存在的最大问题之一找到了解决方案——如何能在不依赖可信权威机构检查每笔交易的情况下，防止用户重复使用同一枚数字货币。

对于实物货币，这个问题基本不存在。一旦硬币或纸币被转交，其原始所

有者就不能再花它了。但数字货币只是计算机上的一小撮信息，而计算机可以轻松地移动和复制信息。中本聪的解决方法是把监督系统的工作交给了用户。比特币会生成一个永久而不断增长的清单——“区块链”，记录下用这种货币进行的每一笔交易。由于所有用户都拥有系统记录的副本，企图两次使用同一个比特币就会被发现。

对于银行这样的集中式机构，每有客户执行交易时它们只需简单地更新内部记录即可。但是，由于比特币是去中心化的，所有交易都必须向网络上的每个人广播，让他们更新区块链的本地副本。当有两方想要交易时，他们会把意图告诉其他所有人。这些交易申请被用户中称为“矿工”的那部分人捆绑成区块。“矿工”的工作是维护记录并确保它的完好诚信。每个区块都通过一个加密链连接到前一个区块，这使得记录一旦确定就几乎无法更改。

为了防止有恶意的矿工破坏这一过程，比特币需要一种称为“工作量证明”的东西，矿工要竞相破解难以解决但答案易于验证的数学问题来证明他们的投入。只有每次竞赛的获胜者才可以在链上添加一个区块。这个网络的目标是平均每十分钟生成一个区块。如果区块的生成比这更快，系统就会增加挖掘的难度以让速度慢下来。

所有这些计算都需要大量的电力，也就需要花钱，所以每个新的区块都会让矿工获得奖励，从2009年的50个比特币开始，每四年减半。它目前是12.5个比特币，或约80,000美元。这些区块奖励是系统中新比特币的唯一来源。中本聪认为我们无法信任中央银行会不通过印钞来让货币贬值，因此他设定了可开采的比特币数量为2100万个的硬限制。

所有这些听起来可能很复杂，但这个系统总体而言还是有效的。比特币可用于在任何两个软件用户之间进行支付，虽然体验和使用现金还不太一样，却也算是一种合理的电子模拟。即便如此，比特币没能成为一种公认的货币，更不用说——像其理念的支持者所希望的那样——成长为传统金融体系的替代品。

一个原因是它对用户仍然不够友好。所有参与者都必须下载专门的软件，而让传统资金进出比特币的生态系统非常繁琐。此外，尽管没有了中央机构使得系统更能够抵御压制，但这也意味着一旦出现问题，就没有人可以解决。

最初的想法是比特币用户将“成为他们自己的银行”，负责自己资金的安全，加密货币观察员和系统管理员大卫·杰拉德（David Gerard）说。但这说来容易做来难。如果您无法访问自己的比特币，例如丢了U盘或意外覆盖了硬盘，那就基本上无法找回来了。因此，许多用户将他们的比特币存储在交易所（允许用户用普通货币换取加密货币的公司）。但是许多交易所的运营都有点业余，它们被黑客攻击的记录并不光彩。而当比特币被盗时，没有任何保险计划可以补偿所有者的损失，也没有任何其他现代消费者习以为常的保护措施。中本聪的原始论文自豪地指出，使用比特币，退单（在信用卡持有人对交易提出异议时使用）是不可能的。

此外还存在结构性问题。单个交易区块的大小是固定的，并且网络强制规定区块生成速率为平均每十分钟一个。实际上，这将比特币的吞吐量限制在每秒约七次交易（维萨卡的支付网络每秒可处理数万次交易）。因此，当对比特币交易的需求很高时，系统就会堵塞。用户不得不接受他们的交易可能会延迟或根本不被通过，或者要向矿工提供额外费用作为优先处理支付的激励。中本聪曾希望比特币的交易费用能够稳定在一美分以内，但在2017年末的高峰时期，交易费用曾短暂达到55美元。之后又不断下降至0.65美元左右。

比特币的开发人员尝试了各种调整和变通来减轻堵塞。2017年8月首次推出的名为SegWit的计划带来了一些新的回旋空间。一个更加宏大的提议称为“闪电网络”，希望能把大部分交易从缓慢又笨重的区块链系统中拿掉，让用户直接相互交易，但经过几年的开发，它仍然饱受可靠性问题的困扰。加密货币研究公司Diar最近的一项评估发现，闪电网络交易额度越大就越难完成。

波动性、不安全性和偶尔的拥堵导致比特币成为一种糟糕的货币，因此它

在边缘经济活动上做得最好。一个用途是从在线黑市购买药品和其他见不得人的东西。买家和卖家愿意忍受种种弊端，因为他们想要掩盖自己的痕迹。拉夫堡大学金融经济学家阿利斯泰尔·米尔恩（Alistair Milne）表示，它可以帮助人们绕开所在国实施的货币管控。一些网络犯罪分子已经用它来索取赎金。

除了少数例外，合法的企业表现得更加谨慎。摩根大通2017年发布的一份报告发现，在最大的500家在线零售商中，只有3家接受比特币，比前一年的5家还要少。那些停止支持它的商家包括旅行公司Expedia和运营在线游戏商店Steam的威尔乌（Valve，它称原因是“高费用和波动性”）。总部位于纽约的研究公司Chainalysis追踪了来自17家比特币支付处理商的数据，发现月度交易在2017年9月达到4.11亿美元的顶峰，到今年5月已降至6000万美元。

波动性让比特币成为糟糕的货币，却也使其成为令人兴奋的投机目标。“老实说，”提供技术咨询的Post Oak Labs公司的创始人蒂姆·斯万森（Tim Swanson）表示，“大多数人买[加密货币]都是因为希望价格上涨，而不是出于什么伟大的哲学原因。”

来自知名人士的谴责让这种货币的吸引力不降反升。富有的美国投资者沃伦·巴菲特称比特币是“老鼠药”。摩根大通（它正是比特币的拥趸讨厌的那类金融机构）的老板杰米·戴蒙（Jamie Dimon）称其为“诈骗”。高盛7月份发布了一份研究报告，将加密货币描述为“一群人头脑发热”，并认为它们“获得了……比其应得多得多的关注”。不过，早在5月份，同样也是高盛宣布计划开设加密货币交易柜台，理由是客户要求。金融研究公司Autonomous Next估计2017年共有175个加密货币基金建立，而前一年只有20个。

未来的赌徒得有强大的心脏。比特币交易量小且几乎不受监管，而交易所不寻常的交易模式支持了大规模价格操纵的传闻。德克萨斯大学奥斯汀分校的两位研究人员发表了一篇论文，质疑另一种加密货币泰达币（Tether）是否被用来支撑比特币的价格。

政府开始注意到这一点。今年5月，韩国监管机构突袭了该国最大的加密货币交易所Upbit。同月，美国司法部开始对操纵比特币价格的事宜展开刑事调查。

官方调查以及最近的价格下跌吓坏了许多投资者。高盛称比特币仍然被高估。但是每只熊后面都有一头牛。靠支持科技公司发家的风险资本家蒂姆·德雷珀（Tim Draper）预计，到2022年一个比特币的价值将达到25万美元。 ■



Berlin, Rawls and Nozick

Rawls rules

Three post-war liberals strove to establish the meaning of individual freedom

ONE definition of a liberal is a person who supports individual rights and opposes arbitrary power. But that does not tell you which rights matter. For example, some campaigners say they want to unshackle transgender people, women and minorities from social norms, hierarchies and language that they see as tyrannical. Their opponents say that this means limiting what individuals do and say, for instance by censoring frank discussions of gender, or forbidding the emulation of minority cultures. Supporters of these kinds of “identity politics” claim to be standing up for rights against unjust power. But their opponents do, too. If both claim to be “liberal”, does the word mean much at all?

The problem is not new. Isaiah Berlin identified the crucial fault line in liberal thought in Oxford in 1958. There are supporters of “negative” liberty, best defined as freedom not to be interfered with. Negative liberties ensure that no person can seize his neighbour’s property by force or that there are no legal restrictions on speech. Then there are backers of “positive” liberty, which empowers individuals to pursue fulfilling, autonomous lives—even when doing so requires interference. Positive liberty might arise when the state educates its citizens. It might even lead the government to ban harmful products, such as usurious loans (for what truly free individual would choose them?).

Berlin spied in positive liberty an intellectual sleight of hand which could be exploited for harm. Born in Riga in 1909, he had lived in Russia during the revolutions of 1917, which gave him a “permanent horror of violence”. In 1920 his family returned to Latvia, and later, after suffering anti-Semitism,

went to Britain. As his glittering academic career progressed, Europe was ravaged by Nazism and communism.

Under positive liberty the state is justified in helping people overcome their internal, mental vices. That lets government decide what people really want, regardless of what they say. It can then force this on them in the name of freedom. Fascists and communists usually claim to have found a greater truth, an answer to all ethical questions, which reveals itself to those who are sufficiently adept. Who, then, needs individual choice? The risk of a perversion of liberty is especially great, Berlin argued, if the revealed truth belongs to a group identity, like a class or religion or race.

To reject positive liberty is not to reject all government, but to acknowledge that trade-offs exist between desirable things. What, for example, of the argument that redistributing money to the poor in effect increases their freedom to act? Liberty must not be confused with “the conditions of its exercise”, Berlin replied. “Liberty is liberty, not equality or fairness or justice or culture, or human happiness or a quiet conscience.” Goals are many and contradictory and no government can infallibly pick among them. That is why people must be free to make their own choices about what constitutes good living.

Yet determining the proper sphere of that freedom has been the great challenge all along. One lodestar is the harm principle. Governments should interfere with choices only to prevent harm to others. But this is hardly a sufficient rule with which to exercise power, because there are plenty of harms that liberals typically do permit. An entrepreneur might harm an incumbent businessman by bankrupting him, for example. The most significant attempt of the 20th century to find a stronger boundary between the state and the individual was made by the Harvard philosopher John Rawls in 1971.

Rawls's "A Theory of Justice" sold over half a million copies, reinvigorated political philosophy and anchored debates between liberals for decades to follow. It posited a thought experiment: the veil of ignorance. Behind the veil, people do not know their talents, class, gender, or even which generation in history they belong to. By thinking about what people would agree to behind the veil, Rawls thought, it is possible to ascertain what is just.

To begin with, Rawls argued, they would enshrine the most extensive scheme of inalienable "basic liberties" that could be offered on equal terms to all. Basic liberties are those rights that are essential for humans to exercise their unique power of moral reasoning. Much as Berlin thought the power to choose between conflicting ideals was fundamental to human existence, so Rawls argued that the capacity to reason gives humanity its worth. Basic liberties thus include those of thought, association and occupation, plus a limited right to hold personal property.

But extensive property rights, allowing unlimited accumulation of wealth, do not feature. Instead, Rawls thought the veil of ignorance yields two principles to regulate markets. First, there must be equality of opportunity for positions of status and wealth. Second, inequalities can be permitted only if they benefit the least well-off—a rule dubbed the "difference principle". Wealth, if it is to be generated, must trickle all the way down. Only such a rule, Rawls thought, could maintain society as a co-operative venture between willing participants. Even the poorest would know that they were being helped, not hindered, by the success of others. "In justice as fairness"—Rawls's name for his philosophy—"men agree to share one another's fate."

Rawls attributed his book's success with the public to how it chimed with the political and academic culture, including the civil-rights movement and opposition to the Vietnam war. It demonstrated that left-wing liberalism

was not dreamed up by hippies in a cloud of marijuana smoke, but could be rooted in serious philosophy. Today, the veil of ignorance is commonly used to argue for more redistribution.

Ironically, since 1971 the rich world has mostly gone in the opposite direction. Having already built welfare states, governments deregulated markets. Tax rates for the highest earners have fallen, welfare benefits have been squeezed and inequality has risen. True, the poorest may have benefited from the associated growth. But the reformers of the 1980s, most notably Margaret Thatcher and Ronald Reagan, were no Rawlsians. They would have found more inspiration in Rawls's Harvard contemporary: Robert Nozick.

Nozick's book "Anarchy, State and Utopia", published in 1974, was an assault on Rawls's idea of redistributive justice. Whereas Rawls's liberalism relegates property rights, Nozick's elevates them. Other forms of liberty, he argued, are excuses for the immoral coercion of individuals. People own their talents. They cannot be compelled to share their fruits.

Nozick questioned whether distributive justice is even coherent. Imagine some distribution of wealth that is deemed to be just. Next suppose that a large number of people each pay 25 cents to watch Wilt Chamberlain, then the top player in the NBA, play basketball. A new distribution would emerge, containing a very rich Mr Chamberlain. In this transition, people would have engaged in purely voluntary exchanges with resources that are properly theirs, if the initial distribution really is just. So what could be the problem with the later one? Liberty, Nozick said, disrupts patterns. Justice cannot demand some preferred distribution of wealth.

His work contributed to a philosophy in favour of small government that was blooming at the time. In 1974 Friedrich Hayek—Thatcher's favourite thinker—won the Nobel prize in economics. Two years later it went to

Milton Friedman. But although the world moved rightward, it did not shift far enough to become Nozickian. “Anarchy, State and Utopia” called for only a minimal, “nightwatchman” state to protect property rights. But vast government spending, taxation and regulation endure. Even America, despite its inequality, probably remains more Rawlsian.

Some of Rawls’s fiercest critics have been to his left. Those concerned with racial and gender inequality have often seen his work as a highfalutin irrelevance. Both Rawls and Nozick practised “ideal theory”—hypothesising about what a perfect society looks like, rather than deciding how to fix existing injustices. It is not clear, for example, whether Rawls’s principle of equality of opportunity would permit affirmative action, or any other form of positive discrimination. Rawls wrote in 2001 that the “serious problems arising from existing discrimination and distinctions are not on [justice as fairness’s] agenda.” Nozick acknowledged that his views on property rights would apply only if there had been no injustice in how property had been acquired (such as the use of slaves, or the forced seizure of land).

Rawls was also more concerned with institutions than with day-to-day politics. As a result, on today’s issues his philosophy can fire blanks. For example, feminists often say he did too little to flesh out his views on the family. His main prescription is that interactions between men and women should be voluntary. That is not much help to a movement that is increasingly concerned with social norms that are said to condition individual choices.

Rawlsianism certainly provides little to support identity politics. Today’s left increasingly sees speech as an exercise in power, in which arguments cannot be divorced from the identity of the speaker. On some university campuses conservative speakers who cast doubt on the concepts of patriarchy and white privilege, or who claim that gender norms are not

arbitrary, are treated as aggressors whose speech should be prevented. The definition of “mansplaining” is evolving to encompass men expressing any opinion at length, even in writing that nobody is compelled to read. Arguments, it is said, should be rooted in “lived experience”.

This is not how a Rawlsian liberal society is supposed to work. Rawls relied on the notion that humans have a shared, disinterested rationality, which is accessible by thinking about the veil of ignorance, and is strengthened by freedom of speech. If arguments cannot be divorced from identity, and if speech is in fact a battleground on which groups struggle for power, the project is doomed from the outset.

Rawls thought that the stability of the ideal society rests on an “overlapping consensus”. Everyone must be sufficiently committed to pluralism to remain invested in the democratic project, even when their opponents are in power. The polarised politics of America, Britain and elsewhere, in which neither side can tolerate the other’s views, pushes against that ideal.

The more that group identity is elevated above universal values, the greater the threat. In America some on the left describe those who have adopted their views as “woke”. Some fans of Donald Trump—who has taken the Republican party a long way from Nozickian libertarianism—say they have been “red pilled” (a reference to the film “The Matrix”, in which a red pill lets characters realise the true nature of reality). In both cases, the language suggests some hidden wisdom that only the enlightened have discovered. It is not far from there to saying that such a revelation is necessary to be truly free—an argument that Berlin warned is an early step on the path to tyranny.

The good news is that pluralism and truly liberal values remain popular. Many people want to be treated as individuals, not as part of a group; they attend to what is being said, not just to who is saying it. Much hand-wringing about public life reflects the climate on social media and

campuses, not society at large. Most students do not subscribe to radical campus leftism. Still, backers of liberal democracy would do well to remember that the great post-war liberals, in one way or another, all emphasised how individuals must be free to resist the oppression of large groups. That, surely, is where liberal thought begins.

LAST IN THIS SERIES: Rousseau, Marx and Nietzsche ■



柏林、罗尔斯和诺齐克

罗尔斯主导

三位战后自由主义者努力确立个人自由的内涵

对“自由主义者”的一种定义是支持个人权利而反对专制权力的人。但这并没有告诉我们哪些权利事关紧要。例如，一些活动家表示，他们希望将变性人、女性和少数民族从他们视之为暴虐的那些社会规范、等级制度和语言的枷锁中挣脱出来。他们的反对者说，这意味着要限制个人的言行，例如审查对性别的坦诚讨论，或禁止模仿少数民族文化。此类“身份政治”的支持者声称自己是为了捍卫抵抗不公正强权的权利。但反对者同样这么说。如果两方都说自己是“自由主义者”，那么这个词是否还真有意义？

这个问题并不新鲜。1958年，以赛亚·柏林（Isaiah Berlin）在牛津大学确定了自由主义思想中一条关键的分界线。一些人支持“消极”自由——对此的最佳定义是不受干涉的自由。消极自由确保任何人都不能用武力夺取邻居的财产、法律不能限制言论。一些人支持“积极”自由，这种自由使得个人能够追求充实、自主的生活——即使这样做需要干预。当政府教育公民时，就可能涉及积极自由。政府甚至可能因此禁止有害的产品，例如高利贷（毕竟，哪个真正拥有自由的人会借高利贷？）

柏林在积极自由中窥探到了一种智力上的花招，可能会被利用而造成损害。他于1909年出生于里加，1917年革命时生活在俄国，那段日子给他留下了“对暴力的永久的恐惧”。1920年他和家人返回拉脱维亚，在遭受反犹迫害后移居英国。他辉煌的学术生涯稳步推进之际，欧洲饱受纳粹和共产主义的蹂躏。

“积极自由”给了政府正当理由来帮助民众克服其内在的、思想的堕落。它任由政府来决定人们真正想要什么，而不管他们自己怎么说。而后它可以以自由之名将这些决定强加于民众。法西斯主义者和共产主义者通常都声称自己找到了一个更宏大的真理、一个能解答所有伦理问题的答案，足够

有见识的人自会领悟。那么谁还需要个人选择？柏林指出，如果这种“天启真理”属于某种群体身份，比如某个阶级、宗教或种族，自由遭到歪曲的风险就尤其高。

拒绝积极自由并非拒绝所有政府，而是承认在值得拥有的事物之间存在取舍。例如，认为把钱再分配给穷人切实增加了其行动自由的观点如何？对此柏林回答说，自由必不能与“行使自由的条件”相混淆。“自由就是自由，它不是平等、公平、正义、文化，也不是人类幸福或问心无愧。”目标有很多，且相互矛盾，没有哪个政府可以在其中做出完美无误的选择。这就是为何人们必须能够自由决定什么才是自己心目中的美好生活。

不过，要确定这种自由的恰当范围一直都是巨大的挑战。有一种指导原则是伤害原则：政府对个人选择的干预只能是出于防止损害他人的需要。但这远非权力行使的充分规则，因为有很多损害是自由主义者通常所允许的。比如，一个创业家可能会导致一位成熟企业家破产而伤害他。在寻找国家与个人之间更合理的边界的过程中，哈佛大学的哲学家约翰·罗尔斯（John Rawls）于1971年做出了20世纪最重要的一次探索。

罗尔斯的《正义论》（A Theory of Justice）卖出了50多万册，为政治哲学重新注入活力，并成为接下来的几十年里自由主义辩论的支点。本书提出了一个思想实验：无知之幕。在这块幕布背后，人们对自己的才能、阶级、性别一无所知，甚至也不知道自己生存于怎样的历史时代。罗尔斯认为，通过思考在这样一块幕布的背后人们会达成什么一致意见，是有可能确定何为正义的。

罗尔斯认为，首先，他们将奉行一个能覆盖最广泛人群的机制，把不可剥夺的“基本自由”平等地赋予所有人。基本自由是人类能够运用其独有的道德思考能力所必需的那些权利。就像柏林认为在相互冲突的理想之间做选择的权力对人类生存至关重要那样，罗尔斯认为理性思考的能力是人类的价值所在。因此，基本自由包括思想、结社和职业的自由，以及拥有个人财产的有限权利。

但允许无限积累财富的广泛产权不在其中。相反，罗尔斯认为无知之幕产生了两个调节市场的原则。首先，必须有获得地位和财富的均等机会。其次，唯有最不富裕的人群也能从中受益时，才能允许不平等存在——这一规则被称为“差异原则”。财富若要任其生成，必须泽被整个社会。罗尔斯认为，只有这样的规则才能确保社会是自愿参与者的合作社。即便最贫穷的人也明白，其他人的成功会帮助而非阻碍自己。“在公平即正义中，人们同意分担彼此的命运。”（“公平即正义”是罗尔斯对自己哲学思想的命名。）

罗尔斯将其著作的畅销归功于它呼应了包括民权运动和反越战浪潮在内的政治和学术文化。它表明左翼自由主义并不是嬉皮士在吸大麻的吞云吐雾间幻想出来的，而可能植根于严肃的哲学。今天，无知之幕常被人援引以提倡扩大再分配。

讽刺的是，自1971年以来，富裕世界基本朝着相反的方向迈进。既然福利国家已经建立起来，政府便放宽了对市场的监管。针对最高收入人群的税率已经下降，福利待遇受到挤压，不平等加剧。诚然，最贫穷的人可能已经从连带增长中受益。但是，上世纪80年代的改革者，尤其是撒切尔和里根，都不是罗尔斯主义者。他们应该是更多地从罗尔斯在哈佛的一位同辈——罗伯特·诺齐克（Robert Nozick）——那里获得了灵感。

诺齐克的著作《无政府、国家和乌托邦》（Anarchy, State and Utopia）于1974年出版。它对罗尔斯的再分配正义发起了针锋相对的攻击。罗尔斯的自由主义贬低了产权的重要性，诺齐克则提升了它。他认为，其他形式的自由都是不道德地胁迫个体的借口。个体的才能归个人所有；他们不能被迫分享自己的才能孕育的果实。

诺齐克质疑“分配正义”甚至无法自圆其说。首先想象社会已经对财富做了一番公正的分配。接下来，假设有一大批人每人花了25美分来观看当时NBA的顶级球员威尔特·张伯伦（Wilt Chamberlain）打篮球。一次新的财富分配发生了，造就了一个非常富有的张伯伦。在这一变化中，如果说最初的分配确实是公正的，那么人们只是用他们正当拥有的资源做了一次纯

粹自愿的交换。那么后一次分配又有什么问题呢？诺齐克说，自由会颠覆模式。正义不能要求财富按照某种倾向来分配。

他的著作促成了一种支持小政府的哲学，这在当时蓬勃发展。撒切尔最热爱的思想家弗里德里希·哈耶克（Friedrich Hayek）于1974年获得了诺贝尔经济学奖。两年后，米尔顿·弗里德曼（Milton Friedman）获得了这一殊荣。不过，虽然世界向右转，幅度却没有大到变成诺齐克主义。《无政府、国家和乌托邦》提倡一个能保护产权的最小规模的、“巡夜人”式的政府。而现实中广泛的政府支出、税收和监管继续存在。就连美国，即便存在那样的贫富不均，可能在更大程度上仍然是罗尔斯主义。

罗尔斯受到的最激烈批评来自较他更左的阵营。那些关注种族和性别不平等的人往往认为他的著作浮夸造作、无甚用处。罗尔斯和诺齐克都提出了某种“理想理论”，亦即假设一个完美社会是何模样，而非致力解决现有的不公。比如说，我们并不清楚罗尔斯的机会均等原则是否会认同平权行动和任何其他形式的积极差别对待。罗尔斯在2001年写道，“现存的歧视和差别所引发的严重问题不在[公平即正义的]探讨范围内。”诺齐克承认，唯有在财产的获得并无涉及不公正（比如使用奴隶或强行没收土地）的情况下，他对财产权的观点才适用。

罗尔斯也更关心制度而非日常政治实践。因此，在当今那些议题上，他的哲学有“放空枪”之嫌。例如，女权主义者常说他没能具体诠释他对家庭的看法。他开出的主要处方是男女之间的互动应是自愿的。对于一场日益关注社会规范、认为它极大地影响了个人选择的社会运动来说，这并没有太大的帮助。

罗尔斯主义当然没有对身份政治提供什么支持。今天的左翼人士越来越多地认为言论是一种权力行使，而一个人的观点不可能脱离其身份。在一些大学校园中，当一些保守派发言者表达对父权制度和白人特权概念的怀疑，或声称性别规范并非专断时，他们就被视为应被禁言的挑衅者。新生词“男性说教”（mansplaining）的定义正在演变为涵盖用长篇大论表达任

何观点的男性，即使他是用书写的方式而并未强迫任何人阅读。据说，观点应植根于“生存经验”。

这不是罗尔斯主义自由社会应有的运作方式。罗尔斯的哲学依赖这样一种理念：人类具有共同的、无私的理性，它可通过想象无知之幕来获得，并由言论自由强化。如果观点不能脱离身份，而言论实则是各个团体争夺权力的战场，那么“无知之幕”从一开始就注定失败。

罗尔斯认为，理想社会的稳定取决于“重叠共识”。每个人都必须充分拥抱多元主义以继续支持民主机制，即使是在他们的对手掌权时。在美国、英国等地的两极化政治中，任何一方都无法容忍对方的观点，违背了罗尔斯的这种理想。

群体身份越被置于普世价值之上，威胁就越大。在美国，一些左翼人士称那些采纳了其观点的人为“觉醒者”。特朗普的一些拥趸——他们把共和党远远带离了诺齐克式自由主义——说自己已“服下红色药丸”（借鉴自《黑客帝国》的一个词，电影中的人物在服下一种红色药丸后看清了现实的真正面目）。两种言辞都暗示了某种隐藏的、仅被觉悟者所发现的智慧。他们可以进一步说，这样的启示对获得真正的自由是必须的——柏林警告称这种说法是通往暴政的第一步。

好消息是多元化和真正的自由主义价值观仍然流行。许多人希望自己被视为个体而非群体的一部分。他们关注言论本身，而不仅仅是发言者的身份。对公共生活的焦虑不安很大程度上反映的是社交媒体和校园的风潮，并非整个社会。大多数学生并不赞成激进的校园左派。尽管如此，自由民主制的支持者还是应当记住，那些伟大的战后自由主义者都以各自的方式强调了个人须拥有自由来抵抗大群体的压迫。毫无疑问，这正是自由主义思想的起点。

本系列末篇：卢梭、马克思和尼采 ■



Schumpeter, Popper and Hayek

The exiles fight back

Between them, three Austrian intellectuals formulated a response to the 20th century's tyrannies

AS THE second world war raged, Western intellectuals wondered if civilisation could recover. George Orwell, the most brilliant of the pessimists, wrote “Animal Farm” and began work on “1984”, which saw the future as “a boot stamping on a human face—forever”. Among the optimists were three Viennese exiles who launched a fightback against totalitarianism. Instead of centralisation, they advocated diffuse power, competition and spontaneity. In Massachusetts Joseph Schumpeter wrote “Capitalism, Socialism and Democracy”, published in 1942. In New Zealand Karl Popper wrote “The Open Society and its Enemies” (1945). Friedrich Hayek wrote “The Road to Serfdom” (1944) in Britain.

Vienna, their original home, had been devastated. In 1900 it was the capital of the Habsburg monarchy, a polyglot, fairly liberal empire. In short order it faced two world wars, the empire’s collapse, political extremism, annexation by the Nazis and Allied occupation. Graham Greene visited in 1948 and described the former jewel of the Danube as a “smashed, dreary city”.

War and violence “destroyed the world in which I had grown up,” said Popper. Schumpeter viewed Austria as just a “little wreck of a state”. “All that is dead now,” said Hayek, of Vienna’s heyday.

Yet the city shaped them. Between 1890 and the 1930s it was one of the brainiest places in the world. Sigmund Freud pioneered psychoanalysis. The Vienna Circle of philosophers debated logic. The Austrian school of economics grappled with markets; Ludwig von Mises made breakthroughs

on the role of speculation and the price mechanism. Von Mises mentored Hayek, who was a cousin of the philosopher Ludwig Wittgenstein, who went to school with Adolf Hitler, who stood at the Heldenplatz in 1938 to welcome “the entry of my homeland into the German Reich”.

The three wartime thinkers had different backgrounds. Schumpeter was a flamboyant adventurer born into a provincial Catholic family. Popper’s family was intellectual and had Jewish roots; Hayek was the son of a doctor. But they had common experiences. All three attended the University of Vienna. Each had been tempted, and then repelled, by socialism; Schumpeter was finance minister in a socialist government. He also lost his fortune in a bank collapse in 1924. He then left for Germany, and, after his wife died, emigrated to America in 1932. Hayek left Vienna for the London School of Economics in 1931. Popper fled Austria just in time, in 1937.

Each was troubled by the Anglo-Saxon countries’ complacency that totalitarianism could never happen to them. Yet warning signs abounded. The Depression in the 1930s had made government intervention seem desirable to most economists. Now the Soviet Union was a wartime ally, and criticism of its terror-based regime was frowned upon. Perhaps most worryingly, in Britain and America war had brought centralised authority and a single collective purpose: victory. Who could be sure that this command-and-control machine would be switched off?

Hayek and Popper were friends but not close to Schumpeter. The men did not co-operate. Nonetheless a division of labour emerged. Popper sought to blow up the intellectual foundations of totalitarianism and explain how to think freely. Hayek set out to demonstrate that, to be safe, economic and political power must be diffuse. Schumpeter provided a new metaphor for describing the energy of a market economy: creative destruction.

Start with Popper. He decided to write “The Open Society” after Hitler

invaded Austria and described it as “my war effort”. It begins with an attack on “historicism,” or grand theories dressed up as laws of history, which make sweeping prophecies about the world and sideline individual volition. Plato, with his belief in a hierarchical Athens ruled by an elite, gets clobbered first. Hegel’s metaphysics and his insistence that the state has its own spirit are dismissed as “mystifying cant”. Popper gives a sympathetic hearing to Marx’s critique of capitalism, but views his predictions as little better than a tribal religion.

In 1934 Popper had written about the scientific method, in which hypotheses are advanced and scientists seek to falsify them. Any hypothesis left standing is a kind of knowledge. This conditional, modest concept of truth recurs in “The Open Society”. “We must break with the habit of deference to great men,” Popper argues. A healthy society means a competition for ideas, not central direction, and critical thinking that considers the facts, not who is presenting them. Contrary to Marx’s claim, democratic politics was not a pointless charade. But Popper thought that change was only possible through experimentation and piecemeal policy, not utopian dreams and large-scale schemes executed by an omniscient elite.

Hayek shared Popper’s view of human knowledge as contingent and dispersed. In “The Road to Serfdom” he makes a narrow point ruthlessly: that collectivism, or the longing for a society with an overarching common purpose, is inherently misguided and dangerous to liberty. The complexity of the industrial economy means it is “impossible for any man to survey more than a limited field”. Hayek built on von Mises’s work on the price mechanism, arguing that without it socialism had no way to allocate resources and reconcile millions of individual preferences. Because it is unable to satisfy the vast variety of people’s wants, a centrally planned economy is innately coercive. By concentrating economic power, it concentrates political power. Instead, Hayek argues, a competitive economy

and polity is “the only system designed to minimise by decentralisation the power exercised by man over man”. Democracy was a “device for safeguarding” freedom.

Schumpeter is a puzzle. (In his history of neoliberalism, Daniel Stedman Jones picks von Mises as his third Viennese thinker instead.) His previous book, a tome on the history of business cycles, flopped in the 1930s. It is fashionable now to describe his follow-up, “Capitalism, Socialism and Democracy”, as one of the greatest works of the 20th century. But it can be turgid and long-winded; parts are dedicated to prophecies of the kind Popper thought nuts. Schumpeter’s contention that socialism would eventually replace capitalism—because capitalism anaesthetised its own acolytes—is sometimes thought to be tongue-in-cheek. Yet, like a gold nugget amid sludge, the book contains a dazzling idea about how capitalism actually works, rooted in the perspective of the businessman, not bureaucrats or economists.

Until John Maynard Keynes published his “General Theory” in 1936, economists did not really concern themselves with the economic cycle. Schumpeter emphasised a different sort of cycle: a longer one of innovation. Entrepreneurs, motivated by the prospect of monopoly profits, invent and commercialise products that trounce their antecedents. Then they are trounced in turn. This “perennial gale” of birth and death, not planners’ schemes, is how technological advances are made. Capitalism, while unequal, is dynamic. Firms and their owners enjoy only limited windows of competitive advantage. “Each class resembles a hotel,” Schumpeter wrote earlier; “always full, but always of different people”. Perhaps he was recalling his own wild ride in Vienna’s banking industry.

Taken together, in the 1940s Hayek, Popper and Schumpeter offered a muscular attack on collectivism, totalitarianism and historicism, and a restatement of the virtues of liberal democracy and markets. Capitalism is

not an engine for warmongering exploitation (as Marxists believed), nor a static oligarchy, nor a high road to crisis. Accompanied by the rule of law and democracy, it is the best way for individuals to retain their liberty.

The reception of their work varied. Popper struggled to get his book published (it was long and paper was still rationed). By 1947 Schumpeter's was hailed as a masterpiece; his battered reputation soared. Hayek's work had little impact until it featured in Reader's Digest in America, turning him into an overnight sensation there. And, over time, the three men's paths diverged. Popper, who moved to Britain in 1946, returned to focus on science and knowledge. Schumpeter died in 1950. Hayek moved to Michigan, becoming a luminary of the Chicago School of free-market economists and a shrill critic of all government.

But their combined stature grew. By the 1970s Keynesianism and nationalisation had failed, leading a new generation of economists and politicians, including Ronald Reagan and Margaret Thatcher, to emphasise markets and individuals. The collapse of the Soviet Union in the 1990s vindicated Popper's searing attack on the stupidity of grand historical schemes. And Silicon Valley's continual reinventions, from the mainframe and PC to the internet and mobile phones, vindicated Schumpeter's faith in entrepreneurs.

The three Austrians are vulnerable to common criticisms. The concentration of their intellectual firepower on left-wing ideologies (rather than Nazism) can seem lopsided. Schumpeter had been complacent about the rise of Nazism; but for Popper and Hayek, the devastation unleashed by fascism was self-evident. Both argued that Marxism and fascism had common roots: the belief in a collective destiny; the conviction that the economy should be marshalled to a common goal and that a self-selected elite should give the orders.

Another criticism is that they put too little emphasis on taming the savagery of the market, particularly given the misery of unemployment in the 1930s. In fact Popper was deeply concerned about workers' conditions; in "The Open Society" he lists approvingly the labour regulations put in place since Marx wrote about children toiling in factories. He thought pragmatic policies could gradually improve the lot of all. In the 1940s Hayek was more moderate than he later became, writing that "some minimum of food, shelter and clothing, sufficient to preserve health and the capacity to work, can be assured to everyone". The economic cycle was "one of the gravest problems" of the time. Schumpeter showed fewer signs of compassion yet was profoundly ambivalent about the social impact of creative destruction.

Today the Austrians are as relevant as ever. Autocracy is hardening in China. Democracy is in retreat in Turkey, the Philippines and elsewhere. Populists stalk the Americas and Europe: in Vienna a party with fascist roots is in the ruling coalition. All three would have been perturbed by the decay of the public sphere in the West. Instead of a contest of ideas, there is the tribal outrage of social media, leftwing zealotry on America's campuses and fearmongering and misinformation on the right.

Together the trio shine a light on the tension between liberty and economic progress, now exacerbated by technology. In the 1940s Hayek and Popper were able to argue that individual freedom and efficiency were bedfellows. A free, decentralised society allocated resources better than planners, who could only guess at the knowledge dispersed among millions of individuals. Today, by contrast, the most efficient system may be a centralised one. Big data could allow tech firms and governments to "see" the entire economy and co-ordinate it far more efficiently than Soviet bureaucrats ever could.

Schumpeter thought monopolies were temporary castles that were blown away by new competitors. Today's digital elites seem entrenched. Popper and Hayek might be fighting for a decentralisation of the internet, so that

individuals owned their own data and identities. Unless power is dispersed, they would have pointed out, it is always dangerous.

LATER IN THIS SERIES: Berlin, Rawls and Nozick; Rousseau, Marx and Nietzsche ■



熊彼特、波普尔与哈耶克

流亡者的反击

三位奥地利知识分子共同对20世纪的暴政做出了回应

第二次世界大战愈演愈烈之时，西方知识分子怀疑文明还能否恢复。最杰出的悲观主义者乔治·奥威尔写了《动物农场》并开始创作《1984》，书中将未来视为“一只靴子踩在一个人的脸上——永远如此”。在乐观主义者中，三个流亡海外的维也纳人发动了对极权主义的反击。他们反对集中，提倡权力分散、竞争和自发性。在马萨诸塞州，约瑟夫·熊彼特（Joseph Schumpeter）写了《资本主义、社会主义与民主》（Capitalism, Socialism and Democracy），于1942年出版。在新西兰，卡尔·波普尔（Karl Popper）写了《开放社会及其敌人》（The Open Society and its Enemies, 1945）。弗里德里希·哈耶克（Friedrich Hayek）在英国写了《通往奴役之路》（The Road to Serfdom, 1944）。

他们的故乡维也纳已经被毁。1900年时它是哈布斯堡王朝的首都，一个使用多种语言且相当自由的帝国。好景不长，它遭受了两次世界大战、帝国崩溃、政治极端主义、纳粹吞并和盟军占领。格雷厄姆·格林（Graham Greene）于1948年访问维也纳，将多瑙河上这颗昔日的宝石描述为一个“破败、沉闷的城市”。

波普尔说，战争和暴力“摧毁了我在其中长大的那个世界”。在熊彼特眼里，奥地利沦为了一个“国家的零星残骸”。哈耶克在谈到维也纳的鼎盛时期时说，“所有那些都已灰飞烟灭。”

然而这座城市塑造了他们。从1890年到上世纪30年代，它是世界上最智慧云集的地方之一。西格蒙德·弗洛伊德开创了精神分析。维也纳哲学圈争论逻辑学。奥地利经济学派与市场缠斗；路德维希·冯·米塞斯（Ludwig von Mises）在投机的作用和价格机制方面取得了突破。冯·米塞斯是哈耶克的导师，哈耶克是哲学家路德维希·维特根斯坦（Ludwig

Wittgenstein) 的堂兄，维特根斯坦与阿道夫·希特勒曾是同窗，希特勒于1938年站在维也纳的英雄广场上，欢迎“我的家乡进入德意志帝国”。

这三位战时思想家有着不同的家庭背景。耀眼的冒险家熊彼特降生于乡下一个天主教家庭。波普尔来自有犹太血统的知识分子家庭。哈耶克是医生的儿子。但他们有共同的经历。三人都曾就读于维也纳大学。每个人都被社会主义吸引，之后又对它心生厌恶；熊彼特曾任一个社会主义政府的财政部长。他还在1924年的一次银行倒闭中失去了财产。然后他去了德国，在妻子去世后于1932年移居美国。哈耶克于1931年离开维也纳前往伦敦经济学院。波普尔在1937年及时逃离了奥地利。

三人都对盎格鲁—撒克逊国家那种认为极权主义永远不会发生在自己身上的自满情绪十分担忧。而不妙的征兆很多。30年代的大萧条使得大多数经济学家都觉得政府干预看起来不错。如今苏联是一个战时的盟友，批评它基于恐怖主义的政权被斥不识时务。也许最令人担忧的是，在英国和美国，战争带来了集中的权威和单一的集体目标：胜利。谁能保证这个命令和控制机器会被关掉？

哈耶克和波普尔是朋友，但他俩和熊彼特不熟。三人并未合作，却出现了某种分工。波普尔试图打破极权主义的知识基础，并解释如何自由地思考。哈耶克试图证明，为了安全起见，经济和政治权力必须分开。熊彼特提供了一个新的比喻来描述市场经济的能量：创造性破坏。

先说波普尔。在希特勒入侵奥地利后，他决定写下《开放社会》并将其描述为“我的战争努力”。它首先攻击了“历史主义”这类装扮成历史规律的宏大理论，它们对世界做出了全面的预言并把个人意志丢到一旁。柏拉图首当其冲，因为他相信一个由精英统治的等级化的雅典。黑格尔的形而上学和他坚持认为国家有自己的精神的理论被斥为“故弄玄虚的空话”。波普尔同情地聆听了马克思对资本主义的批判，但认为他的预言也没比部落宗教好到哪里去。

波普尔在1934年写到了科学方法，即科学家提出假设并试图将其证伪。所

有未被推翻的假设都算是一种知识。这种假定的、谦虚的真理概念在《开放社会》中再次出现。波普尔认为“我们必须打破尊重伟人的习惯”。健康的社会意味着思想的竞争而非中央的指导，还要有批判性思维来考虑事实而不是谁提出了这些事实。与马克思的说法相反，民主政治并非毫无意义的装模作样。但波普尔认为变革只有通过实验和零敲碎打的政策才能达成，而不是乌托邦式的梦想和由无所不知的精英执行的大规模方案。

和波普尔一样，哈耶克也认为人类知识非绝对而且分散。在《通往奴役之路》中，他围绕一个观点展开了不遗余力的论证：集体主义，或者说对一个具有共同首要目标的社会的渴望，本质上是被误导的，对自由十分危险。工业经济的复杂性意味着“任何人都无法在一个有限的范围之外展开探索”。哈耶克以冯·米塞斯关于价格机制的研究为基础提出，如果没有这种机制，社会主义无法分配资源并调和数百万个人的偏好。由于无法满足人们五花八门的需求，中央计划经济天生就是强制性的。通过集中经济权力，它集中了政治权力。相反，哈耶克认为，竞争性经济和政体是“旨在通过分散权力来把人支配人的权力减至最小的唯一制度”。民主是“维护自由的工具”。

熊彼特是一个谜。（在丹尼尔·斯特曼·琼斯[Daniel Stedman Jones]所著的新自由主义史中，他选择了冯·米塞斯而非熊彼特作为他的第三位维也纳思想家。）熊彼特在上世纪30年代出版的关于商业周期历史的大部头著作很不受待见。但如今时髦的说法将他接下来问世的那本《资本主义、社会主义和民主》描述为20世纪最伟大的作品之一。但它可能枯燥晦涩又冗长；有些部分讲的是波普尔视为胡说八道的那类预言。熊彼特关于社会主义最终会取代资本主义的论点——因为资本主义最终会让自己的左膀右臂失灵——有时候被认为只是随便说说而已。然而，就像淤泥中藏着金块那般，书中有一个关于资本主义实际如何运作的思想光彩夺目——它源于商人的视角，而非官僚或经济学家。

在凯恩斯于1936年发表他的《通论》之前，经济学家并没有真正关注过经济周期。熊彼特强调了另一种周期：一个更长的创新周期。受垄断利润的前景驱动，企业家发明并发售打败前辈的产品。然后他们自己又被打败

了。带来技术进步的是这种诞生与死亡的“永恒风暴”，而不是规划者的计划。资本主义虽不平等，却充满活力。公司和它们的老板只在有限的时间窗口里享有竞争优势。“每个阶级都像一家酒店，”熊彼特早些时候曾写道，“总是客满，但永远是不同的人。”也许他是在回忆自己在维也纳银行业里的大起大落。

联合起来看，在上世纪40年代，哈耶克、波普尔和熊彼特对集体主义、极权主义和历史主义展开了强有力的攻击，并重申了自由主义民主和市场的好处。资本主义不是引发战争的剥削引擎（像马克思主义者所认为的那样），也不是静态的寡头政治，更不是通向危机的快车道。在法治和民主的陪伴下，它是个人维护自由的最佳方式。

三本书的反响各不相同。波普尔那本的出版颇费周折（篇幅很长，而当时纸张仍然是配给的）。到1947年，熊彼特的那本已被誉为杰作，令他一度扫地的声誉强势反弹。哈耶克那本少有人关注，直到被美国的《读者文摘》专题介绍，让他在美国一夜成名。而随着时间的推移，三个人又走上了各自的道路。波普尔于1946年移居英国，重新专注于科学和知识。熊彼特于1950年去世。哈耶克搬到密歇根州，成为芝加哥自由市场经济学派的泰斗，并成为所有政府的尖锐批评者。

但他们总体的声望增长了。到了70年代，凯恩斯主义和国有化失败了，导致新一代经济学家和政治家——包括罗纳德·里根和玛格丽特·撒切尔——开始强调市场和个人。苏联在90年代的崩溃证明了波普尔炮轰宏大历史计划愚蠢确有其道理。而硅谷持续不断的发明改造，从大型机和个人电脑，到互联网和移动电话，也支持了熊彼特对企业家的信仰。

这三位奥地利人很容易受到相同的批评。他们的思想火力都集中对准左翼意识形态（而不是纳粹主义），因而会让人觉得有失偏颇。熊彼特对纳粹主义的兴起不太在意；但对波普尔和哈耶克而言，法西斯主义所释放的破坏是不言而喻的。两人都认为马克思主义和法西斯主义有着共同的根源：对集体命运的信仰；坚信经济应该集中于一个共同的目标，由一个自我选择的精英发号施令。

另一个批评是，他们对驯服市场野蛮破坏力的一面着墨太少，特别是考虑到30年代大规模失业的惨状的话。事实上，波普尔深切关注工人的状况；他在《开放社会》中赞许地列出了自马克思描述工厂童工做苦役后实施的劳动法规。他认为务实的政策可以逐步改善所有人的命运。哈耶克在40年代时比他在晚年时更温和，他写道：“每个人都可以保证获得足以保持健康和工作能力的最低标准的食物、住所和衣服。”经济周期是当时“最严重的问题之一”。熊彼特流露出的同情更少些，但他对创造性破坏带来的社会影响怀有深切的矛盾心理。

如今，这几个奥地利人仍与以往一样重要。专制在中国变得更强硬。土耳其、菲律宾和其他地方的民主正在退缩。民粹主义者悄悄靠近美国和欧洲；在维也纳，一个法西斯根源的政党位居执政联盟之中。他们三人应该都会为西方公共领域的衰退感到不安。我们看到的不是思想的竞争，而是社会媒体上的派系愤怒、美国校园中的左翼狂热，以及右翼散布的恐惧和错误信息。

对于自由与经济进步的拉锯——如今的技术发展让它愈演愈烈——他们三人一道提供了重要的见解。在40年代，哈耶克和波普尔尚能主张个人自由与效率相辅相成。一个自由的、分散的社会能比规划者更好地分配资源，因为规划者只能猜测分散在数百万人身上的知识。然而今天，最高效的系统可能是集中式系统。大数据可以让科技公司和政府“看到”整个经济，协调的效率也比苏联的官僚高得多。

熊彼特认为垄断是被新竞争对手吹走的临时堡垒。今天的数字精英却似乎根深蒂固。波普尔和哈耶克可能会为互联网的去中心化而斗争，以求让个人拥有自己的数据和身份。他们会指出，除非被分散，否则权力总是危险的。

本系列后续文章：柏林、罗尔斯和诺齐克；卢梭、马克思和尼采 ■



Rousseau, Marx and Nietzsche

The prophets of illiberal progress

Terrible things have been done in their name

LIBERALISM is a broad church. In this series we have ranged from libertarians such as Robert Nozick to interventionists such as John Maynard Keynes. Small-government fundamentalists like Friedrich Hayek have rubbed shoulders with pragmatists such as John Stuart Mill.

But there are limits. Our last brief seeks to sharpen the definition of liberalism by setting it in opposition to a particular aspect of the thought of three anti-liberals: Jean-Jacques Rousseau, a superstar of the French Enlightenment; Karl Marx, a 19th-century German revolutionary communist; and Friedrich Nietzsche, 30 years Marx's junior and one of philosophy's great dissidents. Each has a vast and distinct universe of ideas. But all of them dismiss the liberal view of progress.

Liberals believe that things tend to get better. Wealth grows, science deepens understanding, wisdom spreads and society improves. But liberals are not Pollyannas. They saw how the Enlightenment led to the upheaval of the French revolution and the murderous Terror that consumed it. Progress is always under threat.

And so liberals set out to define the conditions for progress to come about. They believe that argument and free speech establish good ideas and propagate them. They reject concentrations of power because dominant groups tend to abuse their privileges, oppressing others and subverting the common good. And they affirm individual dignity, which means that nobody, however certain they are, can force others to give up their beliefs.

In their different ways Rousseau, Marx and Nietzsche rejected all these

ideas. Rousseau doubted that progress takes place at all. Marx thought progress is ordained, but that it is generated by class struggle and revolution. Nietzsche feared that society was descending into nihilism, but appealed to the heroic *übermensch* in each person as its saviour. Those coming after them did terrible things in their name.

Rousseau (1712-78) was the most straightforwardly pessimistic. David Hume, Voltaire, Denis Diderot and Rousseau's other contemporaries believed the Enlightenment could begin to put right society's many wrongs. Rousseau, who in time became their bitter foe, thought the source of those wrongs was society itself.

In "A Discourse on Inequality" he explains that mankind is truly free only in the state of nature. There the notion of inequality is meaningless because the primitive human being is solitary and has nobody to look up to or down upon. The rot set in when a person first fenced off some land and declared: "This is mine". "Equality disappeared, property was introduced, labour became necessary, and the vast forests changed to smiling fields that had to be watered with the sweat of men, where slavery and poverty were soon seen to germinate and grow along with the crops."

Rousseau's political philosophy is an attempt to cope with society's regression from the pristine state of nature. He opens "The Social Contract" with a thundering declamation: "Man is born free, and everywhere he is in chains." Mankind is naturally good, but political society corrupts him. Social order does not come from nature, it is founded on conventions. The social contract sets out to limit the harm.

Sovereignty, he says, wells up from the people—as individuals. Government is the servant of the sovereign people and its mandate needs to be renewed periodically. If the government fails the people, they can replace it. Today that may seem like common sense. In a society founded on monarchy and

aristocracy, it was revolutionary.

But society makes people selfish. “The laws are always useful to those with possessions and harmful to those who have nothing.” Religion adds to its ills. “True Christians are made to be slaves.”

Equality, though not an end in itself, thus needs to be enforced as a way to counteract the selfish desires and subservience that society breeds in individuals. “For the social compact not to be an empty formula...whoever refuses to obey the general will shall be constrained to do so by the entire body: which means nothing other than that he shall be forced to be free.”

Revolutionaries have seized on that formula as justification for the tyrannical use of violence in pursuit of a Utopia. Scholars generally dispute this reading. Leo Damrosch, in his biography, couches the notion of the general will in terms of Rousseau’s pessimism. People are so removed from the state of nature that they need help to be free. Anthony Gottlieb, in his history of the Enlightenment, quotes Rousseau as having “the greatest aversion to revolutions”.

Yet that unbroken train of thought from regression to coercion, even in its milder form, rubs up against liberalism. Whenever a person in a position of power compels someone else to act against their free, unimpeded will for their own good, they are invoking the ghost of Rousseau.

Marx (1818-83) believed that progress was produced not by inquiry and debate, but by class struggle acting across history. Like Rousseau, he thought that society—in particular, its economic underpinnings—was the source of oppression. In 1847, shortly before a wave of unrest swept across Europe, he wrote: “The very moment civilisation begins, production begins to be founded on the antagonism of orders, estates, classes and finally on the antagonism of accumulated labour and immediate labour. No antagonism,

no progress. This is the law that civilisation has followed up to our days."

The surplus created by labour is seized by capitalists, who own the factories and machinery. Capitalism thus turns workers into commodities and denies their humanity. While the bourgeois sate their appetite for sex and food, the workers must endure the treadmill and rotten potatoes.

For this reason, capitalism contains the seeds of its own downfall. Competition compels it to spread: "It must nestle everywhere, settle everywhere, establish connections everywhere." As it does so, it creates and organises an ever-larger proletariat that it goes on to immiserate. Capitalists will never willingly surrender their privileges. Eventually, therefore, the workers will rise up to sweep away both the bourgeoisie and the proletariat and create a new—better—order.

This revolutionary job does not fall to a heroic leader, but to the workers as a class. "It is not a question of what this or that proletarian, or even the whole proletariat, at the moment regards as its aim," Marx wrote with Friedrich Engels, his collaborator, in 1844. "It is a question of what the proletariat is, and what, in accordance with this being, it will be historically compelled to do." Four years later, in the opening of "The Communist Manifesto" they predicted revolution: "A spectre is haunting Europe—the spectre of communism."

Liberals believe that all individuals share the same fundamental needs, so reason and compassion can bring about a better world. Marx thought that view was at best delusional and at worst a vicious ploy to pacify the workers.

He scorned the Declaration of the Rights of Man, a manifesto for the French revolution, as a charter for private property and bourgeois individualism. Ideologies like religion and nationalism are nothing more than self-deception. Attempts to bring about gradual change are traps set by the ruling

class. The philosopher Isaiah Berlin summed it up in his book on Marx: “Socialism does not appeal, it demands.”

Yet Marx underestimated the staying power of capitalism. It avoided revolution by bringing about change through debate and compromise; it reformed itself by breaking up monopolies and regulating excesses; and it turned workers into customers by supplying them with things that in his day would have been fit for a king. Indeed, in his later years, as Gareth Stedman Jones, a recent biographer, explains, Marx was defeated by the effort to show why the economic relations between capitalist and worker necessarily had to end in violence.

Marx nevertheless stands as a warning against liberal complacency. Today outrage is replacing debate. Entrenched corporate interests are capturing politics and generating inequality. If those forces block the liberal conditions for general progress, pressure will once again begin to rise.

Whereas Marx looked to class struggle as the engine of progress, Nietzsche (1844-1900) peered inward, down dark passages into the forgotten corners of individual consciousness. He saw a society teetering on the brink of moral collapse.

Nietzsche sets out his view of progress in “On the Genealogy of Morality”, written in 1887, two years before he was struck down by insanity. In writing of extraordinary vitality, he describes how there was a time in human history when noble and powerful values, such as courage, pride and honour, had prevailed. But they had been supplanted during a “slave revolt in morality”, begun by the Jews and inherited by the Christians under the yoke of the Babylonians and later the Romans. Naturally, the slaves elevated everything low in themselves that contrasted with their masters’ nobility: “The miserable alone are the good...the suffering, deprived, sick, ugly are also the only pious, the only blessed....”

The search for truth remained. But this has led ineluctably to atheism, “the awe-inspiring catastrophe of a 2,000-year discipline in truth, which in the end forbids itself the lie involved in belief in God.” “God is dead...” Nietzsche had written earlier. “And we have killed him.”

It takes courage to stare into the abyss but, in a life of pain and loneliness, courage was something Nietzsche never lacked. Sue Prideaux, in a new biography, explains how he tried desperately to warn the rationalists who had embraced atheism that the world could not sustain the Christian slave morality without its theology. Unable to comprehend suffering in terms of religious virtue or the carapace of virtue vacated by religion, humanity was doomed to sink into nihilism, in a bleak and meaningless existence.

Nietzsche’s solution is deeply subjective. Individuals must look within themselves to rediscover noble morality by becoming the *übermensch* prophesied in “Thus Spake Zarathustra”, Nietzsche’s most famous work. Characteristically, he is vague about who exactly an *übermensch* is. Napoleon counted as one; so did Johann Wolfgang von Goethe, the German writer and statesman. In his lucid survey of Nietzsche’s thought, Michael Tanner writes that the *übermensch* is the heroic soul eager to say Yes to anything, joy and sorrow alike.

Nietzsche is not susceptible to conventional criticism—because ideas pour out of him in a torrent of constantly evolving thought. But both left and right have found inspiration in his subjectivity; in linguistic game-playing as a philosophical method; and in how he merges truth, power and morality so that might is right and speech is itself an assertion of strength. He is father to the notion that you cannot divorce what is being said from who is saying it.

The illiberal view of progress has a terrible record. Maximilien Robespierre, architect of the Terror, invoked Rousseau; Joseph Stalin and Mao Zedong

invoked Marx; and Adolf Hitler invoked Nietzsche.

The path from illiberal progress to terror is easy to plot. Debate about how to improve the world loses its purpose—because of Marx's certitude about progress, Rousseau's pessimism or Nietzsche's subjectivity. Power accretes—explicitly to economic classes in the thought of Marx and the *übermenschen* in Nietzsche, and through the subversive manipulation of the general will in Rousseau. And accreted power tramples over the dignity of the individual—because that is what power does.

Liberalism, by contrast, does not believe it has all the answers. That is possibly its greatest strength. ■



卢梭、马克思和尼采

非自由主义式进步的先知们

打着他们的旗号为非作歹

自由主义可谓海纳百川。本系列介绍的人物涵盖从罗伯特·诺奇克（Robert Nozick）等古典自由主义者到约翰·梅纳德·凯恩斯（John Maynard Keynes）等干预主义者。既有弗里德里希·哈耶克（Friedrich Hayek）等小政府原教旨主义者，又有约翰·斯图亚特·穆勒（John Stuart Mill）等实用主义者。

但海纳百川并不等于漫无边际。在末篇中，我们将三位反自由主义者思想的某一面与自由主义加以对照，以期让自由主义的定义更加明晰。他们是：法国启蒙运动巨匠让-雅克·卢梭（Jean-Jacques Rousseau）、19世纪德国革命共产主义者卡尔·马克思（Karl Marx），以及比马克思小近30岁、反传统哲学的著名斗士之一弗里德里希·尼采（Friedrich Nietzsche）。他们各自都有广阔而独特的思想领域，但都对自由主义的进步观不屑一顾。

自由主义者相信形势往往越来越好。财富增长、科学加深认知、智慧传播、社会进步。但自由主义者并非盲目乐观者。他们目睹了启蒙运动如何导致了翻天覆地的法国大革命，以及后来摧毁了大革命的血腥恐怖统治。进步永远受到威胁。

于是自由主义者开始提出进步产生的条件。他们认为辩论和言论自由能产生并宣扬先进的思想。他们抵制集权，因为统治集团往往会滥用特权，压迫他人，破坏公共利益。同时他们肯定个人尊严，也就是说，任何人，不管对自己的理念多有把握，都不能强迫他人放弃信仰。

卢梭、马克思和尼采都拒不接受所有这些观点，但方式各不相同。卢梭根本不相信社会进步。马克思则认为社会注定会进步，但却是源自阶级斗争和革命。尼采担心社会堕入虚无主义，却诉诸于每个人身上具有的英雄式

“超人”，将其视为救世主。后来人打着他们的旗号为非作歹。

卢梭（1712-1778年）有着最直截了当的悲观态度。大卫·休谟（David Hume）、伏尔泰（Voltaire）、丹尼斯·狄德罗（Denis Diderot）等其他同时代的人相信启蒙运动能够逐步纠正社会的很多问题。而卢梭却认为这些错误的根源在于社会本身，并最终成为他们的死敌。

卢梭在《论人类不平等的起源和基础》中解释道，人类只有在自然状态下才是真正自由的。原始人离群索居，没有仰视或轻视的对象，因而也就不存在不平等的概念。而当有人第一次用栅栏圈起一些土地并宣布“这是我的地”时，堕落随之而来。“平等消失了，财产产生了，劳动变得必不可少，广袤的森林变成了欣欣向荣的田野，需要人们用汗水来灌溉，很快奴役和贫困也随着地里的庄稼一起发芽、生长。”

卢梭尝试以其政治哲学应对社会从原始自然状态的倒退。《社会契约论》一开篇便是他振聋发聩的“人生而自由，却无往不在枷锁之中”的宣言。人之初，性本善。但政治社会使人堕落。社会秩序并非源于自然，而是建立在约定俗成之上。社会契约正是要限制这种危害。

他指出，主权来自作为个体的人民。而政府是拥有主权的人民的仆人，受委托执行主权，这种授权需要定期更新。如果政府让人民失望，人民可以更换政府。这在今天似乎是常识，但在当时那样一个以君主制和贵族统治为基础的社会里，却是革命性的。

但是社会使人自私。“法律总是对有产者有利，而对无产者有害。”宗教为虎作伥。“真正的基督徒生来就是奴隶。”

因而需要贯彻平等。平等本身不是目的，而是一种途径，用以抵抗社会在个人身上滋长的私欲和屈从。“为避免社会契约沦为一个空洞的公式……任何人拒不服从公意，全体就会强迫他服从：这不过是迫使他获得自由。”

革命者抓住了这个公式，将其作为在追求乌托邦的过程中使用专制暴力的理由。学者们普遍质疑这样的解读。利奥·达姆罗施（Leo Damrosch）在

传记中用卢梭的悲观主义来诠释“公意”的概念。人们如此远离自然状态，需要帮助才能获得自由。安东尼·戈特利布（Anthony Gottlieb）在他对启蒙运动历史的叙述中引述卢梭说自己“最厌恶革命”。

然而，这一套从倒退到强迫的完整思路，即使形式温和，也与自由主义相抵触。无论何时，掌权者如为了一己之利，强迫他人违背自己不受限制和阻碍的自由意志，他们就是在召唤卢梭的灵魂。

马克思（1818-1883年）认为，进步不是靠研究和辩论、而是通过贯穿历史的阶级斗争实现的。和卢梭一样，他认为社会——尤其是社会的经济基础——是压迫的根源。1847年，就在一场动乱席卷欧洲前不久，马克思写道：“自文明开始之初，生产就开始建立在级别、等级、阶级的对抗上，最终建立在积累劳动和直接劳动的对抗上。没有对抗就没有进步。这是文明直至今天都遵循的规律。”

劳动创造的剩余价值被拥有工厂和机器的资本家攫取。资本主义由此将工人变成了商品，否定了他们的人性。资产阶级饱享食色之欲，而工人们却必须忍受单调的工作和烂土豆。

因此，资本主义本身就包含着自我毁灭的种子。竞争迫使它四处扩张：“它必须到处落户，到处开发，到处建立联系。”如此这般，它创造和组织了一个越来越大的无产阶级，并继续让无产阶级受穷。资本家绝不甘愿放弃他们的特权。因此，工人最终会揭竿而起，同时消灭资产阶级和无产阶级，创建一个更好的新秩序。

这项革命任务不是落在哪一位英雄领袖肩上，而是落在工人这个阶级的肩上。“问题不在于目前某个无产者甚或整个无产阶级视什么为自己的目标，”马克思和恩格斯在1844年出版的合著中写道，“问题在于无产阶级是什么，以及由于它的这种属性，它在历史上必然会有怎样的作为。”四年后，在《共产党宣言》开篇第一句话里，他们预言了革命：“一个幽灵，共产主义的幽灵，在欧洲游荡。”

自由主义者认为所有个体的基本需求是相同的，所以理性和同情心可以让世界更美好。马克思则认为这种观点往好处说是妄想，往坏里说则是安抚工人的恶毒花招。

他批评法国大革命的《人权宣言》是私有财产和资产阶级个人主义的宪章。宗教和民族主义等意识形态不过是自欺欺人。寻求渐进式变革只是统治阶级挖的陷阱。哲学家以赛亚·伯林（Isaiah Berlin）在他写马克思的书中总结道：“社会主义不是求来的，而是争来的。”

然而，马克思低估了资本主义的持久力。资本主义通过辩论和妥协带来变革，从而避免了革命；通过打破垄断和调节过剩来改造自身；通过向工人提供在马克思那个年代里只有国王才能享用的东西，把工人变成了顾客。事实上，正如当代传记作家加雷思·斯特德曼·琼斯（Gareth Stedman Jones）所解释的那样，马克思在晚年力图证明为什么资本家与工人之间的经济关系必然以暴力结束，却以失败告终。

不过，在眼下，马克思倒是给自由主义的自满敲了一记警钟。如今愤怒正在取代辩论。根深蒂固的企业利益正在控制政治，引发不平等。如果这些势力妨碍了自由主义提倡的带来整体进步的条件，压力将会再次增大。

马克思视阶级斗争为进步的原动力，而尼采（1844-1900年）则审视内心，沿着黑暗的通道一路深入到个人意识被遗忘的角落。他看到的是一个濒临道德崩溃的社会。

《论道德的谱系》写于1887年，尼采在其中阐述了他的进步观，两年后他精神崩溃。在他那充满超凡活力的书写中，他描述了人类历史上曾有那么一段时期，勇气、骄傲和荣誉等高尚和强大的价值观蔚然成风。但它们在“道德上的奴隶起义”时期被取代。犹太人是这场起义的始作俑者，之后由前后受巴比伦人和罗马人压迫的基督徒接手。奴隶们自然要抬高自己身上与主人的高贵相反的所有卑微：“惟有可怜人才是好人……惟有受苦受难的人、贫困的人、病人、丑陋的人才是唯一虔诚的人，惟有他们才能得到神佑……”

对真理的探索留存了下来。但这不可避免地导向了无神论——“两千年来探求真理的训练带来的可怕灾难，这种训练使得人类无法继续讲述信仰上帝的谎言。”“上帝死了……，”尼采先前曾写道，“我们杀死了他。”

凝视深渊需要勇气。但在痛苦和孤独的生活中，尼采从来都不缺乏勇气。休·普里多（Sue Prideaux）在他的新传记中解释了尼采如何竭力告诫那些信奉无神论的理性主义者，如果没有基督教，世界就不可能再维持基督教的“奴隶道德”。人类无法再以宗教标榜的美德来理解苦难，也无法用宗教缺失后美德剩下的空壳来理解苦难，所以他们注定会在一种暗无天日又毫无意义的存在中陷入虚无主义。

尼采的解决方案非常主观。他在自己最著名的作品《查拉图斯特拉如是说》中预言了“超人”。个人必须审视自己的内心，通过成为超人来重新发现高尚的道德。对于超人究竟是什么样的人，他一如既往地含糊其辞。拿破仑算一个；德国作家、政治家歌德算一个。迈克尔·坦纳（Michael Tanner）在对尼采思想的明晰易懂的概述中写道，超人是一个英雄式的灵魂，渴望对任何事都说“好的”，无论快乐还是悲伤。

尼采不易受到传统批评的影响——因为他不断演变的思想如洪流般喷涌而出。但是无论左派还是右派都从他那里找到了灵感，包括他的主观性、作为哲学方法的语言游戏，以及他如何将真理、权力和道德融为一体而使得“强权即公理”、“言语本身就是力量的宣示”。他创立了一种观点：你不能把“所说”与“谁说”分离开来。

非自由主义的进步观劣迹斑斑。法国大革命恐怖统治的缔造者罗伯斯庇尔（Maximilien Robespierre）援引了卢梭；斯大林和毛泽东借助了马克思；希特勒利用了尼采。

从非自由主义的进步通往恐怖统治的道路很容易谋划。因为马克思对进步的确信、卢梭的悲观主义，或尼采的主观性，如何改善世界的辩论失去了目的。借助对卢梭思想中的公意颠覆式的操纵，权力开始在马克思思想中的经济阶级和尼采思想中的超人上积聚。增长的权力践踏了个人尊严——

因为这就是权力的用处。

相比之下，自由主义并不认为自己无所不知。这可能正是它最大的长处。





Prospects

Beyond the hype

Cryptocurrencies look like a solution in search of a problem. Blockchains could be more interesting

A FAVOURITE comparison drawn by cryptocurrency and blockchain enthusiasts is with the early world wide web. These technologies are only a decade old, they say. Trying to predict how they might change the world in the future is next to impossible. Who could have known in 1998 that there would be such a thing as Facebook?

The comparison is carefully chosen. The web has been remarkable for the speed with which it has conquered the world. The first web page appeared on the internet in 1991. A decade later Amazon was booking revenues of \$3.1bn a year; America Online, an early internet-service provider, had more than 20m customers; and half of Americans had internet access.

By that yardstick, cryptocurrencies have made very modest progress. But then it is highly unusual for a technology to fare as well as the web has done. A rule of thumb for venture capitalists is that nine out of ten projects they back will fail. Not every new thing is the next big thing.

Better, then, to evaluate cryptocurrencies and blockchains on their own merits. Start with cryptocurrencies. It is clear that, a decade after they were invented, their use for their ostensible purpose—as a means of exchange—is negligible. A lot of work is being done to fit them better for this task, so that could change. But if their use is to become widespread, they will have to offer something that existing currencies do not. Bitcoin's original selling-point—freedom from any kind of central control—holds little appeal for ordinary people, says Gary Barnett of GlobalData. Most of them just want a payment system that is safe and easy to use. And given cryptocurrencies'

shortcomings—the lack of consumer protection, dizzying price fluctuations, fiddly software, slow throughput and a voracious appetite for electricity—at the moment they fail that test.

One thing that might help, despite bitcoin's anti-establishment roots, is more attention from regulators, to combat the epidemic of fraud and sharp practice in the field. Some cryptocurrency firms are focused on exactly that. Chainalysis, for instance, hopes to help firms analyse their clients' cryptocurrency trading to comply with anti-money-laundering rules.

Some think a more radical approach is needed. Despite the absence of a centralised operator, says Angela Walch, a lawyer and member of the Centre for Blockchain Technologies at University College London, the coders whose efforts establish the system in the first place and the miners who maintain a cryptocurrency's ledgers do hold power. So she thinks there is a case to be made for treating both coders and miners as fiduciaries, imposing a legal requirement on them to act in the interests of the system's users.

Even a well-regulated cryptocurrency, though, would be subject to the “network effects” that have led to an oligopoly in social media. New users tend to choose the biggest firms because everyone else is already subscribing to them. In the same way, a currency's utility depends on other people using it. “In order for merchants to start accepting cryptocurrencies, there needs to be demand [from customers],” says Kim Baeur at Chainalysis. “But in order for customers to want to use it, they have to expect to be able to spend it.” Cryptocurrencies would have to offer a compelling advantage over other payment mechanisms to break that logjam. But since speculators love them, they are not likely to disappear either.

Blockchains could be a different matter. Like cryptocurrencies, they have been oversold. Because of its decentralised nature, a blockchain will always be slower and more cumbersome than a standard database. But blockchain

developers are trying to minimise those problems by doing away with features such as proof of work, which is necessary in a public system open to anyone but superfluous in a system designed for private use. As with cryptocurrencies, a sensible attitude to regulation helps. The most credible actors cite their compliance with regulations around finance, personal data and the like as a selling-point.

For now, however, almost all blockchain projects remain experimental. Most will fizzle out. The less world-changing a proposed use, the better its chance of success. For example, the cryptographic structures that make data in a blockchain hard to change are fairly easy to introduce. When they add an extra layer of security to things like financial accounts or official documents, they could be useful.

A bigger prize awaits in the back office, reducing the time-consuming administration required for firms to talk to each other by providing a shared database which everyone can use. This may be easiest where existing systems are minimal and there is no incumbent centralised regulator. Two examples commonly cited are trade finance and international money flows.

Other compelling uses may yet emerge. But it is worth bearing in mind that big IT projects—which is what blockchains amount to—tend to be cumbersome and slow even if they are undertaken by a single company. If they require several companies to work together, they will take even longer. So whatever happens, blockchain's backers will need patience. ■



前景

喧嚣过后

加密货币看起来像是一个还在寻找问题的解决方案。区块链可能会更有趣些

加密货币和区块链的爱好者最喜欢将这些技术和早期的万维网相提并论。它们诞生才十年，他们说。试图预测它们未来将如何改变世界几近不可能。1998年时，谁能想得到会有Facebook这种东西？

这个比照颇费了一番心思。万维网以惊人的速度征服了世界。1991年互联网上出现了第一个网页。十年后，亚马逊的账面收入达每年31亿美元；早期互联网服务供应商美国在线（America Online）的用户超过2000万人；一半美国人可以上网。

若以此为标尺，那么加密货币的进展非常平平。但话说回来，能取得互联网那般成就的技术极为罕见。风险资本家们的经验法则是，自己支持的十个项目中有九个都会失败。并非每一样新事物都是“下一个大事件”。

所以，还是就事论事地来说说加密货币和区块链的价值罢。先说加密货币。显然，在它们问世十年后，在用作交换媒介这一表面目的上，它们作为仍然寥寥。人们正在做很多的努力以求它们能更好地胜任这项任务，所以这种情形有可能改观。但是，如果要被广泛使用，它们就需要提供一些现有货币所不具备的东西。GlobalData公司的加里·巴尼特（Gary Barnett）表示，比特币最初的卖点是不受任何类型的集中控制，而这对普通人来说并没什么吸引力。大多数人只是想要一个安全又方便的支付系统。而鉴于加密货币的缺点——缺乏消费者保护、令人头晕目眩的价格波动、繁琐难用的软件系统、缓慢的交易处理，以及极大的耗电量——目前它们还不过关。

尽管比特币的起源是反建制诉求，但或许获得监管机构的更多关注会对它们有利。这可以抗击该领域里欺诈和不正当牟利肆虐的现状。一些加密货币公司正专注于此。例如，Chainalysis希望帮助企业分析其客户的加密货

币交易以遵守反洗钱法规。

有些人认为需要采取更激进的方法。伦敦大学学院区块链技术中心的成员、律师安杰拉·沃尔克（Angela Walch）表示，尽管缺乏一个中央运营部门，但那些努力创建了初始系统的编程人员以及维持着加密货币分类账的矿工确实拥有权力。因此，她认为有理由将编程人员和矿工都视为受托人，让他们承担维护系统用户利益的法律责任。

然而，即使是受到良好监管的加密货币，仍然会受制于“网络效应”，也就是导致社交媒体领域里的寡头垄断的原理。新用户倾向于选择最大的社交媒体公司，因为其他人都已经订阅了它们。同样地，一种货币的效力取决于其他人是否使用它。“要让商家开始接受加密货币，需要有[来自客户的]需求，”Chainalysis的吉姆·鲍尔（Kim Baeur）说，“但是，要让客户想要使用它，他们得预期能用它来买东西。”要打破这种僵局，加密货币必须能提供较之其他支付机制极具吸引力的优势。不过，由于投机者喜爱它们，它们也不太可能完全消失。

区块链有可能不同。和加密货币一样，它们被吹捧得过头了。由于它去中心化的特性，区块链总是比标准数据库更慢也更笨拙。但区块链的开发人员正尝试削减一些功能来减轻这些问题，比如放弃“工作证明”——在向所有人开放的系统中它是必要的，但在为私密用途而设计的系统中却是多余的。和加密货币一样，对监管抱持一种明智的态度也会有帮助。那些最受信赖的参与者把自己遵守财务、个人数据等方面的法规作为卖点。

然而，就目前而言，几乎所有的区块链项目都还是实验性质的。其中多数都会灰飞烟灭。一种计划中的应用改变世界的野心越小，其成功的机会就越大。例如，令区块链中的数据难被篡改的加密结构很容易应用。当它们为财务帐户或官方文档等事物添加一层额外的安全保障时，会很有用。

更大的用处在后台系统。区块链能提供每个人都能使用的共享数据库，从而减少企业花在相互沟通上的大量时间。在既有系统规模非常小且不存在已确立的中央监管机构的情况下，这种改革可能是最易实施的。两个常被

提到的例子是贸易金融和国际转账。

其他令人信服的用途也可能出现。但值得谨记的是，大型IT项目——区块链就是一例——往往都是繁琐而缓慢的，哪怕是一家公司自行实施。如果需要几家公司合力完成，花的时间还会更多。所以，无论会发生什么，区块链的支持者都需要耐心。 ■



Cryptocurrencies and blockchains

A cryptic message

Cryptocurrencies and their underlying technology, blockchains, have been hyped to the skies. Tim Cross offers a realist's guide

JOSEPH KENNEDY, John F. Kennedy's father, supposedly said that when he started getting share tips from his shoeshine boy, he knew it was time to sell. That was in the late 1920s. One investor in cryptocurrencies recalled that remark when he saw advertisements on the London Underground that seemed to suggest pensioners invest in bitcoin. "Be More Brenda," said the poster, featuring a white-haired lady claiming to have bought bitcoin in under ten minutes.

Cryptocurrencies are everywhere. According to one survey, 5% of Americans hold some cryptocurrencies—not bad for a financial product that is only a decade old. Bitcoin is the best-known, and in 2017 the dramatic rise in its price—from \$3,000 in September to almost \$19,000 by December—made headlines.

It was invented in 2008 by a reclusive cryptographer going by the name of Satoshi Nakamoto. He was dissatisfied with the conventional financial system, so he wanted to create an electronic version of cash that did not rely on a central operator and was free from direct control by a government or central bank. The idea took off. These days anyone who wants to get into cryptocurrencies can weigh the relative merits of bitcoin, ether, Monero, Dash, Litecoin and thousands of others. Many of those who bought in early have, on paper at least, made astonishing gains. Bitcoin's price in 2010 was around 6 American cents. Even at its current price of \$6,470, it would provide an early investor with a handsome profit—though not nearly as handsome as if he had sold at the peak last December.

In keeping with their do-it-yourself image, cryptocurrencies have given rise to initial coin offerings (ICOs), a way for cryptocurrency companies to crowdfund themselves. Cash is pouring in. According to one estimate, from Coinschedule, a firm that tracks such things, by early August 706 ICOs had raised almost \$18bn from a mix of institutional investors and individuals this year. That compares with just 221 ICOs in the whole of 2017, raising \$3.7bn.

Many of those startups hope to capture the benefits of blockchains, the technology that underlies cryptocurrencies. In essence, a blockchain is a database designed to be distributed among many users, to be immutable, to work without oversight from any central authority and to dispense with the need for its users to trust each other. These qualities, it is argued, make it suitable for a huge variety of new and exciting business applications, which many companies are now trying to explore.

For example, a blockchain's immutability and distributed nature would seem perfect for streamlining supply chains. A widget manufacturer in one country, its shipping agent, its customer in another country and customs authorities on both the sending and the receiving end could all use the same database to track the widget. Another promising idea might be to provide an incorruptible record of transactions covering anything from property deeds to the provenance of diamonds.

According to Crunchbase, an industry consultancy, in the first five months of this year a total of more than \$1.3bn of venture capital was invested in blockchain startups. KPMG, a large consultancy firm, reckons that the amount of money venture capitalists want to invest in such things outstrips the opportunities to do so. Established companies are rushing to catch up. Technology firms such as IBM, Oracle and Amazon are giving their customers the chance to experiment with blockchains. KPMG offers a service to advise clients on blockchains, as do most of its rivals. Diar, a

consultancy specialising in cryptocurrencies, lists dozens of blockchain-related patent applications, filed by companies as diverse as Bank of America, Intel, a chipmaker, RWE, an electricity firm, and British Telecom.

This Technology Quarterly will take a more sceptical view. It will point out that, despite a decade of development, bitcoin has failed in its stated objective: to become a usable currency. Security is poor (according to one estimate, around 14% of the supply of big cryptocurrencies has been compromised); its decentralised nature inevitably makes it slow; there is no consumer protection; and the price is so volatile that not many people would want to use it as a means of exchange for goods and services. Other cryptocurrencies suffer from similar problems. Few merchants accept them.

At the same time the technology's built-in antipathy to regulation has attracted plenty of people who feel the same way for the wrong reasons. Some cryptocurrencies amount to Ponzi schemes, and unscrupulous ICO operators have swindled investors. America's authorities are investigating allegations of widespread price manipulation. Social-media firms have banned advertisements for ICOs amid concerns about fraud. Anyone thinking of investing in such instruments will need to do a lot of homework first.

Other drawbacks of bitcoin and such like are becoming increasingly apparent, too. The "mining" process required to verify all transactions is hugely power-hungry. Data centres have sprung up from Mongolia to Quebec, collectively consuming as much electricity as entire countries to run a system that cannot manage more than a handful of transactions per second.

The potential applications for the underlying blockchain technology look rather more attractive, but progress in developing them has been slower than hoped, and some apparent successes turn out to have been

exaggerated. Because they are power-hungry and slow, the blockchains that drive cryptocurrencies have to be remodelled for use in business, which can make them less distinctive and more like other databases. Though the excitement surrounding the technology has provided a useful push to get interested parties around the table and start talking, most blockchain projects are still at the exploratory stage.

Putting a business on a blockchain is as complicated as any other big IT project. Those involved in the planning stage still have to ask the usual questions. What exactly is it meant to do? Why would an individual company want to sign up to such a shared venture? Who will design the system? Who will be in charge if things go wrong? And once a decision is made to build such a system, there will still be a lot of grunt work to be done. All this suggests that, whatever the benefits of blockchains, they will not arrive overnight.

One problem, says Gary Barnett, an analyst at GlobalData, a consultancy, is mutual incomprehension between insiders and outsiders. “There’s a ‘two tribes’ vibe about a lot of this,” he says. Because blockchains and cryptocurrencies are notoriously complicated, non-experts from other industries can end up confused by techno-speak, whereas advocates of the technologies are so excited by the potential that they give insufficient attention to important details of the industries they are aiming to revolutionise.

To understand the pros and cons of cryptocurrencies and blockchains, the best way is to start with bitcoin itself.

Cryptocurrency prices correct as of August 21st ■



加密货币与区块链

加密消息

加密货币及其背后的区块链技术被炒上了天。本期专刊作者蒂姆·克罗斯给出了现实主义指导

据传约翰·肯尼迪的父亲约瑟夫·肯尼迪说，当他开始从擦鞋男孩那里听到炒股秘诀时，他就知道该卖出了。那是在上世纪20年代末。一位加密货币的投资者在伦敦地铁里看到一则广告，想起了这句话。这则广告似乎在建议领养老金的退休人士投资比特币。“再像布兰达一点，”海报说。海报上有一位白发苍苍的女士，声称自己在十分钟内就买好了比特币。

加密货币无处不在。根据一项调查，5%的美国人拥有一些加密货币——对于一种只有十年历史的金融产品来说这还真不错。其中最著名的是比特币，其价格在2017年大幅上涨——从9月的3000美元涨到12月的近19,000美元，成为头条新闻。

它是由一位署名中本聪的隐居密码学家于2008年发明的。他对传统的金融体系感到不满，因此希望创建一种不依赖中央运营商的电子现金，并且不受政府或中央银行的直接控制。这个想法一飞冲天。如今，任何想要入手加密货币的人都可以权衡比特币、以太币、门罗币、达世币、莱特币和其他数千种选择的相对优势。许多早期购买的人至少在纸面上获得了惊人的收益。比特币2010年时的价格约为6美分。即使按照目前的价格6470美元，它也会为早期投资者带来十分可观的利润——尽管远不及在去年12月顶峰时卖出那么丰厚。

为了与“自己动手”的形象保持一致，加密货币催生了“首次代币发行”（ICO），一种让加密货币公司自行众筹资金的方式。大笔现金涌入。根据追踪此类事件的Coinschedule公司的一项估计，今年截至8月初共完成了706次ICO，从机构投资者和个人筹集了近180亿美元。相比之下，2017年全年仅有221次ICO，筹资37亿美元。

许多创业公司希望能从区块链中获益，这种技术是加密货币的基础。从本质上讲，区块链是一个数据库，意图分散在许多用户手中、不可变更、在没有任何中央机构监督的情况下工作，并且不需要用户相互信任。有些人认为，这些特点使其适用于大量令人兴奋的新商业应用，许多公司正在为此努力探索。

例如，区块链的不可变性和分布式性质似乎非常适合简化供应链。某个国家的一个小装置制造商、其运输代理商、身处另一个国家的客户，以及发运和接收国的海关当局都可以使用相同的数据库来跟踪这个装置。另一个有发展前景的想法可能是提供不可摧毁的交易记录，涵盖从房契到钻石来源的任何事项。

根据行业咨询公司Crunchbase的数据，今年前五个月共有超过13亿美元的风险投资注入区块链创业公司。大型咨询公司毕马威（KPMG）估计，风险资本家想要投资于此的金额超过了投资的机会。老牌企业也急于赶上。IBM、甲骨文和亚马逊等科技公司为其客户提供了试验区块链的机会。毕马威为客户提供区块链方面的建议，而它的大多数竞争对手也一样。Diar是一家专攻加密货币的咨询公司，它罗列了几十项与区块链相关的专利申请，来自美国银行、芯片制造商英特尔、电力公司莱茵（RWE）和英国电信等形形色色的公司。

本期技术季刊将抱持更加怀疑的态度。它将指出，尽管经历了十年的发展，比特币的既定目标却失败了：成为一种可用的货币。它的安全性很差（根据一项估计，大约14%的大型加密货币供应被盗用）；去中心化的特质使它不可避免地运行缓慢；没有消费者保护；价格非常不稳定，以至于没有多少人愿意将它用作商品和服务的交换手段。其他加密货币也存在类似的问题。接受它们的商家寥寥无几。

与此同时，这项技术本身蕴含的对监管的憎恶吸引了许多有同感的人，但却是出于错误的原因。一些加密货币与庞氏骗局无异，不择手段的ICO运营商欺骗了投资者。美国当局正在调查大规模价格操纵的指控。由于担心欺诈，社交媒体公司已禁止ICO广告。任何想要投资这些工具的人都需要

先做很多功课。

比特币等加密货币的其他缺点也变得越来越明显。验证所有交易所需的“挖矿”过程极其耗电。从蒙古到魁北克，数据中心如雨后春笋般涌现，消耗的总电量相当于很多国家全国的用电量，运行的系统却每秒钟执行不了几次交易。

底层区块链技术的潜在应用看起来更有吸引力，但开发进展不如预期，并且一些貌似成功的结果最后发现是被夸大了。因为它们很耗电且速度慢，所以驱动加密货币的区块链技术必须进行改造以应用于商业，而这可能会让它们变得不再那么与众不同，而是与其他数据库更相近。虽然围绕这项技术的兴奋之情推动了感兴趣的各方坐到一起开始讨论，大多数区块链项目仍处于探索阶段。

将业务放到区块链上和任何其他大型IT项目一样复杂。参与规划的人们仍然需要提出那些常见的问题。它到底是要干什么用？为什么一家公司会想加入到这样一个共享项目中来？谁来设计系统？出了问题谁说了算？一旦决定建立这样一个系统，仍然有很多繁重的工作要做。所有这些都表明，无论区块链有多少好处，它们都不会在一夜之间到来。

咨询公司GlobalData的分析师加里·巴内特（Gary Barnett）表示，其中一个问题也是圈内人和圈外人互不理解。“很多事都有一种‘两个部落’的氛围。”他说。由于区块链和加密货币非常复杂，来自其他行业的门外汉最终可能会被技术术语绕得晕头转向，而这类技术的拥护者又对潜力太过兴奋，以至于未能充分关注他们希望革命的那些行业的重要细节。

要了解加密货币和区块链的利弊，最好的方法是从比特币本身开始。

加密货币价格截至8月21日 ■



Buttonwood

Are you a stock or a bond?

Why the ideal portfolio depends on the business you are in

IMAGINE two college friends whose careers have taken different paths. Simon is an investment banker. He works long hours, especially when his bank is advising on a big merger. His pastimes include potholing and skydiving. Chris works as a senior civil servant. Early each evening the lights in his office dim to remind his colleagues of the importance of work-life balance. His spare time is spent on long country walks, playing golf and going to the theatre.

How should they invest their money? More specifically, how much of their savings should go to bonds and how much to shares? Textbook theory says it depends on how tolerant Simon and Chris are towards risk. If either can bear the sometimes violent ups-and-downs of stockmarkets, he should hold more shares, which have higher rewards to go with the extra risk. Should such price swings keep him awake at night with worry, he should tilt the mix of his investments towards safer government bonds.

A risk-lover such as Simon is happy to own mostly shares. If you think skydiving is fun, you probably will not lose sleep if the value of your portfolio goes down from time to time. By the same logic Chris, who prefers a quiet life, is content to hold a bigger slug of bonds than Simon. Yet on a broader reckoning, both friends would be better advised to go against their inclinations. Simon, the banker, should buy mostly bonds. Chris, the bureaucrat, should buy mostly stocks.

If that seems paradoxical, consider the nature of each friend's line of work. Simon's professional fortunes are tied to the stockmarket. When share

prices are booming, the general appetite for business risk is high. Investment projects are approved. Deals are done. The demand for the services of investment banks is strong. Simon's bank makes pots of money and his bonus surges. His fortunes are changeable, though. When the stockmarket is down, the bank's profits plunge. So his returns are high, but also volatile—like a stock. To hedge against the stock-like returns of his occupation, Simon should own bonds. In contrast, Chris enjoys a bond-like career. His salary is lower but steadier. His job is not at risk in downturns. So he can afford to take bigger risks with his investments. He should own stocks.

This is not to say that preferences about risk do not matter to investment choices. They do. It is that wealth should be looked at in the round. A proper reckoning would include not only financial assets but human capital—a person's knowledge, skills and talents. This has a big influence on earnings over a working life. Young people, with few savings and decades of employment ahead, have most of their lifetime wealth embedded in their human capital. It has a payoff, just like a stock or a bond. It makes sense to take account of that when deciding what to hold as financial wealth.

This way of thinking comes more naturally to people who work in finance. There are fund managers with most of their professional portfolio in stocks but all of their personal wealth in three-month bills. If the bets on stocks turn bad, they might find themselves out of a job. They do not want to put all their personal savings at risk as well.

But most people do not think like this. The available evidence suggests that households do not attempt to hedge their employment income. In fact, they typically “anti-hedge”, by holding a disproportionate fraction of their savings in the shares of their employer or of companies in the same industry or locality.

A paper, published in 2003, by James Poterba of the Massachusetts Institute of Technology discovered that an average of more than 40% of the value of the 20 largest company-pension plans in America was invested in the firm's own shares. The dangers of such a strategy had recently become apparent. When Enron failed, its employees had over 60% of their retirement savings in company stock. Another study based on Swedish data by Massimo Massa, of INSEAD, and Andrei Simonov, now of Michigan State University, also found that households tend to invest in stocks that are closely related to their employment income.

People stick to what they know for understandable reasons. Investment can seem like an aggressive sport, the preserve of bulls and bears or Wall Street wolves. Yet it would be more helpful to think of investment as self-insurance. People save and invest to protect themselves from contingencies. The best way to guard against some sorts of risks is often to embrace a different kind. The kind of insurance you will need ultimately depends on who you are. ■



梧桐

你该买股票还是债券？

为什么理想的投资组合取决于你在什么行业

想象一下两名大学里的友人后来走上了不同的职业道路。西蒙是一位投资银行家。他的工作时间很长，尤其是当他任职的银行为一桩大规模合并交易提供咨询时。他的消遣包括洞穴探险和跳伞。克里斯是一名高级公务员。每天傍晚他办公室的灯光早早就暗了，提醒他的同事们保持工作与生活平衡的重要性。他的业余时间花在乡间远足、打高尔夫球和看演出上。

他们该如何投资自己的钱？说得再具体一点，他们的积蓄有多少该投资债券，有多少该投资股票？教科书上的理论说，这取决于西蒙和克里斯对风险的承受能力。谁能承受股市时不时的剧烈涨跌，谁就应该持有更多股票。因为股票风险更大，回报也更高。这种价格波动让谁忧心忡忡、夜不能寐，谁就应该将投资组合转向更安全的政府债券。

像西蒙这样喜欢冒险的人乐于把大部分投资都放在股票上。如果你认为跳伞很有趣，那么当你的投资组合时有贬值时，你可能不会失眠。按照同样的逻辑，喜欢平静生活的克里斯会对持有比西蒙更高比例的债券感到满意。但是，如若考虑得更周全一些，这两位朋友最好还是按和自己的意愿相反的方向行事。银行家西蒙应该主要购买债券，政府官员克里斯应主要买股票。

如果这看起来很矛盾，想一想他们各自的工作性质吧。西蒙的职业运势与股市息息相关。当股价上涨时，人们普遍偏好高商业风险。他们批准投资项目，敲定交易。对投资银行服务的需求强劲。西蒙的银行赚得盆满钵满，他自己赚得的奖金也飙升。但是他的财运也有变数。当股市下跌，银行的利润也会暴跌。所以他的回报虽然很高，但也像股票一样波动很大。为了对冲如股票般的工作回报，西蒙应该持有债券。相比之下，克里斯的工作就像债券。他的工资不高，但比较稳定。他的工作在经济衰退中没有

风险。所以他承担得起更大的投资风险。他应该持有股票。

这并不是说投资选择就与风险偏好无关。它们的确有关。但应该全面地看待一个人的财富。正确的计算不仅要包括金融资产，还要包括人力资本，即一个人的知识、技能和天分。后者对一个人职业生涯的收入有很大的影响。年轻人几乎没有积蓄，但后头有几十年的时间去工作，他们一生中的大部分财富都蕴藏在人力资本中。和股票或债券一样，人力资本也有回报。在决定持有哪种金融财富时，应该把这一点计入考虑。

这种思维方式对金融行业的人来说更是自然而然。基金经理在工作中的投资组合的大部分都是股票，但有些人把自己的钱全都拿去买了90天期票据。如果他们选的股票赔了，可能会丢了工作，所以不想把所有个人积蓄也都置于危险之中。

可是大多数人不这么想。现有证据表明，人们并没有尝试对冲自己在工作收入方面的风险。事实上，他们通常都是在“反对冲”，将过多的积蓄投资于自己公司的股票，或是同一行业或地区的公司的股票。

麻省理工学院的詹姆斯·波特巴（James Poterba）在2003年发表的一篇论文中指出，全美最大的20个企业养老金计划平均将40%以上的资金投资了自家公司的股票。近年，这种策略的风险得以彰显。安然倒闭时，其雇员退休储蓄的60%以上都投在公司股票里。欧洲工商管理学院（INSEAD）的马西莫·马萨（Massimo Massa）和目前在密歇根州立大学任职的安德烈·西蒙诺夫（Andrei Simonov）基于瑞典数据的另一项研究也发现，人们倾向于投资与自己的工作收入密切相关的股票。

人们执着于自己所了解的东西，这可以理解。投资看起来好像是一项攻击性很强的运动，是牛、熊或华尔街之狼的领地。不过，把投资看做一种自我保险会更有益处。人们存钱和投资是为了保护自己不受意外事故的影响。防范某些风险的最好方法通常是积极接受另一种不同的风险。你需要什么样的保险最终取决于你是谁。 ■



Internet regulation in Europe

Screen grab

A new copyright law and a court case are the latest examples of the EU's technological assertiveness

LUDWIG VAN BEETHOVEN has been dead for nearly 200 years. The copyright on his music is long expired. But when Ulrich Kaiser, an academic at the University of Music and Performing Arts Munich, recently tried to upload a public-domain recording of his Fifth Symphony to YouTube, he was thwarted by Content ID, an automated copyright filter. Mr Kaiser tried again with recordings of music by Schubert, Puccini and Wagner. Despite being in the public domain, all were flagged for copyright violations by the algorithm.

YouTube built Content ID a decade ago, under pressure from copyright-holders worried that users were uploading commercial music and videos without permission. Ever since users have complained that the algorithm is too aggressive. Now YouTube and other big internet firms may be obliged by European law to employ similar methods there. On September 12th members of the European Parliament approved, by 438 votes to 226, a draft of a new copyright law designed to update the EU's copyright legislation, which predates the rise of big internet gatekeepers such as Google and Facebook. The rules sparked death threats against MEPs and a million-signature petition against the proposals.

Two provisions are particularly contentious. The first is Article 13, which compels internet firms, whose users upload large quantities of video, music, text and the like, to work with copyright-holders to ensure that anything that breaches copyright can be detected as soon as it is posted. That probably means they will have to deploy many more content filters like

Content ID, which are worryingly imprecise.

Technology companies, and those who advocate an open internet, say the effect will be dire. In the quest to give more protection to copyrighted work, everything from political-protest videos to citizen journalism and viral memes, they argue, risks being squashed by overzealous enforcers. The freewheeling nature of the internet could change, they warn. That is a prospect often wheeled out by the internet lobby and is probably an exaggeration. But some collateral damage seems likely. The effects could reach into unexpected places. GitHub, for instance, is an online code repository. It worries that open-source computer code hosted on its site might fall foul of the new filters.

The second fight was over Article 11, which pits tech firms against publishers. It requires social networks and aggregators such as Google's "News" search engine to obtain a licence from publishers before displaying snippets of news reports to their users. Firms such as Google and Twitter profit from the attention generated by news that is gathered by others, note Article 11's advocates, and should therefore share the revenues that result. But critics decry it as a "link tax" that would also radically limit the freedom of internet users.

Article 11 is a Europe-wide version of similar rules introduced in Germany and Spain in 2013 and 2014 respectively. Google's response in Spain was to pull the plug on its news service, to the detriment of publishers that relied on it for traffic. By making a similar law apply across the entire European market, the hope is that Google (and other companies) will be forced to keep services running and share some of their revenues.

Predicting the exact consequences of all these new rules is difficult, says Jim Killock of the Open Rights Group, a British organisation that opposed the changes. They must be approved by both the European Commission and

the EU's 28 member states before they can be finalised. But the planned legislation is another example of rising European assertiveness when it comes to regulating the internet—in May the EU brought into force the General Data Protection Regulation (GDPR), a far-reaching privacy law. One result could be yet more “geo-fencing”, whereby the internet becomes fragmented along geographical lines. After the GDPR came into force, some American websites decided to block Europe-based visitors rather than comply.

More regulation may be in the offing. The day before the parliamentary vote Google was at the European Court of Justice, in Luxembourg, to do legal battle with the CNIL, France's data-protection authority. The dispute concerned the “right to be forgotten”, under which the EU requires search engines, in certain circumstances, to remove links to webpages with personal information about European citizens. Google's approach has been to remove links to the offending pages only for EU users. The CNIL says that, because the tech used to determine where a user is based can be circumvented, links should be removed for all users, anywhere in the world. A ruling is expected next year. Europe may not have its own internet giants, but it is having plenty of impact on America's. ■



欧洲互联网监管

截屏

欧盟面对科技公司立场强硬，新的版权法和法庭诉讼是最新例证

贝多芬去世已近两百年。他的音乐版权已过期很久。然而，最近慕尼黑音乐戏剧学院（University of Music and Performing Arts Munich）的学者乌尔里希·凯瑟（Ulrich Kaiser）想要将贝多芬第五交响曲的一段属于公有领域的录音上传到YouTube时，却被自动版权过滤器Content ID挡住了。凯瑟又尝试了舒伯特、普契尼和瓦格纳的音乐作品。尽管所有乐曲都属于公有领域，却全都被算法标注为侵犯版权。

版权所有者担心用户未经许可就上传商业音乐和视频，在他们的施压下，YouTube于十年前打造了Content ID。自那之后用户一直抱怨这种算法过于激进。而现在，YouTube和其他大型互联网公司可能还得依照欧洲法律，在欧洲也实施类似的操作。9月12日，欧洲议会以438票对226票通过了一项新的版权法草案，将用于更新早在谷歌和Facebook等大型互联网看门人崛起之前就颁布的原欧盟版权法。这引来了对欧洲议员的死亡威胁，还有一份百万人签名反对提案的请愿书。

有两项条款尤其有争议。首先是第13条。它要求互联网公司必须与版权所有者合作，以确保任何侵权的内容都能在发布后立即被发现。鉴于互联网公司的用户会上传大量视频、音乐、文字等内容，这可能意味着它们将不得不配置更多像Content ID之类的内容过滤器，而这些方法不精确的程度令人担忧。

科技公司和那些支持互联网开放的公司表示，这会带来可怕的影响。它们认为，在为版权作品寻求更多保护的过程中，从政治抗议视频到公民新闻再到疯传的搞笑图文等各种内容都有可能被热心过头的执法者压制。它们警告说，互联网随心所欲的本质可能会改变。这一可能性常常被互联网游说团体搬出来说事，或许有些夸张，但一些连带损害似乎还是可能的。其

影响可能会波及意想不到的地方。例如，在线代码库GitHub就担心自己网站上的开源计算机代码可能会与新的过滤器冲突。

另一项引起争议的条款是第11条，它让科技公司与出版商陷入对立。它要求社交网络和谷歌新闻搜索引擎等聚合器在向用户展示新闻报道摘要之前，必须先获得出版商的许可。第11条的拥护者指出，谷歌和Twitter等公司靠其他人收集的新闻吸引到的关注获利，因此应该分享由此产生的收入。但批评者谴责它是一种“链接税”，也会从根本上限制互联网用户的自由。

德国和西班牙分别在2013年和2014年推出过类似的法规，而第11条则会将它们扩展到整个欧盟。谷歌在西班牙的应对方法是终止其新闻服务，这对那些靠它获得流量的出版商不利。通过将类似的法律应用于整个欧洲市场，欧盟希望谷歌（以及其他公司）将被迫继续运营这类服务并分享部分收入。

来自反对这些改变的英国“开放权利组织”（Open Rights Group）的吉姆·基洛克（Jim Killock）表示，很难预测所有这些新规则的确切后果。新规必须得到欧盟委员会和欧盟28个成员国的批准才能最终敲定。但这项立法提案是欧洲对互联网监管日益强硬的又一例证。欧盟今年5月颁布了一项影响深远的隐私法——《一般数据保护条例》（General Data Protection Regulation，简称GDPR）。新规的一个可能的结果是会造成更多的“地理围栏”，让互联网被地理边界切割得支离破碎。GDPR生效后，一些美国网站决定把欧洲的访问者挡在门外，而不是遵守这项法规。

更多的监管可能即将出台。在欧洲议会投票的前一天，在设立于卢森堡的欧洲法院，谷歌正在与法国的数据保护机构国家信息自由委员会（CNIL）打官司。这场争议涉及的是“被遗忘权”。根据该权利，欧盟要求搜索引擎在某些情况下删除含有欧洲公民个人信息的网页链接。谷歌采取的方法一直是只对欧盟用户删除那些指向违规页面的链接。CNIL认为，因为用于确定用户位置的技术是可以被绕行的，所以应该对全世界各地的所有用户都删除链接。预计明年会做出裁决。欧洲或许没有自己的互联网

巨头，但它正在对美国的互联网巨头产生重大影响。 ■



Bartleby

History lessons

Three national leaders from whom managers could learn

BUSINESS leaders often have a poor opinion of politicians, preferring to find their heroes elsewhere—in other boardrooms or on the coaching field. But running a country is an even greater test of leadership and character than running a corporation. Those who have passed through the fire surely have something to teach modern-day managers.

Take three of the most feted national leaders: Otto von Bismarck, Franklin Roosevelt and Winston Churchill. Many will object both to what they achieved and to the violence they used. But their successes and failures hold lessons for CEOs.

Bismarck was an old-school Prussian aristocrat. But he proved remarkably flexible and imaginative during nearly three decades in office. As a manager, he had a clear goal—to unite Germany under his king (who became Kaiser Wilhelm I in 1871). This required him to overcome the suspicions of other German states, which he did by uniting them against a series of enemies, from Denmark through Austria to France—a merger strategy that allowed Germany to compete on equal footing.

Bismarck also proved flexible when it came to domestic policy. Though no social reformer, he worried about the danger of working-class support for socialism. So he pushed through a series of welfare measures in the 1880s, including old-age pensions and health insurance. He understood the benefits of social responsibility long before CSR departments became a thing.

Like many corporate empire-builders, however, he overreached—in his case

by annexing Alsace-Lorraine from France. But his less capable successors were less disciplined still; it was they who led Germany down the path to disaster.

Where Bismarck built a successful conglomerate, Roosevelt proved to be a consummate turnaround artist. Like the Prussian, FDR showed plenty of flexibility. Although he campaigned for office on the promise of a balanced budget, he adapted when circumstances required it to become the first Keynesian leader. Economists will probably spend the rest of history debating the merits of his various policy measures. But like an executive who rescues a failing company, he showed the power of leaders to change the mood, notably with his inaugural declaration that “the only thing we have to fear is fear itself.”

As he took over the presidency, in 1933, unemployment started to fall and GDP began to rise; the latter rose by 9.5% a year in his first term of office. Although there was plenty of doubt about the route that Roosevelt took, there was no question about his desired destination, whether ending the Depression or winning the second world war. He communicated his message clearly and often—a lesson to modern bosses, even if they prefer Twitter to fireside chats on the wireless.

That made him popular enough with voters to remain at the helm for 12 years, until his death in 1945—twice as long as shareholders in America tolerate a typical chief executive today, and three times as long as they do in Britain. Although he was flexible on economic policy, he was unimpressed by ideologies such as fascism and communism, and remained true to the core principles of the American enterprise. Many executives would do well to emulate Roosevelt’s confidence in his own judgment and his ability to convey it (it helped that this confidence seldom proved unjustified).

Like Roosevelt, Churchill was supremely confident. His political career

contained numerous mistakes and many episodes of poor judgment, not least when it came to his attitude towards citizens of British colonies. He would not have lasted long as a modern chief executive, given his bad temper, excessive drinking and eccentric working hours. He was never short of ideas but his subordinates learned to ignore most of them. Like Steve Jobs, a similarly mercurial figure, the first part of his career ended in failure.

But as with Apple's founder, Churchill's other qualities won out. His strategic insight was unrivalled, whether recognising that Hitler was a threat to the world in the 1930s or refusing a peace deal with Germany in the dark days of 1940. He was canny in using his charm to get aid from Roosevelt before America entered the war—and flexible when he accepted an alliance with Stalin's Russia, despite his lifelong anti-communism. His bulldog attitude and powerful speeches inspired after a succession of mediocre leaders.

Clear strategic goals, flexibility in tactics and an ability to inspire others. Those are three qualities that any executive or entrepreneur might usefully acquire. Bosses should read more history books. ■



巴托比

以史为鉴

企业管理者可从三位国家领导人身上获得启示

企业领导人通常对政客评价不高，更愿意在其他地方找寻自己的偶像，像是别家公司的董事会会议室，或训练场。但和经营公司相比，治理国家是更严峻的考验，更能检验领导者的能力和品格。那些历经火的试炼的人必定有可供现代管理者学习之处。

以三位最受尊敬的国家领导人为例：奥托·冯·俾斯麦、富兰克林·罗斯福、温斯顿·丘吉尔。很多人会不认可他们的成就以及他们使用暴力的做法，但CEO们可从这三人的成功与失败中汲取教训。

俾斯麦是一个老派的普鲁士贵族，但他在接近30年的任期内展现出了非凡的灵活度和想象力。作为一名管理者，他目标明确：统一德意志，并使之臣服于他的国王（这位国王在1871年成为了威廉一世）。这就要求他平息其他德意志邦国的疑虑。他的方法是让它们团结起来，共同抵御从丹麦到奥地利、再到法国的一众敌人。通过这种“并购策略”，德意志帝国得以与其他国家在同等水准上竞争。

俾斯麦在国内政策上也显现出灵活性。尽管他不是个社会改革者，但还是担心工人阶级对社会主义的支持所带来的风险。因此他在19世纪80年代推动通过了一系列福利措施，包括养老金和医疗保险。在企业社会责任部门这样东西出现前很久，他就明白了讲求社会责任的益处。

然而他和许多企业帝国的缔造者一样会妄为，像是侵占法国的阿尔萨斯-洛林。但他那些能力欠佳的继任者更是缺乏克制，是他们将德国引向了灾难。

俾斯麦创建了一个成功的企业集团，而罗斯福则展现出力挽狂澜的高超技艺。和那位普鲁士人一样，罗斯福也显现了相当的灵活度。虽然他在竞选

时承诺将平衡预算，但当情势需要时，他做出了调适，成为了第一个奉行凯恩斯主义的领导人。经济学家们日后也许一直会为他的各种政策措施的功过争论不休。但就像一位挽救了一家濒危公司的高管，他展现出了提振士气的领袖力量，特别是他就职演说中的那句宣言：“我们唯一值得恐惧的就是恐惧本身。”

1933年他就任总统后，失业率开始下降，GDP上升。在他首个任期内，GDP的年增速达到9.5%。虽然罗斯福采取的方法引发了诸多疑虑，但他想要达到的目标却是无可置疑的，不管是终结大萧条还是赢得二战胜利。他频繁而清晰地传达自己的信息，这一点值得现代的老板们学习——哪怕比起利用无线电与民众来场“炉边谈话”，他们更愿意发推特。

炉边谈话让罗斯福在选民中获得了足够的好感，而得以掌舵美国12年，直到1945年去世。任期之久，比现在美国的股东通常可忍受的CEO在位时间长一倍，比英国的长两倍。虽然罗斯福在经济政策上能灵活变通，但他不为法西斯主义和共产主义这类思想体系所动，矢志不移地坚守美国企业经营之道的核心准则。许多高管都应效仿罗斯福，像他那样坚信自己的判断并将信心传递给他人（罗斯福的自信很少是那种毫无道理的偏执，这一点也很重要）。

和罗斯福一样，丘吉尔也无比自信。他在政治生涯中犯下很多错误，也多次出现过判断失误，尤其是在对待英国殖民地居民的态度方面。如果他是个现代的CEO，以他的坏脾气、嗜酒成性和异于常人工作时间，这个位子恐怕坐不久。他从来都不乏创见，但他的下属学会了无视它们中的大部分。和性情同样反复无常的乔布斯一样，丘吉尔职业生涯的第一阶段也以失败告终。

但和这位苹果创始人一样，丘吉尔的其他品质占了上风。他的战略眼光无人能出其右，不管是在上世纪30年代认识到希特勒对于全世界都是个威胁，还是在1940年的黑暗岁月里拒绝与德国达成和平协议。他精明地运用自己的魅力，在美国参战前赢得了罗斯福的援助，而且还懂得变通，肯与斯大林领导的苏联结盟，尽管他毕生反对共产主义。在经历了一个又一个

平庸的领导人之后，英国终于有了丘吉尔这样的人物，用他坚毅无畏的姿态、有强大感染力的演讲鼓舞人心。

战略目标清晰，战术灵活变通，有能力激励他人——任何高管或创业家也许都能因习得这三种品质而获益。老板们应该多读一读历史。 ■



The blockchain and energy

Greens meet geeks

Hope, hype and heresy as energy rides the cryptowave

TEPCO, Japan's largest energy firm, is an unlikely advocate of techno-anarchy. The firm is best known for the meltdown at its Fukushima Dai-ichi nuclear-power plant in 2011, during which its buttoned-down executives showed corporate Japan at its most stultified. Yet it is trying to reinvent itself as a pioneer of one of the edgiest forms of energy. It is embracing blockchain technology with an aim, no less, of overthrowing the old order in the electricity business to make it more decentralised.

Blockchains, the technologies on which bitcoin and other cryptocurrencies are built, may at first appear to be an uneasy fit with the energy business. Electricity has in the past been generated centrally, run across vast physical grids, with constant management by system operators to keep power flowing smoothly. Blockchains are distributed digital ledgers, which are not managed by a central authority, but collectively by a group of users. If anything, cryptocurrency blockchains are a drain on energy rather than a support for it. Digiconomist, a blog, estimates that just one bitcoin transaction uses as much electricity as an average household in the Netherlands uses in a month.

Yet in an era when more businesses, communities and households are generating their own energy, chiefly via solar and wind power, startups and big utilities alike believe blockchains will help speed the move towards decentralisation. They are finding ways to do this with minimal energy consumption.

There is lots of hype and a degree of heresy, given that stodgy utilities

are making use of an anti-establishment technology. Almost all blockchain applications are still experimental. But the scope of potential blockchain-energy businesses is so wide that there may be successes to come. The applications range from ways to promote buying, selling or trading of clean energy between individuals (also called peer-to-peer trading), to balancing wholesale electricity markets (ensuring that supply always matches demand), to trading carbon credits. Further uses are enabling households to provide charging stations for electric cars, and funding the development of solar power in poor countries.

Numbers are hazy. The Energy Futures Initiative, a think-tank led by Ernest Moniz, a former American energy secretary, says that \$100m-300m has been invested in over 100 blockchain-related energy ventures. Specialists at the Council on Foreign Relations (CFR), an American think-tank, say most investment so far has gone into peer-to-peer trading and grid-balancing applications. A “try-anything” attitude prevails. “It is like looking at cell phones circa 1995 and not knowing what the future of mobile communications will be,” says Sam Hartnett of the Energy Web Foundation (EWF), a non-profit venture aimed at developing core blockchain technology for the energy industry.

Tepco, for instance, appears to be throwing the digital equivalent of spaghetti at the wall to see what sticks. In December, it made an investment of an undisclosed sum in Electron, a British blockchain company that is focusing chiefly on handling the multiplying options for flexible demand in electricity systems. In April Electrify, a Singapore-based startup, said it had signed a memorandum of understanding with Tepco to experiment with peer-to-peer electricity trading. The Japanese group is also one of more than 70 firms, including utilities Duke Energy and Centrica, and oil firms Royal Dutch Shell and Equinor, that are part of the EWF. Among many initiatives, the EWF is pioneering a blockchain application that tracks renewable-energy certificates used to offset carbon emissions to make them more

transparent and granular.

Experts say it is important to bust two myths—one too positive, the other too negative—about the blockchain and energy. First, there is a view, promoted in many initial coin offerings, that everyone will be able to use the blockchain and cryptocurrencies to trade locally-generated energy (rooftop solar, for instance) with each other, without a centralised utility in the middle. This is largely nonsense. Electricity still needs to travel down poles and wires, for which the transmission and distribution companies will want hard cash. The blockchain will be used, if at all, at either end of the grid.

On the negative side, a view prevails that the blockchain will guzzle too much electricity for energy applications to make sense. But this assumes that projects will use a public blockchain such as bitcoin, which anyone can access with the right software, requiring lots of computing power and time to verify each transaction and protect the blockchain. Energy firms could in fact employ blockchains in which only trusted participants can join, making the process of maintaining the blockchain faster and less energy-hungry.

Mr Hartnett says that, while bitcoin transactions can consume the energy of a medium-sized country when done regularly, those of EWF are “of the order of a medium-sized office building”. The use of trusted pools of participants is where the utilities spy an opportunity to co-opt a potentially insurgent technology; they will use it to remain central to the decentralisation of electricity. “The [blockchain] ventures most likely to achieve commercial traction in the coming years will largely work within the existing system and partner with incumbents such as utilities,” says the CFR report. Or as Electrify’s Martin Lim colourfully puts it, “It’s ironic. Every subversive turns into a dictator.” ■



区块链和能源

绿色能源遇见极客

能源业也搭上了加密列车，带着希望、炒作和离经叛道

很难想得到日本最大的能源公司东京电力（Tepco）会是技术无政府主义的倡导者。该公司最出名的事是2011年它运营的福岛第一核电站发生堆芯熔毁事故，期间保守老套的高管们表现出了日本企业最愚蠢的一面。不过，这家公司正在尝试自我重塑，要变身为实践最激进能源形式之一的先驱。它正在采用区块链技术，目标竟是要推翻电力行业的旧秩序，使其更加去中心化。

作为比特币和其他加密货币的基础技术，区块链乍一看似乎与能源业务不那么匹配。电力在过去一直都是集中生成，在庞大的物理电网中传输，需要系统运营商不间断地管理以确保平稳供电。区块链是分布式数字分类账，它不是由某个中央权威机构管理，而是由大批用户共同管理。真要说两者有什么关系，那就是加密货币区块链是消耗而不是支持能源。博客Digiconomist估计，仅一个比特币交易消耗的电量就相当于荷兰一个普通家庭一个月的用电量。

如今更多的企业、社区和家庭都在自主发电，主要是通过太阳能和风能。在这样一个时代里，创业公司和大型电力企业都相信区块链将加快电力行业去中心化的进程。它们正在寻找以最低能耗实现这一目标的方法。

因循守旧的电力公司却在利用一种反正统技术，这其中有很多炒作，却也有一定程度的离经叛道。几乎所有区块链的应用仍处于试验阶段。但潜在区块链能源业务的范围非常广泛，未来也许会取得成功。这些应用包括促进在个人之间购买、销售或交易清洁能源（也称为P2P交易）、平衡电力批发市场（确保供应始终与需求相匹配）以及交易碳信用额等。进一步的用途还包括让家庭为电动汽车提供充电站，以及为贫穷国家太阳能发电的发展融资。

相关数字模糊不清。美国前能源部长欧内斯特·莫尼兹（Ernest Moniz）领导的智库能源期货计划（Energy Futures Initiative）表示，已有1亿至3亿美元投入到超过100个与区块链相关的能源企业中。美国智库外交关系协会（CFR）的专家表示，到目前为止，大部分投资对象都是P2P交易和电网平衡应用。一种“什么都试试”的态度很流行。非营利机构能源网络基金会（以下简称EWF）力图为能源行业开发核心区块链技术，该基金会的山姆·哈奈特（Sam Hartnett）说：“这就好比在1995年前后看手机的发展，那时候谁也不知道移动通信在未来会是什么样子。”

以东京电力为例，它似乎正在摸着“数字石头”过河。去年12月，它向区块链公司Electron做了一笔数额不明的投资，这家英国公司主攻电力系统中不断增多的弹性需求选择。今年4月，总部位于新加坡的创业公司Electrify表示已与东京电力签署了试验P2P电力交易的谅解备忘录。东京电力是EWF的70多家成员企业之一，其他企业还包括公用事业公司杜克能源（Duke Energy）和森特里克（Centrica），以及石油公司荷兰皇家壳牌和挪威国家石油公司（Equinor）。EWF正在开发的众多项目中包含一种区块链应用，它可以跟踪用于抵消碳排放的可再生能源证书，使其更加透明和细化。

专家们认为，破除有关区块链和能源的两大迷思很重要。这两种误解一种太过积极，一种又太过消极。首先，许多首次代币发行（ICO）都宣扬一种观点，即每个人都能够利用区块链和加密货币来与其他人交易本地产生的能源（例如屋顶太阳能），而无需集中化的公用事业公司作中介。这在很大程度上是无稽之谈。电力仍然需要沿着电线杆和电线传输，传输和配电公司仍要为此收取实实在在的现金。就算真要用区块链，那也是在电网的两端。

在消极那一面，有种流行的观点认为区块链耗电太多，应用于能源不具合理性。但这是假定能源项目将使用类似比特币这样的公共区块链，任何人都可以用合适的软件访问，需要大量的计算能力和时间来验证每笔交易并保护区块链的安全性。而事实上，能源公司可以使用只有受信任的参与者才能加入的区块链，从而使区块链的维护速度更快，能耗更低。

哈奈特说，比特币交易若定期进行，耗电量可能会与一个中等国家的用电量相当，而EWF那类交易的耗电量“仅相当于一座中等规模办公楼的水平”。“受信赖参与者”的方式让电力公司发现了利用一种潜在颠覆性技术的机会，它们将以此确保在电力去中心化的发展中自己仍将处于核心地位。CFR的报告称，“最有可能在未来几年实现商业发展的（区块链）企业将主要在现有系统中运作，并与电力公司等既有企业合作。”Electrify的马丁·利姆（Martin Lim）说得很生动：“这很讽刺。每个颠覆者最后都成了独裁者。”■



Insuring intangible risks

In search of a jelly mould

The value of rich-world companies now lies mainly in assets that are impossible to touch and tricky to insure

THE development, hundreds of years ago, of ship and cargo insurance was revolutionary. It marked the start of commercial insurance; protection against loss from looting, fire and the perils of the high seas fostered global trade. But in the 21st century the value of companies consists less of solid objects, such as boats and buildings, than of weightless, intangible elements, such as intellectual property (IP), data and reputation. “Today the most valuable assets are more likely to be stored in the cloud than in a warehouse,” says Inga Beale, chief executive of Lloyd’s of London.

As Western economies have shifted from making things to providing information and services, the composition of companies’ assets has shifted too. Intangible assets can be hard to define, let alone translate into dollars (under international accounting standards they are defined as “identifiable non-monetary asset[s] without physical substance”). Yet their growth has been undeniable. In 2015, estimates Ocean Tomo, a merchant bank, they accounted for 84% of the value of S&P 500 firms, up from just 17% in 1975 (see chart). This does not merely reflect the rise of technology giants built on algorithms; manufacturers have evolved too, selling services alongside jet engines and power drills, and crunching data collected by smart sensors.

As the importance of intangibles has grown, so has companies’ need to protect themselves against “intangible risks” of two types: damage to intangible assets (eg, reputational harm caused by a tweet or computer hack); or posed by them (say, physical damage or theft resulting from a cyberattack). However, insurance against such risks has lagged behind their

rise. “The shift is tremendous and the exposure huge,” says Christian Reber of the Boston Consulting Group, “but the insurance industry is only at the early stage of finding solutions to close the gap.”

Examples of potential damage are not hard to find. In February a tweet by Kylie Jenner, a celebrity with over 25m followers, rhetorically asking whether anyone still used Snapchat, coincided with a drop of 6% in the share price of Snap, the messaging app’s owner. NotPetya, a widespread ransomware attack last year, is likely to have cost companies more than \$3bn. One of the first events to awaken corporate America to intangible risks, a hack in 2013 of Target, a retailer, resulted in the theft of data on 70m customers, falling sales and profits, and litigation costing millions.

Companies are not oblivious. Respondents to a survey last year by Aon, an insurance broker, ranked reputation as their top risk (up from fourth in 2013) and cyber-risk as their fifth (from 18th). But there is a big difference between how risk managers perceive such risks and how boards do. And if firms do seek insurance against some of these risks, insurers have not exactly been inundating them with novel products. “Even when policies are labelled ‘innovative’ it’s usually to insure physical assets in the sharing economy rather than intangibles,” says Magda Ramada of Willis Towers Watson, another broker. But in a world where Airbnb, in effect the world’s largest hotel chain, owns no hotels and Uber, its largest taxi firm, owns no cabs, such policies are of limited use. Those that do protect assets such as data, IP and reputation are often expensive and bespoke, and include strict exclusions and limits.

Insurers’ caution is understandable. Intangible risks are not only new and complex. “They’re a bit like not-yet-set jelly,” says Julia Graham of Airmic, a trade body. “Their shape constantly changes.” Underwriters like to look at past data on events’ frequency as well as clients’ current exposure—which may be next to impossible when assessing the risk and impact of a

cyberattack, a sexual-harassment scandal, which would have been very differently priced even a couple of years ago, or a celebrity's throwaway tweet. (Snap's share price has fallen by more than one-third in six months, suggesting deeper troubles than Ms Jenner's disapproval.) "The problem with intangible assets is that they have fuzzy boundaries, and for insurance to work you want crispness," says David Teece, of the University of California.

But some underwriters are starting to come up with more suitable policies. One is parametric cover, which pays a fixed amount automatically after a defined event, such as a hack. The advantage of such policies is that they can provide cash quickly, meeting an immediate need after misfortune strikes. The downside is that these products tend to cover only a share of damages.

Some once-uninsurable risks can now be at least partly insured thanks to advances in modelling, indemnity structures and other areas, says Thomas Holzheu of Swiss Re, a reinsurer. Examples include business interruption, cyber-risks, product recalls, damage to reputation and energy prices. A study by Swiss Re points to cover for hoteliers against a drop in occupation after widespread travel disruption or a pandemic, and a flight-cancellation policy for airlines triggered by severe events which do no harm to airports or aircraft but stop air traffic.

Most of the action has been in cyber-insurance. Early policies dealt merely with the immediate costs of an attack—paying to restore a data centre or for crisis management—but insurers now also offer “holistic” cover, which includes knock-ons such as physical damage, loss of revenue and litigation costs. But at the same time, insurers have become more aware of their “silent” exposure to cyber-risks under existing policies. Increasingly they are excluding them from conventional policies, such as property cover, or selling cyber bolt-ons. A huge gap in coverage remains. Cybercrime caused around \$550bn in losses last year, according to Aon. Companies are covered

for only 15% of potential cyber-risk losses, against 59% for property, plant and equipment losses.

Companies also have to do more to protect themselves. Just as insurance was only part of the answer to fire and maritime risk, it is only part of the answer to modern perils. “Instead of buying insurance against a damaged reputation, firms should be looking at preventing it in the first place,” says Richard Wergan of Edelman, a communications-marketing firm. Plenty of cyber-breaches could doubtless have been avoided if software had simply been kept up to date. Insurers need to catch up with the intangible age; but so do their clients. ■



为无形风险投保

寻找果冻模子

如今富裕国家企业的价值主要集中在摸不到、难投保的资产上

数百年前船舶和货物保险的兴起是革命性的。它标志着商业保险的开始。为抢劫、火灾和公海事故等造成的损失提供保险促进了全球贸易。但是，在21世纪，船只、建筑物等实物在公司价值构成中的占比小于知识产权、数据和声誉等没有重量的无形要素。“如今，最有价值的资产更有可能存储在云端，而不是仓库。”伦敦劳合社（Lloyd's of London）的首席执行官因加·比尔（Inga Beale）表示。

随着西方经济体从制造产品转向提供信息和服务，公司的资产构成也发生了改变。无形资产有时难以定义，更别提转换成美元了（根据国际会计准则，无形资产是指“没有实物形态的可识别非货币性资产”）。然而，无形资产的增长却是不争的事实。商业银行Ocean Tomo估计，2015年，无形资产占标准普尔500指数公司价值的84%，而在1975年仅为17%（见图表）。这一变化不仅仅源于基于算法的科技巨头的崛起，制造商也在与时俱进。后者在销售喷气发动机和电钻的同时也销售服务，还会分析智能传感器收集到的数据。

随着无形资产重要性增加，公司也更有必要防范两种类型的“无形风险”：一种是对无形资产的损害，比如一条推特或一次黑客攻击造成声誉受损；一种是由无形资产带来的损害，如网络攻击造成的实物损失或失窃。然而，针对此类风险的保险滞后于风险的增长。“转变是惊人的，潜在风险是巨大的，”波士顿咨询公司的克里斯蒂安·雷伯（Christian Reber）表示，“但保险业才刚刚开始想办法弥合差距。”

潜在损害的例子不难列举。今年2月，在推特上拥有2500多万名粉丝的名人凯莉·詹娜（Kylie Jenner）在推文中反问是否有人仍在使用Snapchat。同一时间，这款消息应用的母公司Snap的股价下跌了6%。去年，勒索软

件NotPetya发起大范围攻击，可能给各家公司带来30多亿美元的损失。最早让美国公司意识到无形风险的事件之一是2013年零售商塔吉特（Target）遭到黑客攻击，导致7000万名客户的数据被盗，销售额和利润双双下滑，并因相关诉讼损失上亿美元。

对此企业并非视而不见。在保险经纪公司怡安（Aon）去年的一项调查中，受访者将声誉受损列为风险之首（2013年排在第四位），将网络风险列为第五（2013年排在第18位）。但是，对于如何看待此类风险，风险管理经理与董事会之间存在巨大差异。而且，即使公司确实想为其中一些风险投保，保险公司也一直都没有大量新产品供它们选择。“即使保险单被贴上了‘创新’的标签，通常也只是为共享经济中的实体资产承保，而不是无形资产。”另一家保险经纪公司韦莱韬悦（Willis Towers Watson）的玛格达·拉马达（Magda Ramada）表示。但在如今这个时代，称得上全球最大连锁酒店的爱彼迎（Airbnb）本身没有一家旅馆，全球最大的出租车公司优步也没有一辆自己的出租车，在这种情况下，这样的保单作用有限。而那些真正为数据、知识产权和声誉等资产投保的保单往往是专门定制、价格不菲，并且包含各种严格的除外责任和限制。

保险公司的谨慎可以理解。无形资产风险不但新颖复杂，而且，“它们有点像还未成形的果冻，”行业组织英国工商企业风险管理与保险协会（Airmic）的朱莉娅·格雷厄姆（Julia Graham）说，“形状一直在变。”保险公司喜欢研究有关事故频率的历史数据和客户当前的风险，而这种方法几乎无法评估网络攻击、性骚扰丑闻，或名人随手发的一条推特的风险和影响。就在两三年前，针对性骚扰丑闻的保险定价还与现在大相径庭。Snap的股价在六个月内跌幅超过三分之一，表明除詹娜的“嫌弃”之外，公司还有更大的麻烦。加州大学的大卫·提斯（David Teece）指出：“无形资产的问题是它们的边界很模糊，而保险需要边界清晰分明。”

但是一些保险公司开始拿出更适用的保单。其中一种是参数化保险，在黑客攻击等可界定的事件发生后自动支付一笔固定数额。此类保单的好处是可以迅速赔付现金，以解灾祸发生后的燃眉之急；缺点是这些保险产品往往只为一部分损害提供赔付。

瑞士再保险集团（Swiss Re）的托马斯·霍尔茨（Thomas Holzheu）表示，由于在建模、赔偿方式等方面的进步，一些曾经无法投保的风险如今至少可以部分投保，包括业务中断、网络风险、产品召回、声誉受损，以及能源价格波动等。瑞士再保险正在研究承保旅馆业者因大范围交通混乱或流行性疾病造成的入住率下降，以及航空公司因某些虽未损坏机场或飞机、却阻断了空中交通的严重事件引发的航班取消。

这些举措大多集中在网络保险领域。早期的保单只涉及网络攻击造成的直接损失——支付恢复数据中心或用于危机管理的费用。如今保险公司也提供“全面”保险，包括实物损坏、收入损失，以及诉讼费用之类的连锁反应。但与此同时，保险公司也日益认识到旧保单中“隐藏的”网络风险。它们正加紧将这些风险从财产险等传统保单中排除，或者销售网络附加险。承保范围仍然存在巨大的缺口。怡安的数据显示，去年网络犯罪造成了大约5500亿美元的损失。企业只为15%的潜在网络风险损失投了保，而为财产、厂房和设备损失的投保比例为59%。

公司也必须加强自我保护。保险在当年只是部分解决了火灾和海上风险等问题，如今也一样，只能部分解决现代风险的问题。“与其琢磨着买保险来弥补声誉受损，公司首先应该考虑的是如何防止声誉受损。”传播营销公司爱德曼（Edelman）的理查德·维根（Richard Wergan）指出。毫无疑问，若是及时更新了软件，大量网络泄露原可以避免。由此看来，不仅保险公司需要赶上这个无形的时代，它们的客户也需要。 ■



Schumpeter

As good as it gets

Goodwill can seem arcane. But it adds up to an \$8trn accounting puzzle

WHEN it comes to concepts with inappropriate names, goodwill is near the top of the list. Instead of benevolence and big-heartedness, it provokes irritation and theological feuds among financial types. Goodwill is an intangible asset that sits on firms' balance-sheets and represents the difference between the price they paid to buy another firm and their target's original book value. If you think that sounds too abstract to care about, the numbers are huge. Total goodwill for all listed firms worldwide is \$8trn, according to Bloomberg. That compares to \$14trn of physical assets. Dry? Yes. Irrelevant? Far from it.

Controversy has boiled ever since takeovers took off in the 1980s. Today, the treatment of goodwill matters for almost all companies. Take the top 500 European and top 500 American firms by market value. Some 50% have a third or more of their book equity tied up in goodwill. The biggest goodwill carriers are the deal-junkies: AT&T (\$143bn), Anheuser-Busch InBev (\$137bn), General Electric (\$82bn) and Berkshire Hathaway (\$81bn). Apple is a rarity: it has little goodwill because it has eschewed big deals.

So it is of some consequence that on August 29th the International Accounting Standards Board (IASB), which frames the rules in most countries apart from America, said that as part of an ongoing review it would consider a shake-up. The existing rules are almost identical in America and Europe—when an acquirer buys a firm, it books the goodwill on its balance-sheet. It then periodically reviews this sum in an impairment test. Has the acquisition flubbed its market-share targets or got flabby? If so the goodwill is adjusted down by the firm, overseen by its auditors (it can

only very rarely be adjusted up). The revised value is based on new forecasts of the expected cashflows. The write-off appears as a loss on the buyer's income statement and life goes on.

Just as the stock of goodwill sitting on balance-sheets has become vast, so have the write-downs. For the top 500 European and top 500 American firms by market value, cumulative goodwill write-offs over the past ten years amount to \$690bn. There is a clear pattern of bosses blowing the bank at the top of the business cycle and then admitting their sins later, splattering their income statements in red. Vodafone has written off \$52bn of goodwill in the past decade, a similar sum to its current market value.

The present system for tracking all this has two disadvantages. First, measurement. When assets like factories or software are booked on balance-sheets, the value bears some relationship to a number that can be validated externally. But there is a queasy circularity about goodwill: the more companies bid up the price of acquisitions, the bigger the asset they can book. Meanwhile, the process of impairment is horrendously subjective. Most buyers fold their acquisitions into their existing businesses, making it hard to separate them in order to measure their performance. And there is usually a gap of several years before companies own up to mistakes. Investors have already reacted long before then so the accounts become a lagging indicator, of diminished utility.

The second problem is comparability. Goodwill relates to intangible assets: a firm's culture or strategic presence in a growth market, say. But these are not normally recognised on balance-sheets. Take two identical firms, with the same operations, cashflow, debt, strategy and value. The firm built through past acquisitions would have a bloated asset base. As a result its ratio of debt to assets would look healthier. Its shares would look artificially cheap compared with their book value. And it would have a lower return on equity. Sophisticated investors adjust for this distortion. But retail investors

and computers may not. Hans Hoogervorst, the IASB's chairman, has noted that many of the computers behind factor funds, a popular type of statistically driven investing, don't adjust properly for goodwill. It is an alarming insight.

One Utopian answer to the goodwill conundrum would be for all firms to recognise all their intangible assets on their balance-sheets. That would eliminate the comparability problem. It might also please economists who fret that accounts do not capture the economy-wide shift from tangible to intangible assets. This was discussed at the gathering of central bankers at Jackson Hole on August 23rd-25th. But the high-wire game of calculating the market value of entire companies is what the stockmarket does. The goal of accounts is more modest: to measure past performance and provide useful information that helps investors. Allowing firms to constantly estimate their own market value would duplicate the job of investors and also be a dog's breakfast.

A potential fix for the measurement problem, which the IASB is considering, is a return to the practice of writing off a fixed amount of goodwill every year, rather like screws are depreciated over time (this was the approach in America and Europe before the 2000s). But this involves spurious precision: no one has any idea how fast a company depletes its brand per year. And since goodwill is not a cash charge, reported profits would diverge from cashflows. Investors would ignore whatever annual charge the accounts showed. This is how Warren Buffett advised Berkshire Hathaway shareholders to view these costs back in the 1990s.

For all its flaws, the status quo is the best available approach. It can be tinkered with sensibly—the IASB is considering asking firms to give more detail about their unrecognised intangible assets. In time this might help develop a coherent methodology for valuing them. But for now the key is for investors to be clear about their objectives. If you are scrutinising a

company's history and working out whether it has wasted vast sums on deals, then goodwill and write-downs are highly relevant. But if the objective is to assess a company's prospective ability to service debts or create value for its shareholders, goodwill does not matter much at all and should be ignored. After a long boom and lots of pricey deals, the write-downs are coming. A discerning eye, not an accounting revolution, is what is required to interpret them. ■



熊彼特

就这样罢

商誉听起来可能晦涩难懂，但却是个总额8万亿美元的会计难题

要说英语中不恰当的名称，“商誉”（goodwill）能排进前几名。它不但和仁慈、善良【译注：goodwill的常用义】无关，还在财务人员中引发了烦扰和“信仰之争”。商誉是存在于企业资产负债表上的一种无形资产，是收购一家公司的价格与这家目标公司原始账面价值之间的差额。如果你觉得这听上去太过抽象、懒得理会，那么换个说法——商誉是一个巨额数字。根据彭博的数据，全球所有上市公司的商誉总额为8万亿美元，而实物资产为14万亿美元。枯燥乏味吗？是的。无关紧要吗？完全不是。

自上世纪80年代收购开始风行以来，有关商誉的争论就很激烈。如今，商誉的会计处理几乎对所有公司都事关重大。比如，在欧洲和美国各自市值最高的500家公司中，大约一半公司有三分之一或更多的账面价值为商誉。商誉数额最大的公司是那些交易狂，比如AT&T（1430亿美元）、百威英博（1370亿美元）、通用电气（820亿美元）和伯克希尔·哈撒韦（810亿美元）。苹果是个异数——因为没做过什么大宗并购，它几乎没有商誉。

由此看来，国际会计准则理事会（以下简称IASB）在8月29日发布的一项声明颇为重要。这家机构为除美国以外的大多数国家制定会计准则。它表示，作为正在进行的审议的一部分，将考虑对商誉会计方法做出重大调整。美国和欧洲现行的规则几乎完全一样：收购方在买下一家公司时，会将商誉计入资产负债表。之后它会在减值测试中定期审查这个数额。此次收购是否未能实现市场份额目标？或是后劲乏力？如果是，公司就会在审计人员的监督下调低（很少会调高）商誉。更新的商誉数额是根据对预期现金流的新预测做出的。减值的部分作为亏损体现在收购方的损益表上，这就结了。

和资产负债表上积累的商誉一样，商誉减值的金额也已经变得十分巨大。过去十年，欧洲和美国各自市值最高的500家公司累计商誉减值达6900亿美元。一种显而易见的模式是：老板们在商业周期的巅峰期大肆挥霍，之后再承认错误，把损益表弄得满目赤字。沃达丰（Vodafone）在过去十年里减记的商誉达520亿美元，与公司目前的市值相当。

现有的商誉追踪机制有两个缺点：首先是计量。当工厂或软件等资产被计入资产负债表时，其价值可通过外界能验证的数字来衡量。但商誉却使用了一种令人不安的循环论证：公司越是抬高收购竞价，入账的资产就越多。同时，减值的过程极为主观。多数买家将收购所得并入现有业务，因而很难分别衡量它们的业绩。而且公司通常在几年后才会坦承错误。而投资者在此之前很久就已做出反应，于是这些账目就成了滞后的指标，作用减小。

第二个问题是可比性。商誉涉及无形资产，比如企业文化或在成长型市场中的战略选择等。但这些在资产负债表上通常不可辨认。以两家在业务、现金流、债务、战略和价值等方方面面都完全一样的公司为例。经过多次并购的那家公司的资产基数会膨胀，因此它的资产负债率会显得更健康。相比于其账面价值，它的股票价格看上去也被人为调低，同时其股本回报率会更低。精明老练的投资者会对这种失真做出相应调整，但是散户和计算机可能就不会。IASB的主席汉斯·胡格沃斯特（Hans Hoogervorst）指出，运作因子基金这种流行的统计驱动型投资的计算机很多都没有就商誉做出适当调整。这一观察具有警示性。

要解决商誉谜题有一个不切实际的办法：让所有公司都在自己的资产负债表上标识出全部无形资产。这将消除可比性的问题，也许还会让一些经济学家高兴——他们担心公司账目未能体现经济整体从有形资产到无形资产的转变。8月23日至25日，各国央行行长齐聚杰克逊霍尔（Jackson Hole），讨论了这个问题。但是，计算整个公司的市值这种高危游戏是股票市场的任务。企业账目的目标更加适度：衡量过去的业绩，提供有用信息以帮助投资者。让公司频繁估计自己的市值会重复投资者的工作，还会把事情弄糟。

要解决计量的问题有一个可能的方案，就是恢复每年冲销固定金额商誉的做法，就像螺丝用久了会折旧一样（本世纪初之前欧美的做法），IASB正在考虑这种方案。但其中的准确性存疑，因为没人说得上来公司每年消耗其品牌的速度有多快。而由于商誉冲销不是一种现金支出，报告的利润就会与现金流有偏差。投资者会忽略账目上显示的年度支出。上世纪90年代，巴菲特就是这样建议伯克希尔·哈撒韦公司的股东看待这些成本的。

尽管存在缺陷，现行的办法却是可行的最好方法。可以对它做一些合理的改进。IASB正在考虑要求公司提供更多有关未列明无形资产的细节。久而久之这可能有助于形成一套评估无形资产价值的统一方法。但就目前而言，关键是投资者要明确自己的目标。如果你在详察一家公司的历史、想弄清它是否在交易中烧掉了大笔钱，那么商誉和减值就至关重要。但如果你的目标是评估公司未来偿还债务或为股东创造价值的潜力，那么商誉就无关紧要，应该忽视它。经过长期的繁荣和大量巨额交易，商誉减值潮即将来临。要看懂这些减值，需要的不是一场会计革命，而是敏锐的眼光。





Poverty estimates

A thin gruel

Extreme poverty is changing, making it harder to wipe out

HANS ROSLING, a Swedish academic who died in 2017, became famous for telling people that the world was faring better than they believed. One of his favourite examples was the rapid decline in extreme poverty. Sadly, just as Rosling's elegant charts and YouTube talks drilled that story into people's minds, the facts began to change.

On September 19th the World Bank released estimates for extreme poverty in 2015, defined as living on less than \$1.90 a day at 2011 purchasing-power parity. The good, Roslingish news is that poverty continued to diminish (see chart). In 2015 the extreme poor numbered 736m people, or 10% of the world. The Bank's best guess for 2018 is 8.6%.

The bad news is that poverty is becoming harder to tackle. Over the past few decades, rapid economic growth and the expansion of welfare in Asia have borne down on extreme want there. That leaves sub-Saharan Africans as a growing majority of paupers. African poverty is especially intractable because of weak economies, high birth rates and the fact that many poor Africans are not even close to the \$1.90 line. Between 2013 and 2015, the World Bank thinks, the poor population of sub-Saharan Africa grew from 405m to 413m. As a result, the global poverty rate is going down about half as quickly as before.

The latest estimates contain another nasty surprise. In the Middle East and north Africa the number of deeply impoverished people appears to have almost doubled in two years, from 10m to 19m. Two war-torn countries, Syria and Yemen, explain this growth. It is hard to be certain, given the

difficulty of collecting data. But the Middle Eastern jump hints at a broad change. Increasingly, extreme poverty is found in chaotic, ill-governed places. Figures on hunger released earlier last month suggest that it is growing in Venezuela.

There is a broader lesson in that, says Laurence Chandy, director of data and research at UNICEF, the UN Children's Fund. The world has been preoccupied with the task of pulling people out of extreme poverty. But there was always another challenge, which is becoming more pressing. How can entire populations be prevented from falling into it? ■



贫困估测

杯水车薪

极端贫困的问题正在发生变化，加大了根除它的难度

去年去世的瑞典学者汉斯·罗斯林（Hans Rosling）因为告诉人们世界的发展好过他们所想而一举成名。他最喜欢引用的例证之一是极端贫困人口急剧减少。可惜，当罗斯林简洁明晰的图表和他在YouTube上的演讲让这个说法渐渐深入人心之时，事实却开始发生变化。

世界银行于9月19日公布了对2015年极端贫困人口的估计。极端贫困的标准为按2011年购买力平价计算，每日生活费不超过1.90美元。带有罗斯林色彩的好消息是贫困率持续下降（见图表）。2015年的极端贫困人口为7.36亿人，占全世界人口的10%。世行对2018年数字的最高预期是8.6%。

坏消息是解决贫困问题的难度正在加大。过去几十年来，亚洲经济迅速发展、福利扩大，极大地缩减了该地区的极端贫困人口。这使得撒哈拉以南非洲地区成为了贫困人口的大多数，而且绝对数字还在加大。经济低迷、出生率高，再加上很多穷苦的非洲人离1.90美元的极端贫困线都还差得远，非洲的贫困问题因而尤其棘手。世行估计，2013年到2015年间，撒哈拉以南非洲地区的贫困人口从4.05亿增长至4.13亿。结果，全球贫困率的下降速度较之前放慢了约一半。

最新的估计还包含了另一个意料之外的坏消息。在中东和北非，赤贫人口的数量在两年内似乎翻了将近一倍，从1000万增长到1900万，叙利亚和也门这两个饱受战火蹂躏的国家是原因所在。考虑到收集数据的难度，很难对贫困状况有确切的了解。但中东贫困人口激增意味着形势发生了广泛的变化。极端贫困越来越趋向于发生在混乱和治理不善的地方。上月初发布的有关饥饿状况的统计数字显示，在委内瑞拉，饥饿问题愈演愈烈。

联合国儿童基金会数据与研究司司长劳伦斯·钱迪（Laurence Chandy）说，这种变化传达出一个覆盖面更为广泛的教训。一直以来，全世界一

心思帮助人们摆脱极端贫困。但令一个挑战始终存在，且正变得愈发紧迫——怎样避免一整个国家或地区的人口堕入极端贫困？■



Recycling

On the plastic highway

Roadmakers are using waste to create harder-wearing surfaces

OF ALL the plastic produced since the 1950s, less than 10% has been recycled. The vast majority ends up being dumped, most of it in landfill. Some is left to litter the natural environment, where it can get into rivers and wash out into the sea (see following story). The plastic-waste problem will worsen before it gets better: some 380m tonnes of the stuff are likely to be made this year. That is more than three times as much as the 120m tonnes of bitumen produced annually, most of which goes into building the world's roads.

There is a connection. Just as plastic is derived from petrochemicals, bitumen is produced as a by-product of refining oil. Both are polymers, which consist of long strands of molecules bound together firmly. It is this characteristic that makes plastic strong and contributes to its great longevity. Such features are also useful for road builders, who use hot bitumen to bind together aggregates made from broken rocks and stones, into what is commonly known as asphalt. All of which has got some people thinking: why not swap one polymer with another?

Recycled plastic is already used to make some products, such as guttering and sewage pipes. Now attention is turning to roads. On September 11th in Zwolle, a town in the Netherlands, a 30-metre bicycle track made from 70% recycled plastic and the rest from polypropylene was opened. It will be used to test a product called PlasticRoad, which is being developed by two Dutch firms—KWS, a road builder, and Wavin, a firm that makes plastic piping—in partnership with Total, a French oil-and-gas firm.

PlasticRoad is prefabricated in a factory as modular sections. The sections are then transported to the site and laid end to end on a suitable foundation, such as sand. Because these sections are hollow, internal channels can be incorporated into them for drainage, along with conduits for services such as gas and electricity. For the Zwolle project, sections that were 2.4 metres long and 3 metres wide were used. These were fitted with sensors to measure things such as temperature, flexing and the flow of water through the drainage channels. A second pilot cycleway is being built in the nearby town of Giethoorn.

If all goes well, the inventors hope to develop the idea and make the sections entirely from recycled plastic. Paths, car parks and railway platforms could follow. Eventually, sections for use as actual roads are planned. These could contain sensors for traffic monitoring. In time, the circuits in the plastic roads might extend to assisting autonomous vehicles and recharging electric cars wirelessly.

Prefabricated plastic roads should last two-to-three times longer than conventional roads and cost less, the companies claim, mainly because construction times would be reduced by almost two-thirds. Anti-slip surfaces could be incorporated, too, including crushed stones which are traditionally used to dress road surfaces. The sections, when replaced, can also be recycled. But engineers will be watching to see how the track stands up to wear and tear and if the hollow structure causes resonance, which would make such a road unduly noisy.

An alternative method of using recycled plastic is to mix the material into hot bitumen when making asphalt. A road is about to be built this way on the campus of the University of California, San Diego, to test a number of specialist roadmaking plastics developed by MacRebur, a British firm. Each mix is produced from plastic that is not easily or cheaply recycled and so typically ends up in landfill, says Toby McCartney, who founded the firm in

2015 with a group of colleagues.

MacRebur cleans and sorts the plastic and then grinds the waste into flakes or pellets. The plan is for this part of the process to be carried out in the localities where roads are being laid or repaired, so that local waste is used to produce local roads. Each mix can contain 20 or so different polymers for specific surfaces. One mix, for instance, might be suitable for a bus lane that carries heavy loads. Another would provide some flexibility in an area of turning traffic, such as a roundabout, where lateral forces from vehicles' wheels can stretch the surface causing it to tear. Extremes of heat and cold can also be adjusted for. And because the addition of plastic helps to seal up small holes, which allow water to get below the surface of a road and cause it to break up, the modified asphalt can help to prevent potholes.

The company's plastic mixes have already been used in roads, car parks and airport runways in various parts of the world. One of the oldest projects is a stretch of road in Cumbria, in north-west Britain, which is extensively used by heavy lorries. This used to need resurfacing every six months or so, but with the addition of plastic it is still going strong after two years, says Mr McCartney. When resurfacing is needed, the material can be recycled again.

Cleaning and sorting plastic made out of multiple polymers can be relatively expensive, especially if it is used to make low-value products such as packaging. But using such plastic as a replacement for bitumen is cost-effective, claims Mr McCartney. As an example, he says that a tonne of bitumen might cost around £400 (\$521) in Britain. A recycled-plastic additive for a standard road works out at £300-£350 a tonne. The additive would replace a proportion of the bitumen, so there are savings to be made. At present 5-10% of the bitumen is replaced by the additives, but this could be increased to 25%.

Mr McCartney decided to develop specialist recycled-plastic additives after

watching a practice sometimes employed in India to repair potholes. Plastic waste collected by pickers is piled into the hole and then set alight with diesel to form a molten mass. It is crude and polluting, but it provides a fix of sorts. A number of roads in India are also made by mixing chopped-up plastic into bitumen.

Australia is another country that is starting to recycle plastic into roads. Earlier this year a 300-metre stretch was completed in Rayfield Avenue, Craigieburn, a suburb of Melbourne, using a substance called Plastiphalt. This consisted of recycled material from more than 200,000 plastic bags and packaging, 63,000 crushed glass bottles and toner from 4,500 printer cartridges. All this was blended into 50 tonnes of reclaimed asphalt to create a total of 250 tonnes of road-building material. The road will be monitored to see how it performs.

Stuart Billing of Downer, a firm involved in constructing the road, said that the cost of using the recycled materials was comparable with building a road in the usual way. But the road is expected to last a lot longer and prove better at coping with heavy traffic.

Officials in Craigieburn reckon that the amount of rubbish used to construct the road, all of which was diverted from landfill, is equivalent to what Rayfield Avenue's residents would have put into their recycling bins over the past ten years. One of the biggest complaints to local councils is about the state of the roads, especially potholes. Households in Australia and elsewhere might well do more sorting and recycling of plastic if they knew it could result in a smoother drive. ■



回收利用

塑料高速路

道路建设公司正利用废品创造出更耐用的路面

上世纪50年代以来生产的所有塑料制品中，已回收利用的不到10%。绝大部分最终都被随意丢弃，其中多数进了垃圾填埋场。还有一部分被人们乱扔在自然环境中，有可能进入河流，进而被冲进海洋。在迎来转机之前，废弃塑料的问题只会变得更严峻：今年可能会产生大约3.8亿吨废塑料。这比每年生产出的1.2亿吨沥青多两倍多。沥青主要用来在世界各地修筑道路。

两者间存在某种关联。塑料源自石化产品，而沥青则是炼油的副产品。它们都是聚合物，由紧密聚集在一起的长链分子构成。正是这一特性让塑料既结实又经年不腐。这样的特点对修路的公司来说也很有用。它们用热沥青将碎石和砂砾制成的骨料结合起来，制成人们俗称的柏油。这让一些人寻思，为什么不用一种聚合物替换另一种？

再生塑料已经被用来生产某些产品了，例如排水管和污水管。如今人们的注意力又转向了道路。9月11日，荷兰小城兹沃勒（Zwolle）开放了一条30米长的自行车道，路面使用材料有70%是再生塑料，其余为聚丙烯。它会被用来测试一种名叫PlasticRoad的产品，由道路建设公司KWS和管材生产商瓦云（Wavin）这两家荷兰公司与法国石油及天然气公司道达尔（Total）合作研发。

PlasticRoad是一家工厂生产的预制组件。之后这些组件会被运输到施工地点，在合适的路基如沙地上首尾相连地拼接起来。组件是中空的，因此可以在其中预留通道，用来排水和安装天然气和电力管道。兹沃勒的自行车道项目采用的是长2.4米、宽3米的组件，它们配备了传感器，可测量气温、弯曲度以及排水管道内的水流。附近的羊角村（Giethoorn）正在修建第二条试验性自行车道。

如果一切顺利，项目的发明者们希望能进一步完善构想，全部用再生塑料来制造组件。小路、停车场和铁路站台可能也将是再生塑料的用武之地。最终的规划是用这些组件修筑真正的道路。组件也许会内置传感器来监测交通。假以时日，塑料道路中的电路也许还可用来辅助无人驾驶汽车以及为电动汽车无线充电。

几家公司称，这种由预制塑料铺设的道路的寿命应该会是常规道路的两到三倍，成本也更低——主要是因为建设周期会缩短近三分之二。道路上还可以加装防滑表面，像是加工传统路面时会用到的碎石。更换下来的组件还可以再回收利用。但工程师们将密切观察塑料道路的抗磨损能力，以及中空的结构会不会引起共振，造成道路噪音过度。

利用再生塑料还有一种方法：在制作柏油时将再生塑料混入热沥青之中。加州大学圣地亚哥分校的校园里将采用这种方法修一条路，以测试英国公司MacRebur研发的若干种路面专用塑料。托比·麦卡特尼（Toby McCartney）在2015年与一群同事创立了这家公司。他说，每种混合物都是由不易回收或回收成本不低的塑料制成，这些塑料通常都会被送进垃圾填埋场。

MacRebur公司先将废塑料清洗并归类，然后将它们打碎成薄片或小圆颗粒。该公司的计划是让这道工序能在修建道路的当地开展，这样就可以用本地废塑料制成本地道路了。每种混合物中可能会含有大概20种聚合物，可用来制作特定的表面。例如，一种混合物也许适用于负荷沉重的公交车道，另一种能在交通环岛等车辆转弯路段增加道路的柔韧性——车轮行驶在这种路段上会产生侧向力拖拽路面，造成路面开裂。还可以对混合物加以调整以适应极端冷热气温。此外，由于塑料可以封住路面上的小孔洞，不让水再顺着孔洞渗透而毁坏道路，这种改良柏油有助于防止道路坑洞生成。

这家公司的塑料混合物已应用于世界多个地方的道路、停车场和机场跑道。建成时间最久的项目之一是位于英国西北部坎伯里亚（Cumbria）的一段路，这是一条重型卡车频繁行经的车道。麦卡特尼说，过去这里差不

多每六个月就要重新铺一次路面，但添加了塑料后，两年过去了路面依旧坚实。等需要铺设新路面时，旧材料还可以再次回收利用。

由多种聚合物制成的塑料的清洁和分类工作成本相对较高，特别是那些用来生产包装材料等低价值产品的塑料。但麦卡特尼声称，用这种塑料替代沥青具成本效益。他举了一个例子：在英国，一吨沥青的成本大约为400英镑（521美元）。用于标准道路的再生塑料添加剂的成本为每吨300到350英镑。这种添加剂可替代一部分沥青，因而可以节省一些成本。目前塑料替代了5%到10%的沥青，但这个比例有可能扩大到25%。

麦卡特尼是在看到印度偶尔会采用的一种修补路面坑洞的方法后，决定研发专用再生塑料添加剂的。在印度，人们将拾荒者捡来的塑料塞进坑洞，淋上柴油点燃使之熔化。这种方法简单粗暴又污染环境，但好歹是一种补救手段。印度还有一些道路是将破碎的塑料混入沥青修成的。

澳大利亚也开始用废塑料修路。今年早些时候，墨尔本郊区克莱基伯恩（Craigieburn）的雷菲尔德大街（Rayfield Avenue）上一段300米长的路段完工，使用了一种名叫Plastiphalt的材料，由来自20多万个塑料袋和塑料包装、6.3万个碎玻璃瓶、4500台打印机墨盒中的色粉的再生材料构成。这种材料与50吨再生柏油混合，总共制作出了250吨筑路材料。接下来工作人员会监测这条道路的性能如何。

斯图亚特·比林（Stuart Billing）所在的公司Downer参与了这条路的建设。他说，采用再生材料修路的成本与传统方法相当，但道路的寿命预计会长得多，也更能应付繁忙的交通。

修这条路用到的垃圾全部来自垃圾填埋场，克莱基伯恩的官员估计它们相当于雷菲尔德大街的居民过去十年里产生的垃圾总量。民众向地方议会抱怨最多的问题之一就是路况，特别是道路坑洞。澳大利亚和世界其他地方的家家户户要是知道自己分类和回收的塑料垃圾可以让车开得更平稳，说不定会更起劲地做这件事。 ■



Economic and financial indicators

World GDP

The world economy grew by 3.56% in the second quarter of 2018

The world economy grew by 3.56% in the second quarter of 2018 compared with a year earlier, according to our estimates. That is almost exactly the same as the 3.57% expansion rate observed in the first quarter. Trends vary between regions: growth rates continue to rise in America and India, but are levelling off in China and the euro area. According to the OECD, a think-tank, growth is also becoming more uncertain because of increased restrictions on trade, the lack of clarity over Brexit and building financial risks. It expects global growth to level off in the coming years, and has tempered its predictions for both 2018 and 2019, from 3.9% down to 3.7%. ■



经济与金融指标

全球GDP

2018年第二季度全球经济较上一年同期增长3.56%

本刊估算，2018年第二季度全球经济较上一年同期增长3.56%，几乎与第一季度3.57%的数字持平。各地趋势不尽相同：美国和印度的增长率持续上行，但在中国和欧元区增长率趋平。智库经合组织认为，由于贸易限制加码、英国脱欧前景不明、金融风险累积，经济增长前景愈发难以预料。它预计未来几年全球经济增长将趋于平稳，并将今、明两年的增长预测从3.9%调低至3.7%。 ■



Buttonwood

The yuan show

How China's currency sets the tone in the foreign-exchange market

MARIO DRAGHI, boss of the European Central Bank (ECB), is a polished speaker, clear and direct. Yet there was a moment after the bank's monetary-policy meeting on September 13th when he was uncharacteristically vague. Asked how the ECB might recycle the proceeds from maturing bonds once it ends its bond-buying programme, he said the issue had not come up. “We haven’t even discussed when we’re going to discuss it.” Perhaps at the meeting in November. Or December. It will be soon, anyway.

Much of what central banks do is now telegraphed well in advance. Despite the occasional absurdities involved in giving fine-grained “forward guidance”, the Federal Reserve, the ECB and others have trained investors to know when to expect an increase in interest rates. Indeed, central-bank watching is no longer just concerned with clues about the timing of interest-rate changes or plans for bond purchases or sales. It has reached a more elevated plane, where statements by central bankers are parsed for signs of what they might soon say about what they may eventually do.

It is a surprise, then, that forward guidance has had consequences for currency markets that have gone almost unnoticed. In China, policies can change without much in the way of prior signalling. So when the yuan moves, it carries rare news—about currency demand, about China and by extension about the world economy. Increasingly it is the yuan that shapes the foreign-exchange market.

It is still a long way from being a global currency. The yuan has not made great strides as a trading or reserve currency. The dollar is still king. Of

the \$5trn traded in currency markets each day, the dollar is on one side of the exchange in almost nine out of ten transactions. Crude oil is priced in dollars. The bonds issued by countries and by globalised firms are likely to be in dollars if they are not in their home currency. And the dollar accounts for two-thirds of foreign-exchange reserves. The yuan barely registers.

China looms large as an importer and exporter. It is the largest trading partner for almost every country on the planet. But the trade it dominates is priced, invoiced and settled mostly in the currency of America. Indeed, such was the importance of exports to China's economy that, until quite recently, the yuan's value was pegged tightly to the dollar.

But no longer. Since August 2015 the yuan has ostensibly been managed by reference to a broad basket of currencies. In principle this is so the yuan's value can better reflect economic forces. In practice it simply allows the yuan to move in a wider range against the dollar, says Mansoor Mohi-uddin of NatWest Markets. Even this has limits. If the yuan strengthens too quickly, it will hurt China's exports. If it weakens too much, the dollar debts of Chinese firms become more onerous. A sharp drop might spark devaluation fears and capital flight.

Yet in one regard, the yuan's influence is increasingly felt. Almost as soon as the yuan was allowed to float a little more freely, the currencies of economies that do a lot of trade with China began to move in tandem with it. The euro-dollar exchange rate, for instance, has closely tracked changes in the dollar-yuan rate recently (see chart). When the yuan weakened against the dollar in 2016, the euro fell to a low of \$1.05. When the yuan rallied last year, so did the euro. This co-movement is probably not a coincidence, says Kit Juckes, of Société Générale, because the currencies of China's other big trading partners show the same pattern. When the yuan moves up or down, other currencies follow it.

This is testament to China's "soft power" in the foreign-exchange market, says Mr Juckes. In large part China owes this clout to its gravity in global trade. But it is enhanced by the forward-guidance straitjacket worn by central bankers elsewhere. Their transparency can be almost comical, as Mr Draghi's comments show. By contrast, little is known about what China plans. A shift in the yuan is a big signal.

China's pull must now be reckoned with when thinking about the outlook for currency markets. A typical long-range forecast for the euro is \$1.30, some 10% higher than where it trades now. That forecast is close to estimates of the euro's purchasing-power parity, the exchange rate that would make the price of a basket of goods the same in Europe as in America. It seems a natural rate for the euro to gravitate towards. But it will be hard for it to reach that level unless China's policymakers allow the yuan to rise against the dollar. And who can say with confidence that they will? ■



梧桐

人民币秀

中国的货币怎样为外汇市场定调子

欧洲央行行长马里奥·德拉吉（Mario Draghi）是一个出色的发言人，清晰，直接。但在9月13日欧洲央行货币政策会议结束后，他一度一反常态地含糊其辞。当被问及欧洲央行在结束债券购买计划后将如何利用到期债券的收益时，他说这个问题还没提上议程。“我们连什么时候讨论这个问题都还没讨论。”也许会在11月的会议上。也许12月。反正，会很快。

如今央行的很多行动早早就显露出来。尽管美联储、欧洲央行等机构在提供详细的“前瞻性指引”上有时甚至有些滑稽，但投资者已经被它们训练出了预测何时加息的本领。实际上，人们对央行的密切关注已不再停留在有关调整利率的时机或债券购买及出售计划的线索上，而是达到了一个更高的水平。他们会逐字逐句地分析行长们的声明，从中找寻种种迹象，猜测他们很快会就最终采取何种行动发表什么样的言论。

在这种情况下，前瞻性指引对货币市场的影响却几乎未受注意，颇为奇怪。在中国，政策可以在事先没有预警的情况下更改。因此当人民币波动时，会带来关于货币需求、中国乃至世界经济的罕见消息。人民币正日益成为那个给外汇市场定调的货币。

人民币距离成为全球货币还很远。它在作为交易或储备货币方面并没有取得很大进展。美元依然称王。外汇市场每天五万亿美元的交易中，其中一方是美元的交易几乎占了九成。原油以美元定价。由国家和全球化企业发行的债券如果不是以本国货币计价，就很可能是以美元计价。而且美元占了外汇储备的三分之二，人民币的占比非常不起眼。

中国作为进口国和出口国地位显赫。它是这个星球上几乎所有国家的最大贸易伙伴。但它所主导的贸易是以美元计价、开票并结算的。事实上，出口对中国经济非常重要，以至于直到不久前人民币一直都与美元紧密挂

钩。

但现在不同了。自2015年8月以来，人民币据称是通过参考一篮子货币来管理的。从原则上说，这可以让人民币的价值更好地反映经济环境。而在实际操作中，这只是让人民币对美元的汇率波动范围变得更大了，国民西敏寺银行市场公司（NatWest Markets）的曼苏尔·莫希-乌丁（Mansoor Mohi-uddin）说。但即便这样仍有限度。如果人民币升值过快，会伤害中国的出口；如果贬值太多，中国企业的美元债务负担就会加重。大幅贬值可能引发对货币贬值的担忧和资本外逃。

不过从某一方面看来，人民币的影响力越来越大了。几乎就在允许人民币略多一点浮动自由的同时，与中国有大量贸易往来的经济体的货币就开始与之同步浮动。例如，欧元兑美元汇率最近就紧紧跟随美元兑人民币汇率的变化（见图表）。2016年，当人民币对美元贬值时，欧元跌至1欧元兑1.05美元的低点。去年人民币反弹，欧元也反弹了。法国兴业银行的基特·朱克斯（Kit Juckes）表示，这种联动可能并非巧合，因为中国其他大型贸易伙伴的货币也表现出了同样的模式。当人民币升值或贬值时，它们也随之变动。

朱克斯表示，这证明了中国在外汇市场上的“软实力”。在很大程度上，中国有这样的影响力要归功于它在全球贸易中的重要地位。但是，其他地方的央行行长们穿上的前瞻性指引“紧身衣”强化了这一点。有时这件衣服的透明度已近乎滑稽——听听德拉吉关于债券收益的回答。相反，人们对中国的计划知之甚少。人民币的浮动就成了一个重大的信号。

现在要预估外汇市场的前景，必须考虑到中国的影响力。对欧元的长期预测一般是1欧元兑1.30美元，比目前的交易价高出约10%。这一预测与欧元按购买力平价的估值（使得一篮子商品的价格在欧洲与美国）接近。这似乎是欧元会自然趋向的汇率。但是，除非中国的政策制定者允许人民币兑美元升值，否则欧元很难升至这一水平。而谁又能很有把握地说中国会这么做呢？■



Schumpeter

Metamorphosis

Two Asian financial giants deserve to be better known

TOYOTA, Unilever, Barclays, Amazon, Tata. There are 71,000 listed firms in the world, but only a few hundred that many people know at least a little about. Schumpeter would like to propose two Asia-centric candidates: AIA and Prudential PLC. They pass the key tests of relevance. They are big, with a combined market value of \$160bn. They are special, having grown profits faster than two-thirds of listed companies over the past decade. They have prospered against the odds, surviving wars, revolutionary Shanghai, decolonisation and the 2008 Wall Street crash. And they illustrate a global trend: the rise of Asia as a mighty force—perhaps eventually the dominant force—in global finance.

AIA and Pru are specialists in getting Asians to save through long-term insurance, typically life or health policies. They span 20 Asian countries, have over 60m customers and employ almost a million agents to sell their services. They are big investors in local financial markets. And they are beneficiaries of powerful trends. Asia's middle class is growing but tends to have its savings stashed in cash. Welfare states do not yet offer an adequate safety net if family members get ill or die. An obvious answer to this is insurance, yet annual premiums are just 2.5% of GDP in emerging Asia, compared with 5% in western Europe.

What is logical is not necessarily easy to achieve. Both firms have had to go on odysseys. AIA was founded in Shanghai in 1919 by an adventurer called Cornelius Vander Starr, and went on to be folded into AIG, a huge, rogue American financial conglomerate that got bailed out in 2008. AIA was spun out in 2010. Pru was founded in 1848 to serve the insurance needs of

Britain's middle class. Its annual report from three decades ago mentions Asia once. But in the 1990s it remembered that it had some operations in the region that were remnants of colonial times and sent out Mark Tucker, a young executive, to investigate. He ignited the business, later became boss of Pru and then AIA, and is now chairman of HSBC—one of several star executives to have been involved. Tidjane Thiam, boss of Credit Suisse, ran Pru in 2009-15.

Expanding life-insurance businesses is hard. You have to spend cash up front on marketing, agents and laying aside capital reserves. The profits are spread over decades: 67% of the undiscounted earnings from AIA's book of policies will be realised after 2038. In Asia each national market grows over time but in volatile fashion, shrinking on average one year in every three. Currencies gyrate. The industry is fragmented—there are at least 100 life firms across Asia. Someone is always starting a price war.

Both firms have found ways to cope. They are geographically diversified. Each of India, Indonesia and Thailand have boomed since 2008, only to slow down. Between 2015 and 2017 Hong Kong took off as mainland Chinese flocked to sign up to policies in a location with rule of law, but it has since hit saturation point. Now parts of South-East Asia and mainland China are growing nicely again. The firms' armies of agents are a barrier to entry that is hard to replicate, and both companies avoid writing policies that require markets to soar in order to be profitable.

The result is that AIA and Pru's Asian arm have increased their operating profits at a compound rate of 13% and 18% respectively, in dollar terms, since 2007. Two decades ago Asia represented 5% of Pru's market value; now it is about 50%. AIA is worth twice as much as its former parent, AIG. The crumbs have become the biggest slice of the cake. For the global life industry Asian firms now represent 49% of total market value, up from 4% two decades ago.

China is a big part of the story. It has had fiascos, including Anbang, a deal machine and patronage vehicle masquerading as an insurance firm, that failed in February. But there are serious companies, too. Ping An is the most valuable life firm in the world and is admired for its use of data. China Life ranks third. AIA owns 100% of a mainland operation and Prudential has 50% of a joint venture with CITIC, a state-run conglomerate. These bets have achieved critical mass, delivering 18% of the new business written so far this year for AIA and 11% for Pru Asia. The two firms are set to join a tiny elite of multinational financial firms that derive a significant share of their global profits from mainland China.

One risk to them is technology. For now, customers still like dealing with a human (armed with an iPad) when signing complex policies. But startups accessing customers through their phones could make agents obsolete. Colm Kelly, an analyst at UBS, has surveyed 800 agents in Asia, and half of them think that digital distribution is a “big threat”. The management of AIA and Pru need to take this more seriously. Another danger is an economic crisis in Asia, spurred by trade wars or a sell-off in emerging markets. Insurers are inherently opaque. Still, in the 2008-09 downturn AIA and Pru Asia avoided big underwriting-and-investing banana skins, while new sales dipped only a little.

Instead the big test may be consolidation. China is easing its rules on foreign ownership, which will prompt a reshuffle among the long tail of 26 other foreign life firms that have a presence there. Ping An and China Life may seek to buy a presence abroad. Continental Europe’s two giants, AXA and Allianz, both say that they eschew big deals, but have spare cash, half an eye on Asia and 20-year records of empire-building through acquisitions.

For AIA, the danger is that it overpays for small deals or faces a big new competitor. For Prudential the risk is it faces an opportunistic takeover bid. It is the smaller of the two, with a less mature book of business that throws

off less cash. In 2019 it will spin off its British arm. The idea is to lose this baggage so that Pru gets a racier valuation, but the unintended effect may be to make it a sitting duck. Ping An has reportedly been sniffing around its Asian business. Pru's board should resist any bid and stiffen its shareholders' resolve. Both it and AIA belong at the forefront of a new generation of Asian financial multinationals. ■



熊彼特

变形记

亚洲两大金融巨头值得人们更好地了解

丰田、联合利华、巴克莱、亚马逊、塔塔。全球有7.1万家上市公司，但能让很多人至少略知一二的不过数百家而已。本专栏想向读者推荐两家以亚洲为中心的公司：友邦保险（AIA）和英国保诚集团（Prudential PLC）。它们通过了我们的重要性测试：它们规模庞大——合并市值达1600亿美元；非同寻常——过去十年利润增速超过三分之二的上市公司；捱过了各种艰难险阻——战争、上海巨变、去殖民化以及2008年华尔街崩溃等；显示了一种全球趋势——亚洲崛起为全球金融的强大力量，或许最终还会成为主导力量。

友邦和保诚是让亚洲人通过长期保险（通常是寿险或医疗保险）来储蓄的专家。它们的业务遍及20个亚洲国家，拥有6000多万名客户，雇用了近百万名代理人来销售它们的服务。它们是当地金融市场的投资大户，也是多股强劲趋势的受益者。亚洲的中产阶级群体日益壮大，却还是倾向于现金储蓄。一旦家庭成员生病或死亡，福利国家还不能提供足够的保障措施。对此，一个显而易见的解决办法是保险。但在亚洲新兴国家，年保险费仅占GDP的2.5%，而西欧为5%。

然而，顺理成章未必就能轻易实现。两家公司都不得不继续它们的艰难旅程。1919年，冒险家史戴（Cornelius Vander Starr）在上海创办了友邦，后来友邦加入大型金融集团美国国际集团（AIG）。涉不诚实交易的AIG于2008年获政府救助，免于破产。友邦在2010年脱离了AIG。成立于1848年的保诚最初是为了满足英国中产阶级的保险需求。它30年前的年报里只提到过亚洲一次。但在上世纪90年代，它想起自己在该地区还有一些殖民地时期残存的业务，于是派出年轻的高管杜嘉琪（Mark Tucker）前往调查。他让这些业务重新发展起来。后来他本人也先后担任保诚和友邦的老板，现在是汇丰银行的董事长。他是保诚发展历史上的几位明星高管之

一。瑞士信贷集团（Credit Suisse）的老板谭天忠（Tidjane Thiam）曾在2009至2015年间执掌保诚。

扩大寿险业务并非易事。必须在市场营销、代理人和准备金等方面预先投入现金。而利润回报周期则长达数十年：友邦保单账目中67%的未贴现收入要到2038年后才能兑现。长期以来，亚洲各国市场虽然都在增长，却不太稳定，平均每三年就有一年出现萎缩。货币波动也很大。亚洲市场相当分散，至少有100家寿险公司。总有人挑起价格战。

两家公司都找到了对策，那就是因地制宜。自2008年以来，印度、印尼和泰国市场都在蓬勃发展，只是速度有所放缓。2015至2017年间，随着中国大陆居民蜂拥到香港这个法治地区买保险，香港的保险业开始腾飞，但此后也达到了饱和。现在，东南亚部分地区和中国大陆的保险业重新向好。两家公司的代理人大军制度是难以复制的准入壁垒。同时，两家公司都避开了那些需要市场保持高涨才能盈利的保单。

其结果是，自2007年以来，友邦和保诚的亚洲业务以美元计算的营业利润复合年增速分别为13%和18%。20年前，亚洲业务占保诚市值的5%，现在是50%左右。友邦目前的市值是其前母公司AIG的两倍。曾经的小虾米如今已经占据了市场的最大份额。亚洲企业目前占全球寿险行业总市值的49%，而20年前这一比例仅为4%。

中国在其中的作用不可或缺。它有一些可耻的惨败案例，比如2月被接管的安邦就是一个披着保险公司外衣的交易机器和瓜分利益的工具。但也不乏正规的公司。平安是全球市值最高的寿险公司，其对数据的使用广受赞誉。中国人寿排名第三。友邦拥有其在中国大陆的公司100%的股份，保诚在与国有企业集团中信成立的合资公司中拥有50%的股份。这些押注已达到关键规模，今年迄今为止，分别为友邦和保诚亚洲公司带来了18%和11%的新承保业务。按这个趋势，这两家公司将加入一小批跨国金融精英企业的队伍，这些企业都有相当一部分全球利润来自中国大陆。

它们面临的一个风险是科技。目前，在签订复杂的保单时，客户仍然喜欢

与人（配有iPad）打交道。但创业公司通过电话接洽客户的做法可能会让代理人制度变得过时。瑞银（UBS）分析师科尔姆·凯利（Colm Kelly）调查了800名亚洲代理人，其中一半人认为数字化分销是一个“重大威胁”。友邦和保诚的管理层需要更加认真地对待这一问题。另一个风险是因贸易战或新兴市场中的抛售所引发的亚洲经济危机。保险公司本质上就高深莫测。尽管如此，在2008到2009年的经济低迷期，友邦和保诚亚洲公司没有在承保与投资上出现大麻烦，新销售额也只是略有下降。

最大的考验可能是整合。中国正在放宽对外资所有权的限制，这将在中国境内现有其他26家外国寿险公司构成的长尾中引发新一轮洗牌。平安和中国人寿可能会寻求海外收购。欧洲大陆的两大巨头安盛（AXA）和安联（Allianz）都表示无意进行重大交易，但它们有闲置资金，对亚洲市场保持着关注，还有着20年通过收购建立企业帝国的历史。

友邦的风险在于它在小交易上花费过高，或者遭遇新的劲敌。而保诚的风险是它会面临投机性收购。保诚的规模比友邦小，它到期的投保人总数更少，兑付的现金更少。2019年，它将剥离自己的英国业务，意在丢掉这个包袱，让保诚的估值更光鲜。但此举也可能带来意想不到的后果，使其成为吞并目标。据说平安一直觊觎保诚的亚洲业务。保诚的董事会应当抵制任何收购企图，并坚定股东的决心。保诚和友邦都是新一代亚洲金融跨国公司的排头兵。■



Bartleby

When teamwork works

The pros and cons of co-operating

COLLABORATION at work is generally seen as a good thing. Production of *The Economist* is a co-operative process. A crack team of editors removes most of the bad jokes before this column makes it into print. All writers sign a “gag” clause. (*How did this get through? Ed.*)

Businesses value collaboration. The latest survey by the *Financial Times* of what employers want from MBA graduates found that the ability to work in a team, to work with a wide variety of people and to build, sustain and expand a network of people were three of the top five skills that managers wanted. Practical qualifications like accounting, programming and applied microeconomics were among the least-desired attributes.

But managers always have to balance the merits of teamwork, which help ensure that everyone is working towards the same goal, with the dangers of “groupthink”, when critics are reluctant to point out a plan’s defects for fear of being ostracised by the group. The disastrous Bay of Pigs invasion of Cuba in 1961 was a classic case of groupthink. Sceptics were reluctant to challenge John F. Kennedy, the newly elected American president.

A related phenomenon is the “wisdom of crowds”. Large groups are remarkably good, on average, at estimating such things as the number of beans in a jar or the weight of a prize calf. But that accuracy relies on the guesses being independent. When people are aware of the views of others, there is a tendency for them to herd, as participants are reluctant to look foolish by deviating from the majority view. The same effect may lead to stockmarket bubbles.

Modern communication methods mean that collaboration is more frequent. Workers are constantly in touch with each other via e-mail, messaging groups or mobile calls. But does that boost, or detract from, performance? A new study* by Ethan Bernstein, Jesse Shore and David Lazer, three American academics, tried to answer this question. They set a logical problem (devising the shortest route for a travelling salesman visiting various cities). Three groups were involved: one where subjects acted independently; another where they saw the solutions posted by team members at every stage; and a third where they were kept informed of each others' views only intermittently.

The survey found that members of the individualist group reached the optimal solution more often than the constant collaborators, but had a poorer average result. The intermittent collaborators found the right result as often as the individualists, and got a better average solution.

When it comes to idea generation, giving people a bit of space to find a solution seems to be a good idea. Occasional collaboration can be a big help; most people have benefited from a colleague's brainwave or (just as often) wise advice to avoid a particular course of action.

Further clues come from a book, "Superminds", by Thomas Malone of the Massachusetts Institute of Technology. He says that three factors determine the "collective intelligence" of collaborating groups: social intelligence (how good people were at rating the emotional states of others); the extent to which members took part equally in conversation (the more equal, the better); and the proportion of women in the group (the higher, the better). Groups ranked highly in these areas co-operated far better than others.

Close teamwork may be vital in the lower reaches of a hierarchy, but at the top someone has to make a decision. At this stage, intense collaboration may be less helpful. In their book, "Friend & Foe", Adam Galinsky of

Columbia Business School and Maurice Schweitzer of the Wharton School of the University of Pennsylvania found that fashion houses with co-creative directors were rated as less creative by industry experts over a decade (from 2000 to 2010) than brands that were individually led. They add that co-led teams of Himalayan climbers are more likely to suffer deaths than those with single leaders.

As the authors note, co-leadership “creates uncertainty over who is really in charge”. The battles between Sandy Weill and John Reed when they were co-chief executives of Citigroup in the late 1990s were infamous; the arrangement lasted just two years. Less than 5% of companies in the *Fortune* 500 have used a co-CEO structure since 1989. In short, collaboration may be a useful tool but it doesn’t work in every situation. Except at *The Economist*, of course.

* “How intermittent breaks in interaction improve collective intelligence”, Proceedings of the National Academy of Sciences, 2018 ■



巴托比

团队合作有用时

合作的利与弊

人们通常认为工作中的协作是件好事。《经济学人》的出版就是一个合作的过程。在本专栏付梓之前，一群老练的编辑删掉了其中大部分的冷笑话。所有作者都要签署一项“封口”条款。（怎么没人把这句删掉？主编注）

企业重视合作。《金融时报》的最新调查显示，在雇主最希望MBA毕业生具备的技能方面，团队协作能力、与各种各样的人合作的能力，以及建立、维持并扩大人脉的能力位列管理人员最看重的五大技能之三。会计、编程和应用微观经济学之类的实用技能是最不被看重的。

但管理人员永远需要在团队合作的优势和“趋同思维”的危险之间做好平衡，前者有助于确保每个人都朝着同样的目标努力，后者则是有不同意见的人因为担心被团队排挤而不愿指出计划的缺陷。1961年美国对古巴猪湾的灾难性入侵就是趋同思维的典型例子。当时持怀疑态度的人不愿质疑新当选的美国总统肯尼迪。

一个相关的现象是“群体智慧”。一般来说，大群体在估算某个罐子里装了多少粒豆子或一头优质小牛犊有多重这样的问题上表现得相当好。但这种准确性依赖于做猜测的个体相互保持独立。而当人们意识到其他人有怎样的看法时，就会有一种从众的倾向，因为参与者不愿因为偏离主流观点而显得愚蠢。同样的效应可能导致股市泡沫。

现代交流方式让合作更加频繁。员工们通过电子邮件、聊天群或打电话持续保持联系。但这提高了还是降低了绩效呢？美国三位学者伊森·伯恩斯坦（Ethan Bernstein）、杰西·肖尔（Jesse Shore）和大卫·雷泽（David Lazer）的一项新研究*试图回答这个问题。他们设置了一个逻辑问题（为一个要走访多个城市的推销员设计最短的路线）。参与实验的有三个组：

一个组的受试者单独行动；一个组的受试者能看到小组成员在每个阶段发布的解决方案；还有一个组的受试者只能断断续续地被告知其他人的想法。

调查发现，独立行动组的成员找到最佳方案的次数多于持续合作组，但平均结果较差。间歇合作组找出正确方案的频率与独立行动组一样高，但平均结果更优。

在创意生成方面，给人们一点空间去找解决方案似乎是个好主意。偶尔的合作会大有帮助——大多数人都曾得益于同事的灵光闪现，或（同样常见地）得益于同事给出的不要采取某种行动的明智建议。

麻省理工学院的托马斯·马龙（Thomas Malone）所著《超级大脑》（Superminds）一书提供了更多思路。他认为有三个因素决定了合作群体的“集体智慧”：社交智慧（人们评估他人情绪状态的能力）；成员参与对话的平等程度（越平等越好）；女性在群体中的比例（越高越好）。在这三方面排名靠前的群体的合作情况要比其他群体好得多。

在一个层级结构的较低位置上，密切的团队合作可能很重要，但在高层，就得有人拍板。到了这个层次，紧密协作可能就没有那么大的帮助了。哥伦比亚大学商学院的亚当·加林斯基（Adam Galinsky）和宾夕法尼亚大学沃顿商学院的莫瑞斯·施维泽（Maurice Schweitzer）在他们合著的《友与敌》（Friend & Foe）中指出，十多年来（从2000年至2010年），在行业专家的眼中，由多位创意总监执掌的时装品牌不如独立设计师引领的品牌更有创意。他们还补充说，与单人带队的喜马拉雅登山队相比，多人共同领导的队伍更容易发生死亡事故。

正如作者们指出的那样，共同领导“让人难以确定谁是真正的负责人”。上世纪90年代末，桑迪·威尔（Sandy Weill）和约翰·里德（John Reed）担任花旗集团联席CEO时的那番窝里斗臭名昭著，这种领导结构只持续了两年。自1989年以来，财富500强企业中只有不到5%采用了联席CEO的架构。总而言之，协作可能是一个有用的工具，但并不适用于所有情况。当

然，《经济学人》除外。

*《互动中的间断如何提升集体智慧》，《美国国家科学院院刊》，2018年■



Free exchange

We the shareholders

A radical idea for reducing inequality deserves more attention

RECENT decades have not been particularly good ones for those who toil on, rather than own, the means of production. Labour markets have made a slow and incomplete recovery from the trauma of the Great Recession. The crisis only briefly dislodged corporate profits as a share of GDP from historically high levels. Across much of the world, the share of national income flowing to labour has fallen over the past 40 years.

Taxing the rich in order to fund spending on the poor is a straightforward solution to inequality. But the well-heeled are adept at squeezing through tax loopholes, and at marshalling the political clout needed to chip away at high tax rates. Those frustrated by enduring levels of inequality are contemplating ever bolder ways to redress the lopsided balance between owners and workers.

In an ideal world, untrammelled markets would ensure that every firm and every worker earned precisely what they deserved. But as economists since Adam Smith have recognised, markets are inevitably distorted by the unequal distribution of power. As Smith wrote: “People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public.”

The socialists of the 19th century reckoned that the best way to check the power of capital was collective ownership. Experiments with state management of the economy in the 20th century made the shortcomings of such systems horribly clear. In practice they tend to be violently coercive, and their inability to take advantage of the distributed knowledge of

markets often produces a grinding stagnation. (China may have so far avoided this outcome, but it has also signally failed to produce an equitable distribution of wealth.)

The market for ideas is, however, stocked with gentler, more practical leftism. Perhaps, for instance, the state could own a share of the economy's assets on behalf of the population. In a recent paper Matt Bruenig, a left-leaning writer, argues for the creation of an American "social wealth fund". The fund, he says, should accumulate stakes in equity, bond and property markets, and then disburse a share of its investment income each year as a "universal basic dividend". Even in the most egalitarian decades of the past century, the richest 10% of the population owned the majority of the wealth. Money passes down the generations through gifts and bequests, but also through the extra educational and entrepreneurial opportunities it affords. A social dividend would counteract this entrenchment of advantage.

The proposal has a certain appeal. If funded through taxes on existing wealth—like property and bequests—such an entity could be a simple way to reduce the unfair opportunities afforded to the rich at birth. And there are workable examples already in operation. Alaska's fund, financed with royalties from its oil industry, is worth 113% of its GDP. It is invested in a diversified portfolio that has yielded annual returns of nearly 10% over its lifetime. The fund's dividend payments appear to reduce wealth inequality and poverty, without discouraging recipients from finding work. Norway's government, through oil-funded sovereign wealth funds created to protect its generous social safety-net against future declines in oil revenues, controls nearly 60% of the country's wealth. Yet the country has not turned into a grey socialist dystopia.

Complications could arise if such a fund operated at a scale proportionate to America's economy and capital markets, however. The disciplining effect of the market might well be muted if the state accumulated stakes in most

firms. Recent work by Martin Schmalz and others suggests that large-scale stock ownership by passive asset managers (like BlackRock and Vanguard), who often control sizeable stakes in many firms within an industry, is associated with less competitive behaviour by firm managers. Active ownership by the state might address that problem. But it could introduce others, such as greater scope for corruption.

More significantly, a social wealth fund raises difficult questions about the structure of the economy. It would create a conflict between workers' interests as wage earners and their interests as recipients of dividends: more revenue flowing towards pay-cheques would mean less for profits. Left-leaning critics worry that a social wealth fund might undermine efforts to strengthen labour unions. A fund might, ironically, soften public attitudes towards capitalism's more ruthless aspects. Working people could feel differently about lay-offs, offshoring and automation if their dividends stood to swell as a result. More worryingly, the public could become more accommodating of corporate behaviour designed to increase market power. Abuses by monopolistic tech firms might prove harder to rein in when they contribute to soaring profits—and to dividends for all.

Other ideas for empowering workers attract similar criticisms. Stronger unions would have every incentive to bargain down capital's share of companies' profits, but very little incentive to support competition-boosting reforms that might undermine the stability of those profits. Offering labour representatives seats on company boards, a policy supported by Elizabeth Warren, a senator from Massachusetts, seems likely to improve workers' fortunes. But it might also make them complicit in preserving revenues at all costs, the better to plump up worker wages.

None of the more radical proposals to tackle inequality are riskless, in other words. But a social wealth fund that turns workers into owners of, rather than antagonists to, capital might appeal to workers without alienating

powerful business interests. And if such a fund were to cultivate a sense of economic solidarity, it might well encourage other steps towards a more equitable society. Don't dismiss the idea. ■



自由交流

人人是股东

一个减少不平等的激进方案值得更多关注

对于那些辛苦劳作而不拥有生产资料的人来说，最近几十年并不是什么好年景。经济大衰退的创伤过后，劳动力市场恢复缓慢，至今未痊愈。而这场危机只是令企业利润占GDP的比例短暂地从历史高位回落。过去40年，在世界大部分地区，劳动力收入占国民收入的比例都下降了。

解决不平等问题的一个简单直接的办法是向富人征税，用于穷人。但是，富人擅长钻税收漏洞，也擅于集结政治影响力来削减高税率。不平等程度持续不减，对此深感挫败的人士正在考虑更大胆的办法来改变资本家与劳动者之间的财力失衡。

在一个理想的世界中，自由市场能确保每家公司和每一个劳动者都获得应得的报酬。但正如亚当·斯密以降的经济学家认识到的那样，市场不可避免会因权力分配不均而扭曲。斯密写道：“同行人士很少碰面，连寻欢作乐的聚会也不多，但如果聚在一起，话题最终总会落到密谋蚕食大众利益上。”

19世纪的社会主义者认为，制约资本力量的最佳方法是集体所有权。20世纪，国家推行计划经济的试验清楚暴露了这类体系的可怕缺点。实践中，容易出现暴力胁迫，加上无法利用分散的市场信息，往往导致经济停滞，人民困苦。（截至目前，中国可能避免了这样的结果，但显然也未能公平分配财富。）

然而，还有更温和、可行的左派方案供考虑。例如，或许可以由政府代表国民持有经济体的一部分资产。在最近发表的一篇论文中，左倾作家马特·布鲁尼格（Matt Bruenig）主张建立一个美国“社会财富基金”。他说，该基金应投资股票、债券和房地产市场，然后每年将收益的一部分作为“普遍基本股利”分配给民众。即使在上世纪最平等的几十年中，大部分社会

财富仍为最富有的10%的人群所有。除了赠与和继承，财富的代际传承也通过财富所提供的更多受教育和创业的机会来实现。社会化分红可以抵抗这种优势固化。

这项提议具有一定吸引力。如果“社会财富基金”的资金来自对现有财富（如房产及遗产）征税，那么这样的机制也许能成为减少富人与生俱来的优先机遇的简单办法。目前已有实际运作中的可行例子。美国阿拉斯加州的社会财富基金资金来自该州石油行业缴纳的使用费，资产规模为GDP的113%。该基金成立以来投资多元化组合，年回报率近10%。该基金向民众支付股利，似乎减轻了财富分配不均和贫困的问题，同时并没有减弱受助人的求职意愿。挪威政府为管理石油收入建立了主权财富基金，保护其慷慨的社会保障体系免受未来石油收入下降的影响。目前，政府通过该基金掌控着挪威近60%的财富，而挪威并没有就此变成黯淡无光的社会主义反乌托邦。

然而，如果要运作一个规模与美国的经济及资本市场相匹配的社会财富基金，恐怕会引起一些错综复杂的问题。如果国家拥有大多数公司的股份，市场的约束效应可能会受到抑制。马丁·舒迈兹（Martin Schmalz）等人近期的研究认为，美国的贝莱德集团（BlackRock）和先锋集团

（Vanguard）这类大规模持有企业股权的被动型资产管理公司（它们通常控制着一个行业内大批公司的大量股权）和企业管理者的竞争行为减少存在关联。政府执行积极所有权可能会解决这个问题，但又可能滋生其他问题，例如腐败的空间加大。

更重要的是，社会财富基金在经济结构方面带来了难题。劳动者既是拿工资的人，又是领红利的人，两者之间存在利益冲突：更多收入流向薪酬意味着红利会减少。左倾批评者担心，社会财富基金可能破坏壮大工会力量的努力。不无讽刺的是，这种基金可能会软化公众对资本主义冷酷无情那一面的态度。如果企业裁员、离岸外包和自动化能让红利增长，有工作的人对这些事情的看法可能就会改变。更令人担忧的是，公众可能会更容易容忍那些意在加强市场支配力的企业行为。垄断科技公司的任意妄为如果让利润飙升并为所有人带来了红利，可能会变得更难遏制。

其他赋予劳动者权力的方案也遭到类似的批评。工会更强大，自然会竭力争取降低公司利润中资本回报所占的份额，却无甚动力去支持那些能促进竞争却可能破坏利润稳定性的改革。马萨诸塞州参议员伊丽莎白·沃伦（Elizabeth Warren）主张让工人代表进入公司董事会，这似乎能提升工人的财富。但为了增加工人工资，他们也可能与资本家合谋，不惜代价保护企业收入。

换句话说，这些较激进的解决不平等的方案都有其风险。但是，社会财富基金如能将工人变成资本的所有者而非冤家对头，也许能吸引工人，同时又不失去强大的商业利益集团的支持。如果这样一个基金能培养出经济团结共荣的意识，也很可能会催生出其他措施来建立一个更公平的社会。别无视这个想法。 ■



Chaguan

China's one-way globalisation

An African enclave in Guangzhou reveals limits to Chinese openness

RICHARD GATHIGI, a Kenyan entrepreneur, has lived in the southern Chinese city of Guangzhou since 2005, oiling the wheels and gears of the low end of globalisation with doses of human trust and acuity. When an African friend had a small but urgent order—450 safety vests bearing the logo of the UN mission to Somalia—Mr Gathigi knew a factory that could help, though he wishes he had asked a higher price. “The UN has a lot of money,” he explains cheerfully, stabbing at a late-night plate of fish and rice in the Xiaobei district of Guangzhou, a hub for African traders. In a world without contracts, confidence is his currency. Near-strangers in Africa trust him to inspect goods ordered online from China. He is an old-timer in Guangzhou’s cramped, fluorescent-lit trading malls. Chinese bosses are cautious about tricking him.

Still, Mr Gathigi is no pioneer of multiculturalism, China-style. He is one of thousands of Africans who work in the city, though their numbers have shrunk since 2014 when officials said 16,000 Africans were living in Guangzhou. He respects his host country. Now 44, he wants his teenage children to study at Chinese universities, after being brought up in Kenya. But in 13 years he has not learned Chinese, visited the Great Wall or eaten at a local’s home. He first saw China in his 30s, he notes. “Most of my values were formed. Apart from business, I don’t have much interest.”

Listening to Mr Gathigi, he could be an 18th-century “supercargo” or trade agent, sweltering on the riverfront to which Westerners were confined, back when the city was known as Canton. Non-Chinese then were forbidden even to learn the language. Mr Gathigi thinks that China still prefers

foreigners to visit, trade with locals, then leave. America and Europe make it difficult for Africans to obtain visas, he observes, but once in the rich world migrants can easily overstay and live in the shadows, doing work that Westerners shun. “With the Chinese it’s the opposite,” he adds. “They make it easy to enter but very difficult to stay.” After all these years, he lives on a business visitor’s visa that must be reset with a run to Hong Kong or Macau every 30 days.

Many countries are questioning the benefits of globalisation. The nastiest rows occur when immigration enters the equation. Citizens chafe against the free movement of goods and capital, but most of all people. China’s leaders speak as globalisation’s champions. President Xi Jinping declared to African leaders in Beijing last month that “with open arms, we welcome African countries aboard the express train of China’s development.”

Yet if Chinese leaders like the idea of goods and capital rushing at express-train speed (ideally with Chinese drivers at the controls), they have never embraced the idea that people should move freely, let alone dream of acquiring hybrid, part-Chinese identities. Even marriage to a Chinese national brings no special residency rights. A decade ago Guangzhou’s diversity prompted articles and books by Westerners pondering whether this was multiculturalism. After watching African men marrying Chinese women, Gordon Mathews of the Chinese University of Hong Kong wondered whether the world might see a “Chinese Barack Obama” (not soon, he concluded). More recently journalists and scholars have debated whether China is displaying racism with campaigns to build a “clean, safe and orderly” Guangzhou, during which street traders have been swept away, restaurants catering to foreigners ordered to close by 10pm and districts like Xiaobei flooded with police checking passports.

Obtuse or callous views of ethnicity are dismaying common in China. Racial assumptions run like an electric current through some official vows

to clean up Guangzhou. But many Africans take a fatalistic view. Emmanuel Ojukwu, a prominent Nigerian trader, has no issue with the twitchy police. “Some people were taking the opportunity to conduct bad business, trading drugs and other criminality,” he says. Kiema Moussa, from Burkina Faso, describes strict visa rules as a business cost. Muslims attract no special scrutiny, he says, chewing on a street-stall kebab after Friday prayers at Guangzhou’s ancient Huaisheng mosque. Chinese officials know “straight away” if a country suffers terror attacks or an outbreak of disease and may refuse visas as a result. “It’s still worth coming,” he shrugs.

Ali Mohamed, a Somali freight forwarder, is a rare African with a Chinese passport, having spent long enough in Hong Kong to earn citizenship. Jaws drop when he joins the domestic immigration line at Chinese airports. He has seen many Africans leave. Officials want a “modern” Guangzhou focused on global finance and commerce, he says. But he insists they are “not targeting Africans”. Mr Mohamed, who is 50, has moved around Asia all his life. Although proud of his new passport, he is keeping an eye on Chinese factories opening in Africa and on businesses moving to Vietnam. “We are Somali nomads. Where it rains, we go.”

Western politicians and CEOs often brag about their countries’ or companies’ long relationships with China, fondly imagining that Communist leaders have a sentimental side. Chinese officials promote schemes offering permanent residence to a few, exceptionally qualified foreigners. But at the ground level of globalisation, the Africans know that outsiders stay on sufferance.

Your columnist watched a packed evangelical Christian prayer service at a dowdy central business hotel, tolerated because only holders of foreign passports may attend. One worshipper, Velile Sibiya, a medical student from South Africa, thinks Chinese leaders have done “magically well” by persuading so many citizens to work hard, think alike and inhabit a “little

cocoon of peace". She is unsurprised that people are not encouraged to become Chinese by naturalisation. "Citizenship gives you rights, it gives you a voice. I think they are protecting this world that they have created." Though grateful for her training in China, she is not planning to stay. Good guests know when to leave. ■



茶馆

中国的单向全球化

广州的“小非洲”暴露出中国开放的局限

理查德·加西吉（Richard Gathigi）是一位来自肯尼亚的生意人，自2005年以来一直在广州生活，用信用和商业嗅觉为全球化的低端链条添加润滑油。有一次，一位非洲朋友要下一笔不大却比较紧急的订单——450件带有联合国索马里援助团标志的安全背心。加西吉知道有一家工厂可以供货，不过他没有要很高的价钱，现在想来有点后悔。“联合国可是很有钱的。”他一边吃着一盘鱼肉配饭的夜宵一边乐呵呵地说。他所在的小北路一带是非洲商人在广州的聚集地。在没有合同的世界里，信任就是他的货币。远在非洲、几乎素未谋面的客户信任加西吉，让他检查从中国在线订购的商品。在广州那些灯火通明的拥挤的贸易商场里，加西吉已摸爬滚打多年。中国老板轻易不敢蒙骗他。

不过，加西吉并不是什么“中国式多元文化”的先驱。他只是在广州工作的成千上万非洲人之一。2014年官方公布非洲在穗人口为1.6万人，现在已有所下降。加西吉尊重东道国。44岁的他自己十来岁的孩子在肯尼亚长大后能到中国来读大学。但是，来中国13年了，他还没学会中文，没登过长城，也没在当地人家吃过饭。他说，第一次到中国时自己已经30多了。“我的价值观大体上都定型了。除了做生意，别的都不怎么感兴趣。”

加西吉说话的口气就好像18世纪的西方“商船大班”或贸易代理商，那时他们被限制在珠江口岸附近汗流浃背地工作。当时的广州被称为Canton，外国人甚至还被禁止学习汉语。加西吉认为，中国现在依旧希望外国人前来和本地人做生意，结束后就离开。他指出，非洲人很难获得去美国和欧洲的签证，但一旦获得签证进入这些富裕国家，就不难逾期逗留，生活在暗处，做西方人厌弃的工作。“中国正好相反，”他补充道，“入境容易，但要留下来很难。”这么多年来，他拿的一直是商务签证，每30天就要到香

港或澳门重签一次。

许多国家都在质疑全球化的好处。当考虑到移民因素时，争议最是激烈。本国公民对货物和资本的自由流动感到厌烦不安，但最让他们恼火的还是人的自由迁移。中国领导人的公开立场是支持全球化的。习近平上月在北京向非洲领导人表示，中国“张开怀抱欢迎非洲搭乘中国发展的快车”。

然而，中国领导人虽然喜欢货物和资本以特快列车的速度（最好由中国司机操控）流动，但却从未接受“人应该自由迁移”这个理念，更别提支持获得包含中国国籍的多重国籍的梦想了。即使与中国公民结婚也不能获得特别居留权。十年前，广州的人口多元化激发不少西方人撰文著书，思考这是否是多元文化的体现。目睹不少非洲男性与中国女性结婚后，香港中文大学的戈登·马修斯（Gordon Mathews）琢磨，中国会不会出现像奥巴马那样的混血领导人（他的结论是短期内不会）。而近些年，广州大力打造“干净整洁、平安有序”的城市环境，清理街头商贩，做外国人生意的餐馆被勒令在晚上10点前关门，小北街头涌现大批警察检查护照。记者和学者们争论这些行动是否显示出中国具有种族主义倾向。

在中国，人们对种族的看法往往迟钝含混或冷漠无情，令人沮丧。在一些整顿广州的官方口号中，对种族的主观臆想如电流般传递。但许多非洲人对此持“认命”的态度。知名的尼日利亚贸易商埃马纽埃尔·奥尤库

（Emmanuel Ojukwu）对警方神经质式的行动没有异议。“有些人会趁机干坏事，买卖毒品和干其他犯罪的勾当。”他说。来自布基纳法索的基亚玛·穆萨（Kiema Moussa）把严格的签证规定看作一项商业成本。在广州古老的清真寺怀圣寺做完周五礼拜后，他在路边摊上嚼着羊肉串说，在这里，穆斯林不会受到特别的审查。如果某个国家遭受恐怖袭击或爆发疫情，中国官员会“立刻”知悉，并可能因此拒发签证。“但来还是值得来的。”他耸耸肩说。

索马里货运代理人阿里·穆罕默德（Ali Mohamed）是少有的持中国护照的非洲人，之前他在香港生活了很长一段时间，才最终获得了中国公民身份。他在中国机场走中国公民通道时，常常引得旁人大吃一惊。他目睹许

多非洲人离开。他说，中国官员希望打造一个专注全球金融和商业的“现代”广州。但他坚持认为官员们“没有针对非洲人”。今年50岁的穆罕默德一生都在亚洲各地生活。他为自己的新护照自豪，但也一直关注着中国企业到非洲设厂以及企业逐步迁往越南的趋势。“我们是索马里游牧民族。哪里下雨，我们就往哪里去。”

西方的政客和CEO们经常吹嘘其国家或公司与中国的长久关系，天真地想象共产党领导人有感性的一面。中国官员推出的中国永久居留权计划面向的只是极少数优秀外国人才。而处于全球化底层的非洲人深知，外来户都只是勉强获准留在这里。

笔者在市中心一家寒酸的商务酒店观看过一场人气爆满的福音派基督徒祷告仪式。这场活动只有持外国护照的人可以参加，因而获官方准允。祷告的人群中有来自南非的医科生费里莉·西比亚（Velile Sibiya）。她认为，中国领导人能说服这么多国民努力工作，思想一致，安居在“和平的小茧”中，已是“出奇地成功”。对于中国不鼓励外国人入籍成为中国公民，她并不感到惊讶。“公民身份给你权利，给你发言权。我觉得他们在保护自己创造的这个世界。”虽然感恩自己在中国所受的专业培训，但她并不打算留下来。好的客人懂得何时该离开。 ■



Schumpeter

Joining the high revvers

Makers of very expensive vehicles strive to be seen as luxury-goods firms, not carmakers

SUGGEST to Torsten Müller-Ötvös, the boss of Rolls-Royce, that he runs a carmaker and with a shake of the head, he explains that he is in the luxury-goods business. You are not buying a car but “commissioning a work of art...building a dream”. Whether swathed in leather from pampered cows or stuffed with racing-car technology, ultra-expensive cars are made by firms that have little in common with the rest of the industry. Ferrari, a maker of sleek Italian sports cars (whose chairman, John Elkann, sits on the board of *The Economist*'s parent company), saw its valuation soar after it was spun off from Fiat Chrysler in 2016. The investors who own Aston Martin, bought from Ford in 2007 for £500m (\$1bn), hope to reap similar rewards. An initial public offering on October 3 valued the firm at £4.3 billion (\$5.6 billion).

The numbers alone show how scant a resemblance such firms bear to mass-market auto manufacturers. Six firms dominate the ultra-luxury sector, where prices start at around \$200,000: Ferrari, Aston Martin, Rolls-Royce (owned by BMW), Bentley and Lamborghini (both divisions of the Volkswagen group), and McLaren. Along with a few tiny specialists, such as Italy's Pagani and Sweden's Koenigsegg, which make track-inspired hypercars (whose prices start at \$1.4m), these firms sold 29,600 cars in 2017, compared with sales of 86m by regular carmakers, according to JATO Dynamics, a research firm. As with superyachts, fine watches and the like, sales of high-end cars have boomed along with the numbers of the global rich. Annual growth looks set to stay at around the 10% mark for the next few years, compared with 2-3% for the car industry as a whole.

Luxury cars are sold for entertainment, not transport, says one executive. Instead of striving to sell as many cars as possible, production is often limited in order to maintain exclusivity. In 2013 Ferrari even elected to cut volumes slightly, from around 7,400 to 7,000 a year. According to Enzo Ferrari, the firm's founder, the ideal is to make one fewer car than the market wants. This means long waiting-lists and vehicles that sell at the advertised price instead of with the discounts common in the mass market.

The relationship with buyers is also unlike the “sell and forget” model of other carmakers. Many customers are collectors, each with a garage-full of fast cars. They are often invited to watch their cars being made. McLaren’s factory includes a purpose-built viewing gallery. No ordinary carmakers offer the same range of custom-made accessories, nor do they invite buyers to the factory to select them in person. At Rolls-Royce’s in-house “atelier” customers can fondle a range of rare woods and other fine materials before making a choice. Bentley offers a Breitling Mulliner Tourbillon clock that costs almost as much as the car it adorns. It is all rather like being measured for a Savile Row suit, says Andy Palmer, the boss of Aston Martin.

For the chosen few, ownership buys entry to an even more exclusive club. Spend on several regular models and you might be invited to put your name down for a limited-edition hypercar, such as the upcoming McLaren Speedtail—only 106 of these beasts will be made and each will probably be capable of hitting 250mph. Such fire-breathing road-rockets are constructed at a cost of \$2m or more. They are massively profitable and usually in such demand that they can be resold immediately for a big return. To ensure that these cars remain the property of the tech billionaires, Hollywood A-listers and sheikhs who are lucky enough to be chosen to buy one, their manufacturers operate blacklists barring anyone who has previously flipped a vehicle. Other perks include invitations to “track days” where outrageous performance can be properly tested, and the carmakers can find out what their customers want next.

But however much these firms disown the label of carmakers, only Ferrari's margins, at over 30%, are known to put them in the same bracket as luxury-goods firms (for comparison, Germany's premium carmakers notch up margins of around 10% in a good year). That is partly because Ferrari has been unusually successful at mastering the trick of the "diffusion line". Just as Chanel makes a few thousand \$2,000 handbags but coins it selling lipstick to the masses, Ferrari also sells cheaper branded goods such as watches and clothes, even down to a \$50 baseball cap.

The difficulty of attaining couturier-like margins also stems from the fact that these businesses retain some trappings of the everyday carmaker. A clothing firm needs to worry about changing hemlines; it does not have to bother with emissions regulations. Capital spending is much higher for an ultraluxury carmaker than for a handbag designer. And though most have coped with the growing taste for SUVs, for Ferrari, whose brand is based on hard-core sports models, its plans to make a beefier car, like Bentley's Bentayga or the Lamborghini Urus, may prove difficult.

Selling cars built for driving pleasure should confer some immunity from industry-wide upheavals like the advent of car-sharing or autonomous vehicles, at least for the time being. A bigger problem, especially for sports-car firms, is the trend to electrification. Hybrid engines can make fast cars faster, but they would also silence those throaty exhaust notes that shout "Look at me".

Aston Martin's IPO will provide further clues to which category ultra-expensive carmakers really belong. It is planning a new SUV and electric saloon, as well as branching out into other areas such as boats and property. A successful debut might tempt others to do the same. McLaren once considered a flotation and may do so again. VW has bundled Bentley and Lamborghini into a "super-premium" group with Bugatti and Porsche that could potentially stand alone in future. If a series of such brands tap the

markets, that would provide a clearer answer to the question of whether luxury cars have more in common with LVMH and Hermès than with Ford and Toyota. ■



熊彼特

车往高处跑

豪车制造商力争成为人们眼中的奢侈品公司，而不是造汽车的

如果你跟劳斯莱斯的老板托尔斯滕·穆勒-奥特沃斯（Torsten Müller-Ötvös）说他经营的是一家汽车制造公司，他会摇头解释说他做的是奢侈品生意。你不是在买车，而是在“委托制作一件艺术品……打造一个梦想”。不管是用了从精心饲养的牛身上扒下的皮，还是大量采用了赛车工艺，顶级豪车的制造商与其他汽车制造商没什么共同点。意大利豪华跑车制造商法拉利（其董事长约翰·艾尔坎[John Elkann]是《经济学人》母公司的董事会成员）2016年从菲亚特克莱斯勒（Fiat Chrysler）分拆后估值飙升。拥有阿斯顿·马丁的投资者2007年斥资5亿英镑（当时合10亿美元）将其从福特手中买下，希望获得类似的回报。阿斯顿·马丁于本月3日上市，公司估值为43亿英镑（56亿美元）。

仅这些数字就显示出这些公司与大众市场汽车制造商的天壤之别。起价在20万美元左右的超豪华汽车市场由六家公司主导：法拉利、阿斯顿·马丁、劳斯莱斯（宝马旗下）、宾利和兰博基尼（这两家均属大众汽车集团），以及迈凯伦。研究公司JATO Dynamics的资料显示，这六家加上意大利的帕加尼（Pagani）和瑞典的科尼赛克（Koenigsegg）等生产赛车风格超跑（售价140万美元起）的小型专门制造商，在2017年共售出2.96万辆，而普通汽车制造商售出8600万辆。与超级游艇、名表等物品一样，高端汽车的销售也随着全球富豪数量的增多而增长。未来几年的年增长率看起来应该会保持在10%左右，而汽车行业整体增长率为2%至3%。

一位高管表示，豪车的卖点在于娱乐而非代步功能。为了保证其独特性，豪车往往会限制产量，而不是尽全力增加销量。2013年法拉利甚至选择轻微下调产量，从每年约7400辆减至7000辆。用公司创始人恩佐·法拉利（Enzo Ferrari）的话来说，理想的状态是产量比市场需求少一辆。这就意味着会有长长的等候名单，车辆可以按广告价格出售，而不像大众市场上

的车那样常常打折出售。

豪车品牌与买家的关系也不同于一般汽车制造商“卖掉就拜拜”的模式。许多客户都是收藏爱好者，每个人的车库里都停满了跑车。他们经常受邀去观看自己订购的车的制造过程。迈凯伦的工厂就有一条专门设计的参观走廊。普通汽车制造商不会像豪车制造商那样提供那么多种类的定制配件，也不会邀请买家到工厂亲自挑选。在劳斯莱斯的内部“作坊”里，客户可以在做出选择之前把玩多种稀有木材和其他精美材料。宾利还在车上配备了一款百年灵陀飞轮钟，钟表的成本几乎都快赶上它装点的这辆车了。阿斯顿·马丁的老板安迪·帕尔默（Andy Palmer）说，这就像是在萨维尔街量身定制西装一样。

对极少数幸运儿来说，买下豪车是获得了加入一个更高档俱乐部的入场券。买下几台常规车型后，你可能会受邀把自己的名字添加到限量版超跑的等候名单上，比如即将推出的迈凯伦Speedtail，这款车限量106台，最高时速可能达到250英里。这种喷火的“马路火箭”生产成本不低于200万美元，利润率极高，而且需求旺盛，通常能立即转手，获得丰厚回报。为了确保有幸获得购车资格的科技界亿万富翁、好莱坞一线明星和酋长们能独享这些豪车，制造商制定了黑名单，禁止任何曾经倒手豪车的人再次购买。拥有豪车的其他福利包括受邀参加“赛道日”，可以在那一天充分测试豪车令人惊叹的性能，制造商也可以了解客户未来的需求。

但不管这些公司多么想甩掉汽车制造商的标签，只有法拉利超过30%的利润率才能与奢侈品公司相提并论（相比之下，德国高端汽车制造商的利润率即使在好年景也只有10%左右）。这在一定程度上是因为法拉利掌握了销售“副线”产品这个窍门，并在这方面取得了巨大成功。香奈儿每年生产几千个2000美元的手提包，但同时也向大众销售口红，获利颇丰。同样，法拉利也销售较便宜的品牌产品，如手表和服装等，甚至还有50美元一顶的棒球帽。

豪车制造商难以获得奢侈品牌那样的利润，原因还在于它们仍保留了普通汽车制造商的一些特征。服装公司只需考虑如何改变裙摆样式，而不必理

会尾气排放法规。超豪华汽车制造商的资本支出远高于手提包设计师。此外，虽然大多数汽车制造商都在迎合民众对SUV不断增长的喜好，但对法拉利这样以高性能跑车为立身之本的品牌而言，它可能很难推进制造像宾利添越或兰博基尼Urus那样更大块头的汽车的计划。

销售为驾驶乐趣而生产的汽车应该能使豪车制造商在一定程度上免受整个汽车行业重大变化的影响，比如车辆共享或无人驾驶汽车的出现，至少是暂时不受影响。一个更大的问题是电气化的趋势，这对跑车制造商来说尤其严峻。混合动力发动机可以让跑车跑得更快，但也会消除犹如大喊“快看我”的排气管轰鸣声。

阿斯顿·马丁的IPO将提供更多线索来揭示超高价汽车制造商究竟属于哪个军团。它正在计划生产新的SUV和电动轿车，并进军船艇和地产等其他领域。如果此次上市大获成功，可能会吸引其他公司跟风。迈凯伦曾经考虑过上市，如今可能再动念头。大众汽车已将宾利和兰博基尼与布加迪和保时捷组成一个“超豪华”团队，将来可能会自成一家。如果一系列此类品牌开始进入资本市场，豪华汽车到底是与LVMH和爱马仕更接近还是与福特和丰田更相像的问题就将得到更明确的答案。 ■



Economic and financial indicators

Economic outlook

The Economist's latest poll of forecasters, October



经济与金融指标

经济前景

《经济学人》10月对各家预测机构的最新调查



Thyssenkrupp

This end, cropped

A European industrial stalwart breaks up under investor pressure

CONGLOMERATES hold a natural appeal for bosses, who fancy themselves capable of managing any number of businesses under one corporate roof. At least in rich countries, investors are sceptical about such bluster. They have long applied a discount to the shares of diversified companies against those of rivals focused on doing one thing and one thing only. Thyssenkrupp, born of the merger of two German conglomerates in 1999, has bowed to frustrated shareholders: on September 30th it said it would split in two. The 17% jump in its share price when the news was announced, though short-lived, will surely spur investors to take on other ungainly corporate structures.

As a purveyor of steel, submarines, robots, lifts and much else besides, thyssenkrupp is as unwieldy as they come. A new strategy announced in 2011 drifted along until the summer when both its chief executive and chairman were ousted. The firm has done little in a decade when its German peers surged. Radical surgery could no longer be delayed.

It is not alone in reaching this conclusion. Across the Atlantic, GE's troubles are well known. Voluntary amputation has taken place at a number of European firms. In August Whitbread, which mainly runs hotels, agreed to sell its Costa coffee shops to Coca-Cola for \$5.1bn. In March A.P. Moller-Maersk finalised a deal to sell its energy assets to Total, a French oil giant, to focus on its logistics and shipping business. Other big firms, from Nestlé to Philips, are shedding units.

At many companies, activist hedge funds are the driving force behind carve-outs and break ups. Freed from their corporate overlords, the thinking goes,

bosses of the liberated divisions can seize market opportunities more readily. Spun-out businesses are also easier to merge with a rival or can be taken over by a private-equity fund, which drives up share prices further.

Thyssenkrupp had been nagged since 2013 by Cevian, a Swedish investor which owns 18% of the group, to rethink its structure. It has long complained that the stagnant parts of the group, notably the ailing steel business, hogged management's attention at the expense of more promising units. One of these is Thyssenkrupp's lucrative lifts business, which generates enough profits to justify the entire conglomerate's €13bn (\$15bn) stockmarket value. This will form the bedrock of the new "Thyssenkrupp Industrials" company, which has roughly half the group's €34bn in sales but generates higher margins. The other firm, "Thyssenkrupp Materials", will include a stake in the historic steelmaking unit being merged with the European business of Tata, an Indian conglomerate. Guido Kerkhoff, the newish chief executive who will oversee the split, says it will take up to two years.

Investors in America have had such successes busting conglomerates apart that they are now largely viewed as creatures from another era. In Europe, battles to break up what few remain are more bruising. Thyssenkrupp's unions have had to be placated. Germany remains hostile territory for Anglo-Saxon financiers: Elliott Management, another activist hedge fund that has targeted Thyssenkrupp, has had to deny claims of inflicting "psycho-terror" on the firm's executives.

Activist Insight, a data provider, says no fewer than 77 European companies, including many conglomerates, are being targeted by activist investors. These funds sit on more corporate boards than ever before. What little time bosses of the remaining conglomerates have between juggling duties at disparate business units will be spent fending off investors clamouring for empires to be dismantled. ■



蒂森克虏伯

一分为二

在投资者施压下，这家欧洲老牌工业巨头终于拆分

企业集团对大老板们有着天然的吸引力，他们自认为能在同一个集团的大屋檐下管理任何数量的业务。但至少在富裕国家，投资者对这种自以为是抱持怀疑的态度。长期以来，相较于只专注一项业务的公司，投资者一直会对业务多元化的公司的股价打个折扣。蒂森克虏伯（Thyssenkrupp）于1999年由两家德国企业集团合并而成。最近，它向不满的股东屈服，于9月30日表示将一分为二。消息一经宣布，股价应声上涨17%，虽然不久后回落，但必定会刺激投资者向其他同样架构庞杂的企业施压。

作为钢铁、潜艇、机器人、电梯等众多产品的供应商，蒂森克虏伯的架构极其臃肿。于2011年宣布的新战略直到今年夏季尚未落实，公司的CEO和董事长也都被赶下了台。在其一众本国同行突飞猛进的十年间，这家公司无甚作为。一台根治性手术已不能再拖。

拿到同样诊断书的不只蒂森克虏伯一家。在大西洋彼岸，通用电气的麻烦人尽皆知。一些欧洲公司已自愿做了“截肢”。8月，主要经营酒店的惠特贝瑞集团（Whitbread）同意以51亿美元的价格将咖啡连锁店咖世家（Costa）出售给可口可乐公司。3月，马士基集团敲定一笔协议，将其能源资产出售给法国石油巨头道达尔，未来将仅专注于物流和航运业务。从雀巢到飞利浦的其他大公司都在精简业务。

在许多公司里，是维权对冲基金在背后推动业务剥离和拆分。它们的逻辑是，从太上皇般的集团公司手里解脱出来之后，获得自由的业务部门的老板能更迅捷地抓住市场机会。分拆出来的公司也更容易与竞争对手合并，也可能会被私募股权基金接管，进一步推高股价。

蒂森克虏伯的瑞典股东Cevian拥有其18%的股份，自2013年以来一直在催促蒂森克虏伯反思公司架构。Cevian长期以来一直抱怨集团管理层把注意

力都倾注在某些裹足不前的业务上，尤其是陷入困境的钢铁业务，损害了那些更有发展前景的部门。蒂森克虏伯利润丰厚的电梯业务就是其中之一，这项业务产生的利润足以支撑起整个集团130亿欧元（150亿美元）的市值。电梯业务将成为新拆分的“蒂森克虏伯工业公司”（Thyssenkrupp Industrials）的基石，这家公司的销售额约占集团340亿欧元总销售额的一半，但利润占比更高。历史悠久的钢铁业务则将与印度企业集团塔塔的欧洲业务合并，蒂森克虏伯另一家拆分出来的公司“蒂森克虏伯材料公司”（Thyssenkrupp Materials）将拥有合并后合资企业的部分股份。新官上任的CEO吉多·科克霍夫（Guido Kerkhoff）将监管拆分工作，他表示此过程最长耗时两年。

美国的投资者在拆分企业集团方面成绩斐然，如今企业集团在美国基本上被视为过时的事物。在欧洲，打破所剩无几的企业集团的战斗更加艰难繁重。蒂森克虏伯的工会必须得到安抚。德国对盎格鲁-撒克逊的投资机构仍然充满敌意：另一个将蒂森克虏伯作为攻击目标的维权对冲基金埃利奥特管理公司（Elliott Management）不得不公开否认对蒂森克虏伯的高管施加“精神恐怖主义”的指控。

数据提供商Activist Insight表示，至少有77家欧洲公司（包括许多企业集团）正被维权投资者盯牢。这类基金进入的公司董事会数量比以往任何时候都多。仅存的一批企业集团的老板们在忙着兼顾各不相干的业务部门之外，剩余的一点点时间都要用来抵御那些叫嚣着要拆掉企业帝国的投资者了。 ■



Buttonwood

Keeping it real

Ever the innovator in these matters, Brazil is shaping up for a unique kind of financial crisis

RUDI DORNBUSCH, a renowned economist who died in 2002, said there were two sorts of currency crisis. The pre-1990s kind is slow. It starts with an overvalued exchange rate, which gives rise to a trade deficit. Foreign-exchange reserves are gradually run down to pay for it. When they are gone, the game is up. The currency drops. The finance minister loses his job. But life goes on much as before. The world does not collapse.

The second sort of crisis is the first sort on steroids. A country that might once have blown some World Bank loans on bad policies is able to tap global capital markets for billions of dollars to misuse. Domestic banks join the party. The economy booms. When the flow of capital suddenly reverses, the currency collapses. Bankruptcy is widespread. The damage is big enough to affect others.

Brazil would seem to demand a third category. Elections this month will decide its next president and the character of its congress. They will thus shape the response to a slow-motion financial crisis. The drama is likely to be played out in the currency market. The impact might be far-reaching. But Brazil shows no signs of an old-fashioned balance-of-payments crisis. It is not at the mercy of global capital. Its crisis is, in essence, a battle with itself.

Compare Brazil with Argentina and Turkey, both in the eye of market storms this year. They fit the template for a currency crisis. Both had run large deficits on the current account, a broad measure of the trade balance. These were financed by foreign borrowing, much of it in dollars. Both suffer high inflation. Both had skimpy foreign-exchange reserves. Brazil is different. Its

current account is broadly in balance. Inflation is close to a record low. Its plentiful currency reserves dwarf its dollar debts.

Brazil's problem is that its government finances are on a dangerous path. Public debt has risen from 60% to 84% of GDP in just four years. That owes a lot to a collapse in revenues after 2013. A brutal recession did not help. But the budget had been flattered by windfall receipts from a mining boom and credit-fuelled consumer spending. Those will not be repeated.

That means spending cuts are needed to fix the public finances. The government wage bill has grown rapidly. But over-generous pensions are a far bigger problem. They already account for 55% of non-interest public spending. The cost will go on rising as Brazil ages. Things would surely be worse were it not for a constitutional amendment in 2016, which caps the rise in public spending. An attempt to reform pensions was aborted when the president, Michel Temer, was implicated in the corruption scandals that have seen one of his predecessors impeached and another sent to jail.

In a different Brazil, politics would seek to reconcile the claims of bondholders (who are almost all Brazilian savers; see chart), pensioners, well-paid government workers and the rest of the country. Instead, to make the sums add up, the last of these groups has suffered a squeeze on public services and living standards. And the corruption crisis has engulfed the governing class. The front-runners for president are polarising figures who might struggle to steer pension reform through congress. The crunch point might come next August, if not before, says Arthur Carvalho of Morgan Stanley. A budget for 2020 must be submitted then. If pension reform is not in place, a big squeeze will be needed elsewhere for the country to stay below the spending cap, he says. Or the cap itself will have to be lifted.

Bondholders would take fright. Though foreigners hold little of Brazil's debt,

there would still be capital flight, a falling currency and rising bond yields. As Brazilian savers anticipated the inflation and chaos that would result from soaring public debt, they would seek to escape it. Savers elsewhere in Latin America have long used dollar accounts as a shield from inflation. This would be novel for Brazilians, says Mr Carvalho. But because short-term interest rates have been slashed to reflect subdued inflation, the opportunity cost of pulling money from Brazil has rarely been lower.

Nothing is ever entirely new. The symptoms of Brazil's past crises were high inflation and external deficits. But below the surface, the underlying problem was lax fiscal policy, says Armínio Fraga of Gávea Investimentos, a hedge fund, and a former governor of Brazil's central bank. In the slow-burning sort of crisis, said Dornbusch, a mid-course correction can prevent the worst. Brazil might yet manage that. If it cannot, its decline is likely to speed up dramatically. ■



梧桐

独善其币

向来勇于经济革新的巴西正面临一场独有的财政危机

著名经济学家、2002年去世的鲁迪·多恩布什（Rudi Dornbusch）曾指出，货币危机有两种。上世纪90年代之前的危机是缓慢发作的。危机伊始是汇率被高估，引发贸易逆差，为此要动用越来越多的外汇储备。当外汇储备耗尽，游戏玩完。货币贬值。财政部长丢了乌纱帽。但日子还和从前差不多。世界并没有陷入瘫痪。

第二种危机就好比第一种危机服用了兴奋剂。一个国家若在从前可能会在糟糕的政策中挥霍掉来自世界银行的贷款，如今却能从全球资本市场上捞取数十亿美元来滥用。国内银行也参与其中。经济一片火热。但当资本流动突然逆转，货币将崩溃。破产比比皆是。损害之大足以影响到其他国家。

似乎得为巴西的危机开辟第三种类别。本月的选举将决定下一任总统人选和国会构成。这进而将决定如何应对一场缓慢推进中的金融危机。这场大戏很可能在货币市场上演，其影响也许会很深远。但是巴西并没有显现出传统的国际收支平衡危机的迹象。它不受全球资本的摆布。它的危机本质上是一场与自身的搏斗。

将巴西与阿根廷和土耳其做一下比对。后两个国家今年都处在市场风暴的中心。它们经历的是典型的货币危机。两国的经常账户（衡量贸易平衡的普遍指标）都出现了巨额赤字。这些赤字通过外债负担，很多是以美元定价的。两国都受困于高通胀，外汇储备也都不足。巴西则不同。它的经常账户大体保持平衡。通胀接近历史低点。和充沛的外汇储备相比，其美元债务微不足道。

巴西的问题在于其政府财政在走钢丝。短短四年内，巴西公共债务占GDP的比重从60%上升到84%。这在很大程度上归因于2013年后财政收入锐

减。一场严重的经济衰退雪上加霜。但采矿业的繁荣和由信贷刺激的消费支出所带来的意外收入改善了财政预算。然而这样的好景不会重演。

这就意味着巴西需要削减支出来解决公共财政的紧张。政府工资支出增长迅速，但是过于慷慨的养老金带来的问题要严重得多。后者已经占到非利息公共支出的55%。随着巴西人口老龄化，这一开支将继续上升。要不是2016年的宪法修正案设定了公共支出增长的上限，情况必定更加糟糕。总统特梅尔卷入腐败丑闻后，改革养老金的尝试就此搁浅。他的两位前任此前因贿赂丑闻一个被弹劾，一个锒铛入狱。

巴西本应在政治上设法调和债券持有人（大部分都是巴西储蓄者，见图表）、养老金领取者、高薪政府职员，以及其余人群的要求。但是，为了控制总体支出，它却只是挤压了“其余人群”获得的公共服务和生活水平。而腐败危机席卷了整个统治阶层。目前在总统选举中领先的候选人立场两极化，可能很难通过国会推进养老金改革。摩根士丹利的亚瑟·卡瓦略（Arthur Carvalho）表示，不出意外的话，关键时刻可能是明年8月。届时政府必须提交2020年的预算。如果养老金改革不到位，巴西就需要在其他地方大幅削减开支才能保持支出不超上限。否则就必须取消上限。

债券持有人会感到恐慌。尽管外国人很少持有巴西的债券，但仍会出现资本外逃、货币贬值和债券收益率上涨的情况。由于巴西储蓄者预料到飙升的公共债务将带来通货膨胀和经济混乱，他们会想方设法摆脱这种局面。长期以来，拉丁美洲其他地方的储户一直使用美元账户抵御通胀。这对巴西人来说仍是新鲜事，卡瓦略表示。但是，由于短期利率已大幅下调以应对受抑制的通胀，从巴西撤资的机会成本鲜有这么低过。

从来就没有什么问题是全新的。巴西历次危机的症状是高通胀和外部赤字。但从深层次看，松散的财政政策才是问题的根本，巴西央行前行长、对冲基金加韦亚投资基金（Gávea Investimentos）的阿米尼奥·弗拉加（Armínio Fraga）表示。多恩布什曾指出，在慢慢加深的那类危机中，中期修正能防止最坏的情况出现。巴西也许还能力挽狂澜。但如果不能，巴

西经济很可能会上升。 ■



How influenza evolves

Mind your H's and N's

Flu's success owes much to its mutability

BOTH “mini-epidemics” of seasonal flu, which happen most years, and much larger pandemics, of which 1918’s was the worst example, are the result of an arms race between the influenza virus and the immune systems of the animals it infects. Here’s how it works.

Type A flu viruses—those which cause pandemics, and also most seasonal flu, have two important surface proteins, haemagglutinin (H) and neuraminidase (N). Haemagglutinin helps the virus invade a target cell. Neuraminidase helps new virus particles break out of that cell. These two proteins are also antigens, meaning that they are parts of a virus that may be recognised and reacted to by the immune system.

But the process by which a flu virus hijacks a host cell’s molecular machinery in order to reproduce itself cuts out of the loop what are known as proofreading enzymes. The virus’s genetic material is thus copied with low fidelity, meaning proteins derived from it vary considerably in detail. That variability generates antigens which immune systems do not always recognise and react to immediately. Each year’s seasonal virus is therefore slightly different, and thus requires an updated vaccine—which is not true for most antiviral vaccinations.

Pandemic viruses represent bigger shifts in this process. These create antigens sufficiently novel that have been given numbers by virologists (eg, N1, H3). Many hosts’ defences are unprepared for such big shifts, which happen, on average, three or four times a century. The 1918 pandemic was caused by a strain with a version of haemagglutinin called H1 and a version

of neuraminidase called N1. The two subsequent flu pandemics of the 20th century, in 1957 and 1968, were caused by viruses carrying H2 and H3 antigens respectively, in combination with N2.

Much of this mutating goes on outside human beings. Influenza is primarily an infection of birds, especially waterfowl. In these animals the virus infects the digestive system rather than the respiratory tract, usually without producing signs of malaise. Occasionally a bird-flu strain arises with molecular tools that enable it to infect people—the H5N1 and H7N9 strains are currently worrying disease-surveillance experts.

The virus sometimes jumps directly from a bird (often a chicken) to a person, but more usually passes via a pig. The cells lining bird guts and human lungs are built differently, meaning that the virus needs different sets of tools to invade them. Pig-lung cells, sharing properties of both, act as intermediaries in which the virus can adapt from one to the other. Even after it has infected a human being, though, a virus cannot go on to cause a pandemic unless it also acquires the ability to pass easily between people. Fortunately, this is something H5N1 and H7N9 have yet to do. ■



流感如何进化

注意你的H和N

流感的成功很大程度上归功于它的易变性

无论是大多数年份里都会发生的“小范围流行”的季节性流感，还是规模大得多的流感大流行（最严重的一次发生在1918年），都是流感病毒与它所感染的动物的免疫系统之间军备竞赛的结果。我们来看看流感病毒的作用机制。

甲型流感病毒引起大范围流行和大部分季节性流感，它有两种重要的表面蛋白：血凝素（haemagglutinin, H）和神经氨酸酶（neuraminidase, N）。血凝素帮助病毒入侵目标细胞。神经氨酸酶帮助新的病毒颗粒从细胞中分离出来。这两种蛋白质也是抗原，也就是说，免疫系统或许可以识别出病毒中的这两种物质并做出反应。

但是，流感病毒会劫持宿主细胞的分子机制以自我复制，这一过程切断了那些具有校正功能的酶的回路。因此，病毒的遗传物质复制的保真度很低，这使得复制产生的蛋白质在细节上差异很大。这种多变性令生成的抗原并不总能被免疫系统识别并立即做出反应。因此每年的季节性流感病毒都略有不同，所以需要更新疫苗，而大多数抗病毒疫苗接种不需要这么做。

引起大范围流行的病毒在这一过程中出现的变异更大。它们产生的抗原非常新颖，已经由病毒学家编号（如N1、H3）。许多宿主的免疫系统对这样的大转变毫无准备，而这种转变平均每一百年会发生三到四次。1918年的流感大流行是由携带H1型血凝素和N1型神经氨酸酶的病毒株引起。20世纪在此之后爆发的两场流感大流行（分别在1957年和1968年）则分别由H2和H3型抗原与N2型抗原组合形成的病毒株引起。

这种变异大部分发生在人类之外。流感主要感染鸟类，尤其是水禽。在这类动物中，病毒感染消化系统而不是呼吸道，通常不会产生不适的迹象。

偶尔会出现可以通过分子工具感染人类的禽流感毒株。目前让疾病监测专家感到担忧的这类毒株是H5N1和H7N9。

这些病毒有时会直接从鸟类（通常是鸡）传染给人，但更多时候是通过猪传播。构成鸟类消化道内壁的细胞和人类肺部内壁的细胞结构不同，病毒需要不同的工具来入侵它们。猪的肺细胞兼具鸟类细胞和人类细胞的特性，因而成为病毒从适应鸟消化道细胞到适应人类肺细胞的中间宿主。不过，即便在病毒感染了人类之后，它也无法继续引起大范围流行，除非它还能获得在人与人之间轻易传播的能力。幸运的是，H5N1和H7N9还没能做到。 ■



The world economy

Pulling ahead

Global growth is slowing, but booming America stands out

IT HAS been a nervy few days for financial markets. A sell-off in bond markets, prompted by monetary tightening in America, last week infected global stockmarkets, too. The S&P 500 share-price index fell by over 3% on October 10th, its worst day in eight months. Markets in Shanghai hit their lowest level for nearly four years the next day; those in Japan and Hong Kong closed around 3.5% lower.

At first glance, the sell-off seems odd. The world economy is still growing briskly enough: last week the IMF only slightly trimmed its forecast for world GDP growth for 2018, from 3.9% to 3.7%. But investors are right to fret. Whereas acceleration was synchronised across much of the world in 2017, the global economy's expansion now looks increasingly unbalanced.

Two divides stand out. The first is between emerging markets, which are suffering from particularly volatile financial conditions, and advanced economies. The cause of this divergence is a strong dollar, which is making emerging markets' debts that are denominated in the currency costlier to service. The latest casualty is Pakistan. On October 8th it announced that it would seek an IMF bail-out, which is expected to amount to \$12bn. It joins the ranks of other emerging markets in distress, notably Argentina, which has negotiated a record \$57bn credit line from the IMF, and Turkey.

Sustained falls in emerging-market currencies and stocks have been painful for investors. Several countries have raised interest rates to stem capital outflows. Yet the damage to the real economy has for the most part been confined to those with large current-account deficits, such as Argentina.

From a global perspective, the bigger worry is China. Authorities there are trying to reduce leverage in the financial system at the same time as American tariffs are squeezing their exports (see next story). The currency is under pressure; growth expectations are being lowered.

The second divide exists within the ranks of advanced economies. Rich countries seem to be gently slowing, with one big exception: America. There, growth has sped up dramatically, exceeding an annualised rate of 4% in the second quarter of 2018. America is the only large advanced economy in which the IMF projects activity will expand more quickly this year than it did last year.

This acceleration is because of President Donald Trump's tax cuts. In September the unemployment rate fell to 3.7%, the lowest since 1969; wage growth is slowly but surely rising. Rampant demand is pushing up interest rates. The Federal Reserve has raised short-term rates by two percentage points since it started tightening monetary policy in 2015. Last week Mr Trump described the Fed's policy as "crazy". The yield on ten-year Treasury bonds has risen by more than in most other rich countries (see chart). It now stands at over 3.2%, higher than at any time since 2011.

These different growth paths could yet separate further, because many of the immediate economic risks threaten countries other than America. One emanates from Italy, where bond yields are also rising rapidly—and not because of a robust economy. Instead, an extravagant budget put forward by its populist coalition government has sparked a confrontation with the European Commission and reignited fears about the sustainability of the country's huge public-debt burden. The spread between yields on Italian and German ten-year bonds now stands at around three percentage points, its widest in over five years. Those rises will chill the Italian economy. Rising yields have not so far spread beyond Italy's borders, but further

increases could mean that crisis engulfs the euro zone again. Such fears will do no favours to European business confidence, which has already softened this year.

Another threat is a rising oil price. In September the price of Brent crude surpassed \$80 per barrel for the first time since 2014, driven in part by falling Venezuelan supply and the prospect of American sanctions on Iran. It now stands at around \$82. Costly fuel used to threaten the American economy. Today, however, it spurs investment in shale rigs. That gives America a natural hedge against oil-price shocks, even though, in the short term, limited pipeline capacity might mean investment responds only slowly.

Finally, there is Mr Trump's trade war. America will eventually suffer from the distortive effects of rising tariffs, but it is not all that dependent on trade to fuel demand in the short term. Forecasts of the effect of existing tariffs on American growth and inflation predict only a small impact. The result is that the trade war so far also looks like an asymmetric shock—certainly as far as China is concerned.

The danger is that America's outperformance pushes the dollar even higher, leading to more volatility in global finance and crimping growth in emerging markets. Yet America's boom will not last for ever. Tax cuts will no longer provide incremental stimulus after 2019. Some forecasters fret that an end to the largesse, together with higher interest rates, may be sufficient to tip the country into recession by 2020. Analysts expect America's economy, with its ageing population, to expand by less than 2% a year in the long run. That suggests that, unless productivity surges, a slowdown must eventually come.

The question then is whether the rest of the world can withstand, let alone make up for, an eventual slowdown in America. Not long ago, the consensus

may have been that it could cope. Now there is more to worry about. ■



世界经济

美国领先

全球增长正在放缓，但蓬勃发展的美国脱颖而出

金融市场近日气氛紧张。受美国货币紧缩政策影响，债券市场遭遇抛售，上周感染了全球股市。标准普尔500指数10日下跌超过3%，是八个月来最糟的一天。第二天，沪市跌至近四年来的最低点；日本和香港股市的收盘价下跌约3.5%。

乍一看，抛售似乎没来由。世界经济的增长仍然足够快：上周IMF仅略微下调了2018年的全球GDP增长预测——从3.9%降至3.7%。但投资者沉不住气也有情可原。2017年时世界大部分地区都在同步加速增长，而现在全球经济扩张看起来越来越失衡了。

两种分化非常明显。首先是在新兴市场与发达经济体之间，前者正在格外动荡的金融环境中煎熬。两者走上殊途的原因是强势美元，它增加了新兴市场以美元计价的债务的偿还负担。最新一个受害者是巴基斯坦。8日，该国宣布将向IMF求援，预计纾困资金将达到120亿美元。之前已经陷入困境的新兴市场中，阿根廷和土耳其尤为突出，阿根廷已从IMF那里协商获得了创纪录的570亿美元贷款。

新兴市场货币和股票的持续下跌令投资者十分痛苦。一些国家已经提高利率以遏制资本外流。然而，对实体经济的损害在很大程度上只局限于那些经常账户赤字巨大的国家，比如阿根廷。从全球角度来看，更令人担忧的是中国。在美国关税压缩中国出口的同时，中国政府正试图降低金融体系的杠杆率。人民币承压；增长预期正在降低。

第二个分化是在发达经济体之间。富裕国家的经济似乎正在轻微放缓，只有一个例外：美国。美国的增长急剧加速，2018年第二季度的年化增长率超过4%。IMF预测今年比去年经济扩张更快的大型发达经济体只有美国。

这种加速源于特朗普的减税政策。9月，美国失业率降至3.7%，为1969年以来的最低水平；工资增长缓慢但确凿无疑。极为旺盛的需求推高了利率。自2015年开始收紧货币政策以来，美联储已将短期利率提高了两个百分点。上周，特朗普称美联储的政策是“疯狂的”。美国十年期国债收益率的涨幅超过其他大多数富裕国家（见图表）。目前收益率超过3.2%，为2011年以来最高。

这些不同的增长道路可能还会渐行渐远，因为许多眼前的经济风险威胁到美国以外的其他国家。其一来自意大利。意大利的债券收益率也在迅速上升，但并不是因为经济强劲。相反，其民粹主义联合政府提出的奢侈预算触发了与欧盟委员会的冲突，并再次引发对该国庞大公共债务负担可持续性的担忧。意大利和德国十年期国债收益率之间的利差现在约为三个百分点，为五年来最大。收益率上涨将使意大利经济降温。到目前为止，收益率上升的现象还只局限于意大利境内，但进一步上涨可能意味着危机将再次席卷欧元区。这种担忧无益于欧洲的商业信心，今年这种信心本已减弱。

另一个威胁是油价上涨。9月，布伦特原油价格自2014年以来首次超过每桶80美元，部分原因是委内瑞拉供应量减少以及美国可能对伊朗实施制裁。布伦特原油价格目前约为82美元。昂贵的能源价格曾经威胁到美国经济，然而今天却刺激了对页岩油开采的投资。这让美国有了对石油价格冲击的天然对冲，尽管在短期内有限的管道运力可能会让投资反应缓慢。

最后，还有特朗普的贸易战。美国最终将受到关税上涨带来的扭曲的影响，但在短期内刺激需求并不完全依赖贸易。预测显示，现有关税对美国经济增长和通胀的影响微小。结果是，到目前为止，贸易战带来的冲击似乎也是不对称的，至少对中国而言是如此。

危险在于美国经济强于全球，推动美元继续走高，导致全球金融更加波动，并抑制新兴市场的增长。然而，美国的繁荣不会永远持续下去。2019年之后，减税政策将不能再发挥更多的刺激作用。一些预测人士担心，等到慷慨的减税政策结束，再加上利率上升，可能足以使美国在2020年前转

入衰退。分析师预计，随着人口老龄化，美国经济从长远来看年增速将低于2%。这表明，除非生产率激升，否则经济最终必然放缓。

接下来的问题是其他国家是否能够承受美国经济最终放缓的影响，更不必说填补空位了。不久前，共识可能还是其他国家可以应对。但现在要担心的问题更多了。 ■



Danger signs

Spotting the black swans

The next crisis could start a long way from New York

TURKEY'S LARGEST city, Istanbul, is intimately linked to the Bosphorus. In the year 324AD, the emperor Constantine established a new capital for the Roman empire on the western side of the strait of water that connects the Black Sea with the Aegean. The location was perfect: easily defensible and strategically invaluable, at the hinge between Europe and Asia.

If one Bosphorus is a strategic asset, two are even better, reasoned Suleiman the Magnificent, sultan of the Ottoman empire in the 16th century. So he proposed to dig a canal to Istanbul's west, providing a second sea route across the Eurasian isthmus. His plan did not come to fruition, but it is back on the agenda now. In 2011 Recep Tayyip Erdogan, another Turkish leader with grand visions, announced a \$20bn project called "Kanal Istanbul" to provide a route parallel to the existing strait. It is an example of what Mr Erdogan himself has called "crazy projects": monumental building feats to reflect the greatness of his regime.

No one is sure if the canal will be finished. But the economic tailwinds that made such grandiose plans possible have abated, so Turkey is now facing an economic reckoning which could threaten the canal's completion and is starting to threaten other emerging markets, too. After the global financial crisis, money draining away from stricken advanced economies flooded into emerging markets. Some of them borrowed too enthusiastically and kept an imprudently loose rein on banks and firms.

The recovery of the rich world, and the withdrawal of monetary support, now threatens those overextended developing economies. Every struggling

emerging market founders in its own way, and Turkey's troubles have been exacerbated by its own particular economic and political woes. But the broad shift in financial conditions that is now squeezing the emerging world will inevitably induce some familiar crises.

Business cycles are a matter of feedback loops. In good times, people spend and invest more. Asset prices rise, worries about risk recede, and banks open their credit taps. Easier credit underpins spending and investment, and on the cycle goes. Governments try to moderate booms but often overdo or underdo it. Eventually some error flips the cycle from expansion to contraction. Nervous consumers cut back, firms shelve investment plans, asset prices fall and banks curtail credit. Lending which looked sensible one day becomes a danger to the economy the next.

The integration of the global financial system has turned national financial systems into a vast single sea of money that rises and falls with changes in saving and investment around the world. In the 2000s, for example, the international banking system channelled massive savings accumulated by oil exporters and large emerging markets into rich-world property markets. If such shifting tides are mismanaged, they almost invariably cause economic trouble. Today, the tide is on the move again.

It is most easily observed in the emerging world. Developing countries bounced back from the global financial crisis relatively quickly, buoyed by an explosive Chinese recovery. As quantitative easing in advanced economies depressed the yield on rich-world bonds, investors increasingly looked to the emerging world for better returns. The double boost of Chinese demand and rich-world capital threatened to create unmanageable credit booms in some emerging economies, which have long viewed such inflows of capital with a wary eye. Reversals in the past often left the unlucky ones with piles of unaffordable debt.

The recent experience of some developing countries such as Turkey may foreshadow a return of the sort of woes experienced by emerging Asia in the late 1990s. Turkey has been running a large current-account deficit (indicating heavy reliance on capital flows from abroad), has borrowed heavily in dollars and has an alarmingly low level of foreign-exchange reserves. A loss of market confidence could lead to a dramatic depreciation, waves of defaults and painful adjustments in the Turkish economy. Turkey is not big enough to cause global economic trouble all on its own. But should the forces squeezing Turkey drag down a broader swathe of emerging economies, governments around the world could have a serious problem on their hands.

In the past, torrents of money from abroad proved irresistible to governments in the emerging world. Most have since learned to borrow more carefully and in local currency, and to accumulate a war chest of foreign-exchange reserves. Even so, borrowing by emerging-market firms (not banks) through issuance of dollar-denominated bonds has increased by an average of more than 10% per year since the financial crisis. It has roughly doubled in Brazil and Mexico, tripled in South Africa and Indonesia, and quadrupled in Chile and Argentina, according to a recent analysis published by the Bank for International Settlements (BIS).

Borrowing from abroad has gone hand in hand with large current-account deficits; net flows of foreign money into a country allow it to consume more than it produces. But as the American economy has strengthened and the Fed has tightened, capital flows into America have grown and the dollar has appreciated. The first big round of post-crisis appreciation took place in 2014, in the wake of the “taper tantrum”, as the Fed phased out the stimulative bond-buying it had undertaken in the early 2010s. As a result, emerging-market currencies dropped and growth in trade, borrowing and GDP slowed. Now monetary policy across rich economies is becoming tighter and the rise in the dollar has resumed.

The problem, says Hyun Song Shin, of the BIS, is that dollar borrowing by emerging-market firms effectively expanded the monetary reach of the Federal Reserve. Higher American interest rates and a stronger dollar will place financial pressure on big emerging-market firms, forcing them to cut back on investment and spending. Foreign-exchange reserves held by governments are probably sufficient to prevent financial stress at big corporations from translating into a broader panic; but the closing of the credit taps, and pressure on firms to deleverage, will cause a sharp contraction in much of the emerging world that will be felt in advanced economies, too. For countries which have been running current-account deficits, that means buying less from the rest of the world and selling more. Advanced economies will be affected as the value of their investments abroad declines and their exports shrink.

Just how much all this will dampen growth will depend on what happens in China. Although it shares some features with other emerging markets, it is so vast and so unique that it represents its own sort of threat. The economic collapse of China's main export markets during the global financial crisis raised the risk of a sharp slowdown, rising unemployment and political instability. Its leaders responded with a massive fiscal stimulus directed primarily at investment, estimated at around 12.5% of GDP and financed mostly by borrowing, much of it by local governments and large firms. Overall, Chinese debt rocketed after the crisis, from about 175% of GDP in 2009 to more than 300% now. To make matters worse, borrowing has become less efficient over the past decade as more of it has been done in places and by firms with declining growth in productivity. In more recent times the government has tried to rein in, though not stop, the credit boom.

Such an extraordinary rise in debt, and particularly in credit used unproductively, would normally ring alarm bells. But China is not a normal country. Highly indebted emerging economies usually worry about servicing foreign-currency-denominated debt as capital flees the country.

But China tightly controls its capital account, and both the government and Chinese banks maintain large asset piles. Moreover, the government has far more control over the economy than in most countries and is determined to avoid the emergence of any kind of destabilising crisis.

Even so, China's debts are hardly problem-free. Economic growth has decelerated steadily since 2010. Still, it continues at more than 6% per year, which adds about \$1.5trn to the global economy each year (a Russia, give or take). To maintain growth at that clip requires a steady increase both in the economy's supply capacity and in demand. Increasing capacity has long ceased to mean adding new factories, railways and skyscrapers; instead, it involves the difficult business of technological advancement and reallocation of resources to sectors with higher productivity. Maintaining political support for the reforms needed to make this possible has proved hard, even for a powerful leader like Xi Jinping. On the contrary, recent borrowing props up low-productivity firms and sectors that ought to have shrunk.

And if China were to succeed in boosting the supply side of the economy, demand might become a problem. Culling unproductive businesses would mean less spending and fewer jobs. Households would be obvious candidates for replacing lost demand, but progress on shifting to a more consumption-based growth model has been slow and has relied in part on increasing levels of household debt. Besides, setting monetary policy in such a way as to reduce borrowing by weak firms but encourage household credit growth is tricky. Rising household incomes could help, but China has had difficulty in achieving this; household incomes as a share of GDP have fallen since 2016.

If China's exchange rate were to weaken sufficiently, the increase in sales to foreigners could help offset weak domestic demand. But that risks enraging America, and encouraging Mr Trump to intensify his trade war. A drop in

the yuan would also add to the financial stress on Chinese firms with large dollar-denominated debts. And China exporting its way out of trouble might place an undue burden on the rest of the global economy.

In the past, rich countries could shrug off the sort of adjustments in emerging markets that appear to be looming. But times have changed. China's last real economic dip occurred during the financial crisis, when the entire world was reeling. The last serious growth hiccup before that was after the Tiananmen Square unrest in 1989. At that time Chinese GDP was about 4% of the global total; now it is 19% (measured at purchasing-power parity, or PPP). Over the same period emerging markets' share of world GDP has risen from 36% to 59% at PPP. Those markets could cause a downturn in the global economy all by themselves.

Yet not everything is rosy in the rich world either. Although the euro-area economy enjoyed faster growth in 2017, the boom has since cooled, even as the European Central Bank (ECB) has moved toward monetary tightening. An end to quantitative easing by the ECB, set for the end of 2018, and the prospect of rate increases, probably would not be enough to endanger the euro-area recovery. But an end to asset purchases could make markets react faster to political changes that threaten to reignite the euro crisis.

Italy, in particular, is a ticking time bomb. The election of a populist coalition in March rattled bond markets. With Italian government debt at around €200bn, or 130% of GDP, it would not take much to set off a new crisis, which would be extremely difficult to control. Panic in Italy might radiate out across financial markets, putting a chill on investment and growth worldwide.

America has its own vulnerabilities. The ratio of non-financial corporate debt to GDP has reached an all-time high of more than 73%. A worryingly large share of recent borrowing has come in the form of leveraged loans, an

alternative to bonds. The business is reminiscent of the mortgage-backed security market which featured prominently in the global financial crisis. Investor demand for such securities has rocketed in recent years, because payouts vary with interest rates, which have been rising. The size of the market has doubled since 2010, to more than \$1trn, and is now nearly as large as the market for high-yield bonds. Expansion in lending has come at the expense of credit standards. The share of new leveraged loans considered to have weak protections against default is growing; in the first quarter of 2018 it exceeded 80%.

Despite the parallels with pre-crisis mortgage lending, a meltdown in this market is unlikely to generate the same havoc. But an outbreak of defaults could contribute to a rapid contraction in lending to firms and a tightening of credit—sufficient, perhaps, to touch off a new American recession. One of the lessons of the crisis is that panics can be caused by things hidden until it is too late.

One such surprise might be a rise in the cost of oil. Prices have crept up over the past year, from \$50 per barrel to around \$80. Politically generated disruptions to supply in Venezuela and Iran could strain the market further. A number of other black swans may be heading upriver even now. Costly frauds may be hiding within underexamined corporate balance-sheets. Elections could go one way not another. Global pandemics might erupt.

Once credit, spending and optimism have reigned for a time, the interplay of foreseen and unforeseen circumstances may cause them to stop doing so. At that point behaviour which seemed reasonable and responsible will start to look like folly, the “crazy projects” of the world will seem unconscionably reckless, and the world will be in trouble again. ■



危险迹象

识别黑天鹅

下一次危机的发源地可能远离纽约

土耳其最大的城市伊斯坦布尔与博斯普鲁斯海峡关系紧密。公元324年，在这条连接黑海和爱琴海的海峡的西岸，君士坦丁大帝建起了罗马帝国的新首都。这个位置非常完美：地处欧亚之交，易于防守又极具战略价值。

如果一个博斯普鲁斯海峡是一种战略资产，那么两个岂非更妙——16世纪奥斯曼帝国的苏丹苏莱曼一世（Suleiman the Magnificent）如此盘算道。于是他提议在伊斯坦布尔的西边挖一条运河，提供第二条海路穿越这个欧亚之间的地峡。他的计划没有实现。但如今，它再次被提上议程。2011年，又一位胸怀大志的土耳其领导人雷杰普·塔伊普·埃尔多安（Recep Tayyip Erdogan）宣布推出耗资200亿美元、名为“伊斯坦布尔运河”（Kanal Istanbul）的项目，将打造一条与博斯普鲁斯海峡平行的海路。埃尔多安上任后大兴土木，彰显其统治之伟大，他本人称它们为“疯狂项目”，这条运河就是其中一例。

没人能确定这条运河能否完工。但是，当日推动这类宏伟计划的经济动力已然减弱，土耳其正面临一场经济清算，不但可能危及运河的建成，而且还开始对其他新兴市场构成威胁。在全球金融危机过后，资金从备受打击的发达经济体流出，涌入新兴市场。部分新兴市场过度借贷，对银行和企业监管松弛。

富裕国家经济复苏，加上从支持性货币政策中退出，现在已威胁到那些过度扩张的发展中经济体。挣扎中的新兴市场各有各的烦恼。土耳其自身特殊的政治和经济困局进一步加重了它的问题。但是，正在挤压新兴世界的广泛的金融气候变化将无可避免地引发一些常见的危机。

商业周期是一种反馈循环。在经济繁荣期，人们更舍得消费和投资。资产

价格上涨，风险顾虑消退，银行打开信贷水龙头。更易获得的信贷为消费和投资提供支撑，如此循环往复。政府试图调节经济热度，但往往下手太猛，又或用力不足。最终，某些错误举措令周期从扩张转为收缩。杯弓蛇影的消费者减少支出，公司搁置投资计划，资产价格下跌，银行收紧信贷。之前貌似明智的贷款一下子变成了威胁经济体安全的高危行为。

全球金融体系的整合使各国金融体系连成一整片货币汪洋，随全球储蓄和投资的变化起伏不定。例如在21世纪的头十年，国际银行系统把石油出口国和大型新兴市场积累的大量储蓄导向富裕国家的房地产市场。如果对这样的潮汐变化管理不善，几乎肯定会造成经济灾难。今天，这股潮汐又开始涌动起来。

这在新兴世界中最为明显。受中国强劲复苏的推动，发展中国家相对较快地从全球金融危机中恢复过来。发达经济体的量化宽松政策抑制了富裕国家的债券收益率，投资者因而逐渐转向新兴市场谋求更高回报。在中国需求和富裕国家资本的双重刺激下，一些向来警惕这类资本流入的新兴经济体眼看要出现难以控制的信贷扩张。在过去，情况逆转往往令不幸的国家背上无法承受的巨额债务。

土耳其等一些发展中国家近期的经历可能预示着，上世纪90年代后期亚洲新兴市场遭遇的那种危机将重新降临。土耳其一直存在巨额经常账户赤字（表明严重依赖来自国外资本流入），大量借入以美元计价债务，而外汇储备水平之低，令人担忧。市场丧失信心会导致土耳其货币急剧贬值，出现违约潮和一系列痛苦的调整。单凭土耳其的经济规模并不足以引发全球性经济问题。但如果挤压土耳其的这些力量拖垮其他更多新兴经济体，世界各国政府可能都会面临一个严峻的问题。

过去，新兴世界政府难以抗拒源源涌入的国外资金。现在大多数政府都学会了更加谨慎地以当地货币借贷，并积累外汇储备应对不时之需。即便如此，自金融危机以来，新兴市场的企业（并非银行）通过发行美元计价的债券所获借款平均每年增加10%以上。根据国际清算银行最近公布的一项分析，在巴西和墨西哥，这种借贷的总额大约增加了一倍，在南非和印度

尼西亚增加了两倍，在智利和阿根廷增加了三倍。

举借外债与巨额经常账户赤字密切相关：外国资金净流入可令一国的消费大于生产。但随着美国经济转强，加上美联储收紧货币政策，流入美国的资本增加，美元升值。金融危机后美元的第一轮大规模升值发生在2014年，也就是美联储逐步停止之前几年开始的刺激性购买债券、进而引起“QE削减恐慌”（taper tantrum）之后。结果，新兴市场货币下跌，贸易、贷款和GDP的增长皆放缓。现在，富裕经济体的货币政策正在收紧，美元又一次上涨。

国际清算银行的申铉松表示，问题在于新兴市场中企业的美元贷款实际上扩大了美联储货币政策的影响范围。美国加息和美元走强将给新兴市场的大公司带来财务压力，迫使它们削减投资和支出。政府持有的外汇储备可能足以防止大公司的财务压力转化为更广泛的恐慌；但信贷水龙头关闭，加上企业去杠杆的压力，将导致大部分新兴市场急剧收缩，而发达经济体也将感受到冲击。一直存在经常账户赤字的国家将从世界其他地方进口更少的产品，并出口更多的产品。而发达经济体也将因为海外投资价值下降及出口萎缩而受到拖累。

这一切将在多大程度上抑制经济增长取决于中国的动态。尽管与其他新兴市场有些共同之处，但中国市场庞大而独特，面对的威胁也自成一格。在全球金融危机期间，中国主要的出口市场经济崩溃，加剧了经济急速放缓、失业率上升和政治不稳的风险。其领导人采取了主要从投资着手的庞大财政刺激方案，估计约占GDP的12.5%，主要依靠贷款，其中大部分借给了地方政府和大企业。整体而言，金融危机后，中国债务飙升，从2009年占GDP的约175%增加到如今的300%以上。更糟糕的是，过去十年，信贷的成效下降，因为更多贷款流向了生产率增长下降的地方和公司。政府近期已设法限制信贷热潮，但并无完全制止之意。

债务增长如此迅猛，尤其是低效利用的信贷，一般会敲响警钟。但中国不是一般国家。高负债的新兴经济体通常都会担心，该如何在资本流出本国的情况下偿还以外币计价的债务。但中国严格控制其资本账户，政府和中

资银行都有庞大的资产储备。此外，中国政府对经济的管控远远超出大多数国家，且坚决防止任何破坏稳定的危机抬头。

即便如此，中国的债务并非高枕无忧。自2010年以来，中国的经济增速一直稳步下降，但仍保持在6%以上，每年为全球经济增加约1.5万亿美元（大概相当于一个俄罗斯）。要保持如此增速，经济产能和需求都必须稳步增长。产能增长早已不再是新建工厂、铁路和摩天大楼，而是涉及更高难度的任务——技术进步以及把资源重新分配给生产率较高的部门。推行改革以实现这一目标需要持续的政治支持，但这并非易事，即使对习近平这样的强势领导人也是如此。与这一目标相悖的是，近期的贷款令一些本该收缩的低效企业和行业又得以苟延残喘。

而假如中国能成功提振供给侧，需求又可能成为问题。淘汰低效企业意味着支出和工作岗位减少。显然，因此减少的需求需要家庭消费来填补，但中国向消费驱动增长模式的转型进展缓慢，而且在一定程度上依赖于家庭债务水平的提高。此外，要制定货币政策以减少向弱势企业贷款而鼓励家庭信贷增长不容易。家庭收入增加可能有所帮助，但中国难以实现这一点——自2016年以来，家庭收入占GDP的比例持续下降。

如果中国的汇率充分下调，则出口增加可能有助于抵消疲软的国内需求。但这可能会触怒美国，并刺激特朗普进一步升级贸易战。人民币贬值也会加大背负巨额美元债务的中国企业的财务压力。而中国在通过出口摆脱困境的过程中可能又会给全球其他地区的经济带来不应有的负担。

在过去，对于新兴市场这类似乎已在迫近的调整，富裕国家可以不屑一顾。但时移世易。中国经济最近一次真正下滑发生在金融危机期间，当时全球经济一片混乱。再前一次严重的经济滑坡是在1989年天安门事件之后。当时的中国的GDP约占全球总量的4%，现在是19%。同一时期，新兴市场占世界GDP的比例已经从36%上升到59%（以上均按购买力平价计算）。单是这些问题就足以引发全球经济衰退。

然而富裕世界也并非一片美好。虽然欧元区经济在2017年增长较快，但已

开始降温，尽管与此同时欧洲央行已逐渐趋向收紧货币政策。量化宽松预定在2018年底结束，并且可能加息，这些也许还不足以危及欧元区经济复苏。但结束资产购买计划可能会令市场对那些有可能重燃欧元危机的政治变革更加敏感。

意大利更是一颗滴答作响的定时炸弹。今年3月，意大利在大选后组成民粹主义联合政府，令债券市场紧张不安。意大利政府债务约为2000亿欧元，相当于GDP的130%，距离引发新一场危机已然不远，一旦爆发将极难控制。意大利的恐慌可能蔓延至整个金融市场，给全球投资和增长泼上一盆冷水。

美国也有软肋。非金融企业债务占GDP比例已升至历史新高，超过73%。近期贷款中包含大量作为债券替代品的杠杆贷款，比例之高令人担忧。这让人想起在全球金融危机中扮演重要角色的抵押贷款证券市场。近年来投资者对此类证券产品的需求飙升，因其收益跟随利率变化，而利率正在走高。自2010年以来，该市场规模翻了一番，突破一万亿美元，现在几乎与高收益债券市场规模相当。贷款扩张是以牺牲信贷标准为代价的。违约保护不足的新杠杆贷款越来越多，在2018年第一季度，其占比已超过80%。

尽管与危机前的抵押贷款相似，但这一市场的崩溃不太可能造成同样大的破坏。然而，如果爆发违约潮，可能致使企业融资迅速萎缩和信贷紧缩，可能足以引发美国新一轮经济衰退。金融危机的教训之一就是恐慌可能由迟迟未能发现的隐患造成。

石油价格上涨可能是这类“意外”的其中一例。在过去一年里，油价从每桶50美元缓慢上涨到约80美元。委内瑞拉和伊朗因政治因素造成的供应中断可能进一步加剧市场压力。而此时此刻，其他一些“黑天鹅”也可能正逆流而上。高额欺诈可能隐藏在未经细察的公司资产负债表中。各地选举可能统统向右倒。流行病可能在全球爆发蔓延。

信贷狂欢、大举支出和乐观情绪主导一段时间后，在那些可预见和不可预见的情况相互作用下，这些热潮可能会退去。届时，原本看似合理和负责

的行为会转而显得愚蠢，世界上那些“疯狂项目”看起来鲁莽无节制，全球将再度陷入困境。 ■



Free exchange

Greener pastures

Paul Romer and William Nordhaus win the Nobel prize in economics

WHY do economies grow, and why might growth outstrip the natural world's capacity to sustain it? There are few more important questions in economics. The answers require a working grasp of the mechanisms underlying growth. For the progress that the profession has made towards that understanding, it owes a particular debt to Paul Romer and William Nordhaus, this year's winners of the Nobel prize in economic sciences.

Although both scholars have long been talked of as potential winners, they are not an obvious pairing for the prize. Mr Romer tends to be described as a growth theorist; Mr Nordhaus's work is in the field of environmental economics. The Sveriges Riksbank, which awards the economics Nobel, found a common thread in their work incorporating two crucial processes—knowledge creation and climate change, respectively—into models of economic growth. But what most links their work is that they have improved the way the profession thinks about impossibly complex systems, while also revealing the extent of its ignorance.

The influence of both men extends beyond their most noted scholarly achievements. Mr Romer's career has been especially varied. He left academia in the early 2000s to found an educational-software company. More recently he served as the World Bank's chief economist (his tenure ended abruptly when staffers bridled at his management style, which included an insistence on more crisply written reports). But it is his analysis of economic growth that has had the greatest impact.

Economists used to think that sustained long-run growth depended on

technological progress, which in turn relied on the creation of new ideas. They struggled, however, to explain convincingly how markets generated and propagated those ideas. When Mr Romer came into economics, most prominent models of growth relied on “exogenous” technological progress: it was simply assumed, rather than generated by the models’ equations.

Dissatisfied by this state of affairs, he sought answers by probing the non-rivalrous nature of knowledge: the fact that ideas, once created, can be endlessly exploited. The firms or individuals that come up with new ideas can only ever capture a small share of the benefits arising from them; before long, competitors copy the original brainwave and whittle away innovators’ profits. In Mr Romer’s work, markets are capable of generating new ideas. But the pace at which they are generated, and the way in which they are translated into growth, depends on other factors—such as state support for research and development, or the protection of intellectual property.

The “endogenous” growth models produced by Mr Romer, and by others influenced by him, were once hailed as a critical step towards understanding patterns of economic growth across the globe. They have not quite fulfilled that promise: knowledge may be necessary for growth, but it is clearly not sufficient. But their shortcomings have themselves raised important questions about the stubborn disparities in growth rates. Why are some countries able to exploit existing ideas and grow, while others are not? Should policymakers who want to boost growth focus on policies that support the creation of knowledge or on those that break down barriers to the exploitation of existing knowledge? Or does it make most sense to shift people and resources from the parts of the world that struggle to grow to those that do not? By provoking such questions, Mr Romer’s work identified a rich vein for other researchers to mine.

Mr Nordhaus, for his part, has been a towering figure in the debate about how to respond to one of the biggest challenges that humanity faces. When

he was beginning his career in the early 1970s, awareness of the dangers of environmental damage and the threat posed by climate change was just starting to grow. Understanding the economic costs such damage imposes is essential to answering the question of how much society should be willing to pay to avert it.

Mr Nordhaus applied himself to solving this problem. That meant working out the complex interactions between carbon emissions, global temperature and economic growth. He combined mathematical descriptions of both climate and economic activity into “integrated assessment models”. This allowed him to project how different trajectories for the world’s carbon emissions would produce different global temperatures. That, in turn, allowed him to estimate the likely costs of these different scenarios—and thus what level of reduction in emissions would be economically optimal. He was the first to suggest that warming should be limited to no more than 2°C higher than the world’s pre-industrial temperature. Models like his have become the linchpin of most analysis of the cost of climate change.

As with Mr Romer’s work, Mr Nordhaus’s contributions are also notable for the lessons imparted by their shortcomings. Four decades after he began publishing research on climate change, the limits to scholars’ predictive abilities have become abundantly clear. Indeed, his work has prompted vigorous debate about how best to think through the huge uncertainties associated with global warming—from how emissions translate into higher temperatures to how well society can adapt to rapid changes in climate.

Policymakers prefer the comfort of hard numbers. But the often-unfathomable complexity of human society and natural processes may mean that other guides are sometimes needed to set policy, from the precautionary principle to moral reasoning. Ironically, Mr Nordhaus’s computations, like those of Mr Romer, made that awareness possible.

Above all, both of this year's prize-winners tackled problems that the field both could not understand and could not afford not to understand. They blazed trails that scholars continue to follow—to the benefit of economics and humanity. ■



自由交流

迈向青草地

保罗·罗默和威廉·诺德豪斯荣膺诺贝尔经济学奖

经济为什么会增长？增长为什么可能超出自然环境支撑、维持它的能力？经济学中几乎没有比这些更重要的问题了。回答这些问题需要对增长机制有充分的认识。经济学在加深这方面认知上取得的进展要特别感谢今年的诺贝尔经济学奖获得者：保罗·罗默（Paul Romer）和威廉·诺德豪斯（William Nordhaus）。

虽然两位学者长期以来都被视为诺奖的可能人选，但两人同时获奖还是出乎大多数人的意料。罗默一般被视为增长理论家；诺德豪斯的研究领域则是环境经济学。颁发诺贝尔经济学奖的瑞典中央银行（Sveriges Riksbank）在他们的研究中找到了一个共同点：将知识创造和气候变化这两个重要过程分别纳入了经济增长模型。但他们的研究之间的最大关联是改进了经济学对极其复杂的系统的思考方式，同时又揭示出这门学问无知的程度。

两位学者的影响都不止于他们最著名的学术成就。罗默的职业生涯尤其变化多端。他在本世纪初离开学术界，成立了一家教育软件公司。前不久他还在担任世界银行的首席经济学家（他的任期突然结束，原因是他手下的职员不满他的管理风格，包括坚持要求他们提高研究报告的清晰准确度）。但他影响力最大的成就还是对经济增长的分析。

过去，经济学家认为持续的长期增长取决于技术进步，而技术进步又依赖于新想法的产生。然而，他们却难以令人信服地解释市场是如何产生和传播新想法的。当罗默进入经济学领域时，大多数著名的增长模型都依赖于“外生的”技术进步——这种进步只是一种假设，而不是模型的公式得出的结论。

这不能让罗默满意，于是他通过探究知识的非竞争特性来寻求答案。这种

特性是指这样一个事实：想法一旦产生，即可被无限利用。提出新想法的公司或个人只能捕获一小部分因之而来的利益，因为竞争对手很快就会照搬创新者的想法并分走部分利润。根据罗默的研究，市场擅于产生新想法，但新想法产生的速度以及转化为增长的方式取决于其他因素，例如国家对研发的支持，或对知识产权的保护。

罗默以及受他影响的人所创造的“内生”增长模型曾被誉为理解全球经济增长模式的关键一步。但这些模型还没有完全做到这一点：知识可能是增长的必要条件，但显然不是充分条件。但模型的不足本身却引发了关于增长率顽固差异的重要问题。为什么有些国家能够利用现有的想法并实现增长，其他国家却不行？想要促进增长的决策者的政策关注点应该是什么？是支持知识的产生，还是如何打破现有知识利用上的障碍？又或者，将人力和资源从世界上那些难以实现增长的地方转移到能够增长的地方才是最合理的方法？通过激发这些疑问，罗默的工作为其他研究人员找到了一座富饶的金矿。

在如何应对人类面临的最大挑战之一的辩论中，诺德豪斯一直地位崇高。当他在上世纪70年代初开始自己的职业生涯时，人们对环境破坏的危险和气候变化的威胁才刚刚有所认识。要回答社会应该愿意付出多少代价来避免环境破坏的问题，了解这种破坏带来的经济成本至关重要。

诺德豪斯致力于解决这个问题。这意味着要搞清楚碳排放、全球温度和经济增长之间复杂的相互作用。他把对气候和经济活动的数学描述纳入“综合评估模型”之中。这让他能够预测不同的全球碳排放曲线会如何导致不同的全球温度。根据这些数据，他能够估算出不同情景下可能的成本，从而得出经济效益上最优的减排水平。他首次提出全球变暖幅度应该限制在不超过工业化前温度 2°C 的水平。他开创的这类模型已经成为大多数气候变化成本分析的关键。

与罗默的研究一样，诺德豪斯的贡献也因其不足所引发的议题而引人注目。在他开始发表关于气候变化的研究成果40年后，学者们在预测能力上的局限性变得非常明显。实际上，他的研究引发了激烈的辩论：当面对与

全球变暖相关的巨大的不确定性时——从排放如何转化为温度升高到社会能在多大程度上适应气候的快速变化——人们如何能做出最好的全盘考虑？

政策制定者更喜欢确凿的数字带来的安全感。但是，人类社会和自然过程之纷繁复杂往往高深莫测，因而有时可能需要从预防原则到道德推理等其他指引来制定政策。未曾料想的是，诺德豪斯的这番计算——罗默的也一样——倒让人们认识到了这一点。

最重要的是，今年的两位获奖者都着手解决经济学无法理解但又必须要去理解的问题。他们开辟了学者们追随前行的道路，造福了经济学和全人类。 ■



Economic and financial indicators

Maritime transport

Global seaborne trade rose by 4% in volume terms in 2017

Global seaborne trade rose by 4% in volume terms in 2017, according to UNCTAD, the fastest growth rate in five years. Expansion was largely driven by increased industrial production in emerging markets, which account for 60% of shipped exports. Rising trade was accompanied by a 3.3% increase in maritime-fleet capacity. UNCTAD thinks the prospects are bright, too. Autonomous ships could boost efficiency in the industry, though job losses and cyber-security concerns may slow adoption of the technology. Despite tensions between America and China, seaborne trade is forecast to rise by another 4% in 2018, and then by 3.8% annually until 2023. ■



经济与金融指标

海上运输

2017年全球海运贸易量增长4%

联合国贸发会议的数字显示，2017年全球海运贸易量增长4%，为五年来最快增速。这一扩张主要受新兴市场工业产出增长的推动，这些地区占到了海运出口量的60%。贸易量上升的同时，商船队的运力增长了3.3%。贸发会议认为前景也很光明。无人船舶也许可以提升航运业的效率，虽然由此带来的职位减少和网络安全方面的担忧也许会放慢采用这项技术的进程。尽管中美关系紧张，2018年海运贸易预期还将增长4%，之后直至2023年每年增长3.8%。 ■



Global warming

War war is better than jaw jaw

Action now might still avert the worst of climate change. But how likely is that?

IN 1996 the European Union became the first significant political body to suggest that the goal of preventing “dangerous anthropogenic interference in the climate”, to which the world had signed on at the Rio Earth summit of 1992, meant, in practical terms, keeping global warming below 2°C relative to the late 1800s. This two-degree limit had been an informal measure of the point where climate change gets serious since the 1970s. William Nordhaus, a pioneer of climate economics who earlier this month shared the Nobel prize for his efforts (see Free exchange) seems to have been the first to use it as such. But between 1996 and the Copenhagen climate summit of 2009 it was transformed from one possible interpretation of the Rio goal to the target on which the world agreed.

At the Paris climate summit of 2015, though, this changed. In light of both new evidence and new concerns, notably those of low lying countries that might not survive the amount of sea level rise two degrees would bring, the nations of the world agreed a new target: keeping warming “well below” 2°C above pre-industrial temperatures. Indeed, they urged themselves to “pursue efforts towards 1.5°C”.

This lower target would presumably be better for all, not just the likes of Kiribati. But exactly how much better has been far from obvious. So the Paris agreement also gave to a body called the Intergovernmental Panel on Climate Change (IPCC) the task of finding out. Given that the world is actually on track for a rise of more than 3°C, regardless of the pieties of Paris, it was also charged with finding out whether limiting the rise to 1.5°C is in any way feasible.

On October 8th, nearly three years, several drafts and some 40,000 reviewer comments later, the panel unveiled the fruit of its labours at a gathering in Incheon, South Korea. The 1,200-page report, written by 91 researchers from 44 countries, presents no truly new science. The panel's brief was to survey all relevant literature—more than 6,000 studies, many spurred by the report's commissioning—and to synthesise the results. It makes for sobering reading, both in terms of what the half-degree difference between the two targets may mean for the planet, and regarding the effort needed to meet the tougher goal.

The authors profess “high confidence” of a “robust difference” between 1.5°C and 2°C worlds. At 1.5°C, 6% of insect species, 8% of plants and 4% of vertebrates would lose more than half their habitat. The figures for 2°C are 18%, 16% and 8%, respectively.

At that temperature rise, ecosystems covering between a twelfth and a fifth of Earth’s land mass can be expected to undergo transformation to another type—savannah to desert, say. That is 50% more than would happen with a rise of 1.5°C. Most dramatically, the IPCC finds it almost certain that a 2°C rise would wipe out more than 99% of corals. By contrast, a rise of 1.5°C would leave 10-30% of them alive, and with them the hope of regeneration if temperatures subsequently stabilised.

Permitting a rise of 2°C rather than 1.5°C could also see 420m more people exposed regularly to record heat. “Several hundred million” more would have to contend with climate-induced poverty. Food security would decline and water scarcity increase, especially in poor and already-fragile areas such as the Sahel region of Africa, just south of the Sahara desert. And an additional 10cm of sea-level rise could hurt the livelihoods of more than 10m people living on the coast.

The report also nods towards the chance of dangerous feedback loops. A

two-degree temperature rise could lead to the thawing of 1.5m-2.5m km² of permafrost—about the area of Mexico. That, in turn, would release methane, a potent greenhouse gas which would lead to further warming, thawing and so on.

The IPCC does not quantify the effects of such feedback. But work which appeared in August, after the deadline for consideration in the report, attempts to do so. This study, led by Will Steffen of the Stockholm Resilience Centre and published in the *Proceedings of the National Academy of Sciences*, concludes that five feedback loops unleashed by a rise of 2°C are likely to be important. These involve the permafrost, natural carbon sinks such as the ocean, increased methane emissions from marine bacteria, and the dying of Amazonian and boreal forests. Together these could add between 0.24°C and 0.66°C of extra warming.

Such alarming conclusions are necessarily subject to the huge uncertainties inherent in climate science. Though they have survived scrutiny by peer review in the journals in which they appeared, and then again by the IPCC's authors, individual studies may yet be challenged. Taken together, however, they paint a picture that looks bleak. There is, remarks Glen Peters of the Centre for International Climate Research in Oslo, who was not involved in the report, perhaps one-tenth of the material where there might be disagreements, but scientists agree 100% about the remaining nine-tenths.

The same uncertainties apply to the report's outline of possible pathways to a 1.5°C future. On the bright side, the IPCC concludes that such a future remains geophysically within reach, thanks to what remains of the Earth's “carbon budget” for 1.5°C—the cumulative sum of emissions at which the climate system stands a good chance of remaining below a particular temperature. The panel's Assessment Report, a septennial compendium of the latest climate science, most recently published in 2013-14, warned that an eventual minimum rise of 1.5°C, though it would not manifest itself until

mid-century, would be “baked” irreversibly into the climate system by 2020 if economic activity continued to belch carbon dioxide at the present rate. In the past few years climate modellers have, controversially in the eyes of some, revised the Earth’s remaining budget to around 12 years’ worth of current emissions, thus pushing back the date of bake-in.

Even with a bigger carbon kitty though, keeping the temperature rise below 1.5°C would take an epic effort. Of 90 published models purporting to chart the most economically efficient way to achieve this goal, the IPCC considers that just nine stay below the threshold throughout this century. The rest overshoot it, and so require removal of carbon dioxide from the atmosphere to offset the excess emissions.

These “negative emissions” could come from planting more forests, which draw in carbon dioxide as they grow. Planting “energy crops” such as fast-growing grasses, which could be burned instead of fossil fuels (with the carbon dioxide thus generated captured and stored underground), is also possible. Either approach, though, would mean converting to that purpose an area of agricultural land somewhere in size between India and Canada. An alternative is “direct air capture”—artificial devices that retrieve carbon dioxide directly from the atmosphere. These exist but they, too, would need to be deployed at a gargantuan scale. (Solar geoengineering, a controversial idea to disperse particles of matter into the atmosphere to reflect heat back into space, was not considered in detail.)

Negative emissions or solar geoengineering might ease the need to decarbonise economies quickly—but not eliminate it. As the charts show, even with negative emissions carbon-dioxide release still needs to fall by 45% or thereabouts by 2030. To have any hope of achieving this, two-thirds of coal use must be phased out in little more than a decade. By the middle of the century virtually all electricity must come from carbon-free sources

(up from a quarter today), and all cars will need to run on electric motors (up from one in 500), as will trains and most ships.

Some of the technology needed to achieve this (solar panels, nuclear-power plants, electric cars and so on) is around, but not all of it. For aeroplanes to keep flying, either novel aviation biofuel will need to be developed or negative emissions used to offset those from aircraft. Because cows produce lots of methane people will either have to switch to laboratory-grown burgers or change diets (see Briefing). Even when appropriate technology does exist, market forces alone will not improve it and spread it fast enough to have the necessary climatic effect.

Were any of this actually to happen, it would transform economies beyond recognition. And it would cost money. How much, the IPCC has resisted predicting, blaming limited economic research in the area. But, for the same reason, it does not attempt to value the flip side—the damage caused by delay.

Another paper that missed the deadline, by Simon Dietz of the London School of Economics and his colleagues (one of whom worked on the IPCC report), tries to fill the first of those gaps. It estimates that keeping temperature rises to 1.5°C would cost 150% more than keeping them to 2°C, though it gives no absolute figures. Like the IPCC, Dr Dietz stops short of comparing this to averted losses. But earlier work by others suggests that a rise of 1.5°C would shave 8% from global GDP per person by 2100, relative to a world with no more warming. A rise of 2°C, by contrast, would cause a discrepancy of 13%.

The world's press reacted to the IPCC's tome with alarm sometimes verging on hysteria. News bulletins, front pages and op-eds harangued governments to get their act together and ratchet up climate action—especially since all of them signed off on the report's 30-page précis. That included the

government of America, which President Donald Trump plans to yank out of the Paris agreement. (Mr Trump has since expressed doubts about the précis's legitimacy.)

On October 9th, a day after the volume's release and ahead of an important UN climate summit in Poland this December, environment ministers from 15 of the EU's 28 members pressed the bloc to revise its climate targets in line with the 1.5°C target. This is welcome. But in a world where even the existing target looks likely to be missed by a mile, how much difference it will make is open to doubt. In climate change, as in so many other areas, words are cheap. It is actions that are eloquent. ■



全球变暖

动口不如动手

现在就行动，或许仍能避免最恶劣的气候变化。但这可能性有多大？

在1992年的里约地球峰会上，世界各国签署公约，确立了防止“气候系统受到危险的人为干扰”的目标。1996年，在各重要政治体中，欧盟第一个提出，在实践中应将该目标定为全球气温比19世纪末升高不超过 2°C 。自上世纪70年代以来，这个 2°C 的限定一直是衡量气候变化严重程度的非正式指标。本月稍早时，气候经济学的开创者威廉·诺德豪斯（William Nordhaus）与他人共获诺贝尔奖，他似乎就是首个创立这项指标的人。但是，在1996年到2009年哥本哈根气候峰会期间， 2°C 的限定已经从对里约目标的一种可能的解释变成了世界各国的一致目标。

不过，在2015年的巴黎气候峰会上，这一点发生了变化。考虑到一些新出现的证据和新的关切点，尤其是那些可能无法在升温 2°C 带来的海平面上升中幸存的低地国家，世界各国达成了一个新的目标：将全球气温较前工业化时期的升幅控制在“远低于” 2°C 的水平。确切来说，各国敦促自己将升幅“努力控制在 1.5°C 的水平”。

这个更低的数字想来会给所有国家都带来更好的结果，而不仅仅是像基里巴斯这样的国家。但究竟能好多少，还远未可知。所以《巴黎协定》还委派了政府间气候变化专门委员会（以下简称IPCC）去寻找答案。尽管《巴黎协定》信誓旦旦，实际上全球目前正朝着升温超过 3°C 的方向奔去，所以IPCC还被赋予了另一项任务：弄清 1.5°C 的限定究竟有多大的可行性。

本月8日，该委员会在韩国仁川举行的会议上公布了其工作成果。这份长达1200页的报告由44个国家的91名研究人员历时近三年撰写完成，其间几易其稿，收到了大约四万条评论意见。但该报告并不包含真正意义上的科学新发现。IPCC的任务是审阅所有相关文献并综合其成果。这些文献包括6000多项研究，其中很多是受IPCC委托而开展的。报告让人们警醒地认

识到两个问题：两个目标之间 0.5°C 的差异对地球可能意味着什么，以及为实现这个更艰巨的目标需要付出怎样的努力。

报告的作者们宣称，他们“高度确信”一个升温 1.5°C 和一个升温 2°C 的世界有着“明显的差异”。在升温 1.5°C 的情境下，将有6%的昆虫物种、8%的植物物种以及4%的脊椎动物物种失去超过一半的栖息地。而在 2°C 的情境下，对应的数字分别增至18%、16%和8%。

在后一种情境下，覆盖十二分之一到五分之一陆地的生态系统可能会转变为另一种类型，比如从稀树草原变为沙漠。发生如此转变的陆地面积会比升温 1.5°C 的情境多50%。最惊人的是，IPCC基本确定，升温 2°C 会使99%以上的珊瑚灭绝。而升温 1.5°C 能让10%到30%的珊瑚存活，如果之后气温稳定下来，这还可能让珊瑚得以大面积再生恢复。

如果升温控制在 2°C 而非 1.5°C ，还可能使经常遭受创记录高温袭击的人口增加4.2亿。不得不与气候引发的贫困做斗争的人口会多出“数亿”。粮食安全会下降，水资源短缺也会更严重，尤其是在贫困和业已脆弱的地区，如正好位于撒哈拉沙漠以南的非洲萨赫勒地带（Sahel）。海平面会多上升10厘米，危及沿岸1000多万人的生计。

报告也认同可能会出现危险的反馈回路。升温 2°C 可能导致150万到250万平方公里（差不多是墨西哥那么大）的永久冻土融化。这反过来又会释放甲烷这种强效温室气体，进而导致更严重的气候变暖、冻土融化等等。

IPCC没有量化这种反馈的影响。但其报告的文献审阅期截止后，在8月出现了尝试对此进行量化的论文。这项研究由斯德哥尔摩复原力中心（Stockholm Resilience Centre）的威尔·斯特芬（Will Steffen）牵头，发表在《美国国家科学院院刊》（Proceedings of the National Academy of Sciences）上。研究表明，升温 2°C 引发的五个反馈回路很可能事关重大，涉及永久冻土、海洋等天然碳汇、海洋细菌的甲烷排放量增加，以及亚马逊流域和欧亚大陆北方森林退化等。这些因素加起来可能会导致 0.24°C 至 0.66°C 的额外升温。

这些惊人的结论必然摆脱不了气候科学本来就存在的种种巨大的不确定性。尽管这些论文先是通过了所发表期刊的同行评议，之后又通过了IPCC报告作者们的审查，但具体到单个研究仍可能受到质疑。然而，这些论文总体上描绘了一幅黯淡的图景。奥斯陆国际气候研究中心（Centre for International Climate Research in Oslo）的格伦·彼得斯（Glen Peters）没有参与撰写IPCC的报告，不过他指出，该报告大概有10%的材料可能引起分歧，但科学家们对余下的90%毫无异议。

IPCC的报告概述了将气温升幅控制在1.5°C的种种可能的途径，但这同样存在不确定性。从乐观的一面来看，IPCC认为1.5°C的升温幅度从地球物理的角度来看仍可实现，原因在于世界为达到1.5°C目标而设定的“碳预算”仍有余额（“碳预算”是气候系统很有希望保持在某一特定温度之下温室气体的累积排放总量）。IPCC每七年对最新气候科学研究做一次汇编，得出一份《评估报告》，最近一期发表于2013至2014年。该报告曾警告称，如果经济活动继续以目前的速度排放二氧化碳，那么到2020年有一件事将成定局而不可逆转：最晚到2050年左右，全球气温将升高至少1.5°C。过去几年里，气候建模专家修改了对碳预算余额的估算，认为以目前的排放水平还可维持12年（虽然对此还存在争议），从而推迟了这一临界点的到来。

即使碳预算增加，将升温控制在1.5°C以内也需要付出惊人的努力。已有90个已发表的模型意在探求实现这一目标的最经济有效的方法。IPCC认为，其中只有九个能在本世纪令碳排放始终保持在临界值以下。其余都超过了临界值，因此需要从大气中清除二氧化碳以抵消超额排放。

这样的“负排放”也许可通过植树造林来实现，因为树木在生长过程中会吸收二氧化碳。种植速生草等“能源作物”来替代化石燃料（并将燃烧发电过程中产生的二氧化碳捕集并封存在地下）也是可行的。不过，无论哪种方法都意味着要把面积大约介于印度和加拿大之间的农业用地用于此类种植。还有一种方法是“直接空气捕集”，即利用人工装置直接从大气中回收二氧化碳。这类装置已经问世，但同样需要大规模部署。（还有存在争议的太阳能地球工程，就是将物质微粒散播到大气中，将热量反射回太空。但该想法还未经详细探讨。）

负排放或太阳能地球工程可能会快速缓解让经济脱碳的需要，但却不能从根本上免除这一需要。如图表所示，即使实现负排放，到2030年二氧化碳排放量仍需减少45%左右。要想实现这一目标，必须在十年略多一点的时间内逐步把煤炭用量减少三分之二。到本世纪中叶，几乎所有电力都必须来自无碳能源（目前这一比例为四分之一）；所有汽车都将使用电动机（目前比例为五百分之一），火车和大多数轮船也一样。

实现这一目标所需的技术有一些（太阳能板、核电站、电动汽车等）已经问世，但并非全部如此。要想让飞机继续飞行，要么需要研发新型航空生物燃料，要么得利用负排放来抵消飞机的排放。因为养牛会产生大量甲烷，人们必须改吃实验室里培养的汉堡，或者改变饮食习惯。即便确实有了合适的技术，仅靠市场力量也不能让技术足够快地得到完善和传播，从而对气候产生所需的影响。

上述任何一种途径模型若要实现，都会给各国经济带来翻天覆地的变化。此外还会耗费大量资金。但具体会耗费多少，IPCC不愿做出预测，并将此归咎于该领域内经济研究不足。但是，出于同样的原因，它也没有尝试去评估事情的另一面——拖延会造成的损害。

另一篇同样错过文献审阅截止期的论文试图填补耗资预测的空白。该论文由伦敦政治经济学院的西蒙·迪茨（Simon Dietz）与几位同事（其中一人参与了IPCC的报告）合著。尽管没有给出绝对数字，但论文估计，将升温控制在 1.5°C 会比控制在 2°C 的多花费150%。迪茨也像IPCC一样，没将这些花费与得以避免的损失作比较。但早前其他人的研究表明，相对于一个不再继续变暖的世界，到2100年，升温 1.5°C 会让全球人均GDP减少8%。相比之下，升温 2°C 会减少13%。

IPCC的鸿篇巨制让全球媒体为之恐慌，有时近乎抓狂。新闻简报、头版和评论专栏都慷慨激昂地敦促各政府团结一致，加大气候行动的力度——尤其是因为这些政府都批准了IPCC报告30页的摘要。其中包括美国政府，其总统特朗普计划退出《巴黎协定》。（特朗普一直质疑该摘要的合法

性。)

10月9日，即IPCC发布报告的翌日（重要的联合国气候峰会将于两个月后在波兰召开），欧盟28个成员国中有15个国家的环境部长敦促欧盟修改其现有的气候目标，以符合 1.5°C 的目标。此举固然可喜。但是，在一个距离现有目标都还相去甚远的世界，这将起到多大的作用值得怀疑。和其他很多领域一样，在气候变化这件事上，说空话很容易，行动才有说服力。 ■



Shipping

Shiver me timbers

Wind-powered ships are making a comeback at sea

AN OIL tanker that ferries nearly 110,000 tonnes of the black stuff between the Middle East and Europe does not sound like a green ship. But *Maersk Pelican* is unique among the world's biggest cargo ships in that it does not rely on fossil fuels alone for propulsion. On September 29th it arrived in Saudi Arabia on its first voyage since the installation of two 30-metre rotor sails.

Coal- and oil-powered cargo ships wiped out wind power in the 19th century. But interest in wind propulsion, and in rotor sails in particular, is growing as shipping lines seek ways to slash fuel bills. Placed on a ship's decks, these giant rotating cylinders propel it using the "Magnus effect", the force that causes a spinning ball to curve through the air.

The concept was demonstrated by Anton Flettner, a German engineer, in the 1920s, but rotor sails failed to catch on, partly because coal was a cheap alternative. The first ones he made were metal and so heavy that they slowed ships.

The rotor sails that Norsepower, a Finnish firm, has developed are made of carbon fibre and are far lighter, says Tuomas Riski, its chief executive. They are also automated, so no extra sailors are needed to operate them, unlike Flettner's version. As well as *Maersk Pelican*, Norsepower has already fitted them to several other ships, including *Estraden*, a ferry which operates between the Netherlands and Britain, and *Viking Grace*, which sails between Sweden and Finland.

The interest in the sails comes because they can slash fuel bills and

emissions, says Tommy Thomassen, chief technical officer of Maersk Tankers. The *Maersk Pelican*'s two rotor sails will cut its fuel bills by 7-10%, he forecasts; if it added two more that could rise to 15-20%. Such savings help with another priority for the shipping industry; complying with new climate-change targets. In April the International Maritime Organisation, a UN agency, agreed to cut by half the global shipping sector's carbon emissions from 2008 levels by 2050.

Sails can make serious contributions to that target. Most other technologies (such as adding bulbous bows) shave only a few percent off fuel bills. Electric batteries cannot store enough energy for long sea voyages.

Upfront costs remain a problem. Norsepower's rotor sails cost €1m-2m (\$1.15m-2.3m) to install; it takes five years on average to earn that back in lower fuel bills. Mr Riski hopes to slash that figure to three years by making the sails more cheaply in China. It would then become worthwhile for charterers, which only tend to lease ships for under three years, to install them.

Rotor sails are not the only ones about. Modern versions of the sort of sails fitted to conventional ships, as well as kites attached to the front of the vessel, have also been mooted as energy-saving solutions. But these are a health-and-safety risk to sailors in bad weather. Wind power may be back in fashion but no one needs to mount the rigging. ■



船运

大风来啦

风力推动的船只正卷浪重来

一艘在中东和欧洲之间运送近11万吨黑乎乎石油的油轮听起来和绿色环保全不沾边。但马士基鹈鹕号（Maersk Pelican）在世界最大型货船中与众不同，因为它的推进动力不单单靠化石燃料提供——它被安装上了两个30米高的转子帆。9月29日，它启动了完成这一改造后的首次航行，顺利抵达沙特阿拉伯。

燃煤和燃油的货船在19世纪完全取代了风力推进的货船。但如今，由于航运公司想方设法削减燃料花费，对风力推进特别是转子帆的兴趣在增长。这种安装在甲板上的巨大圆柱体转动着，通过“马格努斯效应”推动货船前进。“马格努斯效应”是使得旋转的球体在空中划出弧线的一种侧向力。

上世纪20年代，德国工程师安东·弗莱特纳（Anton Flettner）演示了这一概念，但转子帆未能得到广泛应用，部分原因是煤炭的成本更低。弗莱特纳制造的第一批转子帆由金属打造，非常笨重，拖慢了船只的速度。

芬兰公司Norsepower的首席执行官托马斯·里斯基（Tuomas Riski）表示，他的公司开发的转子帆由碳纤维制成，重量大幅减轻。而且它们还是自动化的，因此不像弗莱特纳的帆那样需要额外安排船员来操作。除马士基鹈鹕号之外，Norsepower还在其他几艘船上安装了它的转子帆，包括在荷兰和英国之间运营的货船Estraden号，以及在瑞典和芬兰之间航行的维京魅力号（Viking Grace）邮轮。

马士基油轮公司（Maersk Tankers）的首席技术官汤米·托马森（Tommy Thomassen）表示，转子帆之所以引发业界兴趣，是因为它能够大幅降低燃料费和碳排放。他预测，马士基鹈鹕号的两个转子帆将令这艘船的燃料费用削减7%至10%，如果再增加两个转子帆，数字可能会增加到15%至20%。这有助于航运业应对另一件头等大事——达到新的气候变化目标。

今年4月，联合国机构国际海事组织（International Maritime Organisation）同意到2050年将全球航运业的碳排放量削减至2008年的一半。

转子帆可以为实现该目标做出重要贡献。大多数其他技术（例如添加球状船首）只能将燃料成本削去小小几个百分点。电池无法为长途海航储存足够的能量。

不过前期成本仍然是个问题。Norsepower转子帆的安装费用为100至200万欧元（115至230万美元），平均需要五年时间才能通过降低燃料费收回成本。里斯基希望在中国以更低的成本制造转子帆，从而将这一时间大幅缩短至三年。只有那时，对于承租船只一般不到三年的租船人而言，安装转子帆才是划算的。

转子帆不是唯一的选择。安装在传统船舶上的那类船帆的现代版本以及系在船前部的风筝也被视为可能的节能方案，但它们在恶劣天气下可能会威胁到船员的健康和安全。风力航行可能会重新流行，但无人再需要安装和攀爬绳索。 ■



Human capital

A motivational metaphor

Two new rankings show which countries are raising the most productive humans

DESPITE their dour reputation, economists frequently play with metaphor and simile, just like literary folk. One familiar example is “human capital”, as Deirdre McCloskey of the University of Illinois has pointed out. Economists have been likening knowledge, skill and stamina to physical capital, such as plant and equipment, since Adam Smith, who counted “the acquired and useful abilities” of a country’s people as one of several kinds of fixed capital, alongside “useful machines” and “profitable buildings”.

But unlike poets, economists prefer to quantify their analogies—to measure whether thou art 15% or 20% more lovely and more temperate. In that spirit, the World Bank this month unveiled a new measure of human capital for 157 countries. Its index combines five indicators of health and education (including the chances of dying before the age of five and between the ages of 15 to 60, the chances of stunted growth, the years of education an average child will complete by age 18, and the score they can expect on school tests) to measure how much human capital a person born today is likely to accumulate. It follows a similar measure for 195 countries from the Institute for Health Metrics and Evaluation (IHME) published in the *Lancet*, a medical journal, in September.

Both indices try to reflect the quality of education, not just the quantity. A growing number of countries now take part in initiatives like PISA, the Programme for International Student Assessment, which in 2015 tested pupils in 72 countries. With a little effort, these various measures can be rendered comparable. That allows researchers to calculate what a year of schooling is worth in different parts of the world. For example, the World

Bank calculates that a year of education in South Africa is worth only about 60% as much as one in Singapore.

Unsurprisingly, the correlation between the two indices is close (see chart). America ranks 24th on the World Bank's new index, and 27th on the IHME's. China ranks 46th on the first and 44th on the latter. But there are also notable discrepancies. On the bank's index, Bangladesh does better than India, Vietnam better than Malaysia, and Britain better than France. None of that is true in the IHME's rankings.

Different countries also stand at the top of the two tables. Singapore leads the bank's ranking. But it lies 13th in the IHME index, which instead places Finland top. The divergence reflects two differences in approach. The World Bank's method ignores higher education (which is even more prevalent in Finland than in Singapore). And its measures of health (stunting and survival rates) are too crude to distinguish between Singapore's healthy population and Finland's even healthier one.

The indices are not just exercises in measurement. They are also motivational tools. The World Bank worries that governments underinvest in human capital, because the rewards arrive painfully slowly and often without fanfare. By ranking countries, these indices may appeal to governments' national pride and competitive spirit, much like the bank's annual assessments of the ease of doing business around the world.

The two indices are also intended to be responsive to reforms. Although investments in human capital can take decades to pay off, countries will not have to wait as long to rise up the two league tables. Both indices are designed to be forward-looking, measuring the human capital that will be accumulated if a newborn grows up in the health and educational conditions prevailing now. For example, France's decision to start

mandatory schooling at age three will improve its ranking when the first toddlers are enrolled, long before the economy feels the benefit.

The bank's index offers a further prod to reform. It uses research on the economic returns to health and education to weight the components of its index according to their contribution to productivity. If a country doubles its human-capital score it should, in the long run, double its GDP per person, compared with a scenario where its score stayed the same. That prospect should make a government's eyes widen.

Unfortunately the index is still hobbled by gaps in the data and in economists' understanding. The link between stunting and productivity, for example, remains murky. Only 65% of the world's births are registered, as are only 38% of deaths. Many countries test their schoolchildren infrequently, if at all. If pupils are not tested until the age of 15, then any reform that helps primary-schoolers learn will not improve the country's ranking until they grow old enough to ace the tests.

The World Bank has itself flagged these data shortcomings. It hopes the very existence of its index will motivate governments to collect the data the index needs if it is to work properly. To adapt another metaphor favoured by Ms McCloskey, the World Bank has built a sleek sports car; now it must shame governments into building roads that are worthy of it. ■



人力资本

励志的隐喻

两项新排名显示哪些国家会培养出最具生产力的国民

尽管经济学家出了名地不苟言笑，他们却和文人雅士一样爱用比喻。伊利诺伊大学的迪尔德丽·麦克洛斯基（Deirdre McCloskey）曾指出，一个熟悉的例子是“人力资本”。亚当·斯密将一国民众“习得的有用能力”也算在几种固定资本之内，和“有用的机器”、“可盈利的建筑”放在了一道。自他之后，经济学家一直都将知识、技能以及精力比作像工厂和设备那样的有形资本。

但和诗人不同的是，经济学家更喜欢把自己的类比量化——弄清楚“你比夏日更可爱温和”【译注：此句出自莎士比亚十四行诗】的程度是15%还是20%？本着这样的精神，世界银行本月公布了一项新的人力资本衡量排名，涵盖157个国家。其指数综合了五项健康和教育指标，来衡量如今出生的人可能会积累起多大的人力资本。它们包括：在5岁前死亡的概率、在15岁到60岁之间死亡的概率、发育迟缓的概率、普通孩子到18岁之前接受教育的年限，以及他们在学校测试中有望获得的分数。在这之前，健康指标和评估研究所（IHME）9月在医学杂志《柳叶刀》（Lancet）上发表了一个类似的排名，涵盖195个国家。

两个指数都试图反映教育的质量，而不仅仅是数量。如今有越来越多的国家参与国际学生评估项目（PISA）之类的项目，2015年有72个国家的学生接受了PISA测试。稍稍费些功夫就能在各种衡量标准中找出可比性，研究人员也就得以估算出一年的学校教育在世界不同的地方成效分别几何。例如，世行计算得出，在南非接受一年教育的效果大约只相当于在新加坡接受一年教育成效的60%。

毫不意外，两个指数之间存在紧密的相关性（见图表）。美国在世行的指数中排名第24，在IHME的指数中排在第27。中国的排名分别为第46和

44。但两者间也有显著的差异。在世行的指数中，孟加拉的名次优于印度，越南优于马来西亚，英国优于法国。而在IHME的指数中不是这样。

在两项排名中居首的国家也不相同。新加坡在世行的排名中位列第一，但在IHME的指数中排名第13，第一是芬兰。这种差异源于两个指数在衡量方式上的两点不同。世行忽略高等教育（芬兰的高等教育普及率比新加坡还要高），而且它对健康状况的衡量（发育迟缓率和存活率）太过粗糙，无法在健康的新加坡人口和甚至还要更健康的芬兰人口之间做出区分。

编制这两个指数不仅仅是为了做评估。它们还是种激励手段。世界银行担心各国政府对人力资本投资不足，因为这种投资收获回报的过程极其缓慢，通常也得不到大张旗鼓的宣传。通过为各国排定座次，这样的指数也许会唤起各国政府的民族自豪感和竞争意识，差不多就像世行每年对世界各国营商便利度的评估一样。

两个指数也积极将各国实施的改革考虑在内。虽然投资人力资本的成果可能要几十年才能显现，但各国并不是也得等个几十年才能在两个排名中提高名次。两个指数本身就都具前瞻性，估测的是一个新生儿若在当下普遍的健康及教育条件下成长起来，会积累多少人力资本。例如，法国决定将接受义务教育的年龄提早至三岁，等到第一个幼儿登记入学，法国的排名就会上升，大大早于该决定显现经济效益的时候。

世行的指数还会进一步促使各国实施改革。该指数利用健康和教育的经济效益方面的研究，根据各项指标对生产率的贡献来给它们加权。如果一个国家的人力资本分数翻了一倍，从长远来看，与这一分数毫无变化的情形相比，该国的人均GDP会多一倍。这样的前景应该会让各国政府大感震撼。

遗憾的是，世行的指数仍受限于数据不足以及经济学家理解上的欠缺。例如，发育迟缓和生产率之间存在怎样的关联仍旧很难说清。全世界只有65%的出生人口办理了登记，登记在册的死亡则只有38%。许多国家即使会对学生展开测验，也并不经常举行。如果一国的学生直到15岁才接受测

试，那么在这些孩子长到足够的年龄、在测试中取得了好成绩之前，任何帮助小学生学习的改革都不会提升该国的排名。

世行本身已提示数据存在缺陷。它希望这个指数的存在会激励各国政府去收集让指数正确发挥作用所需的数据。化用下麦克洛斯基喜欢的另一个比方，可以说世行造出了一辆拉风的跑车，现在它得激起各国政府的羞愧感，好让它们去修配得上这辆车的路。 ■



Oil markets

Beyond boom and bust?

America has become a shale superpower. But it still faces constraints

The history of America's shale industry is brief and dramatic. In just a decade the country has seen the spread of innovative techniques to extract oil and gas locked inside shale rock; the lifting of a decades-long ban on crude exports; a price crash that seemed to decimate the industry—and now a price recovery. Next year the shale boom will account for the biggest surge in one country's oil output since the International Energy Agency began keeping track. America is now the world's top oil producer, surpassing Saudi Arabia and Russia.

America's strides are all the more striking because they coincide with wobbles elsewhere. Output from many giant petro-states looks shaky at best. Exports from Iran are plummeting and due to sink further when American sanctions take effect next month. Venezuela's production is in freefall. Supplies are vulnerable in Libya and Iraq. Even before the fallout over the disappearance of Jamal Khashoggi, a journalist last seen entering the Saudi Arabian consulate in Istanbul raised questions about the kingdom (see Middle East and Africa section), many analysts doubted its ability to boost production quickly. Saudi oil exports are already near their peak of the past five years.

The upshot is that the world increasingly relies on American shale. In June America produced 13% of global crude oil, nearly twice the proportion of June 2008; that share will probably rise. This shift is extraordinary, to be sure, but the power it hands to America can also be exaggerated. "The United States is the dominant energy player," Larry Kudlow, Mr Trump's economic adviser, boasted last week, able "to cover any shortfalls". In fact, shale is also

bumping against its limits.

In the short term, these limits include bottlenecks in the pipeline infrastructure needed to get oil to market. Companies in the Permian Basin, which spans west Texas and south-eastern New Mexico, are producing more oil than they can pipe out (see Business section). New pipelines due late next year should help.

Other problems are harder to resolve. Extracting oil from shale has become more efficient since 2014: the median break-even price for producing a barrel is \$46. But costs are rising. Executives complain about a long-term labour shortage. Productivity gains in some regions are slowing as wells are drilled closer together. To blast more oil out of rock, companies are now using eye-popping amounts of water and sand. For a single well, hydraulic fracturing (fracking) can involve a total of nearly 65m litres of water, the volume of 25 Olympic swimming pools. That creates logistical and environmental demands. Pumping water back into shale formations is cheaper than carting it away, but that can cause small earthquakes. Colorado is considering new limits on fracking. Other states may decide to follow suit.

International oil companies have the size and logistical expertise to cope with some of these problems. Even as many of them cut spending on complex, long-term projects, they are putting more money into shale. Costs are more predictable and the timeline far shorter than for a giant project offshore. Chevron, BP and ExxonMobil all own large swathes of America's most productive basins. Their entry makes further consolidation likely, as shale specialists seek the benefits of scale. Those specialists that remain are beholden to investors, not to politicians bent on pursuing energy dominance. And their investors increasingly demand that shale firms earn a profit, rather than merely grow. As the industry matures and costs rise, in other words, recent leaps in output will probably become more modest.

For the first time American shale companies will this year earn more from operations than they spend on new projects and dividends, reckons Morgan Stanley, a bank.

About a decade after American shale firms began to surge, their most fervent backers can rightly claim that innovation has given the world a vast new source of oil and gas. Shale producers can indeed ramp up output relatively quickly. But America is hardly energy-independent. Last year the country imported more than 10m barrels of petroleum each day, equal to about half of its consumption. And the ability of the shale industry to dampen oil-price shocks is easily overstated. The Dallas Federal Reserve recently warned of a “growing likelihood” that the shale industry will be unable to keep up with rising demand, leaving the world vulnerable to geopolitical events that cause prices to spike. Being a shale superpower is useful, but it does not mean that America can control the market. ■



石油市场

摆脱周期？

美国已成为页岩油超级强国，但仍面临局限

美国页岩油行业发展的历史短暂而富戏剧性。短短十年间，这个国家成功推广了用于开采储存在页岩中的石油和天然气的创新科技，解除了实施数十年的原油出口禁令，经历了似乎会导致行业崩溃的油价暴跌，现在又迎来了油价回升。明年，页岩热潮将令美国录得自国际能源署有记录以来一国石油产量的最大增幅。美国目前已超越沙特阿拉伯和俄罗斯，成为全球最大的石油生产国。

由于此时其他地区步履蹒跚，美国的这番阔步挺进就更加惹眼。许多产油大国的产量顶多也是“风雨飘摇”。伊朗的石油出口正急剧下跌，等到下个月美国的制裁措施生效后还会进一步下滑。委内瑞拉的石油产量直线下降。利比亚和伊拉克供应不稳。近日沙特记者贾马尔·哈苏吉（Jamal Khashoggi）被目击进入沙特驻伊斯坦布尔领事馆后下落不明，事件引发外界对沙特的质疑。但在此之前，许多分析师就已经怀疑该国是否能快速提升石油产量。沙特当前的石油出口量已接近过去五年的峰值。

结果是世界越来越依赖美国的页岩油。6月，美国的产油量占全球原油产量的13%，几乎是2008年6月时占比的两倍。这一比例可能还会上升。这种变化无疑非比寻常，但美国由此获得的影响力也可能被夸大。特朗普的经济顾问拉里·库德洛（Larry Kudlow）上周吹嘘“美国是能源霸主”，能“填补任何能源缺口”。而实际上，页岩油开采也面临局限。

短期来看，把石油输往市场所需的管道基础设施存在瓶颈，这是局限之一。位于二叠纪盆地（跨越德克萨斯州西部和新墨西哥州东南部）的企业产油量已超出外运能力。将于明年年底建成的新管道应该会有帮助。

其他问题更难解决。自2014年以来，从页岩中采油的效率已经提升，目前每桶石油的保本价格中位数为46美元。但成本正在上升。油企高管们抱怨

劳动力长期短缺。随着钻井愈加密集，一些地区的生产率增速正在放缓。为了从岩石中钻采更多石油，油企现在的用水和用沙量都很惊人。用水力压裂法从一口钻井里开采石油可能要用到近6500万升水，相当于25个奥运标准游泳池的注水量。这对后勤运输和自然环境都造成了压力。把水泵回页岩层比将其运走成本低，但这可能会导致小型地震。科罗拉多州正考虑对压裂采油实施新限制。其他州可能会效仿。

国际石油公司拥有足够的规模和专业物流能力来应对其中一些问题。很多公司都削减了在复杂的长期项目上的开支，与此同时投入更多资金开采页岩油。页岩油的成本更可预测，投资周期也远短于大型海上采油项目。雪佛龙、英国石油公司和埃克森美孚都在美国拥有大量最高产的开采盆地。随着页岩油开采专业户们寻求规模效益，这些大企业的加入可能会引起业内进一步整合。留下的专业户唯投资者马首是瞻，而非那些一心想要追求能源霸主地位的政客。而投资者愈发要求页岩油企业盈利，而不仅仅是扩张。换言之，随着行业日渐成熟及成本上升，近期的产量飙升可能会变得相对缓和。据摩根士丹利估计，美国页岩油企业今年的业务收入将首次高于在新项目和股息上的支出。

在美国页岩油企业崛起约十年后，其狂热支持者无疑可以高呼，这一创新为世界找到了石油和天然气的庞大新源泉。页岩油生产商确实可以相对快速地提高产量。但美国根本还谈不上能源自足。去年，美国每天进口超过1000万桶石油，约为消费量的一半。页岩行业缓冲油价冲击的能力也很容易被夸大。达拉斯联储最近警告称，页岩行业“愈发可能”无法跟上需求增长，令全球容易受到引发油价飙升的地缘政治事件牵累。成为页岩油超级大国确实有用，但并不意味着美国可以控制石油市场。■



Buttonwood

A private function

American startups are less inclined to list on the stock exchange because they no longer need to

WHATEVER your view of the recent antics of Elon Musk, one thing seems clear. He rather regrets that Tesla, the electric-car maker of which he is boss, ever became a public company. To recap: in August Mr Musk announced that he had secured the funding to take Tesla private. The gyrating stock price is a distraction to staff, he explained. The obligation to report earnings each quarter fosters short-term fixes that may hurt the firm's long-term health. And being listed makes Tesla prey to short-sellers.

Tesla's share price rallied. The shorts lost money. It then emerged that the money to buy out shareholders was not quite as secure as Mr Musk may have suggested. Before long, the board confirmed that the firm would not be taken private. Its shares sank back. The company is now under investigation for possible securities fraud.

Whatever these larger consequences, Mr Musk achieved a minor feat. He has drawn fresh attention to some familiar grumbles about public markets. The number of listed firms in America is in long-term decline (see chart). Mr Musk's beefs seem specific, but they are part of a general explanation for this trend. The red tape, the endless disclosures, the ceaseless spotlight—all have made the cost of being a public company too high. Yet that is not the real cause. The main reason why startups do not become public firms is that many of them no longer need to.

In part, this reflects changes to the supply side of capital markets. In the 1990s specialist venture-capital firms were almost the only option for

startups seeking money to finance their expansion. Nowadays there are large pools of private money that can be tapped. “There is a level of pre-IPO capital that did not exist before,” says Philip Drury, head of capital markets in Europe at Citigroup. Private-equity firms are sitting on piles of cash. Sovereign-wealth funds are willing to tie up capital in new, unlisted ventures. So are hedge funds, family offices and even pension funds.

This shift can be traced back to a piece of deregulation. The National Securities Markets Improvement Act of 1996 made it easier to set up large pools of private investors. A study by Michael Ewens and Joan Farre-Mensa, two academics, finds that the supply of “late-stage” capital (ie, to startups four or more years past their first funding round) accelerated soon after. In the 1990s most young firms seeking \$150m or more had to raise it by an initial public offering. Now such sums are raised privately.

The demand side of capital markets has also changed. In the heyday of public markets, the typical listed firm would be capital-intensive—a railway, say, or a large manufacturer or a chain store. Such enterprises needed pots of capital to pay for land, buildings, plant and equipment. Even the very rich could not fund enterprises on this scale. The ventures were either too large or too risky.

These days the value of new firms is in ideas more than fixed assets. New ventures, notably technology firms, need far less capital to start and to grow than they once did. The building blocks for websites or smartphone apps are available free as open-source code. Computing power and digital storage can be leased. And a mini service industry has emerged to help startups refine and market their business ideas. It is also far cheaper to expand a business based on an idea than one that is based on physical capacity. Software can be copied at almost zero cost. That is not true of factories or warehouses.

Startups need less capital and have more options for raising it as they

mature. Increasingly they choose private money. That is not only because it is more readily available. It is also because private capital is more suited to ideas-rich firms, say Craig Doidge, Kathleen Kahle, Andrew Karolyi and René Stulz in another recent paper. Listed firms are obliged to make public how they are using their capital. That is fine for a firm with lots of fixed assets. Spending on, say, a new plant may lift the firm's value. But when an ideas-led firm reveals plans for its spending, it gives away details of its business plan to rivals. It would be better off seeking funds from a select group of private investors.

There is still a place for IPOs. Lots of asset-heavy firms still need pots of capital. More of those firms are found outside America, where the number of listed firms is still rising. But for most technology firms, an IPO is a way for founders to cash in their chips or to create shares to use as a currency for acquiring other firms. Bargaining-power is shifting. Suppliers of capital once had the whip hand. Now it is users of capital. Mr Musk, a finance whizz, looks on with envy. ■



梧桐

私人盛宴

美国创业公司不再热衷在证券交易所上市，因为它们不再需要这样做

不管你如何看待伊隆·马斯克近期的荒唐之举，有一件事看来很明确。他很后悔让他的电动车公司特斯拉上市。先简单回顾一下事件经过：8月，马斯克宣布他已经争取到将特斯拉私有化的资金。他解释称，波动的股价让员工心烦意乱。每季度必须公布收益的做法也催生出一些可能有损公司长期发展的短期应对措施。上市还让特斯拉成了卖空者的猎物。

特斯拉的股价应声而涨。做空特斯拉的人赔了钱。随后有消息称，买断股东股权的资金并不像马斯克先前说的那么稳妥。不久后，董事会确认特斯拉不会被私有化。股价随即回落。特斯拉目前正因涉嫌证券欺诈接受调查。

不管导致了怎样的严重后果，马斯克取得了一个小小战果：让人们重新注意到那些关于公开市场的常见的牢骚。美国上市公司的数量呈长期下降趋势（见图表）。马斯克的抱怨看似系他独有，实则是在重提对这种趋势的一般解读。繁文缛节的羁绊、没完没了的披露、无休无止的关注——所有这些都造成企业的上市成本过高。然而，这并不是真正的原因。创业公司不上市的主要原因是它们当中有许多已不再需要上市。

这在一定程度上反映了资本市场供应方的变化。上世纪90年代，对那些为自身扩张寻求资金的创业公司来说，专门的风险投资公司几乎是它们唯一的选择。而如今有大量私人资金可供利用。花旗集团（Citigroup）欧洲资本市场主管菲利普·德鲁里（Philip Drury）表示，“上市前融资达到了一个前所未有的规模。”私募股权公司坐拥大量现金。主权财富基金愿意将资金绑定在未上市的新创建企业上。对冲基金、家族理财机构，甚至养老基金也是如此。

这种转变可追溯至一项放松监管的规定。随着《1996年全美证券市场促进法》（National Securities Markets Improvement Act of 1996）的出台，私人投资者大军更容易形成。根据迈克尔·尤恩斯（Michael Ewens）和琼·法尔-门萨（Joan Farre-Mensa）这两位学者的研究，“后期”融资（即创业公司在第一轮融资后的四年或更长时间里的融资）在不久后也加速了。上世纪90年代，寻求1.5亿美元或更多资金的年轻公司大多需要通过IPO来实现。现在这种规模的融资则是通过私募完成。

资本市场的需求方也发生了变化。在公开市场的鼎盛期，上市公司通常会是铁路公司、大型制造商或连锁店等资本密集型企业。这类企业需要巨额资金来购置土地、建筑物、厂房和设备。即使巨富们也撑不起如此大规模的企业。这些项目要么规模太大，要么风险太高。

如今，新兴公司的价值更多体现在创意而非固定资产上。以科技公司为代表的新创企业需要的启动和发展资金远远少于以往。它们构建网站或智能手机应用所需的要素是可以免费获得的开源代码。计算能力和数字化存储可以租用。此外，帮助创业公司改进和推销商业创意的微型服务业也已兴起。比起基于实体产能的企业，基于创意的企业扩张所需的资金也少得多。复制软件的成本几乎为零。但盖工厂或仓库就不是这么回事了。

随着创业公司发展成熟，它们需要的资金更少了，融资的渠道却更多了。它们越来越多地选择私人资本。这是因为私人资本不仅更易获得，而且更适合富于创意的公司，克雷格·多伊奇（Craig Doidge）、卡特勒恩·卡勒（Kathleen Kahle）、安德鲁·科马内奇（Andrew Karolyi）和勒内·斯图尔兹（René Stulz）在近期发表的另一篇合著论文中指出。上市公司必须公布它们的资金使用情况。这对拥有大量固定资产的公司来说还好。比如说，投资新工厂可能会提升公司的估值。但是，当一家创意主导型公司公布其支出计划时，就把自己的商业计划细节泄露给了对手。从一批精选的私人投资者那里寻求资金会更好。

IPO仍有其用武之地。许多重资产公司仍然需要巨额资金。这类公司多在美国以外，那里的上市公司数量仍在增加。但对大多数科技公司来说，

IPO是创始人变现或发行新股来收购其他公司的手段。议价主动权正在转移。曾经大权在握的资金提供者现在让位给了资金使用者。马斯克这位金融高手只有羡慕旁观的份了。 ■



Buttonwood

The long and short of it

When the case for long-term investment makes sense—and when it doesn't

ONE LUNCHTIME around 1960 a professor proposed a wager to a colleague. Flip a coin and call "heads" or "tails". If you call right, you win \$200. If you call wrong, you pay \$100. This is a favourable bet for anyone who would take it. Even so, his colleague refused. He would feel the loss of \$100 more than the gain of \$200. But he would be happy, he said, to take 100 such bets.

The professor who offered the bet, Paul Samuelson, understood why it might be refused. A person's capacity for risk could no more be changed than his nose, he once said. But he was irked by his colleague's willingness to take 100 such wagers. Yes, the likelihood of losing money after that many tosses of the coin is vanishingly small. But someone who takes very many bets is also exposed to a small chance of far bigger loss. A lot of bets, reasoned Samuelson, were no safer than a single bet.

This lunchtime wager was of more than academic interest. It drew the battle lines in a debate on the merits of long-termism. Samuelson challenged the conventional wisdom that his colleague embodied. In later work, he used the bet as a parable. He showed that, under certain conditions, investors should keep the same fraction of their portfolios in risky stocks whether they are investing for one month or a hundred months. But what Samuelson's logic assumed does not always hold. There are cases where a long-term horizon works in investors' favour.

To understand the debate, start with the law of large numbers. It means that the more often a favourable gamble is repeated, the more likely it is that the person who takes it comes out ahead. Though a casino may lose on a

single spin of the roulette wheel, over a large number of spins its profits are determined by the slight advantage in odds (the “house edge”) it enjoys. But a casino that would take a hundred \$100 bets would not refuse a single bet of the same size. That was part of Samuelson’s beef. If his colleague dislikes a single bet, after 99 bets he should refuse the 100th. By this logic he should also refuse the 99th bet, after 98 bets. And so on until all bets are spurned.

Only a naive reading of the law of large numbers would support a belief that risk is diminished by more bets, said Samuelson. The scale of potential losses rises with the number of bets. “If it hurts much to lose \$100,” he wrote, “it must certainly hurt to lose $100 \times \$100$.” Similarly, it is foolish to believe that by holding stocks for the long haul—taking multiple bets on them—you are sure to come out ahead. It is true that stocks have usually yielded higher returns than bonds or cash over a long period. But there is no guarantee they will always do so. Indeed if stock prices follow a “random walk” (ie, an erratic and unpredictable path), long-term investing holds no advantage, said Samuelson.

This logic begins to fray if you relax the random-walk assumption. Stock prices appear to fluctuate around a discernible trend; they have a tendency, albeit weak, to revert to that trend over very long horizons. That means stocks are somewhat predictable. If they go up a long way, given enough time they are likely to fall, and vice versa. In that case, more nervous sorts of investors are able to bear a higher exposure to stocks in the long run than they would be able to in the short run.

Samuelson’s reasoning also assumes that people’s taste for risk does not vary with how rich or poor they are. In reality, attitudes change when a target level of wealth is within reach (say, to pay for retirement or a child’s education) or when outright poverty looms. When such extremes are far off, it is rational to take on more risk than when they are close. The calculus also changes with a broader reckoning of wealth. Young people, with decades

of work ahead, hold most of their wealth in “human capital”, their skills and abilities. This sort of wealth is a hedge against riskier kinds of financial wealth. Indeed the more stable a person’s career earnings are, the greater the hedge. It follows that young people should hold more of their wealth in risky stocks than people who are close to retirement.

Samuelson vigorously disputed the dogma of long-termism, which says that the riskiness of stocks diminishes as time passes. It doesn’t. That is why long-dated options to insure against falling stocks are dearer than short-dated ones. The odds of winning favour risk-takers over time. But they are exposed to big losses in the times when they lose. Still, it would also be dogmatic to say that time horizon does not matter. It does—in some circumstances. What Samuelson showed is that it matters less than commonly thought. ■



梧桐

说长道短

何时该做长期投资，何时不该

一九六零年前后，一位教授在一次午餐上提议他的同事赌一把，抛硬币来“猜正反”。猜对了赢200美元，猜错了输100美元。对于任何想玩一把的人来说，这都是个有利的赌局。但他的同事还是拒绝了。比起赢200美元，他更在乎可能输掉100美元。但他说，如果像这样连赌一百次，他倒是乐意一试。

提议打赌的教授保罗·萨缪尔森（Paul Samuelson）明白为什么有人会拒绝。他曾说过，一个人的风险承受能力就像他的鼻子一样不容易改变。但他的同事愿意赌上一百次，这让他恼火。是的，在这场赌局中，硬币抛上一百次后，赔钱的可能性就微乎其微了。但如果一个人赌了很多次，他也有小小的可能遭受比只赌一次大得多的损失。萨缪尔森认为，赌上许多次并不比赌一次更安全。

这场午餐赌局不仅仅是出于学术上的兴趣。它还在关于长期主义的优点的辩论中区分了战斗立场。萨缪尔森质疑了他的同事所代表的传统观点。在后来的研究中，他用这个赌局来打比方。他指出，在某些情况下，无论是投资一个月还是一百个月，投资者都应让较高风险的股票在自己投资组合中所占的比例保持不变。但萨缪尔森的逻辑所假设的情况并不总是成立。在有些情况下，长期投资对投资者有利。

要理解这场辩论，要先从大数定律说起。根据这一定律，有利赌局重复的次数越多，下注者越有可能获利。赌场虽然可能会在轮盘赌的某一轮中输钱，但它在赔率上的微弱优势（庄家优势）决定了它能在很多轮后获利。不过，赌场要是愿意对100美元的赌局赌上一百次，那么它也不会绝对对同样大的赌注只赌一局。萨缪尔森的牢骚有一部分正源自于此。如果他的同事不喜欢可能会输掉100块的单次赌局，那么在赌第99次之后他应该拒

绝第100次。按照这种逻辑，赌了98次后，他也应该拒绝第99次。以此类推，他应该一次也不赌。

萨缪尔森表示，只有对大数定律的幼稚解读才会支持这样一种观点：赌的次数越多风险越低。随着投注次数的增加，潜在损失的规模也在扩大。他写道：“如果损失100美元让你很痛苦，那么损失100美元一百次当然也让你痛苦。”同样地，认为长期持有股票——也就是多次押注于股票——肯定会赚钱的想法是愚蠢的。的确，股票在一段长时间内的回报率通常高于债券或现金。但无法保证股票始终如此。实际上，萨缪尔森说，如果股价是“随机游动”的（即不稳定且无法预测的波动），长期投资就没有任何优势。

如果“随机游动”的假设不是那么牢靠，这个逻辑就会出问题。股票的价格波动似乎是围绕着可见的趋势进行。尽管很弱，但从很长的一段时间来看，它们有回归这一趋势的倾向。这意味着股票多少可以预测。如果它们上涨了很多，只要时间够长，它们就很可能要回落，反之亦然。在这种情况下，那些更紧张的投资者在长期能够承受比短期更大的股票风险。

萨缪尔森的推理还假定，人们对风险的偏好不会因他们的贫富状况而改变。在现实中，当目标财富水平近在咫尺（比如，为退休做好准备或为孩子的教育买单）或当赤贫隐约可见时，人们的态度就会改变。当这些极端情况离得还很远时，比在它们接近时承担更多风险是合理的。而如果把“财富”的界定扩大，计算方式也会变。年轻人还要工作几十年，他们的大部分财富集中在技能和能力这样的“人力资本”上。这种财富是对更高风险的金融财富的对冲。实际上，一个人的工作收入越稳定，所能对冲的风险就越多。因此，年轻人应该比那些快退休的人持有更多高风险股票。

萨缪尔森大力反驳了长期主义的教条。长期主义认为，随着时间的推移，股票的风险会降低。并非如此。这就是为什么对冲股票下跌的长期期权比短期期权更贵。长期持有股票的冒险者获利的几率更高，但当他们亏钱时要承担巨大的损失。不过，说投资期限无关紧要同样失之武断——在某些情况下它确实重要。萨缪尔森告诉我们的是，它并不像人们通常以为的那

么重要。 ■



A modern space race

The next generation

Private businesses and rising powers are replacing the cold-war duopoly

Some 4,500 satellites circle Earth, providing communications services and navigational tools, monitoring weather, observing the universe, spying and doing more besides. Getting them there was once the business of the superpowers' armed forces and space agencies. Now it is mostly done by companies and the governments of developing countries.

During the early years of the space race reaching orbit was hard. Between 1957 and 1962, 32% of American launches and 30% of Soviet ones failed. Accidents still happen: on October 11th a Russian rocket aborted its ascent shortly after launch (both crew members landed unharmed). Only states could assume such risks—and even if American firms had wanted to bear them, its government would not let them on national-security grounds. Companies eager to send objects into space, including telecoms firms, had to hitch a ride with NASA.

This changed when European countries started building launchers through a mostly state-owned company called Arianespace, which touted for custom among satellite-makers around the world. When the space shuttle *Challenger* exploded in 1986, NASA got out of the satellite-launching business. It and, later, the Pentagon became new customers for private launch firms, alongside the satellite operators.

In the past decade the West's space-launch market has become more competitive thanks to an innovative new entrant, SpaceX. But state-run programmes still lead the way in emerging markets. In 2003 China became the third country to put a person into orbit; India plans to follow suit in

2022. Both sell launch services to private clients. China did legalise private space flight in 2014, but no companies based there have yet reached orbit on their own.

Like their cold-war predecessors, these Asian titans have strategic goals as well as a thirst for publicity. They need independent access to space for communication, intelligence and navigation. However commercialised space gets, the competition will never be solely economic. ■



现代太空竞赛

长江后浪推前浪

私人企业和新兴大国正在取代冷战时期的两大霸主

大约有4500颗卫星环绕地球，提供通信和导航服务、监测天气、观测宇宙、开展侦察和其他很多活动。将卫星发射至太空曾经是超级大国的军队和航天机构的专利。现在这项工作主要由私人公司和发展中国家的政府来承担。

在太空竞赛的早期，进入轨道并非易事。1957年至1962年间，美国和苏联的发射失败率分别为32%和30%。至今仍会发生事故：本月11日，一枚俄罗斯火箭发射后不久便发生故障（两名宇航员安全返回地面）。过去，只有国家才能担当这样的风险——即使美国公司愿意，美国政府出于国家安全的考虑也不会让它们担此风险。电信公司等迫切想将卫星送至太空的企业不得不搭美国国家航空航天局（以下简称NASA）的便车。

当欧洲各国开始通过一家名为阿丽亚娜空间（Arianespace）的国有控股公司制造发射装置时，情况发生了变化。该公司在世界各地的卫星制造商中招徕客户。1986年“挑战者号”航天飞机爆炸，NASA就此退出了卫星发射业务，之后和卫星运营商们一道，成为私营发射公司的新客户。五角大楼后来也加入其中。

过去十年里，因为勇于创新的后来者SpaceX的入局，西方太空发射市场的竞争变得更加激烈。但在新兴市场，国营项目仍占据主导地位。2003年，中国成为第三个实现载人航天的国家。印度计划在2022年实现这一目标。中印两国都向私人客户提供发射服务。中国虽然于2014年就立法准许私人航天活动，但迄今为止还没有一家中国公司凭一己之力进入轨道。

与冷战时期的前辈们一样，这两个亚洲大国既渴望吸引世人的眼球，也有自己的战略目标。它们需要能独立进入太空来从事通信、情报和导航等活

动。无论太空变得多么商业化，竞争永远不会仅仅局限于经济层面。■



Storing computer data in DNA

Virtuous spirals

Nature's data-preservation medium may soon have a new use

DNA is the oldest information-storage system known. It predates every other, from pencil and paper to computer hard drives, by billions of years. But attempts to employ it to store data generated by people, as opposed to data needed to bring those people (and every other living thing) into being in the first place, have failed.

The reason is not so much technological difficulty as cost. Encoding a single gigabyte in DNA would run up a bill of several million dollars. Doing so on a hard drive costs less than a cent. Catalog, a biotechnology firm in Boston, hopes to bring the cost of DNA data-storage below \$10 per gigabyte. That is still on the pricey side. But for really large storage requirements a second ratio also comes into play: gigabytes stored per cubic metre.

Hard drives take up space. Their storage ratio is about 30m gigabytes per cubic metre. Catalog's method can store 600bn gigabytes in the same volume. For organisations such as film studios and particle-physics laboratories, which need to archive humongous amounts of information indefinitely, the ratio of the two ratios, as it were, may soon favour DNA.

The obvious temptation when designing a DNA-based storage system is to see the ones and zeros of binary data and the chemical base pairs (AT and GC) of deoxyribose nucleic acid as equivalent, and simply to translate the one into the other, with each file to be stored corresponding to a single, large DNA molecule. Unfortunately, this yields molecules that are hard for sequencing machines to read when the time comes to look at what data the DNA is encoding. In particular, there are places in computer data that

consist of long strings of either ones or zeros. DNA sequencers have difficulty when faced with similarly monotonous strings of base pairs.

Catalog has taken a different tack. The firm's system is based on 100 different DNA molecules, each ten base pairs long. The order of these bases does not, however, encode the binary data directly. Instead, the company pastes these short DNA molecules together into longer ones. Crucially, the enzyme system it uses to do this is able to assemble short molecules into long ones in whatever order is desired. The order of the short molecular units within a longer molecule encodes, according to a rule book devised by the company, the data to be stored. Starting with 100 types of short molecule means trillions of combinations are possible within a longer one. That enables the long molecules to contain huge amounts of information.

The cost savings of Catalog's method come from the limited number of molecules it starts with. Making new DNA molecules one base pair at a time is expensive, but making copies of existing ones is cheap, as is joining such molecules together. The Catalog approach also means it is harder for data to be misread. Even if a sequencing machine gets a base or two wrong, it is usually possible to guess the identity of the ten-base-pair unit in question, thus preserving the data.

Catalog's combinatorial approach does mean that more DNA is needed per byte stored than other DNA-based methods require. This increases both the time and the cost of reading it to recover the stored data in electronic form for processing. Overall, though, the method promises to have significant advantages over its predecessors.

The next task is to translate that promise into reality. To this end, Catalog is working with Cambridge Consultants, a British technology-development firm, to make a prototype capable of writing about 125 gigabytes of data to DNA every day. If this machine works as hoped (it is supposed to be

ready next year), the company intends to produce a more powerful device, able to write 1,000 times faster, within three years. The second age of DNA information storage may then, at last, begin. ■



在DNA中存储计算机数据

正向螺旋

自然界的[数据存储介质](#)可能很快就有新用途

DNA是已知最早的信息存储系统。它比纸笔、计算机硬盘等其他任何存储系统的历史都要早数十亿年。但是，尽管DNA存储了人类（以及其他所有生物）得以存在所需的数据，想用它来存储人产生的数据却一直未能成功。

个中原因与其说是技术问题，不如说是成本太高。在DNA中编码1GB的数据将耗资数百万美元，而储存到硬盘上的花费还不到一美分。位于波士顿的生物技术公司Catalog希望将DNA数据存储的成本降至每GB不到10美元。这个价格仍然很高，但如果有非常庞大的存储需求，每立方米空间能存储多少数据也是要考量的因素。

硬盘很占空间。其存储密度约为每立方米3000万GB。而采用Catalog的方法，一立方米可以存储6000亿GB。对于一些需要无限期保存海量信息的机构，比如电影公司和粒子物理实验室，在综合考虑价格和存储密度这两个因素之后，天平可能很快会向DNA倾斜。

在设计基于DNA的存储系统时，人们显然很愿意将二进制数据的1和0与脱氧核糖核酸的化学碱基对（AT和GC）对应起来，然后只需在两者间进行转换，这样每个要存储的文件就对应一个DNA大分子。遗憾的是，等到查看DNA所编码的数据时，如此产生的分子难以被测序仪读取。特别是有些计算机数据中会有长串的1或长串的0，DNA测序仪如果碰到同样单调的长碱基对就会有麻烦。

Catalog另辟蹊径。该公司的系统基于100种不同的DNA分子，每个分子的长度为10个碱基对。然而，这些碱基的排列顺序并不直接用来编码二进制数据。Catalog的做法是将这些短链DNA分子连接成较长的分子。关键的一点是，此过程中使用的酶系统能够将短链分子按任意需要的序列组合成

长链分子。根据Catalog编写的操作手册，长链分子内的短链分子单元的序列编码了要存储的数据。使用100种短链分子可以在长链分子中形成数万亿种组合。这使得长链分子能够容纳海量信息。

Catalog的方法之所以能节约成本，是因为它使用了有限数目的基础分子。一次生成一个碱基对来构建新的DNA分子成本高昂，但是对现有分子进行复制和连接却很便宜。此外，这种方法也可以减少数据被误读的几率。即使测序仪弄错一两个碱基，通常也能推测识别出由10个碱基对构成的分子单元，从而保存数据。

与其他基于DNA的方法相比，Catalog的组合法每存储一个字节的数据确实需要更多的DNA。因此，读取DNA、将其中存储的数据恢复为电子格式以便处理的时间和成本都会增加。即便如此，总体来说这种方法还是有望比之前的方法具明显优势。

下一步是将这一希望变为现实。为此，Catalog正在与英国技术开发公司剑桥咨询（Cambridge Consultants）合作，制造一台每天能将大约125GB的数据写入DNA的样机。这台机器预计明年准备就绪，如果能够达到预期结果，Catalog打算在三年内打造出一台更强大的机器，将写入速度提高1000倍。届时，DNA信息存储的第二个时代可能就最终开启了。■



Public health

Grounding bugs

A new way to identify air travellers carrying infectious diseases

The growth of air travel means a potentially pandemic pathogen could spread around the world in days. Even in the absence of that risk, few countries' authorities are keen on admitting travellers who might transmit disease to those already there. Yet the precautions typically employed at airports to screen incomers' health are rudimentary.

It is easy to lie on a questionnaire. A dose of aspirin or other medication can lower body temperatures to the point where they look normal to the infrared cameras which some airports use to monitor passengers' faces for fever. In any case, many of those infected might not show symptoms, and may even be unaware that they are ill. A cheap, uncheatable and instant diagnostic tool would thus be a boon at airports. And Dirk Kuhlmeier and his colleagues at the Fraunhofer Institute for Cell Therapy and Immunology in Leipzig, Germany, think they have one.

Dr Kuhlmeier's invention, being developed as part of a wider project called HyFly that is intended to stop airports being gateways for infection, is based on technology already familiar to travellers, albeit that most will not recognise its name. Ion mobility spectrometry (IMS) is used to sniff swabs taken from baggage, clothing and personal items in searches for those carrying drugs or explosives. It can identify minute traces of volatile compounds, which drugs and explosives often emit. It works by measuring the ease with which ions (electrically charged molecules) can be drawn through an inert gas by an electric field. An ion's mobility depends on its size and shape. Individual compounds can thus be identified, and telltales of illegal activity flagged up.

IMS is used medically, as well, to screen patients' breath for compounds that indicate lung cancer. Dr Kuhlmeier reckoned he could extend this to detecting signs of respiratory bacterial infection—and laboratory tests that he and his team conducted suggested this was indeed possible. They discovered that they could even distinguish strains that have become resistant to antibiotics from those that have not. This shows that, in theory, IMS could quickly determine from a sample of breath if someone had an illness such as tuberculosis or diphtheria.

Turning theory into practice, however, brings complications. Chief among them is that even healthy people exhale lots of organic compounds. They do so especially if they have been eating spicy food, which contains a confusing array of such molecules. To deal with this, the team have developed an initial sorting stage, using a second technique called gas chromatography, to separate compounds so they are more easily analysed.

Bacteria, though, are only one source of illness. Viruses are equally dangerous. But viruses are not exactly living things and so do not have a metabolism which produces the sorts of compounds that bacteria generate. They do, however, change the metabolisms of the cells they infect. So Dr Kuhlmeier and his colleagues are now looking to see whether IMS can pick up these changes as well. If they succeed it would extend the scope of the technology to illnesses such as influenza and SARS.

The team plan to test their machine—essentially a large breathalyser that has one-use disposable mouthpieces—at clinics later this year, with the help of volunteers who have already been diagnosed with either bacterial or viral infections. These volunteers will also provide details of what they have been eating, so that the influence of various foods can be examined. If all goes well, trials at an airport should follow.

As to cost, the group expects that an IMS machine modified to their

requirements would be little more expensive than the \$20,000 price tag for one designed to detect drugs and explosives. And if airport trials prove the technology to be reliable, they hope to close the loop by offering it back to hospitals and clinics for the rapid analysis of infectious diseases. ■



公共卫生

让病菌停飞

一种识别携带传染病的航空旅客的新方法

如今航空旅行越来越频繁，意味着一种可能造成大范围流行病的病原体几天内就可传遍全世界。即使没有这种风险，也没有哪个国家的政府乐于接纳可能把疾病传染给本地居民的旅客。但是，机场里检查入境旅客健康状况的预防措施都很粗陋。

要在回答入境卡上的问题时撒谎很容易。一些机场用红外摄像头监测旅客面部来判断他们是否发烧，但吃片阿斯匹林或别的药物就可以让体温降到让摄像头判定为正常的程度。无论如何，许多感染者可能都没有外在症状，甚至可能都不知道自己的病了。因此，一种便宜、防欺骗且即时的诊断工具会是机场的福音。德国莱比锡弗劳恩霍夫细胞治疗和免疫学研究所（Fraunhofer Institute for Cell Therapy and Immunology）的德克·库尔迈耶（Dirk Kuhlmeier）和他的同事们认为他们就有一个这样的工具。

库尔迈耶的发明是名为HyFly的项目的一部分，这个规模更大的项目是为了阻止机场成为感染的侵入口。它用到了旅客已经很熟悉但大多数人都叫不出名字的一种技术。这种技术叫离子迁移谱（Ion mobility spectrometry, IMS），用来检测在行李、衣服和个人物品上擦拭过的棉签，以寻找携带毒品或爆炸物的人。它可以检测出毒品或爆炸物通常会释放的微量挥发性化合物。它的工作原理是测量离子（带电粒子）在惰性气体中被电场吸引的容易程度。离子的迁移能力取决于它的大小和形状。这样就可以检测各种化合物，从而发现非法活动的迹象。

医学上也用IMS筛检患者呼出物中提示肺癌的化合物。库尔迈耶认为，他可以将此用途扩展到检测呼吸道细菌感染的迹象，而他和团队进行的实验室测试表明这的确可能实现。他们发现用这个方法甚至可以把对抗生素产生耐药性的菌株和没有产生耐药性的菌株区分开来。这表明，理论上IMS

可以通过呼吸样本快速确定某人是否患有肺结核或白喉等疾病。

不过，把理论转化为实践的过程会出现复杂的情形。最主要的麻烦是，即便是健康人也会呼出大量的有机化合物，特别是在食用了辛辣食物的情况下，因为辛辣食物包含各种各样容易混淆的这类分子。为了解决这个问题，团队研发了一个初步分类拣选的步骤，使用称作“气相色谱法”的第二种技术来分离化合物，让它们更便于分析。

不过细菌只是疾病的来源之一。病毒同样危险。但病毒并不是真正的生命体，因此没有新陈代谢，不会像细菌那样产生各种化合物。然而，它们确实改变了它们所感染的细胞的新陈代谢。因此，库尔迈耶的团队正在研究IMS是否也能检测到这些变化。如果他们成功了，这项技术的应用范围将扩大到流感和SARS等疾病。

研究团队计划今年底在各个诊所测试他们的仪器——其实就是一台使用一次性吹嘴的大型呼气测量仪。已被确诊细菌感染或病毒感染的志愿者将为测试提供帮助。他们还会详细告知自己吃了什么食物，这样就可检测各种食物对检测疾病的影响。如果一切顺利，之后会在机场展开测试。

至于成本，该团队预计一款经改造以符合要求的IMS仪器的价格会略高于毒品和爆炸物检测设备2万美元的售价。如果机场测试证明这种技术是可靠的，他们希望再将它回馈给医院和诊所，用于传染病的快速分析。■



A global problem

A load of rubbish

Emerging economies are rapidly adding to the global pile of garbage. But solving the problem should be easier than dealing with other environmental harms, says Jan Piotrowski

THE OFFICES OF Miniwiz in central Taipei display all the trappings of a vibrant startup. The large open space on the 14th floor of an office block overlooking Taiwan's capital is full of hip youngsters huddled around computer screens. A common area downstairs includes a video-game console, a table-tennis table and a basketball hoop. But a hint that this is not just another e-commerce venture comes from neatly sorted sacks packed with old plastic bottles, CDs and cigarette butts.

Rather than peddle brand-new virtual products, Miniwiz derives value from physically repurposing old rubbish. Chairs in the conference room began life as plastic bottles, food packaging, aluminium cans and shoe soles. The translucent walls separating it from executives' dens owe their amber-like quality to recycled plastic mixed with discarded wheat husks. Coffee is served in glasses made of broken iPhone screens. Arthur Huang, the company's 40-year-old founder and chief executive, who holds a masters degree in architecture from Harvard, first tried setting up shop in New York in the mid-2000s. That effort failed when he discovered that few Americans shared his obsession with limiting the world's waste. By contrast, many of his fellow Taiwanese did.

They still do. The island is a poster child for recycling, recovering 52% of rubbish collected from households and commerce, as well as 77% of industrial waste, rivalling rates achieved by South Korea, Germany and other top recycling nations (America recycles 26% and 44% respectively). Its recycling industry brings in annual revenues of more than \$2bn. Lee Ying-

yuan, the environment minister, boasts that 16 of the 32 teams competing at this year's football World Cup in Russia sported shirts made in Taiwan from fibres derived from recycled plastic.

For more than two centuries since the start of the Industrial Revolution, Western economies have been built upon the premise of "take, make, dispose". But the waste this created in 20th-century Europe and America was nothing compared with the rubbish now produced by emerging economies such as China. According to a new World Bank report, in 2016 the world generated 2bn tonnes of municipal solid waste (household and commercial rubbish)—up from 1.8bn tonnes just three years earlier. That equates to 740 grams (1lb 6oz) each day for every man, woman and child on Earth.

That number does not include the much bigger amount produced by industry. Industrial solid refuse contains more valuable materials like scrap metal and has long been better managed by profit-seeking firms. And then there is the biggest waste management problem of all: 30bn tonnes of invisible but dangerous carbon dioxide dumped into the atmosphere every year.

As people grow richer, they consume—and discard—more. Advanced economies make up 16% of the world's population but produce 34% of its rubbish. The developing world is catching up fast. On current trends, the World Bank projects, by mid-century Europeans and North Americans will produce a quarter more waste than they do today. In the same period, volumes will grow by half in East Asia, they will double in South Asia and triple in sub-Saharan Africa (see map). The annual global total will approach 3.4bn tonnes.

This special report will argue that waste generation is increasing too fast and needs to be decoupled from economic growth and rising living

standards. That will require people to throw away less and reuse more—to make economies more “circular”, as campaigners say. This can only happen if people “equate the circular economy with making money”, claims Tom Szaky of Terracycle, which develops technologies to use hard-to-recycle materials. “Take, make, dispose” must now shift to “reduce, reuse, recycle”, he says.

Global waste may not present as apocalyptic a challenge as climate change, but it may be easier to solve. This is because local action to clean it up and recycle it can lead to immediate local effects. That can in turn transform into a virtuous cycle of change. People are more likely to take action if they can quickly see the results of their change in behaviour. All the more so because reducing waste offers two benefits not just one. It not only removes an affliction (solid waste) but, unlike tackling smog, it also creates a tangible benefit at the same time, in the shape of the recycled materials that can be reused. On top of that, solid waste (the only type that this report will discuss) is a visible eyesore. It is hard for anyone to deny that it exists.

That does not mean it will be easy to move to a more circular economy. Currently 37% of solid waste goes to landfill worldwide, 33% to open dumps, 11% to incinerators (see chart). Some goes to compost heaps. Two-thirds of aluminium cans are currently recycled in America, but only 10% of plastic. All told, only 13% of municipal solid waste is recycled globally. Everyone agrees that this is far too little.

The urgency of the problem is not in dispute. In July India’s Supreme Court warned that Delhi, the country’s capital, is buried under “mountain loads of garbage”. When dumps or landfills catch fire, as more than 70 have in Poland over the sweltering summer, noxious smog smothers their surroundings. Toxic runoff can permeate soils and poison waterways. Some rivers in Indonesia are so blanketed with litter that it completely conceals the water

beneath. According to the United Nations, diarrhoea rates are twice as high in areas where waste is not collected regularly, and acute respiratory infections are six times as common.

Discharged into seas, rubbish can return to wreak havoc on land. In August the Arabian Sea spewed 12,000 tonnes of debris and litter onto the shores of Mumbai in two days. Or it can despoil the ocean. Fishermen in the Arabian Sea complain they net four times as much plastic as fish. The “great Pacific garbage patch”, an Alaska-sized ocean gyre in the north Pacific Ocean, where currents channel all manner of flotsam, may contain 79,000 tonnes of plastic debris. Greenhouse gases from the waste industry, mainly emitted by a cacophony of chemical reactions in landfills, could account for 8-10% of all climate-cooking emissions by 2025. Left unchecked, this groundswell of garbage risks overwhelming the planet.

The good news is that around the world politicians and the public appear increasingly alert to the economic, ecological and human costs of waste, as well as to the missed opportunities it presents. Many governments in the developing world are grasping that spending less—or nothing—on waste management means paying more for things like health care to treat its effects. In the developing world, only half of all municipal waste is collected. In low-income countries as much as 90% ends up in open dumps. Lowering these proportions requires more investment in waste infrastructure such as managed landfills or low-polluting incinerators. Taiwan’s example shows that these can be clean and need not discourage recycling.

Rich countries already have such facilities, and more. They need to improve the recovery of valuable materials from their waste streams. For two decades they have relied on emerging economies, primarily China, to recycle their refuse. Over the past 25 years, the world deposited 106m tonnes of plastic in Chinese ports for recycling. The system ran aground in January when

China banned imports of virtually all plastic and unsorted paper, out of concern for its environment. This left Western waste-managers with tonnes of unwanted rubbish—and left policymakers with piles of unanswered questions about how to boost the capacity of domestic recyclers, and ultimately change citizens' carefree approach to waste.

Politicians in Europe and American states and cities—if not Donald Trump, America's distinctly ungreen president—are issuing ambitious recycling targets and trying to revamp the way they manage their rubbish. Techies and entrepreneurs like Mr Huang or Mr Szaky are dreaming up clever—and lucrative—ways to manage and reuse it. Multinationals are toying with resource-light business models based on service contracts rather than product sales. And many consumers are adopting leaner lifestyles.

But municipal budgets are tight everywhere. Trade tiffs can dampen legitimate exchange of scrap (as recycled waste is also known). Regulations for handling waste are necessary but can be obscure. Policymakers have yet to devise a way to boost large-scale investment in recycling, which is discouraged by periodic declines in the cost of primary commodities, with which recyclers compete. And some worry that switching to a more circular economy will harm those built on the old model.

These problems are real. But, as this report will argue, they are not insurmountable. In the 1990s, economic growth, rising living standards and soaring consumption outpaced Taiwan's capacity to clean up its waste, earning it the unflattering moniker of "garbage island". As recently as 1993 nearly a third of Taipei's rubbish was not even formally collected and virtually none was recycled. By 1996 two-thirds of landfills were nearing capacity.

In the face of mounting protests the government undertook to erect 24 incinerator plants to burn the waste instead, at a cost of \$2.9bn. It also

incentivised the Taiwanese to produce less rubbish in the first place. Under an “extended producer responsibility” (EPR) scheme, manufacturers and brands began to contribute to the cost of their products’ disposal, either through paying a fee into a fund earmarked for waste management or sometimes by managing the waste themselves. The less recyclable the product, the more expensive for the company. The scheme continues today. Households are charged for the amount of general mixed waste they produce but not for paper, glass, aluminium or other recyclables. Those caught dumping their trash illegally face hefty fines and public shaming. A typical Taiwanese person now throws out 850 grams daily, down from 1.15kg 20 years ago.

Half a century after environmentalists first began imploring consumers to reduce, reuse and recycle, similar exhortations are now echoing from San Francisco to Shanghai. And the world, drowning in garbage, has begun to listen. ■



一个全球性问题

垃圾之重

扬·彼得罗夫斯基 (Jan Piotrowski) 观察认为，新兴经济体正导致全球垃圾总量迅速增加，但这个问题应该会比其他环境危害更易解决

“小智研发” (Miniwiz) 位于台北市中心的办公室将一家充满活力的创业公司的特征展露无遗。在一栋俯瞰台北的高楼的14层是一个大型开放空间，里头到处可见围坐在电脑屏幕前打扮新潮的年轻人。楼下的一个公共区域里摆放着电子游戏机、乒乓桌和篮球架。不过，有一样东西透露出它不仅仅是又一家电子商务企业：整齐分拣的大麻袋里装着旧塑料瓶、CD 和烟头。

“小智研发”不销售新颖的虚拟产品，而是从对垃圾的实物改造中获利。会议室里的椅子最初是塑料瓶、食品包装、铝罐和鞋底。把会议室与高管们的办公室隔开的墙壁是半透明的，有着琥珀般的质地——再生塑料和废弃小麦壳混合的成果。咖啡杯由破碎的iPhone屏幕玻璃制成。40岁的公司创始人兼CEO黄谦智在哈佛大学取得建筑学硕士学位，最初于2005年左右尝试在纽约开公司，但没能成功。他发现很少有美国人和他一样痴迷于限制世界上的垃圾量。相比之下，他的许多台湾同胞却有着同样的追求。

他们至今如此。台湾堪称垃圾回收的模范，回收了52%的家庭及商业垃圾、77%的工业废弃物，可媲美韩国、德国等其他在垃圾回收上领先的国家（美国的回收率分别为26%和44%）。台湾的垃圾回收业年收入超过20亿美元。台湾环境署长李应元自豪地表示，参加今年俄罗斯足球世界杯的32强队伍中，有16支队伍穿了台湾制造的从回收塑料中提取的纤维制成的球衣。

自工业革命开始以来的两个多世纪里，西方经济一直建立在“获取、制造、丢弃”的模式上。但是，上个世纪欧洲和美国因此产生的垃圾量与今天中国等新兴经济体所产生的垃圾量相比根本微不足道。根据世界银行的一份新报告，2016年世界产生了20亿吨城市固体废物（即家庭和商业垃

圾），而仅仅三年前为18亿吨。这相当于地球上每个男人、女人和孩子每天生成740克垃圾。

这个数字还不包括从工业中产生的多得多的垃圾。工业固体废料含有更多像废金属这样的有价值的材料，长期以来一直有逐利的企业来更好地管理它们。此外还有一个最大的垃圾管理问题：每年有300亿吨隐形却危险的二氧化碳被排放到大气中。

人们越富裕，他们消费的越多，丢弃的也越多。发达经济体占世界人口的16%，却产生了34%的垃圾。发展中国家正在迎头赶上。根据目前的趋势，世界银行预计到本世纪中叶，欧洲和北美将产生比现在多四分之一的垃圾。同一时期，东亚产生的垃圾将增长一半，南亚增长一倍，撒哈拉以南非洲增长两倍（见地图）。全球垃圾年产量将接近34亿吨。

本期专题报道将论述垃圾生成的增速过快，需要和经济增长及生活水平的提高脱钩。这将要求人们减少产生垃圾，而增加重复利用——也就是活动人士所说的让经济变得更“循环”。泰瑞环保（Terracycle）的汤姆·萨奇（Tom Szaky）表示，只有当人们“将循环经济与赚钱等同起来”时，这才会发生。他的公司专门研发新技术来利用那些难以被回收再利用的材料。他说，“获取、制造、丢弃”的模式现在必须转变为“减少、再用、循环”的模式。

全球垃圾的问题可能不像气候变化那样显现出如末日般严峻紧迫的挑战，但它可能更容易解决。这是因为清理和回收垃圾的局部行动会立即产生局部效应。这继而可以转变为一种变化的良性循环。如果人们能快速看到自己行为变化的结果，他们就更有可能采取行动。而在减少垃圾这一点上更是如此，因为这种行为提供的好处不止一个，而是两个。它不仅消除了一种麻烦（固体废物），而且与抗击雾霾不同的是，它同时带来了一种看得见、摸得着的好处——回收材料可被再度利用。除此之外，固体废物（本专题将只讨论这种垃圾）还是一个清楚可见的刺眼之物。任何人都难以否认它的存在。

这并不意味着过渡到更循环的经济会轻而易举。目前全世界有37%的固体废物进了垃圾填埋场，33%进了露天垃圾场，11%进了焚烧炉（见图表）。有些去了混合肥料堆。美国目前回收了三分之二的铝罐，但只回收了10%的塑料。总体而言，全球只回收了13%的城市固体废物。所有人都会同意这远远不够。

问题的紧迫性毋庸置疑。7月，印度最高法院警告称，该国首都德里被埋在了“垃圾山”下。当露天垃圾场或垃圾填埋场起火时，有毒烟雾包裹了周围的环境，就像今年夏天波兰在高温天气中有70多处垃圾场起火那样。有毒的径流会渗透土壤和污染水道。印度尼西亚的一些河流被成片的垃圾覆盖，已经完全看不到下面的河水。据联合国统计，在没有定期收集垃圾的地区，腹泻发生率是常见的两倍，急性呼吸道感染为六倍。

排进大海后，垃圾可能返回到陆地造成严重破坏。8月，阿拉伯海在两天内向孟买的海岸“吐出”了1.2万吨碎片和垃圾。它也会破坏海洋。阿拉伯海的渔民们抱怨他们捕捞到的塑料是鱼的四倍。位于北太平洋、面积堪比阿拉斯加的海洋环流“太平洋垃圾带”的水流携带了各种漂浮物，可能含有7.9万吨塑料碎片。到2025年，来自垃圾处理行业的温室气体——主要排放自垃圾填埋场中的各种化学反应——可能会占到所有导致气候变暖的排放量的8%到10%。如果不加以控制，这股迅速扩大的垃圾潮可能令地球不堪承受。

好消息是世界各地的政客和民众对于垃圾对经济、生态和人造成的损害，以及因垃圾回收不足而错失的机会都日益警觉。发展中国家的许多政府都意识到，在垃圾管理方面花钱少或不花钱，就要花更多钱来支付医疗费和纠正其他后果。发展中国家只收集了一半城市垃圾。在低收入国家，多达90%的城市垃圾最终就被抛在了露天垃圾场里。降低这些比例需要增加对垃圾处理基础设施的投资，比如有人员管理的垃圾填埋场或低污染的焚化炉。台湾的例子表明这些设施可以是清洁的，而不一定会打击人们在垃圾回收上的积极性。

富裕国家已经拥有这类设施，数量也更多。它们需要提高自身从垃圾流中回收有价值材料的能力。20年来，它们依靠新兴经济体——主要是中国——来回收它们的垃圾。过去25年里，全世界将1.06亿吨塑料垃圾运到了中国的港口。但这个系统在今年1月搁浅，因为中国出于对自身环境的担忧，禁止了几乎所有塑料垃圾和未分类废纸的进口。这样一来，西方的垃圾管理者就要面对大量自己不想要的垃圾，而政策制定者则面对一大堆未解的难题，包括如何提高本国回收商的处理能力，并最终改变民众对垃圾漫不经心的态度。

欧洲和美国各州和城市的政客（虽然可能不包括特朗普这位明显不重视环保的美国总统）都在发布雄心勃勃的垃圾回收目标，并试图改进他们管理垃圾的方式。像黄谦智或萨奇这样的技术人员和企业家正在构想聪明又有利可图的方式来管理和再利用垃圾。跨国公司正在尝试基于服务合同而非产品销售的轻资源商业模式。而众多消费者正在转向更经济俭省的生活方式。

但各地的市政预算都很紧张。贸易争端会抑制废料（回收废品的别名）的合法交易。监管垃圾处理的法规是必要的，但有可能模糊不清。政策制定者尚未设计出一种方法来促进对垃圾回收的大规模投资，而这类投资受到初级大宗商品价格周期性下降的抑制——回收商需要和这类商品竞争。还有些人担心，转向更循环的经济会损害那些建立在旧模式上的企业。

这些问题都是真真切切的。但是，就像本报道将要论述的，它们并非不可克服。上世纪90年代，经济增长、生活水平提高和消费飙升超过了台湾清理垃圾的能力，让它收获了“垃圾岛”这个不好听的名声。1993年时，台北甚至还有近三分之一的垃圾未被正规收集，几乎完全没有垃圾被回收再利用。到了1996年，三分之二的垃圾填埋场已接近满负荷运行。

面对越来越多抗议活动，台湾政府承诺耗资29亿美元建造24座焚烧厂来转而把垃圾烧掉。它还实施激励措施，敦促台湾人从源头上减少垃圾生成。根据“生产者延伸责任”（EPR）计划，制造商和品牌开始出资来帮助处理自身产品的丢弃物——要么向垃圾管理专门基金缴费，要么自行管理这些

垃圾。对企业来说，自己的产品可回收的部分越少，花费就越高。这项制度延续至今。家庭则要按它们丢弃的一般混合废物的量缴费，纸张、玻璃、铝等可回收物品除外。被抓到非法丢弃垃圾的人面临巨额罚款和公开批评。一个典型的台湾人现在每天丢弃850克垃圾，低于20年前的1.15公斤。

半个世纪前，环保主义者开始恳请消费者减少垃圾和增加循环再利用。如今，从旧金山到上海，类似的劝诫此起彼伏。而淹没在垃圾中的世界已开始倾听。 ■



Two worlds

Down in the dumps

The poor world and the rich world face very different problems with their waste

EVERY MORNING, JUST before 8am, a digger stretches out its steel limb from the bank of the Ciliwung river in central Jakarta. It claws load upon load of stinking rubbish from a barrier stretched across the stream and deposits it into the back of an orange lorry. A city employee stands by, one of 5,000 people working in *pasukan oranye* (orange teams), which dredge hundreds of tonnes of waste every day from the filthy waterways of the Indonesian capital. A rag-picker, treading precariously, sniffs for plastic bottles and other recyclables. Once full, the lorry departs for Bekasi landfill. There, amid more stench, dozens of waste-pickers mill around beside the swinging arms of the machines that unload the dripping rubbish. Their bounty is divided meticulously and sold on to scrap dealers or reprocessing facilities. The remaining trash is rearranged into landfill.

In many parts of the developing world formal collection is expanding. There are now some 6,000 community waste banks in Indonesia, where residents deposit recyclables in exchange for cash. Once rubbish makes it to the waste-management site, the systems can be relatively efficient. The problem is getting a nation's refuse to such sites in the first place, when door-to-door collection is still rare, and households and businesses seldom sort their garbage.

More than 14,000km from Jakarta, in San Jose, California, trash is arriving at the Newby Island waste-management plant. As in most developed nations, getting it there is not the problem. Domestic and commercial waste is collected from homes and offices efficiently. The difficulties start when the rubbish arrives. With labour costs high, there are no rag-pickers to sift

through everything and work out what is worth recycling. The problem here is in the sorting. Aluminium cans are easy to deal with because they are all the same. But different types of plastics cannot be recycled together and machines do not have the sophistication to tell one type from another. So a lot goes to landfill or incineration, mixed with the remaining worthless waste. And now, suddenly, China has stopped accepting imports of low-grade plastic and paper, so Newby Island no longer has a place to send the mixed garbage that it lacks the hands to separate.

Both processes—in the developed and the developing world—are part of a global system that has improved substantially in recent decades as patterns of consumption, and therefore waste disposal, have changed. But both are under strain, as the volume of rubbish has increased with economic growth and as the global garbage industry has changed.

The improvements at Bekasi are part of a broader trend of developing-world governments finally grasping that proper rubbish collection is more than just keeping your streets smelling nice. It is a vital part of public health. Stinting on rubbish means paying more for hospitals. Numerous studies have shown that life in areas with patchy collection increases the risk of diseases as well as neurological conditions. In 2016 consultants at McKinsey calculated that burning, dumping or discharging a tonne of rubbish into waterways cost south Asian economies \$375 through pollution and disease, against \$50-100 required for basic systems to dispose of that same tonne properly.

In the poorest countries, especially in Africa, rubbish is still just dumped anywhere, and management is limited. But there is also comparatively little of it. A typical citizen of Lesotho produces 110 grams a day, one-fortieth as much as a typical citizen of Iceland (the country with the highest rubbish-generation rate per person). It is the economies that are booming that present the challenge. Many are now pouring money into dealing with

trash. Narendra Modi's government has earmarked \$9.5bn for solid-waste management in its \$30bn Swachh Bharat (Clean India) Mission. Indonesia is ploughing \$1bn into its plastic-clean-up campaign. Authorities in Morocco believe that \$300m they have invested in new sanitary landfills has already averted \$440m in environmental damage. Many projects enjoy backing from the World Bank and other multilateral lenders. Others are promoted by grassroots organisations and entrepreneurs.

They are bearing fruit. Collection rates in low-income countries have nearly doubled to 39% between 2012 and 2016, even as the volume of waste rose by a third. In middle-income countries like China, they rose on average to 51%. Rates for industrial waste are also improving (in places that have industry), though they already tend to be high because factories produce large, predictable volumes of more homogeneous refuse that is often valuable (like metal scrap).

As collection has improved, so has the next stage. China has emulated its rich Asian neighbours and embraced incineration. The Chinese authorities scrapped plans for some plants in the face of protests by local residents worried about air pollution. But they see incinerators as essential to tackling what the World Bank predicts could be a 50% rise in China's solid waste by 2050. They are trying to convince residents that incinerators are clean and safe (as modern ones are, in places like Taiwan) by, for instance, promoting school trips to facilities. The number of incinerators in China has shot up from 57 in 2010 to more than 400. They now consume one-fifth of the 220m tonnes of municipal refuse that the Chinese disgorge each year.

Poorer countries (including Indonesia) continue to rely on landfills, but these have also been getting more sanitary. Bekasi, which receives 7,000 tonnes of rubbish a day, now covers trash heaps with black plastic that captures the methane gas and other pollutants. In 2008-2014 Morocco increased the proportion of rubbish deposited in sanitary landfills rather

than open dumps from 10% to 53%. This is expected to rise to 80% once five additional facilities are completed.

Many authorities enlist the private sector, while monitoring how it performs. Istanbul accelerated a switch to private providers in 2003 after discovering they were a third more efficient than the public sector. In Nepal operators are paid based on how many households get daily collection. Five Moroccan cities, home to a quarter of the kingdom's people, use citizen report cards when deciding to renew contracts with providers. Collection rates in Lahore, Pakistan's commercial capital, shot up from 51% to 88% once the city hired a private company to manage its rubbish. Lorries are monitored with GPS trackers to measure performance and ensure that unscrupulous trash collectors do not dump the stuff illegally rather than drive it to formal disposal sites.

Informal workers, or rag-pickers, remain an important part of the system. UN Habitat, the United Nations agency for human settlements, believes that such people can collect 50-100% of rubbish at no cost to municipalities. The World Bank estimates that they pick 20% of China's municipal waste. "Waste-pickers know physics, chemistry, economics," marvels Gonzalo Muñoz, founder and boss of TriCiclos, a Chilean waste-management company. "They don't know they know—but they do." That is just as well, for ordinary citizens lack this knowledge. In China, for instance, a new requirement for big cities to install colour-coded bins in public areas and buildings has shown mixed results, with few citizens knowing what to throw where.

This explains why the Chinese authorities tolerate informal waste-pickers. Local governments in other countries actively embrace the sector, which is thought to include more than 15m people worldwide. A Brazilian law from 2010 recognised co-operatives of such *catadores* as service providers. This granted them access to benefits such as pensions. Their national union won

the rights to clean up football stadiums during the 2014 World Cup in Brazil. Technology is making informal collection more efficient. Mobile apps to match scavengers with rubbish producers are proliferating. Last year a free mobile app called Cataki, which links those throwing stuff away with those collecting it, was launched in São Paulo. Indian raddiwallahs in Bengaluru have used a similar app called “I Got Garbage” since 2014.

In rich countries like America, the absence of professional waste-pickers presents a problem. The general public is not very good at sorting rubbish. Households and businesses serviced by municipal waste-management providers may actually have got worse at sorting in the past 20 years, says Peter Keller of Republic Services, America’s second-biggest waste-management firm, which runs Newby Island in San Jose.

Citizens of rich countries, where almost 100% of municipal waste gets collected, take such services for granted—unless the collectors go on strike, as happened in the Belgian city of Ghent in early August, leaving streets in a stink for days. In some industrialised nations, increasingly, residents are charged based on volume (known as “pay-as-you-throw”). To encourage sorting, such schemes often exempt recyclables. In Taipei, the binmen will only accept unsorted general waste in official bags, which come in different sizes at different prices. They inspect recyclables to weed out cheats. The recyclables then proceed to materials-recovery facilities (MRFs) for further triage. General waste is whisked to incinerators or (now rarely in Taiwan’s case) landfills.

In many parts of Europe and America rubbish collection is generally paid for by municipal taxes and the garbage disappears to huge facilities like Newby Island. The plant’s operator, Republic Services, runs 91 MRFs nationwide, next door to landfills (of which it runs 191) or incinerators (of which it owns 114) which burn waste to produce electricity. It receives 156 trucks carrying 1,600 tonnes each day from as far afield as Fresno, 200km to the east. That

is down from 2,200 tonnes a day a few years ago. The volume of recyclables has reached 1,400 tonnes a day, a lot by American standards, says Mr Keller.

That should come as no surprise. After all, inhabitants of the San Francisco Bay area pride themselves on their recycling prowess. San Francisco boasts a recycling rate of 80%, one of the highest of any rich-world city. San Franciscans may therefore be shocked to learn that a lot of them, as Mr Keller puts it, “aren’t very good at it”. “A pair of blue jeans can jam the whole line for an hour,” he groans. More than 100 sorters try to pluck such items from the stream before that happens. Even so, a big plant like Newby experiences on average five such stoppages every day. Such disruptions cost the city of Phoenix in Arizona \$1m a year in stalled equipment and repairs.

Scott Smithline, who oversees recycling at California’s Environmental Protection Agency, cites two possible reasons. The first is that many people do not know what is recyclable. Beer bottles and soft-drink cans are, he says. Egg cartons and glossy magazines are not, for there is no market for the materials of which they are made. Some things are recyclable on their own, but not when combined, such as “paper” cups lined with plastic film. It is hard to blame consumers for feeling increasingly baffled, he admits.

The other problem is that residents only have to separate recyclables from non-recyclables (though compost bins for organic waste have appeared now, too). Cans, bottles and papers are all thrown into one bin. This mix can, to some degree, be sorted at plants like Newby, enabled by clever technology which uses optical sensors and magnets to separate materials automatically. These were no match for humans when it came to sorting, but were good enough for China’s recycling industry, when it took off in the 1990s, to supply the country’s growing ranks of manufacturers hungry for all manner of materials. It snapped up tonnes of imperfectly sorted Western waste, preferring it to the even more impure refuse available at home.

As the volume of recyclables swelled in America and Europe, the quality of recycled output declined because everything was mixed in together. This did not trouble MRF operators so long as they could offload their increasingly impure stock abroad. Then China announced it would not accept any plastics or cardboard, and American waste-management companies have been scrambling to find what to do with their poor-quality waste.

Efforts are springing up to teach residents how better to sort their rubbish. Some American and European cities now pick up different materials on alternate days. Reverse-vending machines, which accept empty drinks bottles and return money to users, are appearing in supermarkets. More cities are adopting pay-as-you-throw schemes. Consumer habits will take longer to change. Developing countries need to concentrate on getting binmen to the kerb of every residence and help stop people throwing trash into rivers. The developed world needs to relearn how to recycle. The Chinese ban has lent all of this a new urgency. ■



两个世界

深陷垃圾堆

穷国和富国的垃圾难题很不一样

每天早上快到八点时，一台挖掘机从雅加达市中心的芝利翁河（Ciliwung）河岸伸出它的钢臂。它从横跨河流的一道障碍物上一次次舀起散发着恶臭的垃圾，将它们倾倒在一辆橙色卡车的后部。一名市政雇员守在一旁。他是“橙色团队”的5000名成员之一，这个队伍每天从印尼首都污秽的水道里疏通出成百上千吨垃圾。一名拾荒者小心翼翼地踩在垃圾堆上，翻捡着塑料瓶和其他可回收物品。一旦装满了垃圾，卡车就会开往勿加泗（Bekasi）的垃圾填埋场。在那个更加臭气冲天的地方，摆动着的机械臂从车上卸下湿淋淋的垃圾，几十个拾荒者在旁边来回走动。他们寻获的“奖赏”被一丝不苟地分类，然后卖给废品经销商或回收工厂。余下的垃圾就安置在了填埋场里。

在发展中国家的许多地方，正规垃圾收集正在扩大。目前印尼有约6000个社区废品回收站，居民在那里存入可回收物品，换取现金。一旦垃圾进入了废品管理站点，就进入了一个相对高效的系统。问题是，挨家挨户的收集仍然罕见，而家庭和企业很少给自己的垃圾分类，如何让全国的垃圾首先能抵达这类站点是个难题。

在距雅加达1.4万多公里的加州圣何塞，垃圾正在抵达“纽比岛”（Newby Island）废品管理工厂。和大多数发达国家一样，把垃圾运到这里并非问题所在。从住所和办公室收集家庭和商业垃圾的过程很高效。麻烦是从垃圾运抵管理站后开始的。因为劳动力成本很高，并没有拾荒者来把所有垃圾筛选一遍，找出值得回收的东西。这里的难点在分类。铝罐很容易处理，因为它们一模一样。但不同类型的塑料不能一起回收利用，而机器还没有先进到能区分不同的塑料。因此很多可回收物都和其他无用的垃圾一起被送进填埋场或焚烧炉。而现在，突然之间，中国停止接受低纯度废塑料和纸张进口了，纽比岛这些缺乏人力来分类的混合垃圾无处可送了。

近几十年来，随着消费模式的改变，垃圾的处理方式也已发生变化，这个环节的全球系统已经取得了实质性改善，其中包括上述在发达国家和发展中国家发生的两种过程。但是，随着经济增长导致垃圾量增加以及全球垃圾产业发生变化，两者都在承受压力。

勿加洒垃圾处理的改进反映了一个广泛的趋势：发展中国家的政府最终懂得，正确的垃圾收集不仅仅是为了让街道空气清新，而是公共卫生极为重要的一部分。在垃圾处理上省钱意味着要为看病花更多钱。大量研究表明，在垃圾收集不足的地区生活会增加罹患疾病和神经系统疾病的风险。2016年，据麦肯锡的顾问们估算，燃烧、随意倾倒或排放一吨垃圾进水道使得南亚经济体因污染和疾病而损失375美元，而以基本设施妥善处理这一吨垃圾需花费50到100美元。

在最穷的国家，特别是非洲，垃圾仍然还只是随处倾倒，管理很有限。但是它们生成的垃圾量相对也较小。一个普通的莱索托人每天生成110克垃圾，是一个普通冰岛人生成垃圾量的四十分之一（冰岛是人均垃圾产量最高的国家）。带来挑战的是那些迅速发展中的经济体。它们当中有许多都在投钱处理垃圾。莫迪的政府已在其300亿美元的“清洁印度”任务中辟出95亿美元专款用于固体废物管理。印尼正在为清理塑料的运动投入10亿美元。摩洛哥当局认为，他们为新的更清洁的填埋场投资的3亿美元已经避免了4.4亿美元的环境破坏损失。许多项目得到了世界银行和其他多边贷款机构的支持。其他一些由基层组织和企业家推动。

它们正在结出硕果。2012年至2016年期间，低收入国家的垃圾收集率几乎翻了一番，达到39%，尽管同期垃圾生成量增加了三分之一。在中国这样的中等收入国家，收集率已平均上升到51%。工业废物的收集率（在有工业的地方）也在提高，尽管它们往往本身就已很高，因为工厂生成的大量可预测的同质垃圾通常都有价值（如金属废料）。

随着收集的加强，下个阶段也得到了改进。中国仿效其富有的亚洲邻国，开始使用焚烧炉。地方民众因担心空气污染提出抗议，政府因此取消了部分工厂的兴建计划。但是，官员们认为，要应对世界银行预测的中国固体

废物到2050年增加50%的问题，焚烧炉是必不可少的。他们正在采取鼓励学校开展参观焚烧厂的活动等办法，努力让居民信服焚烧炉是清洁和安全的（比如台湾等地使用的现代焚烧炉）。中国的焚烧炉数量已从2010年的57个猛增至400多个。现在它们共处理了中国人每年产生的2.2亿吨城市垃圾的五分之一。

较贫穷的国家（包括印尼）继续依赖垃圾填埋场，但这些填埋场也在变得更卫生。勿加泗每天接收7000吨垃圾，现在它把可捕获甲烷气体和其他污染物的黑色塑料覆盖在垃圾堆上。2008至2014年，摩洛哥将堆放在清洁填埋场而非露天垃圾堆的垃圾比例从10%增加到了53%。一旦另五个填埋场建成，这个比例预计将增至80%。

许多政府寻求私营部门的帮助，同时监测其执行情况。伊斯坦布尔在发现私营企业比公共部门效率高三分之一后，于2003年加速转向私营供应商。尼泊尔根据有多少户家庭每天都能获得垃圾收集服务来向运营商支付报酬。容纳了摩洛哥四分之一人口的五座城市使用公民报告卡来决定是否与供应商续签合同。巴基斯坦商业中心拉合尔在雇用了一家私营企业管理垃圾后，收集率从51%飙升至88%。收集垃圾的卡车上装载了GPS跟踪器来测量成效，同时也能防止不负责任的垃圾收集商非法倾倒垃圾而不把垃圾送到正规处理场所。

非正式工人或拾荒者仍是该系统的重要组成。联合国人类住区规划部门“人居署”（UN Habitat）认为，这些人可以免费为市政当局收集一半乃至全部的垃圾。据世界银行估计，中国20%的城市垃圾是由拾荒者收集的。“拾荒者了解物理、化学和经济学，”智利废物管理公司TriCiclos的创始人兼老板贡萨洛·穆尼奥斯（Gonzalo Muñoz）表示，“他们不知道自己知道——但他们知道。”这就够好了，因为普通民众缺乏这方面的知识。例如，在中国，一项新规定要求大城市在公共区域和建筑物中摆放标注不同颜色的垃圾箱，但收效不一，因为很少有市民弄得清楚该往哪里扔什么。

这就解释了中国政府为何会容忍非正规拾荒者。其他国家的地方政府积极接纳这个群体——据信全球共有超过1500万人。2010年巴西一项法律承认

这类拾荒者聚集的合作社为服务供应商。这让他们获得了养老金等福利。他们的全国工会在2014年巴西世界杯期间争取到了清理足球场的权利。技术提升了非正规收集的效率。将拾荒者与垃圾制造者相匹配的移动应用大量涌现。去年，圣保罗推出了一款免费移动应用Cataki，把扔东西的人和收东西的人连接起来。自2014年以来，班加罗尔的拾荒者一直在用一款名叫“我有垃圾”（I Got Garbage）的类似的应用。

在美国这样的富裕国家，缺乏专职拾荒者是个问题。普通大众不善于给垃圾分类。圣何塞纽比岛的运营商、美国第二大废品管理公司Republic Services的彼得·凯勒（Peter Keller）表示，过去20年中，获得市政废品管理供应商服务的家庭和企业在垃圾分类上可能愈发“退化”了。

在城市垃圾几乎被百分百收集的富裕国家，民众认为这类服务是理所当然的——除非垃圾收集商罢工，就像8月初在比利时根特市（Ghent）发生的那样，街道臭味弥漫了好几天。在某些工业化国家，越来越多居民要根据自己丢弃垃圾的量缴费（称为“现扔现付”）。为鼓励分类，这类收费机制通常豁免可回收物。在台北，清洁工人只接受用官方包装袋收纳的未分类一般废弃物，根据袋子的尺寸不同收费不同。他们会检查可回收物以防“掺假”。然后，可回收物会被送进垃圾回收厂（MRF）做进一步分类。一般废物则被迅速运至焚烧炉或垃圾填埋场（台湾已很少采用后一种）。

在欧洲和美国的许多地方，垃圾收集通常由市政税收负担，垃圾消失在纽比岛这样的大型设施中。该工厂的运营商Republic Services在全国范围内运行91座垃圾回收厂，设在垃圾填埋场（它运行着191个）或焚烧垃圾来发电的焚化炉（114个）附近。每天有156辆卡车运载1600吨垃圾到纽比岛，包括来自往东200公里远的弗雷斯诺（Fresno）。这比几年前的每天2200吨有所下降。凯勒表示，可回收物已达到每天1400吨，这按美国标准来说已经很多了。

这应该不足为奇。毕竟，旧金山湾区的居民为自己的回收能力感到自豪。旧金山的回收率达到了80%，在富裕国家的城市中名列前茅。因此，如果当地人听到凯勒说他们中有许多人“并不十分擅长这件事”，可能会很吃

惊。“一条蓝色牛仔裤能让整条操作线堵塞一小时。”他哀叹道。在这发生前，100多台分拣机试图从垃圾流中移除这类物品。即便如此，像纽比岛这样的大型工厂每天平均要发生五次这样的暂停。亚利桑那州凤凰城每年因为这类中断引发的设备故障和维修损失100万美元。

加州环境保护局回收部门主管斯科特·史密斯莱恩（Scott Smithline）指出了两个可能的原因。首先是许多人不知道什么东西可回收。他说，啤酒瓶和软饮罐头可以。鸡蛋盒和光面杂志不可以，因为制作它们的材料没有市场。有些东西单独来说可以回收，混在一起就不行了，比如内衬塑料薄膜的“纸”杯。他承认，消费者觉得这件事越来越难了，这也怪不了他们。

另一个问题是居民只需将可回收物与不可回收物分开丢弃（尽管现在又出现了投放有机垃圾的堆肥箱）。罐头、瓶子和纸张都被扔进了同一个箱子。利用有光学传感器和磁铁来自动分离材料的智能技术，这种混合物可以在纽比岛这样的工厂做一定程度的分类。在分拣方面，它们无法与人力匹敌，但对于中国的回收行业来说已经足够好——这个在上世纪90年代起飞的行业为本国不断壮大的、急需各种材料的制造商供货。它将海量分类不够完美的洋垃圾收归囊中，因为它们要好过本国更不纯净的垃圾。

随着美国和欧洲可回收垃圾的总量增加，分拣出来的回收品质量下降了，因为所有东西都混杂在一起。过去，这对垃圾回收厂的运营商来说不是问题，只要它们可以将越来越不纯正的回收品卸到国外就行。然后，中国宣布它不再接受任何塑料或纸板了，美国的废品管理公司都在急着为自己的劣质垃圾找寻去处。

一夜之间，各地都出现了指导居民如何更好地分类垃圾的活动。美国和欧洲的一些城市现在隔天收集不同种类的垃圾。“吃进”空饮料瓶、“吐出”现金的“反向自动售货机”出现在超市中。更多城市开始采用“现扔现付”机制。消费者需要更多时间来改变习惯。发展中国家需要集中精力把环卫工人送到每栋住宅的门口，并帮助阻止人们将垃圾扔进河里。发达国家需要重新学习如何回收利用。中国的禁令给所有这一切带来了新的紧迫感。■



Recycling

Modern-day alchemy

Business-minded fans of the circular economy are trying to reduce, reuse and recycle

IN 2001, WHILE studying economics at the University of California, Los Angeles, Dan Kurzrock got into beermaking. He soon discovered that for every five-gallon (19-litre) batch of ale, the brewing process yielded up to 22lbs (10kg) of mulch-like spent grains. “It felt like making food,” he recalls. And it didn’t taste all bad, either—after all, it was wholesome fibres and protein left over from a process which extracts sugars from cereals for fermentation. If he was producing kilograms of it, how much goodness was going to waste at breweries?

The answer was a lot. A rough calculation based on the volume of beer brewed in America puts the total spent grain at 1.4m tonnes a year. Large brewers often let local farmers pick up the by-products for livestock feed. But at craft breweries sprouting in cities all over the world, these would often head straight for the landfill. “It would be a commodity if there were a market,” Mr Kurzrock remembers thinking. So he set out to create one.

In 2012 he and Jordan Schwartz, a college chum, founded ReGrained to commercialise a recipe they developed to turn spent grain, collected free from local craft brewers in San Francisco, into energy bars. In September they inaugurated a new factory near the city to cook up the main ingredient and sell to food producers. Griffith Foods, a big producer of doughs and condiments, has invested in the company. Barilla, an Italian firm, is working with ReGrained on a line of beer-derived pasta.

Recycling—for that is what ReGrained does—is nothing new. The word (at least its English version) dates back to the 1920s but the activity is as old as

mankind. As the variety of materials churned out by the modern economy has increased, however, so have attempts to repurpose ever more of them.

Fans of the “circular economy” relish epiphanies such as that which led Messrs Kurzrock and Schwartz to their idea. They lower the economy’s environmental footprint twice over: reducing the amount both of natural resources (cereals to make a snack) and of refuse. They take something people would pay someone to take off their hands—waste—and convert it into something people are willing to purchase—a resource.

The trick is performing such alchemy profitably and at scale. It is already happening. In most rich countries a third of glass and two-thirds of paper come from recovered materials. Around half of aluminium sold in North America each year is derived from scrap. Each day the United States alone churns out 25 Eiffel towers’ worth of steel and other ferrous scrap. Recycled copper satisfies two-fifths of global demand for the metal. There are reasons to believe that market forces will drive similar developments for other materials. Electronic and electrical devices look particularly ripe for harvesting. But plastics are the biggest problem, with only 10% currently recycled.

Nearly everything can be recycled, says Tom Szaky of Terracycle. It is not just things like plastic bags or textiles, which a recent survey found one in two Britons incorrectly assumes to be unrecyclable. Mr Szaky’s firm has devised a way to turn cigarette filters, made of a polymer called cellulose acetate, into sturdy plastic boarding. Plastic polymers can be chemically unwound into their original hydrocarbons. In April a Dutch company started selling training shoes with soles made from chewing gum scraped off the streets of Amsterdam.

Some people will pay a premium for products that salve their conscience. The environmental appeal is an inherent part of the brand. For most

customers “environmental considerations continue to be ‘nice to have’,” says Gavin McIntyre of Ecovative Design, which uses fungi to turn agricultural waste into high-grade composite materials. Crucially, they are not yet ‘must have’. The central concern is price.

Recycled materials compete with virgin ones, so recyclers are hostage to volatile raw-material prices. Recyclers’ costs depend on the cost of collection, distribution and processing of scrap, which tend to be stable. Commodity prices—which determine the price for recyclers’ output—can swing wildly. When prices of primary resources drop suddenly, recovered materials are no longer competitive. This can drive recyclers out of business. The uncertainty discourages long-term investments, keeping most recycling firms small and inefficient. That in turn constrains the supply of recycled materials. Big manufacturers want a steady supply of materials, which recyclers therefore find it hard to guarantee.

Things such as glass, paper and many metals have broken out of this vicious circle, typically once economies spewed out enough of them to make it worthwhile to recycle. Reprocessing technology had often been around for a while—paper was being recycled in the 19th century—but greater availability of source materials encouraged efficiencies. That in turn spurred demand for these materials and itself encouraged further improvements in recovery. In other words, a vicious cycle turned virtuous.

In some areas, a similar virtuous turn looks not just possible but imminent. Last year scholars at United Nations University in Tokyo calculated that the 45m tonnes of defunct fridges, radios, smartphones and the like discarded annually worldwide contain \$55bn-worth of gold, silver and other valuables. According to research from Tsinghua University in China and Macquarie University in Australia, it costs Chinese recyclers of defunct electronic devices (known as “e-waste”) \$2,000 to extract a kilogram of gold from old television sets; mined from the ground, the metal fetches \$40,000

a kilo. The recyclers outperform miners even after stripping out the \$13 that the Chinese government subsidises them per television. Facts like these help explain how the American e-recycling business went from less than \$1bn in 2002 to more than \$20bn in 2016, and why today's 20% recycling rate for e-waste looks poised to rise.

Not all materials are as precious as gold and silver. But progress is visible even in areas such as food waste, the world's most common form (see chart, below) and construction debris. "Anaerobic digestion", in which organic matter is broken by microbes in the absence of oxygen, produces biogas which can be burned for energy or heat. In 2009-16 the number of biogas plants in Europe grew from 6,000 to 17,700—heating houses with old banana skins and uneaten porridge. It still produces only 2% of EU electricity but the share looks set to grow as more governments tackle food waste and encourage renewable energy. Meanwhile, Ecovative is an example of a company that turns food waste into durable goods, such as high-grade faux leather. ZEN Robotics of Finland sells smart disassembly lines for construction rubble where computer-vision algorithms identify pieces of metal, cardboard or other valuables for a robotic arm to pluck from the conveyor belt. Companies like Jiangsu LVHE in Changzhou, outside Shanghai, use the system to recover materials for reuse or resale, and bake the remaining debris into bricks, tiles and other building wares.

The problem for plastics is that hundreds of everyday polymers are incredibly cheap to make from petroleum, and comparatively costly to extract from the waste stream compared with less heterogeneous materials like paper, glass or even metals. This has kept plastics stuck in the negative feedback loop of low demand, low investment and low supply. The market will only develop if there is an increase in demand, thinks Jean-Marc Boursier, vice-president of Suez, a giant French waste-management and recycling company.

The Chinese ban may in time provide just such a jolt, by forcing countries used to dispatching their recovered plastics abroad—as Ireland has done with 95% of its total—to reprocess more at home. But even before the prohibition entered into force at the start of the year, rising public angst over plastic pollution had begun to concentrate policymakers' minds on how to make reused plastic more attractive relative to the virgin kind.

Fiscal incentives are one way. For instance, exempting second-hand polymers from value-added tax is defended on the grounds that the primary material has already been taxed. As well as being desirable to combat climate change, carbon taxes favour less energy-intensive recycled plastic production. More hands-on proposals are also being aired. The EU's new recycling targets are one example, especially now that poorly recycled plastic can no longer be palmed off on China. Campaigners are also pressing the EU to mandate a minimum recycled content in plastic containers, as California has had since 1991.

“Extended producer responsibility” (EPR) has become a particular favourite among campaigners and policymakers alike. EPR rules make manufacturers and brands contribute to the net cost of their products’ disposal once consumers are done with them. This cost is lower if the products can be sold to recyclers. The number of such policies rose from a few dozen in the early 1990s to nearly 400 worldwide by 2013, according to the OECD. Nearly all of the club’s 34 mostly rich members now have them for different types of product, as does Taiwan. Latin American countries like Brazil, Colombia and Chile have them, too. South-East Asian countries are working on them. Last year China unveiled a plan to draft comprehensive EPR legislation by 2025. Such policies may in time bring the plastics recycling rate from 10-20% today closer to the 60-80% rate currently enjoyed by other materials such as aluminium, steel and paper.

All of this should help boost recycling. But some firms have ambitions to

embrace the other two components of the circular-economy triad, by reusing products rather than materials, and even reducing production altogether. Companies like the Renewal Workshop are putting a new spin on second-hand clothing. They take old garments and refashion them into new items, with the approval of the original brands (for the Renewal Workshop these include North Face). Darrel Stickler, Cisco's head of sustainability, discerns a promising second-hand market for the company's networking gear, \$3bn-worth of which is bought and sold each year. Cisco's share of this is tiny but could be much bigger, Mr Stickler thinks.

Meanwhile, some big manufacturers are reorienting from making products to selling services. Martin Stuchtey of SystemIQ, a consultancy, says that nine out of ten boardrooms he visits are debating "how to sell freshness, not fridges; kilometres, not tyres". Rolls-Royce has sold "power by the hour" rather than aircraft engines for years. Rather than flog LED lamps Philips leases them to some customers—including Britain's National Union of Students—with a promise to keep buildings illuminated. By 2020 it wants to double to 15% the share of its profits from such contracts, which can lock in customers for 20 years. Safechem, a chemical company, rents out tanks of fresh solvent rather than selling it to manufacturers for cleaning metal parts. It then collects the tanks, purifies the contents and rents them out again.

Business models like these are grist to the mill of circular-economy advocates. They are presented as proof that lower resource intensity need not mean smaller profits. But their widespread adoption would not be painless for everyone. ■



回收利用

现代炼金术

有商业头脑的循环经济拥趸正在尝试减少使用、重复使用和循环再用

二〇〇一年，在加州大学洛杉矶分校学习经济学时，丹·克兹洛克（Dan Kurzrock）开始涉猎啤酒酿造。他很快发现，每酿造一批共5加仑（19升）的啤酒，过程中会产生高达22磅（10公斤）的覆土状麦糟。“好像在生产食物。”他回忆道。而且它的味道也不差——毕竟，它是一种有益健康的纤维和蛋白质，是从谷物中提取糖进行发酵的工艺剩下来的。如果他一个人就生产出了以公斤计的麦糟，那啤酒厂会浪费多少好东西？

答案是很多。以美国酿造的啤酒量来粗略计算，每年生成的废麦糟总量会有140万吨。大型酿酒商经常让当地农民拿走这些副产品用作牲畜饲料。但是，在世界各地的城市中涌现的精酿啤酒厂中，它们往往直接就进了垃圾填埋场。“如果有市场，它将是一种大宗商品。”克兹洛克记得当时自己这么想着。所以他开始创建这样的市场。

2012年，他与大学密友乔丹·施瓦茨（Jordan Schwartz）共同创立了ReGrained公司，把他们开发的一种食谱商品化。他们从旧金山当地的精酿啤酒厂收集来免费的废麦糟，制作成能量棒。同年9月，他们在该市附近开设了一家新工厂，烹制主要原料并出售给食品生产商。面团和调味品大型生产商格里菲斯食品公司（Griffith Foods）已向该公司投资。意大利公司Barilla正与ReGrained合作生产一系列源自啤酒的意大利面。

回收利用——ReGrained在做的事——并不是什么新鲜事。这个词（至少是英文说法）可以追溯到上世纪20年代，但这项活动与人类历史一样久远。然而，随着现代经济的生成物种类越来越多，重新利用它们的尝试也随之增加。

“循环经济”的拥趸津津乐道于让克兹洛克和施瓦茨生出点子的这种顿悟。他们让经济的环境足迹双倍降低：同时减少了对自然资源（制作小吃的谷

物)的消耗和垃圾的数量。他们拿走了别人会付钱让人拿走的东西——垃圾——并将其转化为人们愿意购买的东西——资源。

诀窍是要大规模地开展有利可图的炼金术。这已经在发生了。在大多数富裕国家，三分之一的玻璃和三分之二的纸来自于再生材料。每年在北美销售的铝中约有一半来自废料。每天仅美国就会生产出相当于25座埃菲尔铁塔的钢材和其他废钢铁。再生铜满足了全球对这种金属需求的五分之二。我们有理由相信，市场力量会推动其他材料类似的发展。电子和电气设备看起来尤其是回收业的金矿。但塑料是最大的问题，目前只有10%被回收。

Terracycle公司的汤姆·萨奇（Tom Szaky）说，几乎所有东西都可以回收利用。不仅仅是像塑料袋或纺织品这样的东西——最近一项调查发现，有一半英国人误认为它们不可回收。萨奇的公司设计了一种方法，把香烟过滤嘴（由名叫醋酸纤维的聚合物制成）变成坚固的塑料板。塑料聚合物可以用化学展开成其原始的碳氢化合物。今年4月，一家荷兰公司开始销售一种训练鞋，鞋底用在阿姆斯特丹街头刮掉的口香糖制成。

有些人愿意为那些可以安抚他们良心的产品支付溢价。环境吸引力是品牌的固有组成部分。对于大多数客户来说，“环境因素仍然是‘锦上添花’”，Ecovative Design的加文·麦金泰尔（Gavin McIntyre）表示。该公司使用真菌将农业废弃物转化为高级复合材料。至关重要的是，这些因素还不是“不可或缺”。核心问题是价格。

再生材料要与纯净原材料竞争，因此回收商受到波动巨大的原材料价格影响。回收商的成本取决于废料的收集、经销和加工成本，这些成本往往是稳定的。大宗商品的价格——决定了回收商产出的价格——却会大幅波动。当主要资源的价格突然下降时，再生材料不再具有竞争力。这可能会使回收商破产。这种不确定性阻碍了长期投资，使大多数回收企业停留在小规模和低效率。这反过来限制了再生材料的供应。大型制造商希望拥有稳定的材料供应，而回收商很难保证这一点。

诸如玻璃、纸张和多种金属之类的东西已经脱离了这种恶性循环，一般是在它们在经济体中产生的量足够多而值得回收之后。再加工技术通常已经出现了一段时间——纸张在19世纪就被回收——但原料更易获得促进了效率。这反过来刺激了对这些材料的需求，并且本身也促使回收再作改进。换句话说，恶性循环变成了良性循环。

在某些领域，类似的良性转变看起来不仅可能，而且马上就会发生。去年，东京的联合国大学的学者们计算得出，全球每年丢弃的4500万吨废旧的冰箱、收音机、智能手机等设备包含价值550亿美元的黄金、白银和其他贵金属。根据清华大学和澳大利亚麦考瑞大学的研究，中国的废旧电子设备（即“电子垃圾”）回收商需要花费2000美元来从旧电视机中提取一公斤黄金；若从地下开采，这种金属每公斤售价4万美元。即使在去掉了中国政府为每部电视机补贴他们的13美元之后，回收商的业绩也优于矿工。这些事实有助于解释美国电子回收业务如何从2002年的不到10亿美元增加到2016年超过200亿美元，以及为什么今天20%的电子垃圾回收率似乎注定要上升。

并非所有材料都像金银一样珍贵。但是，即使在厨余垃圾这种世界上最常见的垃圾形式（见下图）和建筑瓦砾等方面也在取得进展。“厌氧消化”是指有机物质在没有氧气的情况下被微生物降解，这个过程产生的沼气可被燃烧获得能量或热量。2009年至2016年，欧洲的沼气厂从6000家增加到17,700家，它们用烂香蕉皮和吃剩的粥为房子供暖。它仍只生产了欧盟电力的2%，但随着越来越多的政府着手解决厨余垃圾并发展可再生能源，这一份额似乎必定会增长。与此同时，Ecovative等公司正在将厨余垃圾转化为耐用品，比如高档人造皮革。芬兰的ZEN Robotics公司销售针对建筑瓦砾的智能拆卸生产线，利用计算机视觉算法识别金属、纸板或其他贵重物品，然后让机械臂从传送带上将它们取出。位于常州的江苏绿和等公司使用这套系统来回收材料以便再利用或转售，并将剩余的碎片烘烤成砖块、瓷砖和其他建筑用品。

塑料的问题在于，从石油中提炼制造数百种日常聚合物非常便宜，而从废

物流中提取它们的成本相对要高于提取纸、玻璃甚至金属等更为均质的材料。这使得塑料停留在低需求、低投资和低供应的负反馈回路中。法国废品管理和回收巨头苏伊士环境集团（Suez）的副总裁让-马克·布尔西耶（Jean-Marc Boursier）认为，市场只有在需求增加的情况下才会发展。

中国的禁令在一段时日后可能会产生这样的推动效果，因为它将迫使那些习惯将本国回收塑料运往国外的国家——如爱尔兰将总量的95%输出——在国内进行再处理。但即使在年初禁令生效之前，公众对塑料污染的担忧已经促使政策制定者们开始思考如何让再生塑料比全新塑料更具吸引力。

财政激励是一种方式。例如，对二手聚合物免征增值税的依据是原始材料已征过税。除了应对气候变化之外，碳税也有利于能源消耗较少的再生塑料生产。各国也提出了更多切实的提案。欧盟的新回收目标就是一个例子，特别是在如今无法再将低纯度回收塑料推给中国的情况下。活动家们还在向欧盟施压，要求其规定塑料容器中可回收成分的含量下限，就像加州自1991年以来所做的那样。

“生产者延伸责任”（EPR）已成为活动家和政策制定者的宠儿。EPR规则使制造商和品牌分担消费者用完其产品后的净处理成本。如果产品可以出售给回收商，则成本较低。根据经合组织的数据，这些政策的数量从上世纪90年代初的几十个上升到2013年的全球近400个。主要由富裕国家组成的经合组织的几乎全部34个成员现在都拥有针对不同类型产品的规定，台湾也是如此。巴西、哥伦比亚和智利等拉丁美洲国家也有此类规定。东南亚国家正在研究它们。去年，中国公布了一项计划，要在2025年前起草全面的EPR立法。假以时日，这些政策可能会使塑料的回收率从目前的10%至20%提高到接近目前其他材料（如铝、钢和纸）60%至80%的回收率。

所有这些都应该有助于促进回收。但是，一些公司甚至有野心，通过重复使用产品而非材料，甚至整体减少生产来贯彻循环经济三元组的其他两个组成部分。像Renewal Workshop这样的公司正在为二手服装注入新的活力。在获得原始品牌的许可后，它们将旧衣服改制成新产品（Renewal Workshop改制的品牌包括北面[North Face]）。思科的可持续发展主管达

雷尔·斯蒂克勒（Darrel Stickler）认识到该公司网络设备的二手市场前景广阔，目前每年交易价值达30亿美元。斯蒂克勒认为，思科在其中所占份额很小，但完全可以大得多。

与此同时，一些大型制造商正在重新定位，从制造产品转向销售服务。咨询公司SystemIQ的马丁·斯图赫泰（Martin Stuchtey）表示，他访问的十个董事会中有九个正在讨论“如何销售新鲜度而非冰箱；销售公里数而非轮胎”。劳斯莱斯多年来一直“按小时销售动力”而不是飞机发动机。飞利浦将自己的LED灯出租给某些客户而不是卖给它们（包括英国的全国学生联盟），承诺保持建筑物的照明。它的这类合同可以锁定客户20年。飞利浦希望到2020年将来自这部分的利润份额翻倍至15%。化学公司Safechem向制造商出租而非出售用以清洗金属零件的一罐罐新鲜溶剂，然后把罐子收集回来，提纯内容物后再次出租。

像这样的商业模式对循环经济的倡导者来说十分有利。它们被用来证明，资源不那么密集不一定意味着利润就低。但要广泛采用它们并非对所有人都轻而易举。 ■



Manufacturing jobs

The producers

Factory employment is defying expectations. Should the president get the credit?

“Nation longs for one more day with dying manufacturing sector.” This headline, published in 2014 by the satirical website the Onion, anticipated both President Donald Trump’s fears and the retorts he gets from his critics. Mr Trump campaigned on a promise to bring back jobs in manufacturing after decades of decline. To those who see the future of the American economy in services, these promises seemed backward. When he was head of the National Economic Council, Gary Cohn reportedly asked the president which he would prefer: sitting in nice air-conditioned office, or standing on his feet all day.

In 2018 it looks as though the president is winning the day. Industrial output is on a tear, and the last few months have seen the best run for growth in manufacturing jobs since the late 1990s. After spending about two decades on a steady march downwards, manufacturing’s share of the labour market appears to have all but stopped falling. Between 1948 and 2008, manufacturing employment fell as a share of private non-farm employment by around 0.4 percentage points each year (see chart). Since January 2010 it has fallen by only 0.3 points in total.

Put another way, the number of American manufacturing jobs has been rising almost in line with overall employment for the past eight years, defying both historical experience and expectations. In the recoveries from the recessions of the 1990s and the 2000s manufacturing never regained its share of the labour market. In 2017 the Bureau of Labour Statistics forecast that the number of manufacturing jobs would continue to fall at an average annual rate of 0.6% per year between 2016 and 2026.

What is going on? It is possible that the surprising strength of manufacturing employment is a temporary phenomenon, and that it will soon revert to its earlier, downward trend. Is it a prelude to an industrial revolution, in which humans will be replaced by a more programmable kind of factory worker?

Peter Schott of Yale University points out, however, that over the past 60 years the norm has been for the number of manufacturing jobs to recover fully after downturns. The early 2000s was an exception because of a large increase in goods imported from China. If recovery is normal, perhaps it is unsurprising that the current one has lasted so long, because the downturn in 2008 was so deep.

Alternatively, the robustness of manufacturing jobs could reflect a more permanent shift. "It seems unlikely that the share of manufacturing employment will go to zero. Maybe we have hit the point where the share flattens off," says Mr Schott. The trend is similar in both non-durable goods and durable goods industries, even though durable goods include things like cars, where sales tend to be more sensitive to the economic cycle.

Robert Lawrence of Harvard University argues that the shift away from manufacturing employment during the second half of the 20th century was mostly the result of gains in productivity, rather than competition from imports. More so than in other sectors, technological progress allowed fewer workers to make more stuff. Consumers did not respond to the resulting lower prices by buying very much more of that stuff, so employment fell.

Since the recession, productivity growth in manufacturing relative to services has slowed. Mr Lawrence calls the associated jobs boom the exception that proves the rule. Overall, one can have growth in manufacturing productivity, or growth in manufacturing employment, but

not both, he suggests.

The lacklustre productivity growth could be a temporary feature of the economic cycle. An abundance of workers looking for jobs since the financial crisis has kept a lid on wage growth, perhaps blunting companies' incentives to invest in labour-saving automation, thereby reducing productivity growth. According to numbers crunched by Nick Bunker of Indeed, a job-matching website, manufacturing is one of the few sectors where the number of unemployed workers continues to exceed the number of job openings.

Mr Trump's brand of import-blocking economic nationalism is supposed to encourage companies to bring production back to America. It is possible that his threats to rip up trade deals and impose tariffs are making risk-averse business executives keener to plant their factories at home. However, tariffs on imported steel and aluminium could be pushing them in the opposite direction, by raising input costs for American factories. The same goes for tariffs on imported Chinese parts.

In any case, the manufacturing renaissance Mr Trump is presiding over does not mark a return to those bygone days when America was great. Historically, the sector was seen as a gateway into the middle classes for Americans with only a high-school education. But over time the composition of employment has shifted towards managerial and professional roles, and away from production jobs that can be done by those with less schooling. Manufacturing workers today are also less likely to be unionised than they once were, so they have fewer benefits.

The type of work being done is changing, too. The rise since 2011 in manufacturing employment has been concentrated production of food and transport equipment, which includes carmaking. Meanwhile, printing, computer-making and the production of clothes each account for a smaller

share of manufacturing jobs than they did seven years ago.

Jobs are also moving geographically. Since the recovery started, the East North Central region, which includes places like Michigan and Illinois, has captured a share of employment gains that exceeds its share of job losses during the recession. Meanwhile the Middle Atlantic region, which includes New York and Pennsylvania, has seen no net increase in manufacturing employment at all since 2011.

In politics, however, not all places are created equal. Calculations by *The Economist* suggest that the counties that voted for Mr Trump in November 2016 have experienced larger manufacturing job gains since 2011. They have also tended to see the largest gains since the election. In these places, manufacturing's share of overall employment has risen relative to the rest of the country. Far from dying off, manufacturing in America appears to be humming the president's tune. ■



制造业岗位

制造者

美国制造业就业超出预期。是总统的功劳吗？

“制造业生命垂危，国人依依不舍。”2014年，讽刺网站“洋葱网”发布了这样一个大标题，预言了总统特朗普的忧惧和批评人士对他的反驳。特朗普在竞选中承诺要挽回数十年间不断减少的制造业就业岗位。在那些认为服务业才是美国经济未来的人看来，这样的承诺是种倒退。据说加里·科恩（Gary Cohn）还在担任国家经济委员会（National Economic Council）主任的时候，曾问特朗普他是更喜欢坐在舒服的有空调的办公室里，还是站一整天。

到了2018年，看起来是特朗普最终占了上风。工业产出一路上扬，而且最近几个月制造业就业实现了自上世纪90年代末以来最强劲的增长。制造业在劳动力市场中的占比在经历了约20年的稳步下行后，基本已经停止下跌。1948年至2008年间，制造业就业人口占私营非农就业人口的比重每年约下降0.4个百分点（见图表）。而自2010年1月起，该比重总共只下降了0.3个百分点。

换个说法，过去八年来，美国制造业就业数量差不多随总体就业率的提高而增长，这既不符合历史经验，又出乎人们的预料。在从上世纪90年代和新千年的两次经济衰退中恢复的过程中，制造业在劳动力市场中的占比从未恢复至原有水平。2017年劳工统计局（Bureau of Labour Statistics）预测，2016年到2026年间，制造业岗位数量将会继续以平均每年0.6%的速度减少。

这是怎么回事？制造业就业显现出令人意外的强劲态势有可能只是个暂时现象，也许很快就会回归之前的下行趋势。这种局面会不会是一场工业革命的序幕——人类将会被一种更容易编程的工厂工人取代？

然而耶鲁大学的彼得·肖特（Peter Schott）指出，过去60多年来的常态一直都是经济衰退后制造业岗位会完全恢复至先前水平。本世纪初是个例外，原因在于进口自中国的商品大幅增加。如果说就业恢复是正常状况，那么眼下这一次持续了这么久可能也就不足为奇了，毕竟2008年的衰退是那么惨重。

或者，制造业就业强劲也许反映出一种更持久的变化。“制造业就业的占比似乎不太可能会降到零。或许我们已经下行到了最低点，这个比例会稳定下来。”肖特说。非耐用品和耐用品行业都出现了这样的趋势，尽管耐用品中还包含像汽车这样销售状况往往对经济周期更加敏感的产品。

哈佛大学的罗伯特·劳伦斯（Robert Lawrence）认为，20世纪后半叶就业人口从制造业流出主要是生产率提高的结果，而不是来自进口商品的竞争。由于科技进步，用更少的工人就能生产更多的产品，这一点在制造业尤为突出。而由此带来的价格下降并没有促使消费者大量购买产品，制造业就业率因而下降。

自经济衰退以来，制造业生产率增速相对于服务业已经放缓。劳伦斯认为就业增加这个例外反证了生产率增速放缓的事实。他认为，一般来说，一国可以实现制造业生产率提高，或者制造业就业率提高，但不会两者兼得。

生产率增长乏善可陈有可能是经济周期的一个暂时表现。金融危机后大量出现的求职者抑制了工资增长，可能削弱了企业投资于能节省劳动力的自动化技术的动力，进而降低了生产率增长。求职网站Indeed的尼克·邦克（Nick Bunker）分析数字后得出，制造业是为数不多的失业人口持续超过职位空缺的部门之一。

特朗普那套企图将进口产品阻挡在外的经济民族主义被认为可以促使企业将生产迁回美国。在特朗普撕毁贸易协定、加征关税的威胁下，那些追求规避风险的企业高管可能更有意愿回归美国建厂。然而，对进口钢铝加征关税也许会造成美国工厂投入成本上升，进而将它们推向相反的方向。对

进口自中国的零部件加征关税也会有同样的影响。

总之，特朗普治下出现的制造业复兴并不标志着美国就此回到了它堪称伟大的旧日时光。从历史上看，制造业是那些只有高中学历的美国人通往中产阶级的途径。但随着时间的推移，就业人口已向管理和专业领域转移，并从无需太高教育水平就能胜任的生产岗位上转走。制造业工人如今加入工会的可能性也不比从前，因而获得的福利也更少了。

人们从事的工作种类也在发生变化。2011年后增加的制造业就业人口主要集中在食品生产和包括汽车制造在内的运输设备生产领域。与此同时，印刷、计算机制造和服装生产如今在制造业就业中的占比较七年前均有下降。

工作岗位在地理层面也发生了转移。自制造业开始复苏起，密歇根州和伊利诺伊州所在的中部东北区在岗位增长中贡献的份额已经超过了该地区在经济衰退期间岗位流失所占份额。而纽约州和宾夕法尼亚州所在的中大西洋地区自2011年起未录得任何制造业就业人口净增长。

然而，在政治上，不是所有地方都“生而平等”。经本刊估算，那些在2016年11月投票给特朗普的县自2011年以来在制造业岗位上的增幅更大。它们在大选后的增幅往往也是最大的。相较于美国其他地区，这些地方的制造业在总体就业中的占比上升。看起来，美国制造业远远还未闭眼，倒是哼起了特朗普的调门呢。 ■



Arab aviation

Take the long way home

Where the shortest distance between two points is a squiggle

In calmer times the flight from Dubai to Beirut ends with stunning vistas of the hills of Damascus and the mountains of Lebanon. But for years the airspace over Syria has been crowded with warplanes. The Gulf airlines no longer use it. Instead Emirates, the flag carrier of Dubai, detours across Saudi Arabia and Egypt, adding 700km to the trip. The journey takes even longer on Qatar Airways, which was barred from Saudi airspace after a dispute between the Gulf countries erupted last year. Its route from Doha to Beirut resembles a crook: north over Iran, west across Turkey and south down the coast. What should be a 1,825km flight drags on for 2,865km.

The best way to visualise the Middle East's many conflicts is, literally, from 30,000 feet. Because of wars and political disputes, large bits of the region are off-limits to passenger jets. A straight line between Cairo and Amman is about 500km. That line crosses north Sinai, though, where Egypt is fighting an Islamist insurgency. Pilots fly south to avoid it, adding an extra 190km to their trips. Libya and Yemen are beset by civil wars, complicating routes to Africa.

Since most Arab countries do not recognise Israel, their airlines avoid it. Even the national carrier of Egypt, which signed a peace treaty with Israel 40 years ago, skirts Israeli airspace. (It operates a daily flight to Tel Aviv via a subsidiary, Air Sinai, often on an unmarked Embraer.) Royal Jordanian is a rare exception, but it cannot cross Israel en route to Lebanon. As the crow flies it is 220km from Amman to Beirut. As Royal Jordanian flies they are 1,070km apart, an almost circular route that dodges both Israel and Syria. El Al faces similar restrictions: to reach Asia the Israeli carrier flies all the way

down the Red Sea, to the Horn of Africa, before turning east.

For travellers this is a nuisance, adding an extra hour or two to journeys. But for airlines it imposes real costs. Qatar Airways posted a \$766m profit in the 2017 financial year. In the 2018 financial year (which ended on March 31st) it lost \$69m. Operating costs were up by 15%; passenger numbers were down 9%. “We didn’t raise the ticket price,” says Akbar al-Baker, the CEO. “We had to absorb the additional cost.” Emirates and Etihad, the flag carrier of Abu Dhabi, run five daily flights to Beirut. With the detour around Syria, they log an extra 2.7m km every year. Depending on the aircraft, that means up to 19m litres of additional jet fuel, about \$11.4m at current prices.

Travellers in a hurry do have one option. Middle East Airlines (MEA) of Lebanon kept flying throughout the country’s 15-year civil war, despite losing half of its fleet to shelling. The dangers over Syria have not fazed it. MEA did reroute in April, as America weighed a punitive strike over a Syrian chemical-weapons attack. But only briefly. Soon after the cruise missiles landed, MEA’s planes were back in Syrian skies. ■



阿拉伯航空业

绕路回家

在这里，两点之间曲线最近

在比较和平的时期，在迪拜飞往贝鲁特的航班终段可以望到大马士革的丘陵和黎巴嫩的群山这样令人惊叹的壮丽景象。但多年来，叙利亚上方的空域一直遍布战机。波斯湾的航空公司已不再飞经这一区域。迪拜的国家航空公司阿联酋航空（Emirates）改道飞经沙特阿拉伯和埃及，航行距离因此增加700公里。卡塔尔航空（Qatar Airways）的航班还要飞更久，因为去年海湾国家之间爆发争端后，这家公司被禁止进入沙特领空。它从多哈到贝鲁特的航线形状像个钩子：先向北取道伊朗，向西飞经土耳其，再沿地中海海岸线向南飞行抵达。本应是1825公里的飞行距离拉长到了2865公里。

要感受中东地区的众多冲突，最直观的方式就是飞上三万英尺的高空。由于战争和政治争端，该地区很多地方都禁止民航飞行。开罗和安曼之间的直线距离约为500公里。但这条直线经过北西奈，埃及与伊斯兰叛乱分子正在这里作战。为避开这一冲突区域，飞行员要向南飞行，行程因而增加了190公里。利比亚和也门深陷内战，让通往非洲的航线也变得复杂。

大多数阿拉伯国家都不承认以色列，因此它们的航空公司都会绕飞以色列。埃及在40年前与以色列签署了和平条约，但就连埃及的国家航空公司都会绕过以色列领空。埃及航空通过子公司西奈航空（Air Sinai）运营一班每日飞往特拉维夫的航班，执飞的通常是不携带标志的Embraer（巴西航空工业公司制造）飞机。约旦皇家航空（Royal Jordanian）是一个罕见的例外，但它也不能经以色列飞往黎巴嫩。从安曼到贝鲁特的直线距离是220公里，而约旦皇家航空的飞机得飞1070公里：航线绕开以色列和叙利亚，几乎是画了个圈。以色列航空（El Al）也面临类似的限制：为了到达亚洲，它的飞机要一路飞过红海到达非洲之角后才能向东转。

对于旅客来说，旅程增加了一两个小时很烦人。而对于航空公司来说，却要为这一两个小时花费真金白银。卡塔尔航空在2017财年的利润为7.66亿美元。而2018财年（截至3月31日）亏损了6900万美元。运营成本上涨了15%，乘客人数却下降了9%。“我们没有提高票价，”CEO阿克巴尔·阿尔贝克（Akbar al-Baker）说，“我们不得不自己承担额外成本。”阿联酋航空和阿布扎比酋长国的国家航空公司阿提哈德航空（Etihad）每天有五趟飞贝鲁特的航班。由于要绕开叙利亚，它们每年要多飞270万公里。这意味着最多要额外消耗1900万升的燃油——具体要看机型——按现价计算约为1140万美元。

赶时间的旅客倒还有个选择。黎巴嫩的中东航空公司（MEA）在持续15年的黎巴嫩内战期间不曾中断航班服务，尽管因炮击损失了一半的飞机。叙利亚上空的危险并没有困扰它。由于美国因叙利亚化学武器袭击事件对其实施了惩罚性打击，中东航空在4月曾变道飞行，但也只持续了很短一段时间。巡航导弹落地后不久，中东航空的飞机就又回到了叙利亚的上空。





Looking ahead

What goes around

Introducing a more circular economy is necessary, but it will meet with resistance

A SINGLE, BARE lightbulb helps illuminate part of the Livermore-Pleasanton fire department on the eastern edge of the San Francisco Bay area. It does not look out of place, if a little dim. But it is no humdrum piece of electrical equipment. For the Centennial Light, as it is known, has been burning almost continuously since 1901. To proponents of a less resource-intensive, more circular economy, the bulb (pictured) shows that everyday products can be affordable and built to last.

Not everyone has an interest in such longevity, however. In 1924 a cartel of big lightbulb manufacturers, including General Electric, Osram and Philips, agreed to keep lifetimes of their products to 1,000 hours or so, down from an average of 2,500 hours, in order to sell more of them. Many companies still make it difficult, or even illegal, to mend their products. This has provoked push-back from customers demanding a “right to repair”. French prosecutors are investigating whether Apple, which has admitted slowing older iPhones with software upgrades, deliberately intended to shorten the product’s lifetime to make customers replace it—a criminal offence in France. Legal or not, such activities look economically inefficient and environmentally foolish, even though they may make perfect sense for individual companies. The question is how to persuade those firms to go against their apparent self-interest in order to create a more circular economy.

Forecasts can help focus minds. Last year the International Resource Panel, an independent scientific body under the auspices of the UN Environment Programme, suggested that wiser use of resources could add \$2trn, or

roughly the GDP of Italy, to the global economy by 2050. Limiting food waste alone could contribute \$252bn a year by 2030. Analysis by Circle Economy, a consultancy, found that, of the 84bn tonnes of materials consumed each year by the global economy—including biomass, sand, metals and fossil fuels—barely 9% are reused.

Workers need not lose out, either—in their jobs or as shoppers able to snap up more durable smartphones. A series of reports for the Club of Rome, a think-tank, found that, if product lifetimes were doubled and half the virgin materials consumed today replaced with recovered ones, the resulting economic shift would create 200,000 net new jobs in Spain and 300,000 in France. (Improving energy efficiency and replacing half of all fossil fuels used with renewables would add another 565,000 jobs across all the countries studied.) Most new work would come in green industries such as recycling. After reviewing 65 studies on the effects of a more circular economy, academics at the University of Augsburg found that related job creation outweighs job destruction. A report by McKinsey said the global net employment gains would be anywhere between 9m and 25m jobs.

The environment would benefit, with fewer mines, more trees and less need for landfills and incinerators. Recycling aluminium saves 95% of energy compared with smelting new metal. The savings are 88% for plastic, 60% for steel and paper, and 38% for glass. According to Sitra, Finland's state-run innovation fund, raising recycling rates for aluminium, steel and plastic by 50-80% would cut European industrial emissions, which account for one-tenth of the continent's total, by a third.

However, what makes sense environmentally may not look good for the bottom line of an individual company or region. The most obvious casualties would be purveyors of fossil fuels, minerals, agricultural produce and other primary materials, the demand for which would suffer. If everything else remained constant, eliminating 1.3bn tonnes of food waste

could mean \$750bn less in sales for farmers—the value which the UN’s Food and Agriculture Organisation ascribes to all the food spoiled or lost annually between farm and fridge. More durable consumer products could mean that fewer have to be made, potentially hurting manufacturers’ volumes. More Uber rides may ultimately lead to fewer people buying cars of their own. Less need to ferry merchandise could hit shipping companies, too. The Club of Rome study found that, in Poland, where many people continue to be employed in agriculture, more productive use of resources could potentially destroy jobs overall.

Politicians in most rich countries may calculate that repatriating offshored factory jobs to plants back home where recovered materials are reprocessed is a vote-winner. But it may be less appealing to their counterparts in poorer places where workers found employment in manufacturing. Research by Garth Frazer of the University of Toronto found that clothes donated to Africa harmed African garment-makers. Between 1981 and 2000 second-hand imports explain two-fifths of the decline in African apparel production and half of the fall in garment-industry employment. South Africa has restricted imports of used Western garb. Six countries of the East African Community are considering a ban. China already has one.

This leads to a final concern about “closing the loop” of circularity: that it can ring-fence parts of economy from globalisation. As Mr Abbasov of Scrapo laments, the circular economy rarely crosses borders. Sometimes, as in the case of the Chinese ban on foreign recovered plastic and paper, ring-fencing seems to be the explicit objective. But it can also be an unintended consequence. New repair shops would by their nature be more local. Recyclers often gripe about national and international rules which, by not drawing a clear distinction as to what is hazardous, raise transport costs and hamper trade. For second-hand electronics, which are treated as waste even if they are in perfectly good working order, regulations make it several times costlier to freight within most countries and almost impossible to send

abroad. “Our industry has been in almost constant strife with regulators,” grumbles Ranjit Singh Baxi, president of the Bureau for International Recycling.

Such concerns are real. But they are not insuperable. For a start, other things are never constant. Populations grow; by 2050 Earth will have 2bn more consumers and mouths to feed. As people become richer, they consume more. In poor places like Lesotho, whose citizens waste little, consumption can increase by a lot before it comes close to Western levels—especially if it is accompanied by improvements in rubbish collection. African garment-workers deserve assistance, but shoppers there benefit from cheap, decent-quality foreign wear. And “circular” industries create employment in their own right.

Even if Club of Rome or McKinsey forecasts prove wide of the mark, history teaches that reshaping the economy creates more work than it destroys. Waste disposal generates just 0.1 job per 1,000 tonnes, compared with two jobs recycling the same amount, according to one study. A single Kenyan e-recycling programme is estimated to have generated over 2,000 jobs within four years of its launch. Recycling and repair industries could go global, too. Platforms like Scrapo or MerQbiz lubricate the exchange of recyclables across borders, showing that circular economies are not inherently protectionist.

The right response is therefore to experiment, not eschew resource efficiency. As this report has illustrated, there are signs that this is happening. Cities in the developing world are trying to get better at collecting rubbish and making sure that as little as possible goes to waste. The Chinese import ban is stirring many people in the West to relearn how to recycle. Campaigners and entrepreneurs are chivvying them along. Governments, especially in the West, are crafting “circular” strategies. By 2035 all EU states will be required by law to recover 65% of their rubbish,

from an average of 40% today. America under Donald Trump is an exception, but American cities and states are compensating by helping people sort their rubbish and send less to the landfill.

Yet, while rich countries are cleaning up at home, they are only beginning to deal with the fact that (as with carbon emissions) they have exported their throwaway Industrial Revolution model around the world, outsourcing their waste to developing countries. Westerners continue to enjoy products that are made elsewhere, and whose disposal does not affect them personally. Rather than being smug about how well they are doing at home, they need now to encourage the developing world in its quest for a less wasteful growth model.

Some middle-income countries appear willing to listen (see chart). China's latest five-year plan reaffirms its commitment to a "circular economy" and last year's party congress called for the creation of a "waste-free society". Indonesia, Nigeria and other emerging economies are emulating developed ones by making producers help pay for managing the waste created by their own products.

Most have a long way to go before they emulate Taiwan. Poor countries must prepare to cope with an increase in waste as they develop a middle class consuming at Western levels. Only when they see that proper handling of solid waste can aid prosperity will the global tide of rubbish be stemmed. ■



展望未来

轮回

引入循环度更高的经济是必要的，但它会遭遇阻力

在旧金山湾区东部边缘的利弗莫尔-普莱森顿消防局，有一部分区域只有一个孤零零的灯泡在照明。它看起来并没有稀奇古怪之处——或许稍有点暗。但它不是一件无聊的普通电器。它被称为“百年灯泡”，自1901年以来几乎一直点亮。对于那些支持节省资源、提升经济循环度的人来说，这个灯泡（如图）说明日常产品可以既经济实惠又经久耐用。

然而，并非所有人都对这种长寿感兴趣。1924年，包括通用电气、欧司朗和飞利浦在内的大型灯泡制造商卡特尔同意将它们产品的使用寿命从平均2500小时降低到在1000小时左右，以便销售更多产品。许多公司现在仍然令修复其产品十分困难甚至非法。这引起了要求“维修权”的客户的抵制。法国检察官正在调查苹果公司是否故意缩短产品的使用寿命以迫使客户更换，这在法国是一种刑事犯罪。苹果公司此前承认用软件升级令旧iPhone变慢。无论合法与否，此类做法看起来在经济上效率低下，对环境来说更是愚蠢，即使它们对单个企业来说可能是完全合理的。问题是是如何说服这些公司违背其显在的自身利益，以创造一个更具循环性的经济。

预测可以帮助人们统一想法。去年，由联合国环境规划署主持的独立科学机构国际资源小组（International Resource Panel）提出，到2050年，更明智地利用资源可以为全球经济增加2万亿美元，大致相当于意大利的国内生产总值。到2030年，仅仅限制食物浪费就可以每年贡献2520亿美元。咨询公司“循环经济”（Circle Economy）的分析发现，在全球经济每年消耗的840亿吨材料中——包括生物质、沙子、金属和化石燃料——只有9%得到了重复利用。

工人们也不必因此而受损，无论是保住饭碗，还是作为购物者来购买更耐用的智能手机。智库“罗马俱乐部”（Club of Rome）的一系列报告发现，

如果产品寿命翻倍，且今天消耗的原始材料中有一半被回收材料取代，由此产生的经济转变将在西班牙净增20万个新工作岗位，在法国净增30万个。（提高能源效率并用可再生能源替代人们消耗的化石燃料的一半，将在所有被调研国家另增56.5万个岗位。）大多数新工作都将是来自回收等绿色行业。在审查了65项关于更具循环性的经济有何影响的研究之后，奥格斯堡大学的学者们发现相关的就业创造超过了职位流失。麦肯锡的一份报告称，全球净就业增长将在900万至2500万之间。

环境将受益，矿山减少，树木增多，对垃圾填埋场和焚化炉的需求也会减少。与冶炼新金属相比，使用回收铝可减少95%的能源消耗量。塑料减少88%，钢和纸减少60%，玻璃减少38%。据芬兰国家创新基金（Sitra）称，将铝、钢和塑料的回收率提高50%至80%将使欧洲工业排放量（占欧洲大陆总排放量的十分之一）减少三分之一。

然而，对环境有意义的事情，对于单个企业或地区的利润来说可能并不好看。受冲击最明显的将是化石燃料、矿产、农产品和其他原材料的供应商，因为需求将会减少。如果其他一切保持不变，消除13亿吨食物浪费可能意味着农民的销售额将减少7500亿美元——这是联合国粮农组织认为每年从农场到冰箱的路上腐坏或损失的食物的价值。更耐用的消费品可能意味着必须制造的产品更少，这可能会损害制造商的产量。更多人乘坐优步可能最终导致买车自用的人数减少。运送商品的需求下降也可能对航运公司造成打击。罗马俱乐部的研究发现，在波兰仍有大量人口从事农业，更高效地利用资源可能会在整体上破坏就业。

大多数富裕国家的政客可能会推测，将离岸外包工厂的岗位转移回本国处理回收材料的工厂会赢得选票。但对于较贫困地区的政客来说，这种变化可能不那么吸引人，因为自家的工人要寻求制造业就业。多伦多大学的加思·弗雷泽（Garth Frazer）的研究发现，捐赠给非洲的衣服伤害了非洲的服装制造商。在1981年至2000年间，二手进口导致非洲服装产量下降五分之二，服装业就业减少一半。南非已经限制进口二手西方服装。东非共同体的六个国家正在考虑实施禁令。中国已经实施了一个。

这导致了对循环的“闭环”的最后一个担忧：它可以将经济的一部分限制起来而不参与全球化。正如Scrapo的阿巴索夫哀叹的那样，循环经济很少跨越国界。就像中国禁止进口外国回收塑料和纸张那样，有时候限制性保护似乎是显而易见的目的。但它也可能是一个非预期的后果。新的维修店自然会更加本地化。回收商经常抱怨国家和国际规则没有明确规定什么是危险品，这提高了运输成本也阻碍了贸易。对于二手电子产品而言，哪怕是处于完美的工作状态也被视为废弃物，监管使得大多数国家的国内运输成本翻了几倍，而且几乎不可能将它们运往国外。“我们的行业和监管机构的冲突几乎就没有停过。”国际回收利用工业局（Bureau for International Recycling）的总裁兰吉特·辛格·巴克希（Ranjit Singh Baxi）抱怨道。

这些担忧是真实的。但它们并非不可克服。首先，其他事物并非一成不变。人口会增长：到2050年，地球将多出20亿消费者和要填饱的肚子。随着人们变得更富裕，他们消费的量也更多。在莱索托这样贫穷的地方，其国民几乎没有浪费，消费还可以提升很多才会接近西方水平——特别是如果伴随着垃圾收集改善的话。非洲服装工人应该得到援助，但那里的购物者则受惠于便宜而质量上乘的外国服装。而且“循环”产业本身就能创造就业机会。

即使罗马俱乐部或麦肯锡的预测失之千里，历史告诉我们，重塑经济创造的工作比摧毁的要多。一项研究表明，丢弃每千吨废物仅产生0.1个工作岗位，相比之下，回收相同的量会创造两个岗位。据估计，单是肯尼亚的电子回收计划在推出后的四年内已创造了2000多个岗位。回收和维修行业也可以走向全球。像Scrapo或MerQbiz这样的平台促进了跨境可回收物的交换，表明循环经济并非天生就是保护主义者。

因此，正确的做法是试验，而不是避免提升资源利用效率。正如本报道所示，各种迹象表明这正在发生。发展中国家的城市正试图更好地收集垃圾，并尽可能减少最终丢弃的量。中国的进口禁令正在激励西方许多人重新学习如何回收利用。活动家和企业家正在敦促他们。各国政府，特别是西方国家，正在制定“循环”战略。到2035年，法律要求所有欧盟国家回收65%的垃圾，而今天平均为40%。特朗普领导下的美国是一个例外，但美

国的城市和州正在通过帮助人们给垃圾分类并减少填埋量来做出补偿。

然而，虽然富裕国家开始清理自家的垃圾，他们只是刚刚才开始应对这样一个事实（就像碳排放一样）：他们已经将其工业革命的一次性使用模式输出给全世界，将垃圾外包给了发展中国家。西方人继续享受其他地方生产的产品，而这些产品的废弃物处理对其个人毫无影响。他们现在需要鼓励发展中国家寻求一种不那么浪费的增长模式，而不是对自己在国内的美好生活沾沾自喜。

一些中等收入国家似乎愿意倾听（见图表）。中国最新的五年计划重申了对“循环经济”的承诺，去年的党代会呼吁建立一个“零浪费社会”。印度尼西亚、尼日利亚和其他新兴经济体正在效仿发达经济体，让生产商帮助支付管理自己产品生成垃圾的费用。

大多数国家在效仿台湾之前还有很长的路要走。贫穷国家在发展出以西方水平消费的中产阶级时必须准备应对废物的增加。只有当它们看到妥善处理固体废物有助繁荣时，才能阻止全球的垃圾浪潮。 ■



China

Exit the dragon

A Chinese ban on imports of rubbish is shaking up the global junk trade

ON THE FIRST day of 2018, a huge shock hit the global recycling industry. China, which is the world's biggest scrap importer, stopped accepting virtually any recycled plastic and unsorted scrap paper from abroad, and severely curbed imports of cardboard. The amount of recovered material that America, the world's biggest exporter of scrap, sent to China was 3m tonnes less than in the first half of 2018 than a year earlier, a drop of 38%. China plans to phase in bans on most other rubbish, of which it imports \$24bn-worth a year. At recycling plants across the Western world, bales of mixed paper and polymers now languish in forecourts awaiting offers.

China used to import a significant portion of the world's scrap. Suddenly, revenues from selling mixed waste to China which waste-management companies used to cross-subsidise collection, dried up, hitting margins for American waste-management companies.

The Chinese ban removed the third leg of the “collect, sort, export” system on which the West had long relied. Improvements to automation could in time sort some of the surplus rubbish no longer sailing to China, but they have been incremental. High labour costs make hiring enough human sorters to deal with Western waste volumes prohibitively expensive. Because they, too, cannot rely on cheap labour, Western reprocessing firms need cleaner inputs than their Chinese counterparts, so shun a lot of what MRFs currently spit out. Even if they did not, their capacity is insufficient to deal with the glut. Incinerators and landfill will take some of the surplus waste. But the capacity of both is limited. Building a new incinerator costs upwards of \$200m. Landfills are being gradually regulated out of existence,

with many places, including California and the European Union, mandating cuts to the volume of waste being landfilled.

The prohibition is not the only way in which China is affecting the scrap trade. The trade spat provoked by American tariffs on imported steel and aluminium (which exempt scrap) has already prompted trading partners to impose retaliatory levies (including on recovered metals). If the current tiffs escalate into a full-blown trade war, scrap—\$109bn of which crosses borders each year—would suffer along with many other products.

The ban is likely to prove more of a long-term headache than the trade spat. It is part of a broader clampdown on polluting industries championed by China's all-powerful president, Xi Jinping. It aims to banish “solid waste with major environmental hazards” and thus prevent “intense public reaction”. That will deprive many countries of the destination of choice for their waste. But, though it has disrupted the whole global scrap trade, many experts are already seeing a silver lining. Activists and advocates of “circularity” say that it is forcing rich countries to rethink what they do with their waste now that a chunk of it can no longer be swept away overseas. It is in that way forcing longer-term change.

China came to dominate the global rubbish trade in much the same way it has come to dominate all areas of trade. It has an insatiable appetite for resources, including second-hand ones, to feed its booming economy. China's \$24bn-worth of recycled-materials imports are a quarter of the total traded globally, and up from \$12bn a decade earlier. On the eve of the ban, more than half of the world's used plastic, paper and cardboard—around 32m tonnes each year in all—sailed to China, chiefly from the rich world. Plenty of metal scrap went there too, especially copper to wire cities or manufacture electronics.

It was also helped by the nature of its trade flows. Bulky scrap shipments

to Chinese ports were only affordable thanks to “backhauling”. Container vessels had crossed the Pacific laden with Chinese products for North American markets. Rather than let them sail back empty, shipping companies ferried scrap for the return leg at rock-bottom prices. Around half of all westbound trans-Pacific container traffic was rubbish for recycling.

Because of the ban, shipping companies, whose low margins were offset by massive volumes, now risk losing the backhaul trade. Drewry, a shipping consultancy, estimates that the ban could jeopardise 4m-5m containers sailing west across the Pacific annually. That is equivalent to 3% of worldwide container traffic. Port authorities from New York to California are rewriting their long-term strategies to take account of the disruption.

Even China is not immune from the impact. Its operation, dubbed “National Sword”, looks distinctly double-edged, striking at a thriving domestic reprocessing industry—and manufacturing more broadly. Western scrap-industry veterans express astonishment at the Chinese authorities’ willingness to sacrifice the needs of its industrial base, parts of which rely heavily on reprocessed materials. China recycled 85% of the 7m tonnes of plastic it imported in 2016 (the rest went to landfills or was incinerated). Many Chinese reprocessing firms are now fearful about the future.

Some also see the benefits. Liu Jianguo, an expert on waste management at Tsinghua University in Beijing, calls the ban “good news for domestic waste recycling”, for the same reason that it will help Western countries. It will force the Chinese industry to change, adapt and be less reliant on imported foreign trash (though there is a danger in the short run that some Chinese reprocessors, starved suddenly of imported inputs, could fold, resulting in the dumping or burning of even more rubbish than it does already).

The China ban has, however, given a boost to one group of Western

entrepreneurs. In 2017 Rashad Abbasov co-founded Scrappo. It is an online marketplace that matches buyers and sellers of second-hand polymers in different countries. Since its inauguration in November, suppliers have posted offers to sell 1.5m tonnes of recovered plastic on Scrappo. It now has more than 10,000 users, 70% outside America. Just 6% are from traditional plastic-waste importers like China, Indonesia or Vietnam.

Other parts of the trade are also moving online. Scrap Monster, a platform for trading recovered metal, has 50,000 registered users. MerQbiz is a digital platform to streamline the \$30bn annual reused-paper market. Another forum, the Materials Marketplace, allows American manufacturers to exchange factory by-products and leftovers more easily. State-level versions exist in Ohio and Tennessee. Two years ago the project spawned an offshoot in Turkey. Another is under development in Vietnam. Advocates of “circularity” welcome such initiatives, which aim to wring the most out of available resources. The Chinese ban has done them all a favour by enabling recovered materials to flow to the highest bidder—and so the highest-value use. But it has also exposed the shortcomings of the recycling industry. ■



中国

巨龙抽身

中国禁止进口垃圾正撼动全球垃圾贸易

今年伊始，全球回收行业受到了巨大的冲击。世界上最大的废料进口国——中国——停止接收几乎任何来自海外的回收塑料和未分类废纸，并严格限制进口纸板。今年上半年，世界最大的废料出口国——美国——送往中国的回收废料量同比减少了300万吨，下降了38%。中国计划逐步禁止大多数其他垃圾进口，目前这部分的年进口额达240亿美元。在西方世界各地的回收工厂里，大捆大捆的混合纸张和聚合物正在院子里苦苦等待报价。

中国在过去进口了全球废料中的很大一部分。转眼之间，向中国出售混合废品的收入枯竭了，而废品管理公司正是靠这笔收入来对垃圾收集进行交叉补贴。这冲击了美国废品管理公司的利润率。

中国的禁令拆掉了西方长期依赖的“收集、分类、出口”体系的第三根支柱。假以时日，自动化技术的改进可能会为一部分不再流向中国的过剩垃圾做分类，但这种改进是渐进的。由于劳动力成本高企，要雇用足够的分拣员来应对西方的废品量要付出天价。西方的再处理公司同样无法依赖廉价劳动力，因此需要比中国同行更清洁的输入，这导致它们对目前回收厂吐出的许多东西敬而远之。哪怕它们没有拒绝，其能力也不足以应对超量的供应。焚烧炉和垃圾填埋场能处理掉一些过剩的废品，但两者的容量都是有限的。建造一座新的焚烧炉成本在2亿美元以上。监管导致垃圾填埋场逐渐消失，包括加州和欧盟在内的许多地方都规定要减少垃圾填埋量。

中国影响废料贸易的方式不只是禁令。美国对进口钢铝征收关税（废金属免征）引发的贸易争端已经促使贸易伙伴展开报复性征税（包括对回收金属）。如果目前的争执升级为全面的贸易战，废料——每年共有1090亿美元跨越国界——将与许多其他产品一起遭受冲击。

比起贸易争端，这项禁令可能是更叫人长期头疼的事。中国无上权威的国家主席习近平倡导严厉打击污染行业，这项禁令是这一广泛举措的一部分。它旨在驱逐“环境危害大的固体废物”，从而避免“群众反映强烈”。这将让许多国家失去首选的废品目的地。但是，虽然它扰乱了整个全球废料贸易，许多专家已经看到了事情好的一面。“循环性”的积极分子和倡导者说，既然很大一部分废品无法再被扫到海外，这迫使富裕国家重新思考它们处理废品的方式。而这将真正推动长期变革。

中国主宰全球垃圾贸易的过程和它主宰所有贸易领域的方式无甚两样。为支撑其蓬勃发展的经济，它对各种资源都有着难以满足的胃口，包括二手资源。中国240亿美元的回收材料进口量占全球废料贸易总额的四分之一，而十年前这个数字是120亿美元。在禁令颁布前夕，全世界超过一半的废塑料、纸张和纸板运往中国，主要来自富裕国家——每年总计约3200万吨。还有大量的废金属，特别是给城市铺设线路或制造电子产品所需的铜。

中国贸易流通的特点也推动了垃圾进口。幸亏有了“载货返航”，将大批废品运往中国港口的成本才可以负担。集装箱船横穿太平洋，满载面向北美市场的中国产品。航运公司不是让它们空载返航，而是以最低价格在回程运送废品。所有西向的跨太平洋集装箱货运中，大约一半都是用于回收的垃圾。

现在，垃圾禁令可能使得那些靠高周转弥补低利润的航运公司失去回程业务。航运咨询公司Drewry估计，该禁令可能会危及每年四五百万个西向的跨太平洋集装箱。这相当于全球集装箱流量的3%。从纽约到加利福尼亚的港务局正在改写长期战略以应对这一变故。

即便是中国自己也不能免受影响。它这项所谓的“国门利剑”行动看起来明显是把双刃剑，挥向蓬勃发展的国内再处理行业——以及更广泛的制造业。西方废料业资深人士对中国当局宁愿牺牲其工业基地（其中一些严重依赖再加工材料）的需求表示惊讶。中国回收了2016年进口的700万吨塑料中的85%（其余的进入垃圾填埋场或被焚烧）。如今许多中国再处理公

司都对未来感到担忧。

有些人也看到了好处。清华大学废品管理专家刘建国称，这项禁令“对于国内垃圾回收来说是个好消息”，原因和它将给西方国家带来的改变是一样的。它将迫使中国工业改革、适应，减少对进口洋垃圾的依赖（尽管存在短期危险，因为一些国内再处理商可能会因为进口输入突然断供而破产，结果导致倾倒或焚烧的垃圾比现在更多了）。

不过，中国的禁令推动了一类西方创业者。2017年，拉沙德·阿巴索夫（Rashad Abbasov）和其他人一起创立了Scrapo。这是一个在线市场，可以匹配来自不同国家的二手聚合物买家和卖家。自去年11月成立以来，供应商已在Scrapo张贴了150万吨回收塑料的销售报价。它现在拥有超过一万名用户，70%来自美国以外。只有6%来自中国、印度尼西亚或越南等传统废塑料进口商。

回收行业的其他部分也开始转到线上。回收金属交易平台“废品怪物”（Scrap Monster）拥有五万名注册用户。数字平台MerQbiz让每年300亿美元的再生纸市场变得更加高效。另一个名叫“材料市场”（Materials Marketplace）的论坛让美国制造商更便捷地交易工厂副产品和剩余物。俄亥俄州和田纳西州都有相应的州级版本。两年前，该项目在土耳其设立了分支机构；越南分支目前正在开发中。“循环性”的倡导者欢迎这类意在最大限度利用现有资源的举措。中国的禁令帮了它们的忙，使得回收材料能够流向出价最高的人——因此获得了价值最高的利用。但回收行业的缺陷也因此暴露无遗。 ■



Generation gap

Millennial longing

Firms are gradually adapting to the tastes of younger consumers

OLDER people are not the only ones to try too hard to be hip and youthful. Long-established firms can, too. Just look at Procter & Gamble (P&G), one of the world's largest consumer-goods firms, which this year applied to America's federal patent office to trademark LOL, NBD, WTF and FML, abbreviations commonly used in text messages and social media. If it succeeds, the 181-year-old firm plans to use the phrases to market soap, cleaners and air fresheners to young buyers. Its move is the intellectual-property equivalent of Dad dancing. But it is a sign of large firms' eagerness to woo millennial consumers.

To many firms they are a mystery. KPMG, a consultancy, reckons nearly half do not know how millennials—typically defined as those born between 1980 and 2000—differ from their older counterparts. That may be because such differences are overblown. According to Ipsos-MORI, a pollster, millennials are “the most carelessly described group we have ever looked at”. Many claims about them are simplified or wrong. It is often said, for example, that they ignore conventional ads; in fact they are heavily influenced by marketing.

Given such misconceptions, it is little wonder that firms sometimes get it wrong. In February, MillerCoors, an American brewer, released Two Hats, a light fruit-flavoured brew the beer-maker said would suit millennials' tastes and budgets (tagline: “Good, cheap beer. Wait, what?”). Consumers just waited; the beer was pulled from shelves after six months. But some stereotypes about millennials have roots in reality. Companies are finding that three broad approaches do succeed when trying to sell to them:

transparency, experiences (over things) and flexibility.

On the first of these, transparency, younger brands have led the way. In clothing, one example is Everlane, an online clothing manufacturer based in San Francisco. It discloses the conditions under which each and every garment is made and how much profit it generates as part of its philosophy of “radical transparency”.

Some large companies have made dramatic changes. ConAgra, an American food giant, has simplified its recipes and eliminated all artificial ingredients from many of its snacks and ready meals. After years of falling sales, it is growing again; millennials now account for 80% of its customer growth. “Bringing in these folks has been absolutely critical to growing the brands,” says Bob Nolan, ConAgra’s senior vice-president of insights and analytics.

Millennials’ appreciation of experiences over “stuff” is also real. Online platforms such as Airbnb have capitalised on youngsters’ taste for splurging on holidays, dinners and other Instagrammable activities, but so too have some older bricks-and-mortar firms. In 2016 JPMorgan Chase, a bank, launched Sapphire Reserve, a premium credit card that offers generous rewards for spending on travel and dining. Touted as “a card for accumulating experiences”, the \$450-a-year product has been a hit with well-off millennials, who represent more than half of cardholders.

Younger consumers also have more debt, fewer assets and less job security than previous generations. In this regard, flexibility matters. Ally Bank, a subsidiary of Ally Financial, the former financial wing of General Motors, for example, does not charge its current-account customers any maintenance fees or require them to hold minimum balances. Such features have earned it the loyalty of millennials.

Business models are being revamped to serve commitment-phobic

millennials. Big carmakers, including GM, Volvo and BMW, offer subscription services for their cars, offering access to new vehicles without lengthy financial obligations.

Yet many firms still have too homogeneous a view of millennials, says Laura Beaudin, a partner at Bain & Company, a consultancy. “If you want to resonate with a group that prides itself on diversity, having a one-size-fits all solution does not make sense,” she says. Some firms do embrace customers’ individuality—in May, Gucci, an Italian fashion house, introduced customised versions of a popular tote bag and pair of sneakers as part of a campaign called Gucci DIY. Gucci reportedly maintains a cadre of under-30 staffers to advise its boss. Expect more companies of a certain age to hark back to youth. ■



代沟

千禧渴望

企业在逐渐迎合年轻消费者的喜好

不止上了年纪的人会拼命装嫩扮酷，历史悠久的企业也会如此。看看全球数一数二的消费品公司宝洁吧，该公司今年向美国联邦专利局申请把LOL、NBD、WTF和FML这些在短信和社交媒体中常用的缩写用作其产品商标。如获批，这家181年历史的公司计划使用这些符号向年轻消费者推销肥皂、清洁剂和空气清新剂等产品。宝洁在知识产权上的这番举动就如同老爸笨拙地秀起舞技。但这也显示出大公司多么渴望吸引千禧一代消费者。

对许多公司而言，千禧世代是个谜一样的存在。咨询公司毕马威估计，近半数公司不明白千禧一代（通常被界定为1980年至2000年间出生的人）与之前的世代有何不同。这可能是因为其中的差异被夸大了。民意调查机构Ipsos-MORI表示，在所有调查过的群体中，有关千禧一代的描述是“最漫不经心的”。许多关于他们的说法都是过于简化或错误的。例如，人们常说千禧世代不看传统广告，而事实上，他们受市场营销的影响很深。

有了这些误解，企业时有失策就不足为奇了。今年2月，美国酿酒商米勒康胜（MillerCoors）推出了一款果味淡啤酒Two Hats，称这款啤酒适合千禧一代的口味和预算（广告语是：“好喝又便宜的啤酒。等一下，真的？”）结果消费者就只是等着。六个月后，这款啤酒在冷遇中下架。但对千禧世代的某些刻板印象确有其现实根源。企业逐渐发现，要成功向千禧世代推销产品，大致有三个路子行得通：透明度、体验（比物品重要）、灵活性。

首先，在透明度这方面，年轻品牌已经在引领潮流。在服装行业里，位于旧金山的服装电商Everlane便是一例。作为其“彻底透明度”经营哲学的一部分，该公司主动披露所制造每件衣服的生产条件以及产生的利润。

一些大企业已改弦易辙。美国食品巨头康尼格拉（ConAgra）简化了所生产食品的材料构成，并从许多零食和即食快餐中剔除了一切人工配料。销售下滑多年后，开始重现增长，而千禧一代贡献了新增顾客的80%。公司的洞察与分析高级副总裁鲍勃·诺兰（Bob Nolan）说：“吸引这些群体对品牌发展至关重要。”

相较于购“物”，千禧一代也确实更愿意花钱买“体验”。像爱彼迎这类在线平台充分利用了年轻人的喜好——甘愿为假期、晚餐和其他可以到社交媒体上晒照片的活动大把撒钱。但一些老牌实体公司也看准了这一点。2016年，摩根大通（JPMorgan Chase）推出了高端信用卡蓝宝石卡（Sapphire Reserve），对旅行和餐饮消费提供优厚的积分返点。这款号称“积累体验的信用卡”、年费450美元的产品受到富裕千禧一代的追捧，他们在持卡人中占比超过一半。

与前几代人相比，年轻消费者的债务更多，资产更少，工作保障也更低。如此一来，灵活性就变得很重要。例如，通用汽车的前金融部门Ally Financial的子公司Ally Bank对活期账户客户不收取任何管理费，也不要求最低余额。这些特点使它赢得了千禧一代的忠诚。

千禧一代有“承诺恐惧”，为此企业也在更新商业模式。包括通用汽车、沃尔沃和宝马在内的大型汽车制造商提供汽车租赁服务，令顾客无须背上长期财务负担就可以用上新车。

咨询公司贝恩的合伙人劳拉·鲍丁（Laura Beaudin）表示，许多公司对千禧一代的看法仍然过于单一。“如果你想与一个以多样性自诩的群体产生共鸣，靠千人一面的解决方案是行不通的。”她说。一些公司确实考虑到了顾客的个性。今年5月，意大利时尚品牌古驰推出了名为“古驰DIY”的活动，其中包括为一款流行手提袋和运动鞋提供个性化定制服务。据报道，古驰拥有一支由30岁以下员工组成的智囊团，为公司老板出谋划策。可以预见，未来将有更多老牌公司努力“卖萌”。 ■



In praise of the basics

Captain Sensible

Large economic gains can result from mundane policy improvements

Readers of *The Economist* are easily roused by debates over unconventional monetary policy, the merits of fiscal stimulus and innovative structural reforms. (Don't deny it.) Other areas of economic policy may lack the same thrilling sense of excitement, but dullness is not the same as irrelevance. There are large gains to be had by doing drab things a little bit better. Take three examples: maintenance, management of state assets and public-sector accounting.

Raising money for repairs is harder than finding the cash for flashy new projects that you can stick your name on. In recent decades America has built many useless new roads, yet the fraction of existing road surfaces that are too bumpy has risen from 10% in 1997 to 21% today. Potholes gradually damage vehicles that drive over them. Faulty locks on the Kiel Canal, which connects the Baltic and North seas, leave ships queuing to get through; sometimes they are forced on a detour around Denmark. Maintenance failures can also lead to fatal catastrophes like the recent bridge collapse in Genoa in Italy.

Yet if the costs of skimping on repairs can become tragically apparent, it is hard to spot maintenance shortfalls across the economy as a whole. Estimating how quickly assets deteriorate is tricky; so too is the job of tracking repairs, which are often undertaken by companies in-house (see Finance section). Canada has the best figures. It reckons that firms spend 3.3% of GDP on maintenance, more than twice what the country shells out on research and development. That makes repairs important to the economy in the short term, as well as over time.

Penny-pinching governments often let infrastructure crumble regardless. Even stimulus programmes typically favour vanity projects. After the financial crisis America spent twice as much per person on transport projects in sparsely populated areas as it did in cities, where the needs are greatest. Diverting more money into maintenance would be an easy win for society.

If some public assets are poorly maintained, others are inefficiently used. Governments own huge asset portfolios, including swathes of land, firms such as utilities or post offices, and financial assets, such as investments held by public-sector pension funds. The IMF recently studied 31 big countries covering about three-fifths of the global economy and found their collective assets to be worth \$101trn, or 219% of their combined GDP. The yields these assets produce vary wildly. SNCF, France's state-owned railway, earned a return on capital of 7.9% in 2017; Amtrak, America's closest equivalent, holds assets worth \$15bn but makes a loss. The fund reckons that a country moving from the 25th to the 75th percentile for risk-adjusted returns on only some kinds of assets would add annual revenues worth 3% of GDP to its coffers. That is roughly what rich countries earn, on average, from collecting corporate taxes.

How best to encourage more maintenance or to raise asset yields? Our third boring suggestion, improving public-sector accounting, is part of the answer. At the moment governments focus too much on cashflow and annual borrowing. Crumbling infrastructure and forgone yields do not feature in these figures. So when the state tightens its belt, it often preserves day-to-day spending by cutting maintenance and investment, even when doing so harms the public sector's net worth once all the beans are properly counted.

A businesslike focus on the balance-sheet would improve incentives. Finance ministers might invest more, were the resulting boost to public

wealth made clear. And if all state bodies had to account for the capital tied up in their operations, they might feel obliged to put it to better use, or to sell it off. Only in one country, New Zealand, is public-sector accounting up to scratch. It updates its public-sector balance-sheet every month, allowing for a timely assessment of public-sector net worth. Britain produces good numbers, too, but with a delay of over a year—too long a lag for the figures to shape policy.

All this may sound more like a cure for insomnia than for economies' ills. Yet getting basic issues right would produce greater gains than many of the brilliant ideas that politicians trumpet in order to dazzle voters. Being boring might not capture attention. But it could actually do some good. ■



赞美基本

务实带动

平淡的政策改进可以带来巨大的经济效益

《经济学人》的读者很容易因为有关非常规货币政策、财政刺激和创新结构改革的优点的争论而兴奋起来。（别不承认。）经济政策的其他领域可能不会这么激动人心，但沉闷不等于无关紧要。把乏味的事情做得略微好些就能获得巨大的收益。举三个例子：维修养护、国有资产管理和公共部门会计。

筹钱来做维护比融资兴建可以给自己贴金的光鲜新项目更难。近几十年来，美国建了大量无用的新路，而现有路面过于颠簸不平整的比例却从1997年的10%上升至今天的21%。坑洼的路面会让行驶其上的车辆逐渐受损。在连接波罗的海和北海的基尔运河（Kiel Canal）上，故障船闸让等待通过的船只排起了长龙，有时它们不得不绕道丹麦。维护不到位还可能导致致命灾难，之前发生在意大利热那亚（Genoa）的桥梁坍塌就是个例子。

然而，虽说在维护上省钱可能会付出惨重的代价，但要在整个经济中查找维护缺口并不容易。估算资产损耗的速度很难，追踪通常由企业内部承担的维修工作也一样。在这方面加拿大的数字最亮眼。加拿大估计本国企业在维护上的投入相当于GDP的3.3%，是该国研发投入的两倍多。这使得维修在短期和长期都对经济十分重要。

吝啬的政府经常任由基础设施朽坏，不顾后果。即使是刺激计划也往往偏向面子工程。金融危机之后，美国在人口稀少地区的交通项目上的人均支出是在交通需求最大的城市的两倍。将更多资金投入维护将可以让社会轻松受益。

如果说一些公共资产维护不善，其他公共资产存在的问题则是未能高效利用。政府拥有庞大的资产组合，包括大片土地、公用事业公司或邮局等企

业，以及公共养老基金持有的投资等金融资产。国际货币基金组织（IMF）最近研究了占全球经济规模约五分之三的31个大国，发现它们所持资产的总额为101万亿美元，占其GDP总量的219%。各国资产的收益率差别很大。国有的法国国家铁路公司（SNCF）2017年的资本回报率为7.9%；在美国，对等的美国国家铁路客运公司（Amtrak）持有价值150亿美元的资产，却是亏损的。IMF认为，一个国家若能将其仅仅是部分资产的风险调整后收益从第25百分位上升到第75百分位，就能为国库贡献相当于GDP的3%的年收入。这大致等于富裕国家从公司税中获得的平均收入。

如何能最有效地鼓励加大维护投入或提高资产收益率？我们第三个沉闷的建议是改善公共部门会计，这能在一定程度上解决这些问题。目前政府过分关注现金流和每年债务额度，相关数据都没有体现陈旧的基础设施和被弃之不理的资产回报。因此，当国家勒紧腰带时，通常会通过减少维护投入和投资来保证日常开支，即使在最后算总账时发现这样做会损害公共部门的净值。

务实地关注资产负债表将可以改善激励机制。如果增加投资对公共财富的提升作用清楚体现在账目上，那么财政部长可能就会做更多投入。如果所有国家机构都必须对与其运营相关的资本做出清晰的记录和解释，那么它们可能就会觉得有必要更好地利用该项资本，或将其卖掉。只有一个国家的公共部门会计是达标的，那就是新西兰。该国每月更新公共部门的资产负债表，以便及时评估公共部门的净资产。英国的公共部门会计做得也不错，但是要等一年多才出结果——要用来制定政策，这样的滞后太久了。

所有这些听起来更像是治疗失眠的妙方，而不是解决各个经济体弊病的良药。然而，正确处理基础问题能产生巨大的收益，远非政客为震撼选民而鼓吹的许多高招所能及。沉闷可能不会引人注意，但有可能带来切实的好处。 ■



Coffee wars

Full of beans

Competition is hotting up in the coffee industry

IN 1934, in the Italian city of Trieste, Francesco Illy came up with a way to package coffee in pressurised containers that kept it fresh. In 1935 he invented the first automatic coffee machine. In 1974 Illy, the company he founded, became the first to sell a kind of coffee pod—single servings of ground, tamped beans that produced espresso anywhere, any time.

Aluminium capsules, the successors of those pods, have become a fiercely contested battleground for the world's biggest coffee companies, notably Nestlé, a Swiss food-and-drink giant, and JAB Holdings, an investment firm intent on building a coffee empire. On October 8th, in the latest sign that the coffee wars are hotting up, Illy signed a licensing deal for capsules with JAB, blending Illy's coffee and cachet with JAB's commercial clout.

Two decades ago as many as 20 substantial companies competed in the retail-coffee trade, says Jeffrey Young of Allegra World Coffee Portal, a consulting firm. In the past few years the market has consolidated—and at a faster pace in the past year or so.

In 2015 JAB bought Keurig, America's biggest coffee-pod system, for \$13.9bn. It has also swallowed Jacobs Douwe Egberts, Espresso House and Peet's Coffee. Nestlé signed a \$7bn deal in May with Starbucks to distribute the ubiquitous chain's products. Today JAB and Nestlé together control about a third of the market for fresh and instant coffee, which Euromonitor International, a research firm, estimates to be worth \$83bn a year.

Capsules—an expensive but convenient way of making coffee—have been the market's fastest-growing area in recent years. The pace has slowed

recently, notably in America where the market has matured, but Europe is still bubbling away. Nespresso, owned by Nestlé, leads in Europe but has failed to make inroads in America. Keurig got there first, offering a variety of brands, and selling them through supermarkets. Until recently Nespresso only sold its products in its own shops and through its website. Nestlé's acquisition in 2017 of a majority stake in Blue Bottle Coffee, a hip Californian brand, is a sign of its eagerness to boost its presence in America.

Despite JAB's and Nestlé's heft, others are keen to compete. Coca-Cola bought Costa, a British chain, in September for £3.9bn (\$5bn). This month Lavazza, another Italian coffee-maker, bought Mars's coffee business, including its Flavia and Klix vending systems. But—as for many other products—Amazon is the great unknown. Sales of hot drinks have been slow to take off online. As capsules' popularity grows that may change, says Matthew Barry of Euromonitor. Amazon's purchase of Whole Foods, a trendy grocer, in 2017 brought with it Allegro, another fancy coffee brand. A bigger battle may be brewing. ■



咖啡之战

热气蒸腾

咖啡业的竞争正在升温

一九三四年，在意大利的里雅斯特市（Trieste），弗朗西斯科·意利（Francesco Illy）想出了一种用加压容器包装使咖啡保鲜的方法。1935年，他发明了第一台自动咖啡机。1974年，他创立的公司意利（Illy）成为第一家销售咖啡包的企业，这种磨好压实的单份咖啡豆让人们可以随时随地冲制浓缩咖啡。

这些咖啡包后来演变成铝制胶囊，已成为世界上最大的咖啡公司激烈竞争的业务，特别是瑞士食品和饮料巨头雀巢公司，以及有志于建立咖啡帝国的投资公司JAB Holdings。10月8日，意利与JAB签订了胶囊咖啡特许经营协议，将意利的咖啡和盛名与JAB的商业影响力相结合，是咖啡战争升温的最新迹象。

咨询公司Allegra World Coffee Portal的杰弗里·杨（Jeffrey Young）表示，20年前，在零售咖啡业中竞争的大型公司多达20家。过去几年市场发生了整合，并且在过去一年左右的时间里加速整合。

2015年，JAB以139亿美元的价格收购了美国最大的单杯咖啡机公司Keurig。JAB还吞并了Jacobs Douwe Egberts、Espresso House和Peet's Coffee。今年5月，雀巢与星巴克签署了一项70亿美元的交易，销售无处不在的星巴克连锁的产品。如今，JAB和雀巢共同控制着现磨咖啡和速溶咖啡市场的约三分之一，研究公司欧睿（Euromonitor International）估计这一市场每年价值830亿美元。

胶囊这种昂贵但便捷的咖啡制作方式近年来一直是咖啡市场增长最快的部分。最近增速有所放缓，特别是在市场已经成熟的美国，但在欧洲仍然蓬勃发展。雀巢拥有的Nespresso在欧洲处于领先地位，但未能在美国立足。Keurig已经抢先占领了美国市场，供应各种品牌，并通过超市销售。

直到最近，Nespresso都仅在自己的门店和网站上销售产品。雀巢于2017年收购了加州时尚品牌蓝瓶咖啡（Blue Bottle Coffee）的多数股权，表明雀巢渴望提升自己在美国的影响力。

尽管JAB和雀巢实力雄厚，但其他企业仍积极参与竞争。可口可乐9月以39亿英镑（50亿美元）的价格收购了英国咖啡连锁店咖世家（Costa）。本月，另一家意大利咖啡生产商乐维萨（Lavazza）收购了玛氏（Mars）的咖啡业务，包括Flavia和Klix咖啡饮品贩售机业务。但是，和众多其他产品所面对的一样，亚马逊是一个巨大的未知数。热饮的销售在网上起步缓慢。而随着胶囊不断普及，这种局面可能会发生变化，欧睿的马修·巴瑞（Matthew Barry）表示。亚马逊于2017年收购了时尚食品百货商全食（Whole Foods），由此获得了另一个时尚咖啡品牌Allegro。更大规模的咖啡之战可能正在酝酿之中。■



The world's best business-education programmes

Which MBA?

American schools rule this year's ranking

The first mba was taught at Harvard University in 1908. More than a century later, American institutions still dominate the business-school landscape. This year they claim 16 of the top 20 places in The Economist's ranking of full-time mba programmes, and 53 places in the top 100.

The University of Chicago's Booth School of Business regains first place from neighbouring Northwestern's Kellogg School of Management. It is the sixth time in seven years that Booth has come top. The rankings weight data according to what students tell us is important. The figures are a mixture of hard numbers and subjective marks given by students and alumni in four categories: opening new career opportunities (35%), personal development and educational experience (35%), better pay (20%) and networking potential (10%).

Students rate Booth's course the best of the 100 programmes surveyed. They also praise its world-class facilities and faculty, which includes several Nobel laureates. Job opportunities are among the best, thanks to a highly rated careers service and an alumni network of 52,500 people, one of the largest in the world. Employment outcomes are outstanding: 97% of students find a job within three months of graduation. Graduates pocket an average salary of \$129,400, a 67% rise on their pre-MBA pay cheques. The relationship with alumni lasts beyond graduation. The school runs refresher courses for former students on subjects such as entrepreneurship.

All this comes at a price. Fees at prestigious American schools in the top 20 now average \$123,000, and have risen quickly in recent years. By contrast,

European schools are cheaper because courses are generally shorter, so the return on investment is quicker. At IESE, at the University of Navarra, which has the top-ranked programme outside America, students pay \$96,000 for its 19-month course. The Spanish school has moved up 11 places to sixth, mainly because of a big boost in the average salary for its graduates to \$123,000 and a job-placement rate of 99%. Those looking for a bargain should head to Warwick Business School in Britain. A one-year course costs just \$49,400, thanks in part to the depreciation of the pound. ■



全球最佳商学院课程

MBA哪家好？

美国商学院雄霸今年的排行榜

全球首个MBA课程于1908年在哈佛大学开设。一个多世纪之后，美国高校仍然在商学院中称雄。在《经济学人》今年的全日制MBA课程排行榜里，它们在前20位中占据16席，在前100位中占据53席。

芝加哥大学布斯商学院从邻居西北大学凯洛格商学院手中重夺第一宝座。这是它七年来第六次登顶。这项排名主要依据商学院学生看重的因素来给数据加权。结果结合了以下四个方面的硬数据和学生及校友给出的主观评价：开启新的职业机会（35%权重）、个人发展和教育经历（35%）、薪水增长（20%），以及发展人脉的潜力（10%）。

在我们调查的100个MBA课程中，学生们对布斯商学院的课程评分最高。他们还称赞该学院世界一流的教学设施和师资，其中包括几位诺贝尔奖得主。职业发展机会也居最佳之列，这要得益于它备受赞誉的就业服务以及52,500人的校友网络——世界最大的校友网络之一。就业结果也很出色：97%的学生在毕业后三个月内找到了工作。毕业生的平均薪水为129,400美元，比就读MBA之前提高67%。学院和学生的关系延续到毕业以后。它为往届毕业生提供创业等方面进修课程。

所有这些都代价不菲。排行榜前20名中，美国商学院的平均学费为123,000美元，且近年增长迅速。相比之下，欧洲的商学院学费较低，因为课程期限通常较短，所以投资回收更快。纳瓦拉大学的IESE商学院是排名最高的非美国学院，学生们为其19个月的课程支付96,000美元。这所西班牙商学院的名次上升了11位，排名第6，主要是因为它的毕业生平均薪水大幅上涨至123,000美元以及99%的就业率。想要学费便宜，可以去英国的华威商学院。该学院一年期课程的学费只要49,400美元，这在一定程度上是因为英镑贬值。 ■



Bartleby

Keep calm and go home

A management book that is refreshingly different

MANAGEMENT books have a deservedly poor reputation. Too often they are written by people who confuse insight with jargon, the types who love to call a spade a “manual horticultural utensil”. At the other end of the scale are tomes containing a plethora of pithy platitudes about “breaking the mould” and “worshipping the kill”. The choice, in short, is between the incomprehensible and the inconsequential.

So it was a joy for Bartleby to read “It Doesn’t Have to be Crazy at Work”, by Jason Fried and David Heinemeier Hansson, who run a software company in Chicago called Basecamp. Their book is funny, well-written and iconoclastic and by far the best thing on management published this year.

The authors argue that it is perfectly possible to run a business with consistently growing profits (as they do) without requiring employees to work madly long hours. Tired workers will not be productive since “creativity, progress and impact do not yield to brute force”. Sleep-deprived managers are likely to be counterproductively impatient.

Basecamp employees have a 40-hour week, except in the summer when the company runs a four-day, 32-hour week. They also get three weeks’ holiday every year (subsidised by the firm to the tune of \$5,000 per person), a month-long sabbatical every three years, and a monthly massage at a spa.

Those are the right sort of perks, say Messrs Fried and Heinemeier Hansson. The wrong kind, found in many offices, include free dinners, games rooms and snack bars, which are all devices to keep employees at the office for longer. Workers should also beware of companies that declare “we’re all

family here”—a ruse to get workers to put their employers ahead of the needs of their real families.

Another criticism of corporate culture levelled by the book is that offices have become interruption factories. People are working longer and later because they cannot get stuff done at the office any more. At a conference attended by 600 people, the authors asked how many had recently enjoyed 3-4 hours of uninterrupted work; only 30 hands went up.

Open-plan offices are particularly bad at providing an environment for calm, creative work, they argue. So “library rules” are imposed at Basecamp. Conversations are kept to a whisper and there are separate rooms when meetings are needed.

Meetings are avoided, especially those involving lots of people. As the authors rightly point out: “Eight people in a room doesn’t cost one hour, it costs eight hours”. Workers do not need to be kept abreast of every single corporate development via memos or all-staff emails. The firm encourages JOMO, the “joy of missing out”, so employees can concentrate on their own work projects.

Another way to reduce stress is to avoid turning deadlines into “dreadlines”—unrealistic targets for project completions accompanied by ever-changing requirements. “Goals are fake,” the authors write. In their telling, made-up numbers function as a source of unnecessary stress until they are either achieved or abandoned.

Nor should workers demand that their colleagues deal with a query straight away. In almost every situation, the expectation of an immediate response is unrealistic. Allowing workers more time means they can come up with a more considered and helpful answer.

The overall aim of the firm should be couched in modest terms. Too many

businesses talk about “changing the world” and becoming a “disrupter”. Such aims are far too grandiose and put everyone under too much pressure. As a manager, if you set out to do a good job for your customers, and to treat your employees fairly, things will probably turn out fine.

In short, the book aims to persuade managers to take their “mission” less seriously and to take their employees more so. Furthermore, executives should stop equating the work ethic with the practice of working long hours. Work should not be frantic. A calm company can be good for employees and very profitable as well.

Whether or not it is as nice to work at Basecamp as the authors make it sound is hard to tell from the outside. It was voted one of America’s best small companies in 2017 by *Forbes*, a magazine. It helps that the group is private and has no activist investors to please. Some of its practices might not be possible at a giant, listed firm. But a lot more executives ought to reflect on its message. A relaxed ethos in the office might work better in the long run than the hard-charging approach that, at the moment, is all too common. ■



巴托比

淡定些，回家吧

一本管理学著作独出机杼，令人耳目一新

管理学著作声誉不佳也是咎由自取。它们的作者大多把“行话”当作思想洞见——也就是那种喜欢把铲子唤作“手工园艺工具”的人。其余的大部头著作充斥着精炼的陈词滥调，什么“打破模式”啦，“崇拜杀戮”啦。简言之，你只有两种选择：要么看不懂，要么不用看。

因此，当本专栏作者读到杰森·弗莱德（Jason Fried）和大卫·海涅迈尔·汉森（David Heinemeier Hansson）的《工作何须卖命》（It Doesn't Have to be Crazy at Work）一书时着实开心。两位作者在芝加哥经营着一家叫Basecamp的软件公司。他们的这本书文笔上乘、妙趣横生、打破传统，绝对是今年出版的管理学著作中的最佳。

作者指出，经营一家企业，完全可以在不要求员工疯狂加班的情况下实现利润持续增长（他们就做到了）。疲惫的员工难有成效，因为“用蛮力是逼不出创造力、进步和影响力的”。睡眠不足的管理者很可能会变得焦躁不耐烦，反而影响效率。

Basecamp的员工每周工作40小时，到了夏季一周工作四天、共32小时。他们每年有三周假期（公司提供高达每人5000美元的补贴），每三年可休一次一个月长假。另外，每个月可享受一次水疗按摩。

弗莱德和海涅迈尔·汉森说，这些才是正确的福利。很多公司给予员工的福利都不对，像是免费晚餐、游戏室和小吃吧。这都是公司为让员工在办公室多待些时候而耍的花招。如果有公司宣称“我们都是一家人”，员工们就要小心了——这也是个诡计，为的是让员工优先考虑雇主，而不是自己真正的家人。

这本书对公司文化提出的另一条批评是办公室已成为制造干扰的工厂。人

们之所以加班到很晚，是因为他们已经没法在办公室里把活儿干完。在一个600人出席的大会上，作者问有谁最近有连续工作三、四个小时没被打断的经历，只有30个人举手。

二人认为，开放式办公室尤其难以提供适当的环境，让员工去做需要安静的、创造性的工作。因此，Basecamp实行“图书馆馆规”，员工只能轻声交谈，如果需要开会就要另找房间。

Basecamp避免开会，特别是那种很多人参加的大会。作者指出的一点很有道理：“八个人开一个会，花费的不是一个小时，而是八个小时”。没必要通过备忘录或给全体员工发邮件让他们了解公司发展的每一个动态。公司鼓励员工“享受错失”（JOMO，joy of missing out的缩写），这样他们就可专注于自己的工作内容。

另一个减压的方法是避免让截止日变成“要命日”——设定不切实际的完成时间，项目要求却又一变再变。“目标都是假的。”两位作者如此写道。他们认为，领导大笔一挥定下的目标数字在被达成或放弃之前，只会成为无谓的压力之源。

员工也不应要求同事第一时间回应自己的询问。几乎在所有的情形下，期待他人当即作出回覆都是不现实的。给员工多一些时间，他们有可能给出更周全、更有帮助的答复。

在表述公司总体目标时，措辞应谦逊。太多企业都在谈论要“改变世界”和成为“颠覆者”了。这样的目标实在太过浮夸，让所有人都背负沉重压力。身为一名管理者，如果你以尽心服务客户、平等对待员工为己任，结果也许就不赖。

简言之，这本书力图说服管理者别把自己的“使命”看得那么重，倒是要多多重视员工。此外，高管们应停止在工作伦理与长时间工作之间划等号。工作不应那么疯狂忙乱。一家淡定的公司可以在造福员工的同时也赚取丰厚的利润。

在Basecamp工作的体验是不是真像作者们描述得那样好，作为局外人很难知晓。《福布斯》杂志去年将该公司评选为美国最佳小型公司之一。Basecamp是一家私营公司，也没有维权投资者要去讨好，这两点不无帮助。它的有些举措对于巨头上市公司来说可能并不可行。但众多高管都应仔细思考它传达的信息。眼下把员工逼到拼命的公司太常见了，而从长远来看，在办公室引入放松的氛围也许会更富成效。■



Digital advertising

Amazon's ad-renaline rush

Building a big digital-advertising business will help the e-commerce giant to continue its expansion

An award-winning series, “The Marvellous Mrs Maisel”, follows the fortunes of a woman in the 1950s who undergoes an unlikely transformation from a typical housewife of the day into a talented standup comedian. It is produced by Amazon and can be viewed on Prime Video, the e-commerce giant’s on-demand service. Since its birth in 1994, Amazon has starred in several dramatic metamorphoses of its own. It has pushed beyond retailing into fields as varied as electronic books, private-label goods and cloud computing, as well as online video. Now it is intent on becoming a force in digital advertising.

Amazon has a long way to go before it catches up with the giants of the industry. It has 4% of an American market worth \$111bn, compared with Google’s 37% and Facebook’s 21% (see chart). But Amazon started experimenting with ads only six years ago, and its young business is growing fast in a rapidly expanding market. By the end of the year it will overtake Microsoft, a software giant, and Verizon, a big telecoms firm, to rank third in America, according to eMarketer, a research firm.

Despite trailing far behind the leaders, Amazon’s ads are having an outsize effect on the company itself. Its revenues from ad sales worldwide in 2018 could hit \$8bn, contributing perhaps \$3bn in operating profit—over a quarter of the total. Michael Olson of Piper Jaffray, a brokerage, says that by 2021, it is “highly likely” that profits from Amazon’s ad business will exceed those from its lucrative cloud-computing unit, Amazon Web Services. Amazon loses money on its core e-commerce business, but can use the fat

profits from advertising in the same way as it has used the cash from cloud computing—to push into new businesses and countries, says Brian Nowak of Morgan Stanley, an investment bank.

Closing the gap between Facebook and Google will be difficult but not impossible. Like those two, Amazon has a rich pool of data about users which it can use to aim its ads, including information about past purchases, which product reviews consumers have read, where they are and their online browsing behaviour. Amazon has a unique advantage, because consumers who are using the site usually intend to buy things right away. Some 56% of Americans start the search for any product on Amazon.

That will help it to grow as brands shift marketing dollars away from physical retailers. “Trade spending”—payments to retailers by makers of soap, mouthwash, canned food and other household basics for prime shelf space and promotional offers—adds up to around \$200bn in America alone. Amazon is especially attractive to makers of such consumer packaged goods. Brand loyalty is weak and buyers are more likely to be swayed by prominent ads.

Amazon’s ads will not appeal to all businesses. Firms that do not sell goods through the site, such as fashion brands, carmakers and travel companies, will not advertise there. But online video is one potential opportunity to attract more business. Amazon allows video ads on Twitch, its online-gaming site, but it could also put adverts onto Amazon Prime to win some of the advertising spending aimed at conventional television channels.

Allowing advertising on Alexa, its voice-assistant, and Echo, its smart speakers, is another possibility. In the future, when people ask questions of Alexa or order something by voice, Amazon could incorporate advertising. Earlier this year it was reported that Amazon was in discussions with Procter & Gamble and Clorox about voice ads for their wares.

As it chases growth, Amazon will face three obstacles. First, it must consider whether its advertising will put off customers. Voice ads butting in to conversations, even ones with inanimate objects such as smart speakers, are potentially irritating. And subscribers who have paid to watch online videos are unlikely to enjoy sitting through commercial breaks. Amazon must take care to avoid alienating the people it spends so much trying to please.

Second, Amazon will have to balance its relationship with vendors and address potential conflicts of interest. Advertisers can buy space at the top of product searches or pay to sponsor products. In addition, some search results are labelled “Amazon’s choice”, which favour important vendors and advertisers, says Matti Littunen of Enders Analysis, a research firm. (Amazon does not disclose how products get this designation.) And as Amazon becomes a manufacturer and seller of more of its own private-label items, it will have to decide how much prominence to give paying advertisers and how much to its own goods.

According to research by RBC Capital, an investment bank, of 100 product searches on Amazon’s app, in only three instances was the top ranking result not a sponsored ad. Those were for three Amazon devices: two smart speakers and a Kindle e-reader. Makers of competing products will be unhappy if it appears that Amazon is favouring its own products on its site or discouraging competition by driving up the cost of ad space on products that directly challenge its private-label goods.

Amazon will also have to contend with a more active regulatory environment. In September the European Commission announced a probe into its use of data and whether it could use information about third-party retailers on its site, which are also competitors, to boost its profits. As the inquiry progresses, advertising practices could become an area of interest.

Amazon has so far avoided a privacy backlash from customers. “Facebook uses your personal life and friend graph to target ads. Amazon has a more clearly commercial relationship” with users, says Jonathan Nelson, the head of digital at Omnicom, a large advertising agency. But as its ad business grows, so will scrutiny. Amazon gives users little control over how much information they share for advertising purposes, which could violate new data-collection and privacy rules in Europe, says Mr Littunen.

As it gathers more information about people in the physical world, including their spending habits at Whole Foods, the grocer it bought last year for \$13.7bn, its dossier of data on consumers will become larger and more personal. That will propel Amazon’s rise. Just as Mrs Maisel discovers she has a new talent for cracking jokes, Amazon has a chance to thrive in a new venture. Before long it could make the digital-ad duopoly a three-way affair. ■



数字广告

亚马逊的广告强心针

建立大型数字广告业务将帮助这家电子商务巨头继续扩张

获奖剧集《了不起的麦瑟尔夫人》（The Marvelous Mrs Maisel）讲述了上世纪50年代一位女性的人生转折。她从那个时代一名典型的家庭主妇不可思议地蜕变成为才华横溢的脱口秀演员。该剧由电商巨头亚马逊制作，可通过其视频点播服务Prime Video观看。自1994年成立以来，亚马逊自己也扮演了几次戏剧性蜕变的主角。它突破零售业的疆域，进入了电子书、自有品牌商品和云计算，以及在线视频等各异的领域。如今它又决意成为数字广告业中的重要力量。

亚马逊要赶上业界巨头还有很长的路要走。它目前在价值1110亿美元的美国数字广告市场中的份额为4%，而谷歌和Facebook的市场份额分别为37%和21%（见图表）。但亚马逊六年前才开始涉足广告，它的这项年轻业务正在一个快速扩张的市场中迅速成长。根据研究公司eMarketer的数据，到今年年底，亚马逊将超越软件巨头微软和大型电信公司威瑞森（Verizon），成为美国第三大数字广告商。

尽管亚马逊的广告业务远远落后于业界领袖，但对公司本身正在产生巨大的影响。2018年亚马逊全球广告销售收入可能会达到80亿美元，贡献大概30亿美元的营业利润——占其总营业利润的四分之一以上。券商派杰（Piper Jaffray）的迈克尔·奥尔森（Michael Olson）表示，到2021年，亚马逊广告业务的利润“极有可能”超过其利润丰厚的云计算部门Amazon Web Services。投行摩根士丹利的布莱恩·诺瓦克（Brian Nowak）表示，亚马逊的核心电子商务业务是亏损的，但它一直凭借云计算部门的收入进军新的业务和国家，来自广告的丰厚利润可以发挥同样的作用。

要缩小和Facebook及谷歌之间的差距并非易事，但也不是不可能。亚马逊和这两家公司一样，拥有可用于精准投放广告的丰富的用户数据，包括历

史购物信息、消费者阅读过的商品评价、他们的地理位置，以及在线浏览习惯。亚马逊享有一个独特的优势：使用其网站的消费者通常有立即购物的打算。在网上搜索物品时，大约56%的美国人会先上亚马逊。

随着各种品牌减少在实体零售店的营销支出，这项优势会帮助亚马逊的发展。单在美国，肥皂、漱口水、罐头食品和其他家庭日用品的制造商为获得最佳货架位置和举行促销活动而向零售商支付的“渠道费”就高达约2000亿美元。亚马逊对这类包装消费品的制造商尤其具有吸引力。买家对这类产品的品牌忠诚度较弱，购物时更可能受到醒目广告的影响。

亚马逊的广告并非对所有企业都有吸引力。时尚品牌、汽车制造商和旅游公司等不在亚马逊上销售商品的企业不会在它的网站上做广告。但在线视频是一个可能吸引到更多业务的机会。亚马逊的在线游戏网站Twitch上已经可以播放视频广告，但它也可以将广告投放到亚马逊Prime上，以赢得一些打算花在传统电视频道上的广告支出。

另一种可能的做法是通过亚马逊语音助手Alexa和智能音箱Echo播放广告。未来，当人们向Alexa提问或通过语音订购产品时，亚马逊可能会加入广告。据报道，今年初亚马逊与宝洁和高乐氏（Clorox）洽谈了为它们的商品提供语音广告的事宜。

亚马逊在追求增长的过程中将面临三个障碍。首先，它必须考虑其广告是否会让用户反感。在对话中插入语音广告，哪怕是跟智能音箱等非活物的对话，都可能令人恼火。付费观看在线视频的用户也不太可能愿意忍受插播广告。亚马逊为取悦用户投入了很多，它须小心行事，以免失去他们的支持。

其次，亚马逊必须平衡与供应商的关系并解决潜在的利益冲突。广告主可以购买产品搜索结果页面的顶部位置或购买点击付费广告。研究公司恩德斯分析（Enders Analysis）的马蒂·利特宁（Matti Littunen）表示，除此之外，有些搜索结果会被标记为“亚马逊之选”（Amazon's Choice），这一标记会优先选择重要供应商和广告主的产品。（亚马逊没有透露产品如何

得到这种称号。) 而随着亚马逊更多地生产和销售自有品牌商品，它必须决定如何在分配“吸睛”的位置时平衡付费广告主和自有商品的需求。

投行RBC Capital的研究显示，用亚马逊的应用搜索100种产品，仅有三种的搜索结果首项不是支付了广告费的商品。这三个都是亚马逊的自有品牌：两款智能音箱和一款Kindle电子阅读器。如果亚马逊疑似在其网站上偏向自己的产品，或通过提高广告位成本来阻止竞争产品的制造商直接挑战它的自有产品，肯定会引起这些制造商的不满。

亚马逊还必须应对日益积极的监管环境。9月，欧盟委员会宣布对亚马逊展开调查，包括亚马逊对数据的使用情况，以及它是否可能使用其网站上第三方零售商的信息来提高自身利润，因为这些零售商同时也是亚马逊的竞争对手。随着调查的推进，亚马逊的广告业务也可能卷入其中。

到目前为止，亚马逊还未因隐私问题遭到用户的抵制。大型广告公司宏盟媒体集团(Omnicom)的数字业务主管乔纳森·尼尔森(Jonathan Nelson)说：“Facebook会利用你的个人生活和朋友的信息来发送定向广告。亚马逊(与用户之间)有更明确的商业关系。”但随着亚马逊广告业务不断增长，它也将受到更多关注。利特宁表示，亚马逊的用户没法控制他们共享的信息有多少可用于广告用途，这可能会违反欧洲最新的数据收集和隐私法规。

亚马逊收集了现实世界中人们的许多信息，包括他们在全食超市(Whole Foods，去年由亚马逊以137亿美元的价格收购)的购物习惯。随着这些信息的增多，亚马逊的消费者数据档案将变得更庞大也更具体。这将推动亚马逊的崛起。正如麦瑟尔夫人发现自己有讲笑话的天赋，亚马逊也有机会在一项新事业中成功。不久之后，它可能会让数字广告业双雄称霸的局面变成三足鼎立。 ■



Asian economies

War profiteering

China's regional rivals are seeking to benefit from the country's trade conflict with America. It will not be so simple

You can judge a nation by its plastic bags. Or so you might conclude after a visit to An Phat, a Vietnamese company that is one of South-East Asia's largest exporters of plastic packaging. Japanese clients insist on the highest-quality bags, composed entirely of new plastic, not recycled materials. Eco-friendly Europeans demand biodegradable bags. Convenience-loving Americans want bag handles that tie easily into knots.

Lately the workers at An Phat have spent more time catering to American tastes. Of the \$2.5bn-worth of bags that America imports annually, roughly two-fifths come from China. In September these were among the 5,745 Chinese-made products that started facing American tariffs of 10%—high enough to tempt retailers to look for suppliers elsewhere. “America has been a hard market to break into, and we saw we could make a push,” says Nguyen Le Hang, An Phat’s deputy chief executive. Over the past three months its sales to America have more than doubled.

Around the world, companies and countries are vying for business that is seeping away from China because of the trade war. America’s president, Donald Trump, hopes his hardball tactics will bring more factories home, but there is little evidence of that so far. Instead, other countries in Asia are more likely to benefit, because they can more readily step into the voids left by China. Both those further up the value chain than China and those below it spy opportunities.

Wealthier countries are eyeing some of the high-end manufacturing that they lost to China. Taiwan is trying to lure back computer companies, while

Malaysia and Thailand want to expand their footholds in electronics. In low-income countries, the focus is on the cheaper sectors that China has long dominated. Vietnam is strong in food processing; Cambodia in footwear; Bangladesh in clothing.

But the trade war cuts both ways. “Factory Asia”—the web of supply chains that is spread across the region, often centred around China—accounts for nearly half of global manufacturing. The more closely countries are integrated with China, the more that they, too, will suffer from America’s tariffs. The question is whether the gains from any business they snap up from China will offset the slowdown in China-centred trade.

The shift in factories away from China in fact predates the trade war. For the better part of a decade, soaring wages have nudged companies, particularly those in labour-intensive industries such as garment-making, towards poorer Asian countries. Those in more sophisticated sectors are also affected: university graduates in China now earn nearly as much as their Taiwanese counterparts. Over the past few years China has also ratcheted up its environmental standards, pressuring factory owners to invest in more modern facilities or shut up shop. It is not just foreign companies that are looking for more hospitable climes. Chinese firms are doing the same: their investment in manufacturing in South-East Asia has been growing by nearly 50% a year. Mr Trump’s tariffs should help accelerate these trends.

Yet the transition away from China is far from straightforward. It is the world’s biggest exporter for good reasons. The country’s dense clusters of companies offer everything manufacturers need: electronics in the south, automobiles in the east and heavy industry in the north. They are supported by top-notch roads and ports. As wages have risen, companies have poured money into automation. Moreover, China itself is a big market, and manufacturers want to stay close to their customers.

All these advantages make China's factories productive. Dan Krassenstein, director of Asian operations for Procon Pacific, a manufacturer of heavy-duty bags for transporting fertiliser, sand and the like, says that China still has its attractions. Workers in India earn 75% less than those in China. But because they are also less efficient, Mr Krassenstein estimates that his savings per bag in India are only around 35%. His company is shifting some production to India—but only gradually.

Others can only absorb so much manufacturing from China before their costs spiral. Its workforce is more than double that of all South-East Asian countries combined. Walter Blocker, chief executive of Vietnam Trade Alliance, a group of consumer-product firms, describes the flow of business from China into Vietnam as a deluge. Already, wages are rising quickly, as are land prices in industrial parks.

The upshot is that China cannot easily be replaced. Sudhir Shetty of the World Bank reckons that others in the region thus have more to lose than gain from the trade war. Pain for Chinese exporters will spread to their suppliers, from chipmakers in South Korea to textile-makers in Myanmar. On top of all that, uncertainty about the global trading system could take a toll on investment in Asia. “We are talking about the part of the world that has gained the most from openness,” says Mr Shetty.

There is little precedent to help estimate the impact of trade war. Zhang Zhiwei of Deutsche Bank has used America's anti-dumping duties on China-made washing machines, imposed in 2017, as a case study. China's exports of washing machines to America collapsed, but those to other countries stayed strong. Meanwhile South Korean firms shifted production to Vietnam and Thailand, which let them expand their sales in America—a decent outcome for Factory Asia. But then in January 2018 Mr Trump whacked tariffs on all imported washing machines. That finally led Asian makers to open factories in America. Machines there are now 15% more

expensive.

One thing looks clear from recent data: the region is already being buffeted by trade headwinds. In 2017 exports from both richer countries—Japan, South Korea and Taiwan—and poorer ones, such as the Philippines and Vietnam, rose at double-digit rates. This year the pace has slowed sharply. Strikingly, Chinese exports have fared much better; in September they were 15% higher than a year ago. But that was because companies were shipping as much as they could before tariffs took effect. Disruption is on the horizon.

For some, that prospect is welcome. Already South Korea's Samsung Electronics produces a third of its global output in Vietnam, and it plans to expand. Japanese investment in Vietnam is booming. At An Phat, there is almost giddy excitement about its chances of acquiring big new customers, and not just for plastic bags. The company is refashioning itself as a maker of complex parts for washing machines, mobile phones and more. It has brought in state-of-the-art robots and plans to double its workforce next year. The trade war, it hopes, will be a bags-to-riches tale. ■



亚洲经济体

大发战争财

中国在亚洲的对手想从中美贸易战中得利。事情并没这么简单

你可以从一国民众使用的塑料袋来了解这个国家。当你参观完东南亚最大的塑料包装出口商之一、越南安帕特公司（An Phat）后，也许会得出这样的结论。日本客户坚持购买最高质量的塑料袋，完全由原生塑料制成，不要再生塑料。讲求环保的欧洲人要的是可生物降解的塑料袋。喜欢便利的美国人要求袋子有提手，能轻松绑结。

最近，安帕特的工人们投入了更多时间来迎合美国人的需求。美国每年进口价值25亿美元的塑料袋，其中约五分之二来自中国。9月，5745类中国制造的产品开始面临10%的美国关税，塑料袋是其中之一。这足以促使美国零售商从其他地区另觅供应商。“美国向来是个难以打入的市场，我们要加把劲。”安帕特的副首席执行官阮黎康（音译，Nguyen Le Hang）表示。过去三个月里，该公司对美销售额增长了一倍以上。

在全球各地，企业和国家都在争夺中国因贸易战而流失的商机。美国总统特朗普希望自己的强硬手段能令更多工厂回迁国内，但迄今为止这样的例子并不多。亚洲其他国家倒更有可能受益，因为它们更容易填补中国留下的空白。在价值链中处于中国上游和下游的国家都在窥探机会。

较富裕的地区紧盯着过去被中国大陆抢走的一些高端制造业。台湾正努力吸引计算机公司回流，马来西亚和泰国希望扩大自己在电子制造业中的势力。低收入国家则着力于中国长期称霸的更廉价商品。越南、柬埔寨和孟加拉国分别在食品加工、制鞋和服装制造上有优势。

但这场贸易战是把双刃剑。“亚洲工厂”（指遍布整个亚洲地区的供应链网络，往往以中国为中心）在全球制造业中占比近一半。国家与中国联系越紧密，受美国关税的影响就越大。所以，问题是，以中国为中心的贸易放缓后，各国即便从中国抢走生意，所得收益能否抵消损失。

事实上，早在贸易战爆发前，不少企业就已开始从中国撤走工厂。在过去十年的大部分时间里，中国的工资飙升，促使企业向较贫穷的亚洲国家转移，尤其是在服装制造业等劳动密集型行业。更高精尖的行业同样受到影响：中国大陆大学毕业生的收入如今几乎和台湾相当。过去几年，中国还提高了环境标准，迫使工厂所有者投资更现代化的设施，否则只能关门。不只外国公司在寻找更欢迎它们的地方，中国企业也是如此：它们在东南亚制造业的投资年增速近50%。特朗普的关税应该会加速这些趋势。

然而，从中国转移远非一走了之那么干脆。中国成为世界最大的出口国是有其道理的。中国国内密集的公司集群为制造商提供了所需一切：南方有电子产业，东部有汽车产业，北方有重工业。企业也得到一流的的道路和港口的支持。而随着工资上涨，企业已大笔投资开展自动化生产。此外，中国本身就是一个大市场，而制造商还是想离顾客近一些。

所有这些优势使得中国的工厂高效多产。生产用于装运化肥、沙子等物料的重载包装袋的璞凯包装（Procon Pacific）的亚洲业务总监丹·克拉森甸（Dan Krassenstein）表示，中国仍有吸引力。印度工人的工资比中国低75%。但是，由于他们的效率也更低，克拉森甸估计在印度生产每个包装袋仅能节省35%左右。他的公司正把部分生产转移至印度，但只是逐步推进。

其他地区能从中国吸收的制造业务有限，超过一定规模后成本会加速上升。中国的劳动力规模是所有东南亚国家总和的两倍多。消费品公司团体越南贸易联盟（Vietnam Trade Alliance）的首席执行官沃尔特·布洛克（Walter Blocker）把制造业务从中国向越南的转移形容为一股洪流。越南的工资水平已经水涨船高，工业园区的土地价格也一样。

结果就是中国不可能被轻易取代。世界银行的苏迪尔·谢蒂（Sudhir Shetty）估计，贸易战因而会令该地区的其他竞争者得不偿失。中国出口商遇到的麻烦会蔓延至其供应商——从韩国的芯片制造商到缅甸的纺织品制造商。最重要的是，全球贸易体系的不确定性会打击在亚洲的投资。“我们说的是世界上那些从开放中获得最多好处的地区。”谢蒂说。

要估量贸易战的影响，并没有多少先例可循。德意志银行的张志伟将2017年美国对中国制造的洗衣机征收反倾销税用作研究案例。中国对美洗衣机出口萎缩，但对其他国家的洗衣机出口依然强劲。同一时期，韩国企业将生产转移到越南和泰国，以此扩大了对美销售，这对“亚洲工厂”整体而言结果还不赖。但随后在今年1月，特朗普对所有进口洗衣机加征关税。这最终促使亚洲制造商在美国开设工厂。美国的洗衣机现在贵了15%。

从近期数据看，有一点已经很明确：亚洲地区已经受到贸易逆风的冲击。2017年，日韩台等富裕国家地区以及菲越等较穷国家的出口额均以两位数的增速上升。但今年，增长步伐急剧放缓。令人诧异的是，中国的出口表现相对好得多——9月份同比增长了15%。但这是因为企业在新关税生效前尽量出货。一场动荡已迫在眉睫。

对于某些人来说，这是值得期待的好事。韩国三星电子的全球产量已有三分之一在越南生产，还计划扩大规模。日本人正大举在越南投资。在安帕特，人们欣喜若狂，因为获得新的大客户的机会就在眼前——而且还不止塑料袋。这家公司正在转型，要为洗衣机、手机等产品制造复杂零部件。它引进了最先进的机器人，还计划明年把员工人数增加一倍。它希望这场贸易战能成就它从塑料袋起家的逆袭传奇。 ■



Pig farms in China

Sows in the cloud

As swine-rearing modernises, Chinese internet firms go into pigsties

The sleek offices of NetEase in Hangzhou, a traffic-clogged city in eastern China, seem an unlikely place to find a farmer. Yet the video-gaming company also runs a pig-rearing division. Ni Jinde launched Weiyang, its swine affiliate, almost a decade ago, after a stint in its financial team. At a state-of-the-art farm in nearby Anji county, Mr Ni oversees the rearing and slaughter of 20,000 organic free-range hogs a year, with the aid of tracking sensors, big-data analysis and soothing music. A second farm, to open in December, will raise another 150,000.

NetEase has become part of a gigantic agricultural venture. China's 430m porkers account for over half of the world's herd, and its \$1trn industry produces more pork than any other country. Yet pig-rearing remains remarkably inefficient. It has long been a family affair: nine in ten of an estimated 40m pig farmers are thought to raise fewer than 50 hogs a year. Only about one in five Chinese sows is in industrialised production, estimates Bill Christianson of Genus, a British firm that is the world's biggest supplier of breeding pigs.

But small-scale farms lack measures to prevent the spread of disease; this has allowed a deadly swine fever to run riot since a first reported case in August. In 2013 over 16,000 carcasses of pigs dumped by farmers were dredged from a river that supplies tap water to Shanghai. Since then, new pollution standards that ban livestock production near water sources or towns, and which require proper treatment of manure, have led to closure for tens of thousands of smallholdings.

The closures are likely to accelerate China's transition to modern production. Large-scale experiments in pig-rearing are under way in the form of multi-storey farms. A complex on Yaji mountain in southern China has 13 levels, with 1,000 pigs to a floor. But these structures are pricey, partly because of the measures they require to prevent disease from tearing through the building.

China's internet giants think that bringing technology to the pigsty is the answer. Mr Ni says that farms like Weiyang are "setting the example". It prides itself on rearing its hogs for 300 days in clean and wholesome conditions before they are sent to slaughter, twice as long as the typical life of a Chinese pig. This makes for tastier pork sausages and other pig products it sells online. NetEase is not alone in marrying tech and animal husbandry. JD.com, an e-commerce firm that is an investor in Weiyang, raises and sells "jogging chickens" that each take 1m steps before the chop, making the meat more succulent than that of sedentary fowl. In June the cloud-computing arm of Alibaba, an internet company based in Hangzhou, unveiled an "agricultural brain" that helps farmers monitor pigs in real time through visual and "voice" recognition powered by artificial intelligence.

Alibaba's programme, which is undergoing tests in Sichuan province, picks up the squeal of a crushed piglet or the bleat of a sick sow, and alerts the farmer. Cameras in the pens track daily activity and vital signs by way of numbers stamped on the animals' backs. It uses this trove of data to draw up exercise regimes. It reckons that its system can increase to 32 the number of piglets per sow per year, a measure of efficiency in the pig business. That would double the output of many Chinese farms.

Foreign suppliers also hope to put their snouts in the trough as pig farming industrialises. Hog Slat, an American maker of pig-barn floors, opened its third plant in China this year and plans seven more within four years. DSM, a Dutch supplier of feed, has launched an app through which Chinese

farmers and suppliers can place orders, track inventories and monitor feed quantities, as well as check pork prices. The app will eventually offer live-streaming and facial-recognition tools, which could detect the features of a porker's face and identify its genetic make-up. In China big data is meeting pig data. ■



中国养猪场 云端的母猪

随着养猪业的现代化，中国互联网公司走进了猪圈

网易时髦漂亮的办公室位于中国东部交通拥挤的城市杭州，里面似乎不太可能见到农民。但这家网络游戏公司还有个养猪部门。在网易的财务部门工作了一段时间后，倪金德于近十年前创办了网易的养猪子公司味央。在附近的安吉县一个最先进的养殖场里，倪金德在追踪传感器、大数据分析和舒缓音乐的帮助下，每年监督两万头自由放养的有机生猪的饲养和屠宰。第二座养猪场将于12月开业，饲养15万头生猪。

网易已经成了一个超大型农业产业的一部分。中国共存栏4.3亿头生猪，占全球总量的一半以上，这个价值一万亿美元的产业生产的猪肉比任何其他国家都多。不过养猪仍然极为低效。这个行业一直是以家庭为单位：全国估计有4000万养猪户，其中九成每年饲养的生猪不到50头。全球最大的种猪供应商、英国Genus公司的比尔·克里斯蒂安松（Bill Christianson）估计，中国只有约五分之一的母猪是工业化养殖的。

但小规模农场缺乏预防疫病传播的措施。自8月报告首例疫病以来，这已造成一场致命的猪瘟的肆虐。2013年，从一条作为上海饮用水源的河流中打捞起了农民抛投的1.6万多头死猪。之后出台的新污染防治标准禁止在水源地或城镇附近养殖牲畜，并要求妥善处理粪便，导致数万个小养殖场关闭。

这场关闭潮很可能会加速中国向现代化养殖的转变。大规模养猪试验正在多层建筑养殖场中展开。在中国南方的亚计山上有栋13层建筑，每层养了一千头猪。但这些建筑造价高昂，原因之一是需要各种设施来防止疫病在楼内迅速传播。

中国互联网巨头认为，把科技引入猪圈才是正解。倪金德说，像味央这样的养殖场正在“树立榜样”。味央很自豪，它的猪在宰杀之前要在干净卫生

的环境下饲养300天，是普通中国养猪出栏时间的两倍。这让它在网上销售的猪肉香肠和其他猪肉产品更加美味。网易并不是唯一一家让科技与畜牧业联姻的公司。电子商务公司京东是味央的投资者之一，它饲养并销售的“跑步鸡”在宰杀前要跑够一百万步，比笼养鸡的肉更加美味多汁。今年6月，总部位于杭州的互联网公司阿里巴巴旗下的云计算部门推出了“农业大脑”，用人工智能支持的视觉和“语音”识别技术帮助农民实时监控生猪。

阿里巴巴的这个项目正在四川做测试，它能监测到小猪被挤压时发出的长声尖叫，或是母猪生病时的哼哼，并向猪农发出警报。围栏里的摄像头通过猪背上印有的数字监控它们的日常活动和生命体征。它利用这个数据宝库来制定锻炼计划。公司估计，该系统可以将每头母猪每年的产仔量（衡量养猪效率的一个指标）增加到32头。这会让中国许多养殖场的产量翻一番。

随着养猪的工业化，外国供应商也想来分一杯羹。美国猪圈地板制造商Hog Slat今年在中国开设了第三家工厂，并计划在四年内再开七家。荷兰饲料供应商帝斯曼（DSM）推出了一款应用，让中国农民和供应商通过它下单、跟踪库存、监控饲料用量，以及查看猪肉价格。该应用最终将提供实时视频和面部识别工具，可以检测猪的面部特征并识别其基因组成。在中国，大数据（big data）遇上了猪数据（pig data）。■



Artificial intelligence

Learning, fast and deep

New schemes aim to teach anyone to use AI

Over the past five years researchers in artificial intelligence have become the rock stars of the technology world. A branch of ai known as deep learning, which uses neural networks to churn through large volumes of data looking for patterns, has proven so useful that skilled practitioners can command high six-figure salaries to build software for Amazon, Apple, Facebook and Google. The top names can earn over \$1m a year.

The standard route into these jobs has been a PhD in computer science from one of America's elite universities. Earning one takes years and requires a disposition suited to academia, which is rare among more normal folk. Graduate students are regularly lured away from their studies by lucrative jobs.

That is changing. Last month fast.ai, an education non-profit based in San Francisco, kicked off the third year of its course in deep learning. Since its inception it has attracted more than 100,000 students, scattered around the globe from India to Nigeria. The course and others like it come with a simple proposition: there is no need to spend years obtaining a PhD in order to practise deep learning. Creating software that learns can be taught as a craft, not as a high intellectual pursuit to be undertaken only in an ivory tower. Fast.ai's course can be completed in just seven weeks.

Demystifying the subject, to make it accessible to anyone who wants to learn how to build AI software, is the aim of Jeremy Howard, who founded fast.ai with Rachel Thomas, a mathematician. He says school mathematics is sufficient. "No. Greek. Letters," Mr Howard intones, thumping the table

for punctuation.

It is working. A graduate from fast.ai's first year, Sara Hooker, was hired into Google's highly competitive AI residency programme after finishing the course, having never worked on deep learning before. She is now a founding member of Google's new AI research office in Accra, Ghana, the firm's first in Africa. In Bangalore, some 2,400 people are members of AI Saturdays, which follows the course together as a gigantic study group. Andrei Karpathy, one of deep learning's foremost practitioners, recommends the course.

Fast.ai's is not the only alternative AI programme. AI4ALL, another non-profit venture, works to bring AI education to schoolchildren in the United States that would otherwise not have access to it. Andrew Ng, another well-known figure in the field, has started his own online course, deeplearning.ai.

Mr Howard's ambitions run deeper than loosening the AI labour market. His aim is to spread deep learning into many hands, so that it may be applied in as diverse a set of fields by as diverse a group of people as possible. So far, it has been controlled by a small number of mostly young white men, almost all of whom have been employed by the tech giants. The ambition, says Mr Howard, is for AI training software to become as easy to use and ubiquitous as sending an email on a smartphone.

Some experts worry that this will serve only to create a flood of dodgy AI systems which will be useless at best and dangerous at worst. An analogy may allay those concerns. In the earliest days of the internet, only a select few nerds with specific skills could build applications. Not many people used them. Then the invention of the world wide web led to an explosion of web pages, both good and bad. But it was only by opening up to all that the internet gave birth to online shopping, instant global communications and search. If Mr Howard and others have their way, making the development of

AI software easier will bring forth a new crop of fruit of a different kind. ■



人工智能

快速深度学习

一批新项目想教所有人编写AI

过去五年里，人工智能（以下简称AI）的研究人员已然成了科技界的摇滚明星。AI技术的一个分支、运用神经网络处理大量数据并从中寻找模式的“深度学习”被证明非常有用，亚马逊、苹果、Facebook和谷歌愿意开出六位数高薪，聘请熟练的专业人员编写软件。顶级专家更是年薪过百万美元。

要从事这类工作，标准路径一般是在美国的某所顶尖大学取得计算机科学的博士学位。一个人要为此付出多年时间，性情也得适合做学术研究，普通人能有如此耐性的不多。面对高薪工作的诱惑，研究生往往会放弃研究生涯。

但事情正在发生变化。上月，位于旧金山的非营利性教育机构fast.ai进入了它开办深度学习课程的第三年。自推出以来，这门课吸引了从印度到尼日利亚的全球各地十多万名学生。这类课程都有一个简单的主张：要从事深度学习方面的工作，没必要花几年时间拿博士学位。打造会学习的软件可以当一门手艺来教，而不是一种只能在象牙塔里传授的高级智力探索。Fast.ai的课程短短七周就可学完。

让深度学习不再神秘是杰里米·霍华德（Jeremy Howard）的目标，为此，他和数学家雷切尔·托马斯（Rachel Thomas）一起创立了fast.ai，让任何想学习编写AI软件的人都能学习这门技术。霍华德说有中学数学知识就足够了。“没有，希腊，字母。”他在桌上敲着拍子，一字一顿地说道。

效果已经开始显现。莎拉·霍克（Sara Hooker）是fast.ai第一年的毕业生，毫无深度学习工作经验的她在修完课程后便被谷歌竞争非常激烈的AI实习项目录用。她现在是谷歌在加纳首都阿克拉新建的AI研究中心（谷歌在非洲的首个AI研究机构）的创始成员。在班加罗尔，巨型学习小组“AI星期

六”（AI Saturdays）的2400名成员一起修读该课程。深度学习的权威专家安德烈·卡尔帕西（Andrei Karpathy）也推荐了这门课。

Fast.ai的课程并非攻读博士以外的唯一选择。AI4ALL是另一家非营利性机构，为无法获得AI教育的美国学童提供这方面的培训。该领域另一位知名人物吴恩达则已启动了自己的在线课程deeplearning.ai。

霍华德的雄心壮志远不止于缓解AI行业人才短缺的问题。他的目标是向更广泛的人群传播深度学习技术，以让尽可能多样化的人群将它应用于尽可能多样化的领域。到目前为止，AI技术一直由几乎全部受雇于科技巨头的少数人掌握，这些人大部分是年轻白人男性。霍华德表示，他的志向是让AI训练软件变得像在智能手机上发送电子邮件那样易用而普遍。

一些专家担心这只会造就大量劣质的AI系统，它们至多毫无用处，最糟的情况下还会构成危险。一个类比也许能打消这种疑虑。在互联网早期，只有少数有特定技能的书呆子才会编写应用。没有多少人使用它们。然后万维网问世了，网页呈爆炸式增长，品质良莠不齐。但是，正是因为互联网向所有人开放了，才出现了在线购物、即时全球通信和网络搜索。如果霍华德和其他人如愿以偿，那么让AI软件开发变得更容易将会催生出一批新的不同的果实。■



Schumpeter

The tech sell-off

The shares of the world's tech giants have sunk by a sixth in the past two months. Wobble or wipeout?

BUSINESS BOOMS and busts follow a pattern. They start with an exciting change in the economy. Managers and investors collectively create a story about it, which begins as an explanation, then morphs into an extrapolation, and then into an exaggeration. Eventually the data contradict the narrative, boom turns to bust, and a bout of austerity follows. A rout in internet firms' share prices since August has led plenty of people to ask if the tech industry is experiencing this sequence of hope, hubris and hurt for the second time in two decades. The answer is: to a degree, yes. The level of hype is particularly high, and some of the numbers are decidedly soft. That matters because tech firms are now so big and so spendthrift that a slowdown could damage the economy.

Rarely in stockmarket history have so many investors made so much money from so few shares going up for so long. Some 37% of the rise in the value of all firms in the S&P 500 index since 2013 is explained by six of its members: Alphabet, Amazon, Apple, Facebook, Microsoft and Netflix. About 28% of the rise in Chinese equities over the same period is owing to two firms: Alibaba and Tencent. Managers and investors have bought into a tale of effortless disruption by an elite of firms led by the world's brainiest people.

Now the trend has reversed in startling fashion. The median drop in value of those eight firms has been 21% since the start of September, double the decline in global stockmarkets. Some \$900bn has been vaporised—more than the eight firms were worth a decade ago, and double the value of Indonesia's stockmarket. The pain has spread beyond the giants. The share

price of Xiaomi, the largest tech listing of 2018, done in Hong Kong, has fallen by half from its peak (in dollar terms). Africa's most valuable firm, Naspers, has sunk by 38% from its high, thanks to its large stake in Tencent. Scottish Mortgage, a FTSE 100 investment trust that has bet big on tech, has tumbled by 18%.

Tech investors must have known that hyperbole was rife. In September Jeff Bezos, boss of Amazon, boasted that there was no limit to the size of his firm's market and that he did not focus on day-to-day matters. Bankers have told Uber, a midsized, unprofitable firm, that it might be worth \$120bn, double its valuation in May. Ads for tech-focused exchange-traded funds fill America's financial press—there are 239 specialist options for retail investors. Unfashionable firms are blowing the bank to mimic the cool kids: Walmart has paid \$16bn to buy 77% of Flipkart, an Indian e-commerce firm which is expected to lose over \$1bn next year.

What, then, do the recent falls say about the big tech firms? A rise in real interest rates in America is not the technology sector's fault, and explains about a third of the decline in the eight tech firms' market value (using a discounted-cashflow model). But the rest of the drop reflects three, tech-specific worries: decelerating growth, falling profit forecasts and rising capital intensity.

Start with growth. In the third quarter the median of the eight firms saw their sales rise by 25% compared with a year earlier (using a blend of actual figures and estimates for firms that have yet to report). That is impressive but below the rapid pace set in the prior quarter, of 40%, and the slowest figure for three years. On October 26th Amazon gave a range for its expected sales growth in the fourth quarter for which the midpoint was 15%; a sharp slowdown from the 31% underlying rate in the first quarter. It pointed to one-off factors, including currency moves and an accounting change, but perhaps the law of large numbers is catching up with it. Of the eight firms,

all but Microsoft have seen their rate of growth slow.

The second worry is falling forecasts for profits. To justify their loftier valuations at the start of September, the eight firms would collectively need to triple their profits over the next decade, to \$550bn. The median odds of any one of the firms achieving this are 14%, based on the performance of all listed firms in America since 1950. More ominously, Wall Street forecasts for medium-term earnings are also falling as analysts take a more realistic view of tech business models. For the median of the eight firms, estimates for 2020 have dropped by 8% from their peak. Predictions for Facebook in particular have sunk by 18% to reflect the cost of sanitising its platform—hiring more moderators and carrying less virulent (and appealing) material. Analysts have cut their forecasts for Netflix by 11% to reflect escalating content costs, and by roughly a quarter at Alibaba and Tencent to reflect competition in China.

The last concern is rising capital intensity. Investors love tech stocks for their high margins and low investment. But this view no longer fits reality. For the eight firms total investment has tripled since 2013, to \$180bn a year. Internet firms are now the corporate world's largest spenders, but exhibit little of the rigour seen at conventional big investors such as Shell or Intel. The probable result is lower returns as firms throw cash at mediocre new businesses and enter the markets of rivals. China's big companies are battling over e-commerce, entertainment and payments. In America there are more signs of overlap, with Amazon moving into advertising and Apple into video. Measuring tech firms' return on capital is tricky owing to their intangible assets. But if you treat research and development as an asset with a ten-year life, the median return for the eight firms has dropped from 40% in 2013 to 26% this year.

Only one of the eight firms—Netflix—needs capital markets to finance itself. The others sit on \$350bn of net cash and in most cases are controlled by

their founders, who can shrug off slower earnings and share-price gyrations. If a crash in valuations is unlikely, however, some belt-tightening is in order. That raises a new risk. The big six American tech firms employ almost a million staff, and account for a fifth of all investment by S&P 500 companies. Amazon's cut-throat pricing has lowered online inflation by about one percentage point. It is the ultimate tribute to the rise of the tech industry that if it sneezes the economy could catch flu. ■



熊彼特

科技股抛售潮

过去两个月全球科技巨头的股价已跌去六分之一。这是一时波动吗？还是会从此一蹶不振？

商业兴衰有其模式。先是经济体内出现激动人心的变革。企业主管和投资者围绕变革联手造势：刚开始是解释现象，接着推断发展趋势，再后来就演变成夸大其词。最终，现实数据驳斥了这套叙事，繁荣转衰，一轮紧缩随之而来。自8月以来互联网公司股价大跌，许多人不禁发问，科技行业会不会正在经历20年来第二次“希望——狂妄——衰亡”的循环。答案是：在某种程度上的确如此。目前宣传炒作尤其喧嚣，而一些数据也确实疲软。这事关紧要，因为如今的科技公司规模如此庞大又如此挥霍无度，一旦增长放缓可能会伤及整个经济。

如此多的投资者从上涨如此之久的寥寥几支股票上大赚特赚，这在股市历史上相当罕见。自2013年以来，六家公司贡献了标普500指数企业总市值增长的约37%：Alphabet、亚马逊、苹果、Facebook、微软和Netflix。同一时期，中国企业市值的上涨约有28%来自两家公司：阿里巴巴和腾讯。对于由绝顶聪明的领导人带领的一些精英公司轻松创造颠覆的传奇故事，主管们自己和投资者都深信不疑。

现在这一走势却出现了惊人的逆转。自9月初以来，上述八家公司市值降幅的中位数达到21%，是全球股票市场跌幅的两倍。约9000亿美元蒸发，比这八家公司十年前的总市值还高，相当于印尼股市总值的两倍。跌势已蔓延至这些巨头企业以外。2018年规模最大的科技股IPO是小米公司在香港的上市，但其股价已从峰值下跌了一半（按美元计算）。非洲市值最高的公司Naspers由于大量持有腾讯的股份，股价已从高位下跌了38%。苏格兰抵押贷款公司（Scottish Mortgage）是富时100指数内的一家投资信托基金，由于大量投资科技企业，其股价已经下跌了18%。

科技股投资者肯定感受到了浮夸之风盛行。9月，亚马逊的老板杰夫·贝佐

斯放言其公司的市场规模没有上限，又称自己不关注公司的日常事务。银行家们对优步这家中等规模、尚未实现盈利的公司估值为1200亿美元，是5月份时估值的两倍。重点投资科技股的交易所交易基金的广告遍布美国财经媒体，面向个人投资者的专家推介期权就有239种。传统企业正倾全力模仿新兴的炫酷公司：沃尔玛已豪掷160亿美元收购印度电子商务公司Flipkart 77%的股权，而这家公司预期明年将亏损超过10亿美元。

那么，近期这番下跌说明了大型科技公司的什么问题？美国实际利率上升并非科技业界的过错，八家科技公司市值下降的三分之一是由利率上升导致（运用贴现现金流模型计算）。但下跌的其余部分反映了科技业特有的三个忧虑：增长放缓、预期利润下降、资本密集度上升。

先说增长。今年第三季度，八家公司的销售额同比增幅中位数为25%（根据实际数字与尚未公布数字的公司的估计数字）。虽然成绩不错，但低于上一季度高达40%的快速增长，也是三年来的最慢增速。亚马逊在10月26日公布了第四季度预期销售增长区间，中点为15%，相比第一季度31%的基本增长率显然是大幅放缓。这指向了一些偶发因素，包括货币汇率变动和会计方法变更，但也许大数定律的影响正在显现。八家公司中，除微软以外其他公司的增长都在放缓。

第二个担忧是预期利润下降。要配得上9月初的高估值，未来十年八家公司需将整体利润提升两倍，达到5500亿美元。从1950年以来美国所有上市公司的业绩来看，八家公司分别实现利润增长两倍目标的几率的中位数为14%。更不祥的是，华尔街对中期收益的预测也在下降，因为分析师对科技公司商业模式的看法更现实了。八家公司2020年预期收益从峰值下跌的跌幅中位数为8%。对Facebook的预测更是下降了18%，反映了这家公司净化平台的成本——要雇用更多内容审核员并减少（更吸睛的）仇恨言论。分析师已将对Netflix的预测下调11%，反映内容成本上升；对阿里巴巴和腾讯的预测下调约四分之一，反映中国国内市场的竞争。

最后一个忧虑是资本密集度上升。投资者喜欢科技股，因为它们利润率高、投资低。但现实不再如此。自2013年以来，这八家公司的总投资增加

了两倍，达到每年1800亿美元。在企业界，如今属互联网公司开支最大，但它们在投资上远不像壳牌或英特尔等传统投资大户那样严谨。可能的结果是，随着它们在业绩平庸的新业务上撒钱并闯入竞争对手的市场，投资回报下降。中国的大公司正在电子商务、娱乐和支付领域混战。在美国，随着亚马逊涉足广告业，苹果打入视频流媒体，业务重叠的迹象愈加明显。要衡量科技公司的资本回报率很难，因为涉及无形资产的问题。但如果将研发视为具有十年寿命的资产，那么八家公司的回报率中值已从2013年的40%下降至今年的26%。

八家公司中只有Netflix需要通过资本市场融资。其他公司坐拥3500亿美元净现金，而且大多为创始人控制，他们大可不把利润放缓和股价波动当回事。然而，即使不太可能出现估值崩盘，一定程度的紧缩开支也是需要的。这就带来了新的风险。六大美国科技公司雇员近百万人，投资额占标普500企业的五分之一。亚马逊的低价策略已令在线通胀水平下降了约一个百分点。科技业打一个喷嚏，整个经济可能就要感冒，这可谓对该行业崛起的终极致敬。 ■



Bartleby

For richer, not poorer

When executives are matched together

“Thirty-something executive with great plans for a startup business would like to meet similar. Must possess relevant experience and have gsoh (graduated from Stanford or Harvard).”

Romance-seekers place adverts like this on the internet all the time. So why not entrepreneurs? People who want to start a business may be aware they do not have all the skills required to make the operation a success. If that is the case, they need to find a co-founder.

That is how Kim Atherton and Erinn Collier ended up running Just3Things, a software company, together. The firm offers a platform designed for companies that want to be “agile”, a popular model in recent years. Agile companies organise themselves in small interdisciplinary teams designed to complete a single project, rather than with a more formal hierarchical structure. The software keeps the team members both informed and connected.

The system was developed by a group at OVO Energy, a British energy-supply firm, where Ms Atherton worked. She had dreamed up the idea when working as chief people officer. There was nothing available on the market, so she hired developers to create it. When she spoke about it at a conference in 2017, a delegate asked if the platform was available for other organisations.

That inquiry made Ms Atherton see an opportunity to spin the business out from OVO. But she had trained as an occupational psychologist and had spent seven years working in human relations. She therefore had no

idea how to sell a software platform to potential customers. She needed a partner. Her answer was to ask a recruitment business, Stanton House, for help. This led to an exhaustive process, involving interviews with 35 to 40 candidates.

Ms Collier had previously worked for both Salesforce and Uber on the sales side. She first met Ms Atherton in November 2017. Like many romantic couples, they started their corporate courtship slowly. It took four or five meetings, including a dinner, before Ms Collier joined the company in May this year.

It makes sense that it will take a while to see if two executives can work together. A good relationship is essential given the number of hours that they will spend in each other's company. When starting a business, executives are likely to spend more time with their colleagues at work than with their families at home.

Ms Atherton says that she wanted "someone in the trenches with me", so finding the right person was essential. Ms Collier says the main reason for her change of career was that she wanted to be a co-founder rather than just a sales leader. But it had to be with the right person. "The further you get in your career, the more critical it is that you like the people you work with," she says.

In such instances of "executive dating", the most important element is to ensure that the philosophies of the potential partners match. Ms Atherton said that many of the people she interviewed talked about money or contracts, but she was impressed that Ms Collier asked: "Tell me what kind of company you want to build." The answer, according to Ms Atherton, was to create a business that she could be proud of, and which had good working conditions. That turned out to be the reply Ms Collier was hoping to hear.

It may not work out, of course, but nor do plenty of relationships. In this case, the partnership might not last if the outcome is “for poorer” rather than “for richer”. But at least the co-founders have started out on corporate life together with their eyes open.

David Fleming of Stanton House, the recruiter who brought the women together, says this was an unusual assignment. Normally a business will be founded by a small team who already work together. Ms Atherton was unusual in realising that she needed someone with complementary skills. There were a lot of people actively looking for someone new. But finding someone who had the same values and principles was much more difficult.

This kind of executive link-up will probably never become the norm. But if the key to generating more economic growth is the creation of more startup companies, then there is the need for a way to bring entrepreneurs together. Instead of eHarmony, there could be eEquity; instead of Tinder, Turnover. Now there's an idea. Would anyone like to be a co-founder? ■



巴托比

只为同甘，不为共苦

当高管配成对

“高管，年过三十，怀创业宏图，欲觅志同道合者。须有相关经历和“gsoh”（毕业自斯坦福或哈佛）。”【译注：gsoh在征友广告中常用，意为“有幽默感”（good sense of humor），这里被改作了graduated from Stanford or Harvard】

觅友寻伴者一直都在网上登这样的广告。那创业者有何不可？想自己开公司的人可能意识到，自己并不具备让公司成功所需的所有技能。若是如此，就需要找一个人来一起创业。

金·阿瑟顿（Kim Atherton）和艾琳·科利尔（Erinn Collier）就是这样走到了一起。她们共同经营的软件公司Just3Things为那些追求“敏捷”的公司提供一个平台。“敏捷”是近年流行的一种模式。敏捷型公司组织起一个跨学科小团队来完成单个项目，而不采用更正式的等级式架构。Just3Things的软件让团队成员都能知晓项目进展和保持联系。

这个系统由阿瑟顿的前雇主、英国能源供应公司OVO Energy的一个团队开发。阿瑟顿在担任这家公司的首席人力官时想到了这个主意。当时市场上没有现成的系统，于是她雇用了开发人员来创建这个平台。她在2017年的一次会议上谈到它时，一名与会者询问平台是否也能为其他机构所用。

这让阿瑟顿看到了将这项业务从OVO剥离出去的机会。但她是一个职业心理学家，此前七年都在从事人事工作，因此对于如何向潜在客户推销这个软件平台一无所知。她需要一个搭档。为此她求助于招聘公司Stanton House。接下来便开始了全面的考察过程，面谈了35到40个候选人。

而科利尔此前曾供职于Salesforce和优步的销售部门。她第一次见到阿瑟顿是在去年11月。就像许多情侣那样，她们的事业联姻之旅是缓步推进

的。科利尔在与阿瑟顿见了四、五次面（包括共进一次晚餐）后，才于今年5月加入Just3Things。

要检验两名高管能否共事，自然需要时日。鉴于双方共事的时间不在少数，良好的关系不可或缺。创业时，高管们和同事一起工作的时间很可能超过与家人共处的时间。

阿瑟顿说希望找到“和自己在同一条战壕里的人”，所以找对人至关重要。科利尔表示，自己转行主要因为想成为联合创始人，而不仅仅是做个销售主管。但必须是和合适的人在一起。“你在事业上走得越远，情投意合的共事者对你就越重要。”她说。

在像这样的“高管约会”案例中，最重要的是确保两个可能成为搭档的人在理念上投契。阿瑟顿说，她面谈的许多人说的都是钱或合同，但科利尔问了一句：“你想创办一家什么样的公司？”这打动了她。阿瑟顿的回答是创立一家能让自己引以为荣、拥有良好工作环境的公司。这正好也是科利尔想听到的回答。

当然了，她们未必能“修成正果”，就像很多婚恋关系那样。在这一例中，假如两人日后面对的是“贫穷”而非“富有”，那么合作关系可能就不会再继续。但至少，两位联合创始人是在对未来可能的困境和结局了然于胸的情况下携手迈进了企业生活。

将两位女士撮合到一起的招聘公司Stanton House的大卫·弗莱明（David Fleming）表示，这是一项不同寻常的任务。通常情况下，一起创办企业的小队人马都是先前就已经在共事了。阿瑟顿的特殊之处在于她意识到自己需要一个在技能上互补的人。很多人都在积极寻找一个让自己耳目一新的伙伴。而要找到与自己价值观和原则一致的人却要难得多。

这类“高管联姻”可能永远不会成为常态。但是如果经济增长的关键在于创建更多创业公司，那么就有必要找到一种连结创业者的方式。既然有eHarmony，就可以有eEquity；有Tinder，也可以有Turnover。一个新想法诞生了。有人愿意成为联合创始人吗？ ■



The American economy

What goes up

Strong growth data obscure a probable slowdown to come

FINANCIAL MARKETS may have wobbled in recent weeks—the S&P 500 fell by 7.3% in October. But America's real economy still seems to be in rude health. Figures released on October 26th showed economic growth of 3.5%, at an annualised rate, in the third quarter of 2018. Most economists had expected a sharper slowdown after the 4.2% expansion recorded in the preceding three months. On just one other occasion since the financial crisis, in 2014, has America clocked up two consecutive quarters of such speedy growth. Can it last?

Some fear not. The economy has been given temporary fizz by President Donald Trump's tax cuts. Though these will be in place for some time, the impact on growth may not last. Together with February's budget bill, they will boost annual GDP growth by 0.6-0.8 percentage points by the end of 2018. But the impact will fade to 0.3 percentage points in 2019 at best, estimate Karen Dynan and Jason Furman of the Peterson Institute for International Economics, a think-tank. Most forecasters expect America to return soon to a growth rate close to 2%, with the main legacy of the tax cuts being weaker public finances.

Boosters retort that the tax cuts will unleash permanently higher growth and investment. Although an ageing population is a drag, a hot economy could enable productivity to grow faster. That would provide the recovery's final missing ingredient and support growth even as the immediate effect of fiscal stimulus wears off.

At first glance the growth data do little to settle this debate. Over the first half

of 2018 taxes on personal income were lower as a share of GDP, compared with the same period in 2017, by around 0.4 percentage points, and those on corporate income by around 0.7 percentage points. In the third quarter government taxation and spending contributed around 0.7 percentage points of the overall 3.5% growth rate, according to estimates by the Brookings Institution, a think-tank (see chart). Though this is the government's biggest contribution to real GDP growth since 2010, the economy would probably still be enjoying an uptick in growth without it.

Yet a closer inspection offers more support for a pessimistic view. Consider two components of growth: investment and trade. Non-residential investment was disappointingly weak in the third quarter, particularly given the economy's broader strength. Just 12% of 116 businesses recently surveyed by the National Association of Business Economics reported that they had increased their investments in response to the tax cut. Investments take time to plan and the data are noisy. But Mr Trump's tax cut was supposed to lead to a sustained investment bonanza. There are few signs of that so far.

There may be trouble in the housing market, too. Private investment in housing, including spending on equipment by landlords, fell for the third consecutive quarter. Explanations include demand constrained by affordability, as well as supply constrained by pricier land, a shortage of immigrant labour for construction and tariffs that have driven up costs. Changes in the tax treatment of housing and interest-rate rises may matter, too.

Meanwhile Mr Trump's tariffs are buffeting trade. A surge in soyabean sales has gone into reverse. Businesses have stocked up on inventory—enough to add more than two percentage points to growth in the third quarter. But this may be because they were preparing for dearer imports after tariffs

on Chinese goods came into effect. If so, then those inventories represent spending brought forward rather than genuine growth. Trade worries may be behind the investment slowdown. The latest edition of the Federal Reserve's Beige Book, which gathers anecdotal evidence on the economy from the private sector, includes repeated mentions of uncertainty about the trade environment.

If investment continues to sag, growth will depend more on consumption, which in turn depends on rising employment, working hours and real wages. "The resiliency of the expansion rests purely with the labour market," says Julia Coronado of MacroPolicy Perspectives, a consultancy. So far this seems to be holding up. Private-sector wages are growing faster than in a decade; figures released on November 2nd showed another month of strong employment increases, as well as enough wage growth to push the year-on-year change above 3% for the first time since 2009.

Another risk looms as a result: that the Fed might raise interest rates too fast. It is the central bank's job to respond appropriately to the application and withdrawal of fiscal stimulus. It did not raise interest rates at the meeting ended on November 8th. But investors do expect another rate rise in December, and three more in 2019. As markets have swooned, these expectations have barely shifted. That might change if data on the real economy took a sharp turn for the worse. (Higher rates may be another explanation for the investment slowdown.)

The pessimists are surely right that, even if there is scope for productivity to grow faster, growth will slow as fiscal stimulus fades. And it is easier for the Fed to manage a downturn that it knows is coming than one that comes out of the blue. Still, excessive monetary tightening often precedes recessions. Growth may look good for now. But policymakers need to be ready to turn on a dime. ■



美国经济

有起必有落

强劲的增长数据掩盖了可能到来的放缓

最近几周金融市场或许有些动荡——标准普尔500指数10月下跌了7.3%，但美国的实体经济似乎仍然十分健康。10月26日公布的数据显示，今年第三季度的年化经济增长率为3.5%。之前三个月录得4.2%的增速后，大多数经济学家都曾预计增长将大幅放缓。自金融危机以来，美国经济仅在2014年连续两个季度实现如此高速的增长。目前这种增速能持续下去吗？

一些人担心难以继。特朗普的减税措施为经济注入了暂时的活力。虽然这些措施还会持续一段时间，但对经济增长的影响可能不会持续。加上2月份的预算法案，这两个因素到2018年年底将推动GDP年增长率提高0.6到0.8个百分点。然而智库彼得森国际经济研究所（Peterson Institute For International Economics）的凯伦·戴南（Karen Dynan）和詹森·弗曼（Jason Furman）估计，这一影响在2019年最乐观也会降至0.3个百分点。大多数人预测美国经济增速将会很快退回到近2%，而减税的主要后果也将显现——公共财政会陷于疲软。

支持者反驳说，减税会带来长期的高增长和高投资。虽然人口老龄化拖累了经济增长，但活跃的经济可能会加快生产率的提高，从而为经济复苏补上最后一块拼图，即使在财政刺激的即时效应逐渐消退之时也会支撑增长。

乍看上去，经济增长的数据无助于解决争论。2018年上半年，个人所得税占GDP的比例同比下降约0.4个百分点，而企业所得税占比则下降了约0.7个百分点。智库布鲁金斯学会（Brookings Institution）估计，第三季度政府的税收和支出为整体3.5%的增长率贡献了约0.7个百分点（见图表）。尽管这是自2010年以来政府对实际GDP增长贡献最大的一次，但没有它，美国经济仍可能保持增长。

然而，仔细查看数据就会发现更有理由悲观。看看经济增长的两个组成：投资和贸易。第三季度非住宅投资疲软得令人沮丧，特别是与经济整体的强劲反差强烈。最近接受美国国家商业经济协会（National Association of Business Economics）调查的116家企业中，只有12%的企业表示因为减税而增加了投资。投资需要时间来规划，数据也纷繁芜杂。但特朗普的减税措施按说应该带来持续的投资热潮，而到目前为止几乎看不出有这种迹象。

房地产市场也可能有问题。私人住房投资，包括房主在设备上的支出在内，已经连续第三个季度下滑。究其原因，除了无力负担造成需求受限外，可能还包括土地价格上涨限制了供应、移民建筑工人短缺，以及关税推高了成本等。另外，住房征税方式的变化和利率上升可能也有关系。

与此同时，特朗普的关税政策正对贸易造成冲击。大豆销量激增的情形已经逆转。企业大量储备库存，足以将第三季度的经济增长提高两个百分点以上。但这可能是因为企业正在为对华商品征税生效后进口商品涨价做准备。如果是这样，那么这些库存代表的只是提前支出，而非真正的增长。对贸易的担忧可能是投资放缓背后的原因。美联储的褐皮书从私营部门收集经济方面的坊间证据，最新一期多次提到了贸易环境的不确定性。

如果投资继续下滑，经济增长将更加依赖消费，而消费又转而取决于就业率、工作时间和实际薪资的增长。“经济发展的韧性完全取决于劳动力市场。”咨询公司MacroPolicy Perspectives的朱莉娅·科罗纳多（Julia Coronado）表示。迄今为止劳动力市场似乎表现良好。私营企业的薪资创十年来最高增速；11月2日公布的数据显示又一个月就业增长强劲，薪资同比增幅自2009年以来首次超过3%。

由此可能引发另一个风险：美联储可能加息过快。央行有责任恰到好处地实施或停止财政刺激政策。美联储在11月8日结束的会议上决定维持利率不变。但投资者预计12月份会有另一次加息，2019年还会有三次。近期股市大跌，这些预期几乎没有变化。而如果实体经济数据急转直下，情况可能有变。（加息可能是投资放缓的另一个原因。）

悲观论者认为，即使生产率有加速增长的空间，但随着财政刺激影响的消退，这种增长也会放缓。这无疑是对的。而且，对美联储来说，应对预料之中的衰退要比应对突如其来的衰退更容易。不过，过度的货币紧缩往往会造成经济衰退。目前经济涨势看似不错，但政策制定者需要做好随机应变的准备。 ■



Information technology

IBM's rebel yell

The group's takeover of Red Hat is the biggest ever between software firms

BIG BLUE is donning red headgear. Even a few months ago the idea that IBM, a venerable corporate IT firm, would buy Red Hat, the biggest vendor of open-source software, would have been considered highly unlikely, not least because of IBM's aversion to big mergers. But on October 28th IBM announced that it would take over the firm for \$34bn, which represented a 63% premium over Red Hat's closing share price at the end of the previous week.

Red Hat is no household name, but in the IT industry the firm is considered a big success. Founded in 1993, it reached \$2.9bn in revenue in its most recent fiscal year. It takes free open-source software, makes some improvements, bundles it with other tools and services such as technical support, and charges a monthly subscription fee. The first product was a version of Linux, an operating system. It later acquired or developed more and more pieces of software that are needed to power computing clouds. One of the latest additions to its collection was OpenShift, a program that allows computing tasks to be easily moved around between data centres.

IBM, for its part, has been struggling in recent years to transform itself from a firm which made most of its money from IT services, software and mainframe computers to one that is based on cloud computing and artificial intelligence (AI). After 22 quarters of declining revenue, IBM seemed to be over the worst when its turnover started to increase early this year. But in the most recent quarter, revenue dipped again.

The deal will probably mean that Ginni Rometty, the firm's chief executive,

stays on for a few years to see through the integration. Analysts thought she was on her way out, not just because her strategy seemed to be failing, but because at 61, she is older than the standard retirement age for IBM bosses of 60.

More importantly, IBM hopes that the acquisition will give it a chance to catch up in the market for cloud computing. Big Blue failed to take the trend seriously in the late 2000s and decided not to invest in a network of huge data centres. As a result it has fallen behind the big “public” clouds (as opposed to “private” ones, which only serve a particular company), in particular Amazon Web Services and Microsoft Azure. Red Hat’s OpenShift is supposed to create an über-cloud, allowing computing workloads to run anywhere: whether it is in corporate data centres, on any of the big public clouds or a combination thereof.

There are plenty of ways for the merger, which is the largest in IBM’s history, to go wrong, however. One question is whether the added flexibility of such mixed systems and the promise of not getting locked into any one vendor will be enough to lure firms onto IBM’s new platform. They could shy away from the additional complexity and still prefer to put their data into one cloud. Another is the risk of a cultural clash between IBM’s still relatively strait-laced culture and Red Hat’s freewheeling one. Such concerns, in addition to the high price tag, explain why the firm’s shares fell by 4% the day after the deal was announced.

And then there is the question of what the acquisition means for Watson, IBM’s much-promoted AI business, which has disappointed so far. Some have suggested that buying Red Hat could mean that IBM will turn away from Watson, instead focusing even more on cloud computing. Yet the opposite is true: Red Hat’s software containers are meant to be a vehicle to deliver AI everywhere. The idea is that IBM’S cloud failure held Watson back; now it has the chance to spread more widely.

However the merger plays out, it has already produced one big winner: open-source software, which is developed collectively by firms that benefit from it and also by volunteer programmers. Red Hat is the third multi-billion dollar acquisition of an open-source firm this year after MuleSoft, bought by Salesforce for \$6.5bn, and GitHub, taken over by Microsoft for \$7.5bn. Not bad for a type of code whose pioneers saw themselves as rebels fighting “evil” proprietary-software makers. Such origins were the inspiration for Red Hat’s name, as Bob Young, the company’s co-founder, once explained: 18th-century revolutionaries in America and France wore red caps during their uprisings. Now, open-source firms look more like the establishment. ■



信息技术

IBM的反叛呐喊

IBM收购红帽是史上最大的软件企业并购案

蓝色巨人给自己戴上了红帽子。就在几个月前，外界还认为企业IT服务老店IBM收购最大的开源软件供应商红帽（Red Hat）的可能性极小，主要是因为IBM不喜欢大规模并购。但在10月28日，IBM宣布将以340亿美元收购红帽，比前一个周末红帽的收盘价溢价63%。

红帽公司并非家喻户晓，但在IT行业内部被视为非常成功的企业。它创立于1993年，最近一个财年的收入达29亿美元。它把免费的开源软件拿来做些改进，将其与其他工具和技术支持等服务捆绑销售，按月收取订阅费。它的第一个产品是一版Linux操作系统。后来它又获得或开发了越来越多的软件以驱动云计算。它最新增加的产品中有一个OpenShift程序，能在数据中心之间轻松转移计算任务。

而IBM近年一直在竭力从一家主要依赖IT服务、软件和大型计算机赚钱的公司转变为基于云计算和人工智能（AI）的企业。在连续22个季度收入下降之后，今年年初IBM的营业额开始增长，似乎熬过了低谷，但在最近一个季度又调转头下跌。

这次收购可能意味着IBM的首席执行官罗睿兰（Ginni Rometty）将继续留任几年，以带领两家公司顺利整合。分析师早先认为她即将卸任，不仅是因为她的战略似乎不起作用，还因为她已经61岁，超过了IBM老板的标准退休年龄60岁。

更重要的是，IBM希望此次收购能让它有机会在云计算市场上赶上对手。大约十年前，蓝色巨人没把云计算的趋势当回事，决定不投资大型数据中心网络。其结果是它被那些大型“公有”云（相对于仅服务于某一家公司的“私有”云）甩在了后头，特别是亚马逊网络服务（Amazon Web Services）和微软Azure。IBM希望红帽的OpenShift能创建一个“超级云”，让计算工

作可以在任何地方运行：无论是在企业数据中心还是任何大型公有云，抑或两者的混合。

然而，此次IBM历史上最大的合并仍有多种出错的可能。其中一个问题 是，这种混合云系统带来的额外灵活性以及不被锁定到任何一家供应商的 承诺是否足以吸引企业进入IBM的新平台。企业可能会避开额外的复杂 性，仍然倾向于将数据放入同一个云中。另一个问题是，IBM相对而言依 旧古板的文化和红帽自由灵活的文化之间有发生冲突的风险。这些担忧加 上收购价格高昂，也许是导致IBM在宣布收购后的第二天股价下跌4%的 原因。

还有一个问题是此次收购对IBM的AI业务沃森的影响。IBM大力发展沃 森，但迄今为止其表现令人失望。有人认为收购红帽可能意味着IBM将从 沃森抽身，而进一步加码发展云计算。然而实情恰恰相反：IBM意在把红 帽的软件容器用作一种载体，把AI传送到任何地方。IBM认为它在云业务 上的失利拖了沃森的后腿，现在它有了更广泛推广沃森的机会。

不管合并的结果如何，一个大赢家已然产生：开源软件。它们的开发者既 包括志愿者程序员，也包括本身是从开源软件获益的公司。继Salesforce 以65亿美元收购MuleSoft、微软以75亿美元收购GitHub之后，红帽是今年 第三家收购价格在数十亿美元以上的开源软件公司。开源软件的先驱自视 为与“邪恶”的专有软件制造商作战的反叛者，这种代码能取得这样的成绩 实属不赖。开源软件这种意识形态上的起源正是“红帽”这个名字的灵感来 源，正如公司联合创始人鲍勃·杨（Bob Young）曾解释过的那样：18世纪 时，美国和法国的革命者在起义时头戴红帽。而现在，开源公司看起来越 来越像传统企业了。 ■



Doing Business rankings

Red in tooth, claw and tape

Most criticisms of the World Bank's annual rankings miss the point

ADAM SMITH visited a pin factory to discover how the wealth of nations was created. Hernando de Soto, a Peruvian economist, went one step further. In 1983 his team set up their own garments factory outside Lima to discover how the potential wealth of nations was obstructed and frustrated by bundles of red tape. His experiment, which revealed that it took 289 days to register and license a new factory, inspired the World Bank's annual assessment of how countries welcome businesses. The latest of these Doing Business rankings was published late last month.

Because they arouse countries' competitive spirit, the rankings are unusually influential. India's success last year, jumping by 30 places, helped stir China to lift its position this year—by 32 places. And because they are influential, the rankings are also controversial. In January Paul Romer, then the bank's chief economist, suggested that the political leanings of bank staff had potentially tainted some of the results. That allegation, which he could not substantiate and which led to his resignation, has encouraged critics to renew older lines of attack. They argue that the reports do not match the actual experience of entrepreneurs; that they promote a mindless deregulatory race to the bottom; and that their methods are too unstable to allow anyone to judge countries over time.

Take each of these criticisms in turn. Rather than setting up factories itself, the bank rates countries by asking thousands of lawyers, accountants and others how long it would take a small firm to be registered, obtain a building permit, pay taxes and so on (see Finance section). Their answers, it is true, do not always fit well with what firms themselves say about their own

experience. But this objection largely misses the point. Everyone knows that some firms are big enough to bend the rules and others shadowy enough to evade them. Certainly Mr de Soto knew that no other factory actually wasted 289 days observing the letter of the law. But it is still useful to know what full compliance would entail. The answer helps explain why many companies stay in the shadows and others need friends in high places.

Other critics argue that the race to the top of the bank's rankings encourages a race to the bottom in regulatory standards. A country in a Hobbesian state of nature would get a perfect score on almost all of the bank's indicators, says one commentator. This charge is easy to rebut. In a war of all against all, firms would struggle to get a loan or a quick electricity connection. The top-ranked country is New Zealand, where life is hardly nasty, brutish or short. It is true that the rankings chiefly assess the costs, not the benefits, of regulations and taxes. But why should it be otherwise? No one would expect an index of pollution to include the benefits of carbon-emitting industrial production.

Critics also point out that the bank occasionally fiddles with its methods of assessment, adding new indicators and tweaking others. Countries can therefore jump up or down the rankings through no action of their own. This can be unfair. But the unfairness is minor in the grand scheme of things. Politicians are always getting credit and blame for rallies, crashes, booms and busts outside of their control. And since governments cannot dictate the bank's methodological tweaks, their best bet for improving their rank is still to cut red tape.

Unfortunately some governments now game the rankings, enacting reforms engineered to yield the biggest jump in their standing for the smallest political effort. But in these cases, the blame surely lies with the governments rather than the bank. And any policymaker bothered enough about the rankings to game them, probably cares at least a little about

business. The worst governments do not care enough to cheat.

In such places, regulations are both grossly inefficient and wholly ineffective, protecting almost nobody; most firms struggle for survival outside of the government's limited reach. Mr de Soto and his followers do not want to liberate firms from all regulation. They want to help garment-makers and pin factories escape an informal economy that can be truly brutish. ■



营商环境排名

野蛮竞争和繁冗监管

对世界银行这项年度排名的批评大多不得要领

亚当·斯密曾为探究国家财富的创造过程参观了一家别针厂。秘鲁经济学家赫尔南多·德·索托（Hernando de Soto）更进一步：1983年，他的团队在利马郊外开办了自己的制衣厂，以求亲身探明要使潜在的国家财富生成，会如何受到重重繁文缛节的阻挠乃至扼杀。他的实验显示，注册一家新工厂并拿到执照要花289天。世界银行受这项实验启发，开始推出对各国营商环境的年度评估。最新的《营商环境报告》于上月末发布。

这项排名激发了各国的好胜心，产生了异乎寻常的影响力。印度去年成功上升30个名次后，中国不甘示弱，今年一举提升了32位。而正因为影响力巨大，排名也引发了争议。今年1月，时任世行首席经济学家的保罗·罗默（Paul Romer）称世行员工的政治倾向可能导致一些排名结果有失偏颇。他未能具体证实这一点，之后为此辞职。不过这促使排名的批评人士再度发起抨击。他们说这些报告与企业家的实际经验不符；推动了一场竞相放松监管的盲目的“逐底竞争”；评估方法太不稳定，让人没法对一个国家形成长期判断。

我们依次来看这些批评。世行没有自己设立工厂，而是向成千上万名律师、会计师和其他人员询问注册一家小公司、获得施工许可证、纳税等等需要多长时间，以此来给国家评级。没错，他们的答案并不总是与企业根据自身经验得出的结论一致。但这条批评很大程度上没有抓住问题的关键。每个人都知道，有些公司规模大到可以歪曲规则，而另一些公司隐蔽到可以规避规则。德·索托当然知道，其实没有另外哪家工厂会为遵纪守法而浪费289天时间。但是，了解如果完全遵纪守法会如何仍是有用的。答案有助于解释为什么许多公司躲在暗处，而另一些需要身居高位的朋友。

其他批评人士认为，在世行排名中力争上游实则鼓励了对放宽监管标准探底。一位评论人士表示，一个处于霍布斯式自然状态的国家，在世行几乎所有指标上都能拿高分。这种指责很容易反驳。在一场“所有人大战所有人的”战争中，企业会很难获得贷款或是快速接上电。排名最高的国家是新西兰，那里的生活并不“险恶、野蛮又短暂”。诚然，排名主要评估的是监管和税收带来的营商成本而非益处。但这有什么不对呢？没人会指望一个污染指数还要包含造成排放的工业生产的好处。

批评人士还指出，世行有时会更改评估方法，增加新指标，调整旧指标。因此，各国可能会因为非自身因素而在排名中上升或下降。这的确不公平。但这种不公平性对于大局并不重要。政客们总会为他们无法控制的反弹、崩溃、繁荣或萧条被赞扬和指责。而既然各国政府无法决定世行如何调整评估方法，它们提高排名的最佳选择仍是减少繁冗的监管。

不幸的是，一些政府如今在排名上耍花样，它们提出的一些改革试图以最小的政治努力换取排名上的最大进步。但在这种情况下，责任肯定在这些政府，而非世行。而且，任何对排名如此上心以至于要玩花样的政策制定者可能对商业至少还有点上心。最糟糕的政府连作弊都懒得去做。

在那些地方，监管既极度低效，又全无效果，几乎无法保护任何人；大多数公司在政府有限的触角之外挣扎求存。德·索托和他的追随者并不想将企业从所有监管中解放出来。他们希望帮助制衣厂和别针厂逃脱真正可能野蛮嗜血的非正规经济。 ■



Ubernomics

A hard bargain

The externalities of ride-hailing may be larger than previously thought

ECONOMISTS HAVE always been fond of Uber. Its willingness to battle incumbents, use of technology to match buyers and sellers, and embrace of “surge” pricing to balance supply and demand make the ride-hailing giant a dismal scientist’s dream. Steven Levitt, the author of the bestselling “Freakonomics”, called it “the embodiment of what the economists would like the economy to look like”. But if economists subjected Uber and its competitors to a cost-benefit analysis, they might not be so impressed.

This might surprise customers. A study in 2016 by researchers from Oxford University, the University of Chicago and Uber itself found sizeable benefits from ride-hailing services for consumers. Using data from 48m Uber trips taken in four American cities in 2015, they estimated the difference between how much customers were willing to pay and their actual fare. Each \$1 spent on UberX rides generated a “consumer surplus” of \$1.60. Across America, that surplus was estimated to be \$6.8bn a year.

Drivers also benefit. Few sign up for lack of anything else, as is true of some gig work: in America roughly eight in ten have left another job to get behind the wheel. The typical American Uber driver makes \$16 per hour (\$10 after expenses), higher than the federal minimum wage. In London earnings after expenses come to £11 (\$14) per hour and a recent survey found Uber drivers reporting higher levels of life satisfaction on average than other workers.

But against these benefits, there are costs to weigh. Far from reducing congestion by encouraging people to give up their cars, as many had hoped, ride-hailing seems to increase it. Bruce Schaller, a transport consultant,

estimates that over half of all Uber and Lyft trips in big American cities would otherwise have been made on foot or by bike, bus, subway or train. He reckons that ride-hailing services add 2.8 vehicle miles of driving in those cities for every mile they subtract.

A new working paper by John Barrios of the University of Chicago and Yael Hochberg and Hanyi Yi of Rice University spells out one deadly consequence of this increase in traffic. Using data from the federal transport department, they find that the introduction of ride-sharing to a city is associated with an increase in vehicle-miles travelled, petrol consumption and car registrations—and a 3.5% jump in fatal car accidents. At a national level, this translates into 987 extra deaths a year.

What could be done to tip the balance back to benefits overall? “Congestion pricing is the most direct solution,” says Jonathan Hall of the University of Toronto. Several cities, including London, Stockholm and Singapore, have moved in this direction, charging drivers for entering busy areas at peak hours. If ride-hailing firms tweaked their pricing to encourage carpooling, that would help, too.

One of the worst things a city can do, says Mr Barrios, is to cap the number of ride-hailing cars on their streets, as New York did in August. That marked a step back towards the days when barriers to entering the taxi market were high and competition was low. A dismal outcome, as most right-thinking economists would agree. ■



优步经济学

便宜的代价

网约车的外部性可能比人们先前以为的要大

经济学家一直都青睐优步。它乐与既有企业竞争，利用科技匹配买卖双方，并积极采用“峰时定价”平衡供需——这个网约车巨头满足了经济学家的种种想象。畅销书《魔鬼经济学》（Freakonomics）的作者史蒂文·莱维特（Steven Levitt）称优步“体现了经济学家理想中的经济运行模式”。但是，经济学家如果对优步及其竞争对手做一番成本效益分析，可能就不会对它如此高看了。

这可能会让乘客意外。2016年，牛津大学、芝加哥大学以及优步自己的研究人员的一项联合研究发现，消费者从网约车服务中的获益很可观。他们根据2015年优步在美国四个城市的4800万次出行数据，估计了顾客愿意支付的车费与实际车费之间的差额。搭乘UberX每花1美元就会产生1.60美元的“消费者剩余”。据估计，全美一年由此产生的消费者剩余为68亿美元。

司机也从中受益。不像其他一些临时工作，极少有人是因为找不到其他工作而签约优步：在美国，大约80%的优步司机是辞掉了原来的工作去开网约车的。美国优步司机一般每小时挣16美元（扣除费用后为10美元），高于联邦最低工资。在伦敦，优步司机扣除费用后每小时收入为11英镑（14美元），而且当地一项近期调查发现，优步司机的生活满意度总体上高于其他劳动者。

但对于这些好处，还需要权衡其代价。网约车非但没像许多人期望的那样，因为鼓励了人们放弃自己开车而缓解交通压力，似乎反倒加剧了拥堵。交通顾问布鲁斯·夏勒（Bruce Schaller）估计，在美国大城市，超过一半的优步和Lyft出行原本会以步行或骑自行车、坐公交、地铁或火车等方式完成。据他估算，在这些城市，网约车每减少1英里私家车行程，就新增了2.8英里的车程。

芝加哥大学的约翰·巴罗斯（John Barrios）以及莱斯大学的雅尔·霍奇伯格（Yael Hochberg）和易涵毅（音译，Hanyi Yi）新近发布的工作论文阐述了这一交通增长带来的一个致命后果。他们研究联邦运输部的数据后发现，在一座城市中引入共享汽车与行驶里程、油耗和汽车登记数量上升相关联，与之相关的还有致命车祸事故增加了3.5%。在全美范围内，这导致车祸死亡人数每年增加987人。

怎样才能让结果在总体上转为有益？多伦多大学的乔纳森·霍尔（Jonathan Hall）表示：“拥堵费是最直接的解决方案。”包括伦敦、斯德哥尔摩和新加坡在内的几个城市已经朝这个方向行动，对在高峰时段进入繁忙区域的司机收费。如果网约车公司调整定价以鼓励拼车，也会有所帮助。

巴罗斯指出，限制网约车的数量是一个城市最糟糕的举措之一，就像纽约8月份所做的那样。这无异于倒退到那个出租车市场准入门槛高、缺乏竞争的时代。正如大多数信奉自由市场的右翼经济学家会认同的那样，这会是个令人沮丧的结果。 ■



Tencent at 20

WeFlat

A Chinese internet titan shakes things up after a singularly bruising year

“WHO IS KILLING Tencent?” was the headline of an article on a Chinese business news site this autumn. Those sharing the link on WeChat, a social-media and payments service that is the crown jewel of the Chinese technology giant, see something else: “This title contains exaggerated and misleading information”. The swap is ostensibly the result of a move by Tencent in April to sanitise content, after a crackdown on popular online platforms by government regulators, but is also self-serving. Scoffing WeChat users circulated the article just to highlight the switch.

It would be no surprise if Tencent were feeling touchy as it approaches its 20th anniversary on November 11th. Its shares, traded in Hong Kong since 2004, have fallen by 28% in 2018 (see chart). This time last year it was the first Asian company to be worth half-a-trillion dollars, hitting a record valuation in January of \$573bn. It has since shed \$218bn, roughly equivalent in value to losing Boeing or Intel. Other Chinese internet stocks have fared worse than Tencent, among them NetEase, a gaming rival, and JD.com, an e-commerce firm. But even so, the drop stands out.

The company posted its first quarterly profit decline for nearly 13 years in the three-month period ending in June. A regulatory hold-up that was blocking it from charging for new video games was the chief culprit, it explained. Although it has sprawled into all sorts of areas, from online lending (WeBank) and insurance (WeSure) to offline medical clinics (Tencent Doctorwork), the company still derives over two-fifths of its revenue from gaming. Its latest big bet in mobile games, “PlayerUnknown’s Battlegrounds”, has accrued a huge audience of some 50m Chinese gamers

who play daily, but because of the monetisation freeze, Tencent cannot cash in.

The government suspension, which began in March without explanation, had been expected to ease in the autumn. Analysts now assume that Tencent will need to tough it out until the second half of 2019. Even once game approvals start up again, the government has said that their number will be limited. To allay Communist Party concerns about the mental and physical health of young gamers, Tencent is also having to curb gaming time and set up a system of user-identity checks.

Capricious regulators may not be wholly to blame for the slowdown in online games, says Steve Chow of Agricultural Bank of China International (ABCI), a Chinese investment bank. Users may simply be spending less time on Tencent's online entertainment, as other players eat into its market share. For its flagship game, "Honour of Kings", for example, the average number of daily active users has dropped by a fifth in the past year or so, to 54m in September.

For skittish investors, all this has concentrated minds on whether the giant can maintain its momentum as it enters its third decade. Most agree that gaming will remain an important part of the company, but not its chief driver of revenue growth.

Two concerns are particularly acute. Because its games have done so well, Tencent has been lackadaisical in monetising other parts of its business. It has rightly been nervous about expanding advertising within WeChat, though the service sees unrivalled Chinese mobile traffic of over 1bn monthly active users. Last year Tencent took about one-tenth of total third-party spending on digital ads in China. But Baidu, China's leading search engine, took 19% and Alibaba, a giant in e-commerce, drew in almost a third.

A second worry is that crimped profits will make it harder for the firm to keep investing heavily in areas outside its core business. Tencent has been backing promising startups in a race with Alibaba to find new users and sources of growth, battling indirectly in areas as varied as food delivery and online education. In some, such as cloud computing, the pair compete directly. Although Tencent's investors are supportive of this approach, Jerry Liu of UBS, a bank, says the wider tech sell-off stems from a recognition that China's maturing internet sector is becoming "a zero-sum game": dominant platforms are having to invest more to stay ahead and so their margins are shrinking.

Tencent's first internal-restructuring plan since 2012, announced in September, offers a clue to the company's thinking. In it Tencent set out a long-term shift away from the consumer internet towards business services, marking "a new beginning for the company's next 20 years". It has set up a new unit for cloud and "smart" industries, combining all its on-demand software and online services for firms that seek to go digital. Pony Ma, Tencent's boss, said the "main battlefield" for mobile internet is moving from consumers to companies.

Alibaba, born to bring businesses online through its virtual emporia, has a strong lead in this arena. Last year it took 45% of China's fledgling cloud-computing market, worth 69bn yuan (\$10bn), compared with 10% for Tencent, according to IDC, a research firm. Still, Tencent doubled revenue in cloud services in the second quarter compared with the same period last year. Earnings from "other businesses" (ie, payments and cloud) overtook those from its social networks for the first time.

Mr Chow reckons that Alibaba and Tencent can both create large businesses in cloud computing since the market has lots of room to grow. And Tencent boasts powerful assets. WeChat is on over four in every five Chinese smartphones, so offers a massive market for firms. Last year it introduced

a cloud-based platform that allows companies to offer services to users in WeChat via “mini programs” (ie, tiny apps). There are more than 1m mini programs, used by over 200m people every day.

For now, however, its revenue from such mini programs and other built-in services is still “close to zero”, notes David Dai of Sanford C. Bernstein, a research firm. Meanwhile rivals have introduced their own offerings of mini programs. Among them is Bytedance, a newish giant that has young Chinese hooked on its flawlessly addictive video and news offerings, curated with artificial-intelligence technology. It is a thorn in Tencent’s side.

In particular, the way in which Bytedance is capturing very young users, as well as young talent, makes Tencent look increasingly grizzled. To increase its appeal to youngsters, Tencent in April revived a short-video app it had shut down, called Weishi, and made it a near-copy of Bytedance’s wildly popular Douyin app.

Pan Luan, a former tech journalist who published a widely-read essay in May contending that Tencent had “no dream”, says the giant looks lumbering at times because its whole structure is ageing. Young staff say they have few channels for promotion to decision-making positions, says Mr Pan, and few opportunities to build sparky products, as Tencent spends on stakes in other companies. A young Tencent employee who left to work for a newer tech firm says that pay at firms like Bytedance and Kuaishou, a short-video app (in which Tencent has a stake), is “in another band”, and that they feel more like foreign startups.

Tencent’s outsize influence in China’s online world is ballast that should steady it as it targets business customers. For sheer scale, WeChat seems likely to hold its own. It has given Tencent a powerful distribution channel for its own games, and has allowed it to stymie new rival products, including Douyin, by blocking them from its platform. But the giant is

under pressure, and seems to know it. "We have to stay awake," urged its president, Martin Lau, last month. Such introspection is necessary. Mr Chow says it was thought until this year that "Tencent could win every battle". With more formidable competitors on the scene, the company will need to pick its fights more carefully. ■



腾讯20岁

微逊

经历了形势尤其严峻的一年后，这家中国互联网巨头展开大调整

《谁在杀死腾讯？》——今年秋天，中国某家商业新闻网站发表的一篇文章用了这样的标题。当人们在腾讯的王牌产品微信（这家中国科技巨头的社交媒体和支付服务应用）上分享此文时，看到标题旁多了一条提示：“标题夸大误导”。乍一看，这种处理是腾讯自4月起为响应政府监管部门整顿流行网络平台的行动而启动“自净”的结果。但它也不无私心。微信用户纷纷转发，调侃这种变化。

腾讯若有些敏感易怒也不奇怪。这家于11日迎来成立20周年纪念日的公司于2004年在香港上市，今年以来股价已下跌28%（见图表）。去年11月，它成为首家市值突破五千亿美元的亚洲公司，到今年1月时达到5730亿美元的历史高位。自那以后，其市值已蒸发了2180亿美元，大致等同于没了一整个波音或英特尔。其他中国互联网公司的股票表现更差，包括腾讯在游戏业务上的竞争对手网易以及电子商务公司京东。但即便如此，腾讯这番大跌也很惹眼。

腾讯此前发布的财报显示，在截至6月的三个月里出现了近13年来首次季度利润下滑。公司解释说，主要原因是监管部门延迟审批网络游戏，使得它无法就新游戏收费。虽然腾讯的业务范围已延伸至各种领域，包括网络贷款（微众银行）、保险（微保）和线下医疗诊所（企鹅医生）等，但仍超过五分之二的收入来自游戏。它在手游上最新的大手笔投注是《绝地求生》，吸引了众多玩家——约5000万中国人每天必玩这款游戏，但因为收费受阻而无法变现。

今年3月，政府在未做解释的情况下暂停了网络游戏的审批，外界原本预计会在秋季解冻。现在，分析师认为腾讯将需要捱到2019年下半年。即使游戏审批重新启动，政府也已表示其数量将受限制。为了减轻共产党对游

戏有损年轻玩家身心健康的担忧，腾讯还不得不对玩游戏的时间设限，并建立用户身份核查系统。

中国一家投资银行农银国际的周秀成认为，网络游戏业务放缓也许不能完全归咎于捉摸不定的监管机构。随着其他对手蚕食市场份额，用户可能本就已减少了花在腾讯在线游戏上的时间。例如，其王牌游戏《王者荣耀》的平均日活跃用户数量在约一年时间里减少了五分之一，9月份为5400万人。

对于紧张兮兮的投资者来说，这一切都让他们关注这家巨头在迈入第三个十年之际能否保持发展势头。大多数人都认为网络游戏仍将是腾讯的重要组成部分，但不会是其收入增长的主要来源。

有两个问题尤其突出。由于游戏业务战绩彪炳，腾讯对于从其他业务上赚钱一直漫不经心。尽管微信在中国拥有超过10亿月活跃用户，移动访问流量无与伦比，但腾讯对于在微信平台上扩展广告一直有所顾虑——这是对的。去年，腾讯在中国第三方数字广告支出总额中占比为十分之一。中国最大的搜索引擎百度占19%，电子商务巨头阿里巴巴占了近三分之一。

第二个担忧是，利润下降将令腾讯更难继续在核心业务以外的领域大举投资。腾讯与阿里巴巴在发掘新用户和增长源上展开角逐，为此一直在支持有发展前景的创业公司。它们在餐饮外卖和在线教育等各种各样的领域间接较量，而在另一些领域如云计算，两者直接对撼。尽管腾讯的投资者支持这种做法，但瑞银的分析师刘杰表示，科技股近期普遍下跌，是因为投资者认识到中国日渐成熟的互联网行业正在变成一场“零和游戏”：主导平台为保持领先地位不得不投入更多资金，利润因此萎缩。

腾讯于9月宣布推出自2012年以来首个内部重组计划，从中可一窥其发展思路。腾讯在其中制定了从消费互联网向商业服务转移的长期目标，标志着“腾讯迈向下一个20年的新起点”。它新建了一个云与“智慧”产业部门，把所有针对企业的按需软件和在线服务整合起来，推动企业的数字化升级。腾讯的老板马化腾表示，移动互联网的“主战场”正在从消费者转向企

业市场。

阿里巴巴自诞生之初就打造虚拟商城来让商家“上线”，它在这一领域具有强大的领先优势。根据研究公司IDC的数据，去年阿里巴巴在中国价值690亿元的新兴云计算市场中占据了45%的份额，腾讯占10%。尽管如此，与去年同期相比，腾讯在今年二季度的云服务收入翻了一番，来自“其他业务”（即支付和云计算）的收入首次超过了来自社交网络业务的收入。

周秀成认为阿里巴巴和腾讯都可以在云计算领域大力扩展业务，因为这个市场有很大的发展空间。而腾讯拥有强大的资产。中国超过五分之四的智能手机都安装了微信，这为企业提供了一个巨大的市场。去年，腾讯推出了一个基于云的平台，能让企业通过“小程序”（即微型应用）为微信用户提供服务。现在已有超过100万个微信小程序，每天有超过两亿人使用。

然而，研究公司盛博的戴昊指出，目前来自这些小程序和其他内置服务的收入仍旧“接近于零”。与此同时，竞争对手也推出了自己的小程序，其中包括互联网新晋巨头字节跳动。该公司借助人工智能技术打造出让人欲罢不能的视频和新闻服务，让中国的年轻人爱不释手。这让腾讯有如芒刺在背。

尤其叫人难耐的是，字节跳动吸引青少年用户和年轻人才的方式让腾讯愈显老态。为了增强对青少年的吸引力，腾讯在4月重启了之前已关闭的短视频应用“微视”，而且几乎将它打造成字节跳动的爆红应用“抖音”的翻版。

前科技新闻记者潘乱在5月发表了一篇广为流传的文章，称腾讯“没有梦想”。他说这家巨头有时看来迟缓笨拙，因为它的整个组织架构老化。潘乱提到，年轻员工表示几乎没有晋升到决策职位的通道，而随着腾讯大量投资入股其他公司，他们打造亮眼新产品的机会也不多。一名离职去了一家新科技公司的年轻人表示，像字节跳动和短视频应用“快手”（腾讯持有股份）这类公司的薪资水平在“另一梯队”，而且氛围更像国外的创业公

司。

腾讯在中国网络世界中的巨大影响力犹如压舱石，应该会让它在转向商业客户时保持稳定。微信以其规模之大似乎就足以稳住阵脚。它为腾讯自家的游戏提供了强大的发行渠道，还可以在自家平台上封杀新的竞争产品，包括抖音，从而打压它们。但巨人正在承受压力，而且它自己似乎也清楚这一点。“我们需要时刻保持清醒。”上个月腾讯总裁刘炽平催促道。这种自省是必要的。周秀成说，直到今年以前，这家公司还认为“腾讯可以百战百胜”。随着更多强大的竞争对手粉墨登场，腾讯需要更谨慎地选择自己的发力点。 ■



Free exchange

A hard place

The path to economic development is growing more treacherous, again

IN THE 1990S economists had almost given up on the developing world. Although individual countries, like Singapore or South Korea, occasionally scaled the income ladder, the overall picture was, in the words of Lant Pritchett, a development economist at Harvard University, “divergence, big-time” between advanced economies and the rest. Then the scene changed. From the late 1990s global trade grew explosively, and the gap between the rich and the rest closed fast. Poverty tumbled. The share of people living on no more than \$1.90 a day (at purchasing-power parity) fell from 36% in 1990 to just 10% in 2015. It would be the best of news if this trend could be maintained. Sadly, convergence seems to be slowing. That is bad news for Africa in particular.

The path to becoming a rich country usually runs through industrialisation, supported by opening up to trade and developing export industries. Trade facilitates technology transfer. Global markets weed out all but the most productive firms and allow even companies from small countries to scale up using techniques such as mass production.

Historically, few poor countries had stable, growth-oriented governments for long enough to build a broad, competitive industrial base. But in recent decades the once-exclusive club of fast-growing economies welcomed scores of new members, ushered in by the rapid growth in trade associated with the emergence of global supply chains. Supply-chain trade allowed countries to sidestep the arduous process of building an industrial base from the ground up. Cheap labour and proximity to big markets were often enough to lure foreign plants. The growth of China, sitting at the heart

of Factory Asia, served as a “force multiplier”. It also shifted the world’s economic centre of gravity towards Asia’s poorer economies, and sparked a commodity boom that buoyed parts of the emerging world not linked into supply-chain networks—notably Latin America and parts of Africa.

A quarter of a century on, the limits of this development miracle are increasingly clear. Incomes in the poorer parts of Asia and Europe surged towards those in America (see chart). Elsewhere, there was less convergence. Indeed, in Latin America and Africa recent income growth did not fully make up the ground lost during the tumultuous 1980s and 1990s, and real output per person is once again falling compared with that in America. The end of convergence would be bleak news for Africa, where incomes are lowest. The share of Africans who are extremely poor fell from 54% in 1981 to 41% in 2015. But because the population has grown so rapidly the number of poor Africans has increased.

Most countries languishing on the lower rungs of the development ladder place their hopes in replicating China’s experience. Industrialisation in East Asia has followed a “flying geese” pattern: as leading economies become more advanced and wages rise, less sophisticated production jobs shift to poorer places with lower labour costs. China benefited in this way from growth in South Korea and Taiwan. And as Chinese workers have become more expensive, some firms have shifted jobs again, for example to Vietnam. Perhaps rising wages in emerging Asia will eventually push manufacturers to look to Africa for cheap labour.

But it could be a long wait. As Ewout Frankema of Wageningen University in the Netherlands and Marlous van Waijenburg of the University of Michigan note in a recent paper, the flow of jobs from more advanced to less advanced economies depends in part on a very wide wage gap. During the early 20th century, when textile producers in Japan challenged British manufacturers, wages in the former were roughly an eighth of those in the latter, for

example. In most African countries wages are around a third of those in newly industrialising countries such as Vietnam and Bangladesh.

That gap might be too small to offset the costs of poor infrastructure and low labour productivity. There are exceptions, such as Ethiopia, where wages are much lower than in emerging Asia and where value-added in manufacturing has risen sharply over the past half-decade as a share of GDP. Yet it is still only 5.6% of GDP, tiny by global standards. And a recent study by Chris Blattman of the University of Chicago and Stefan Dercon of Oxford University suggests that Ethiopia is attracting the dregs of industrial work. Its factory workers earn no more than their compatriots in other sectors, and their health is worse.

Africa faces other obstacles, too. Its governments are mostly weaker than those in developing Asia. Slowing growth in global trade and rich-world protectionism will not help. Nor will economic weakness in China, which hoovers up lots of African exports. Robots, too, will erode the attraction of cheap labour.

Industrialisation is not the only route to development. Exporting business services has helped India to grow fast. But the benefits to such growth have been limited; roughly 70m Indians remain in extreme poverty. And as Poonam Gupta of the World Bank and Barry Eichengreen of the University of California, Berkeley, have noted, India's services exports are uniquely large, and higher than economic fundamentals would predict, suggesting that its experience will prove hard to imitate. Natural resources can also power an economic boom. Botswana, Africa's greatest development success story, depends heavily on diamonds, for instance. But as Mr Frankema and Ms van Waijenburg point out, growing populations mean that resource riches will have to be spread more thinly—and this is assuming that elites do not grab the lot. Botswana, notably, has one of the least dense populations in the world.

Africa's case is not hopeless. Few economists predicted the emerging world's growth spurt. But the path to development may be getting steeper once more. To make progress the continent's governments must improve education and economic institutions. Rich countries, for their part, should be lowering, not raising, barriers to trade and migration, which prevent Africans from playing a full part in the world economy. The fate of billions is at stake. ■



自由交流

艰难之境

谋求经济发展的道路又一次变得愈发艰险

上世纪90年代，经济学家几乎已经对发展中国家不抱希望。尽管个别国家如新加坡和韩国偶尔还是会在收入阶梯上更上一层楼，但若论及总体局面，用哈佛大学的发展经济学家兰特·普利切特（Lant Pritchett）的话来说，就是发达经济体与其余地区之间“严重趋异”。自那之后，形势发生了改变。90年代末以来，全球贸易呈爆炸式增长，富国与其余国家之间的差距迅速缩小。贫困率急剧下跌。每日生活费不超过1.90美元（按购买力平价计算）的人口占比从1990年的36%降到2015年的仅10%。如果这种趋势能够保持，那是再好不过的了。可惜，趋同的速度似乎正在放慢。这对非洲来说尤其是个坏消息。

成为富裕国家的途径通常都是在开放贸易和发展出口产业的支持下开展工业化。贸易促进了技术转移。在全球市场的淘洗下，只有效率最高的企业留存下来；此外，由于这个市场的存在，即使小国的公司也可以凭借大批量生产等手段扩大规模。

从历史上看，几乎没有哪个贫穷国家有过稳定的、以增长为导向而执政时间又足够长的政府，以让它们建立起广泛而具竞争力的工业基础。但近几十年来，全球供应链的形成推动贸易迅速增长，曾经是某些国家专属的“快速增长俱乐部”迎来了许多新成员。供应链贸易让各国绕过了从头开始打造工业基础的艰辛过程。廉价劳动力和毗邻大型市场这两点往往就足以吸引外国公司前来建厂。处于“亚洲工厂”核心的中国的增长起到了“力量倍增器”的作用。它也使得世界经济的重心向较贫穷的亚洲经济体倾斜，并引发了一轮大宗商品繁荣期，提振了新兴世界中没有接入供应链网络的那部分地区，特别是拉美和非洲部分地区。

25年后，这种发展奇迹的局限日益清晰。亚洲及欧洲较贫穷地区的收入水

平飙升，逐步向美国看齐（见图表）。其他地方则未出现这种程度的趋同。事实上，拉美和非洲近些年收入水平虽见提升，但并未完全恢复到动荡的八九十年代之前的水平，而且人均实际产出相较于美国也再次下降。对于收入水平垫底的非洲来说，趋同进程的终结是个令人沮丧的消息。非洲极度贫困人口的占比在1981年为54%，到2015年降到了41%。但由于人口急剧增长，当地贫困人口数量上升。

那些在发展阶梯的底端裹足不前的国家大多希望复制中国经验。东亚各国的工业化遵循的是一种“雁行模式”：随着领先的经济体变得愈加发达及工资水平上涨，那些不那么精密复杂的生产岗位会转移到劳动力成本更低的较贫穷地区。中国就是这样从韩国和台湾的发展中获益的。而随着中国劳动力成本上升，一些企业又再一次将生产岗位转移到像越南这样的国家。也许亚洲新兴经济体工资的上涨最终会推动制造商向非洲寻求廉价劳动力。

但这可能会是一场漫长的等待。正如荷兰瓦格宁根大学（Wageningen University）的伊沃特·弗兰克玛（Ewout Frankema）和密歇根大学的马洛斯·范瓦詹博格（Marloes van Waijenburg）在近期发表的一篇论文中指出的那样，工作岗位是否从较发达经济体流向欠发达经济体，一定程度上取决于两者是否存在非常大的工资差距。例如，20世纪初日本纺织品生产商向英国制造商发起挑战之时，前者的工资大致相当于后者的八分之一。而非洲大多数国家的工资大约是越南和孟加拉等新近开展工业化国家的三分之一。

这点儿工资差距也许不足以抵消基础设施薄弱、劳动生产率低下带来的成本。倒是也有例外，比如埃塞俄比亚：该国工资水平远低于亚洲新兴经济体，过去五年来制造业附加值占GDP的比重也急剧上升。然而这个占比仍旧仅为5.6%，按全球标准来看是个小数字。而且，芝加哥大学的克里斯·布拉特曼（Chris Blattman）和牛津大学的斯特凡·德尔康（Stefan Dercon）近期的一项研究显示，埃塞俄比亚吸引来的都是工业领域内没人愿意干的边角工作。该国的工厂工人挣得并不比其他行业里的同胞多，但健康状况更差。

非洲还面临其他难关。非洲国家政府的能力大多比亚洲发展中国家和地区的政府弱。全球贸易增长放缓以及富裕国家的贸易保护主义也是个问题。吸收了大量非洲出口的中国经济疲软，可谓雪上加霜。机器人也会令廉价劳动力的吸引力逐渐失色。

工业化并不是唯一的发展之路。印度就通过出口商业服务实现了快速增长。但这种增长带来的益处有限：约7000万印度人仍处在极度贫困状态。而且，正如世界银行的普纳姆·古普塔（Poonam Gupta）和加州大学伯克利分校的巴里·艾肯格林（Barry Eichengreen）指出的那样，印度的服务出口有着绝无仅有的庞大规模，且高于基于经济基本面的预测，这表明印度的经验将难以效仿。自然资源也可能推动经济繁荣。例如非洲最成功的发展案例——博茨瓦纳——就严重依赖钻石。但就如弗兰克玛和范瓦詹博格指出的那样，随着人口增多，资源带来的财富也会被摊薄——这还是在假定财富不被精英阶层独吞的情况下。值得注意的是，博茨瓦纳是全世界人口密度最低的地方之一。

非洲并不是希望全无。当初几乎没有经济学家成功预测到新兴世界会突飞猛进。但如今发展之路也许又一次变得更险峻了。要取得进步，非洲各国政府必须改善教育及经济制度。而富裕国家则应降低而不是提高贸易和移民的壁垒，从而保障非洲人在全球经济中充分发挥作用。亿万非洲人民的命运已岌岌可危。 ■



Farming in America

Tough row to hoe

Donald Trump's trade war will make American agriculture less competitive and more distorted

A CALM USUALLY descends on America's farm belt in November. Combines have mostly finished churning across fields; trucks have hauled crops to grain elevators; and farmers retreat to their living rooms to rest. This year, at least by one measure, they should feel particularly content. Randy Sims, a hog-and-grain farmer in western Illinois, produced 75 bushels of soyabean per acre, a third more than in the past. Indeed American soyabean production in 2018 is expected to reach 4.69bn bushels, a record. But it is unclear who will buy them.

America's farmers are at the centre of President Donald Trump's trade war. More than a fifth of agricultural exports face new tariffs. From January to September pork exports to Mexico and China fell by 31% and 36%, respectively. Sales of soyabean, America's biggest farm export, to China have plunged by 98% since January (see chart). "It's a big concern," says David Williams, who farms 3,800 acres in Michigan. He flew to Shanghai for a conference in early November with a group of soyabean growers keen to maintain ties with Chinese importers, in the hope that the trade standoff ends soon. In the meantime America's agriculture department expects farm incomes to drop by 13% this year. The ratio of farm debt to assets is forecast to rise to its highest level since 2009.

It is all reminiscent of the 1980s, when America suspended grain sales to the Soviet Union, interest rates rose, incomes sank and many farmers left the business. For now debt levels are climbing but still manageable. But much depends on how long tariffs persist. By the time the trade war ends, they

may have caused enduring harm.

American farmers are titans of international commerce. From 2000 to 2017 the value of agricultural exports nearly tripled. Exports comprise more than a fifth of farm output. Grain gushes abroad in the highest volumes. As the world eats more meat, livestock producers need more animal feed, raising demand for soybeans. Exports last year reached \$21.6bn, more than double the value of corn, the next largest export.

These successes are due in part to government subsidies that incentivise production, such as farm payments that rise when commodity prices fall. These mainly support big operations: farms with incomes of \$167,000 or more received nearly 70% of commodity payments in 2016, according to the Heritage Foundation, a think-tank.

Productivity-boosting measures have helped, too. Mr Sims, for instance, now uses data on yields to fine-tune the application of fertiliser. He flies drones to inspect crops for insect damage. Farmers often coat seeds before planting to fend off rot and pests. Environmentalists worry about the impact on water and biodiversity. But production has boomed.

This has helped depress prices for corn and soybeans in recent years, even as land, fertiliser and seed have remained relatively expensive. So a trade war is particularly ill-timed. Mr Trump announced tariffs on steel and aluminium imports in March, and extended them to Mexico, Canada and Europe in May. In retaliation Mexico, the second-largest importer of American pork by value, raised tariffs to 20%. China's tariffs of up to 70% on pork, and 25% on soybeans, hurt even more.

Mr Trump is due to meet Xi Jinping, China's president, at the G20 summit later this month, but neither man may concede much. In September Mr Trump agreed on a new deal to replace the North American Free Trade

Agreement with Canada and Mexico. But it does not affect America's tariffs on steel and aluminium, so Mexico's pork tariffs remain in place. Indeed Canadian and Mexican retaliatory tariffs wipe out the modest gain in exports from the new deal, according to analysis from Purdue University, leading to a \$1.8bn net loss in farm exports.

When one export market shuts, it can be hard to divert goods elsewhere. Pork, for instance, can be transported to Mexico in refrigerated trucks. It is more expensive to freeze and ship it across an ocean.

Soyabean farmers fear that demand and trade flows will shift permanently. China's appetite for imports would wane if producers lower the soya protein in pig feed or if, as some traders fear, the government urges consumers to switch to chicken or beef, which require less soya than pork does. What demand remains may increasingly be met by Brazil and Argentina. Wallace Tyner of Purdue University estimates that Brazil has another 9m acres of farmland that it could convert to soyabeans relatively quickly. "The market loss that we face in the short run really opens the door to competitors," says Jim Sutter of the United States Soybean Export Council.

The price of American soyabeans is now depressed, compared with that of Brazilian beans. Many farmers must accept an even lower price than that published on the Chicago Board of Trade, as elevators struggle to store and transport grain for which there are few buyers. Mr Williams has had to sell his soyabeans at a discount. In North Dakota, which usually sends soyabeans to ships in the Pacific Northwest, some elevators have stopped buying them altogether.

Economists at the University of Illinois expect the average farm in central Illinois to make an overall loss of \$70,000 next year. A recent survey from the Kansas City Federal Reserve found that farm lending from July to September was a third higher than in the same period last year. Most of the

increase was not to buy new machinery but to support the basic business of farming. Farmers may plant more corn next year, rather than soyabeans, but that is not a permanent solution. Continuously planting corn, rather than rotating crops, lowers yields.

In 2015, 51% of output came from farms with sales of at least \$1m, compared with 31% in 1991. The trade dispute may speed consolidation. Bigger farms have more cash to invest in yield-boosting technology and the scale to win better terms from buyers. Mr Sims is one of many large farmers to invest in bigger silos, in order to store crops while waiting for better prices.

The government may also become even more involved in agriculture, to muddled effect. Mr Trump, having disrupted global trade flows, is now using \$12bn of taxpayers' money to offset some of farmers' losses. Concern for their welfare may buoy support for a new farm bill—but the version favoured by Republicans in the House of Representatives would make even richer farmers eligible for payments. Mr Sims is hopeful that Mr Trump will win better trade terms for farmers. "I am willing to weather the storm," he says. But by the time the president strikes a deal, whatever it is, American farming is likely to have become less competitive and more distorted. ■



美国农业

锄禾不易

特朗普的贸易战将使美国农业的竞争下降且更加扭曲

宁静通常会在11月降临在美国的农场带。联合收割机大多已在田间作业完毕；卡车已把作物运到了谷仓塔；农民们回到起居室休息。今年，至少从一个方面来说，他们应该会感到特别满足。兰迪·西姆斯（Randy Sims）是伊利诺伊州西部一位养猪种粮的农民，他的地里每英亩产出了75蒲式耳大豆，比过去多三分之一。事实上，2018年美国大豆产量预计将达到46.9亿蒲式耳，创历史新高。但目前还不清楚谁会购买。

美国农民位于特朗普总统发起的贸易战的震中。美国超过五分之一的农产品出口面临新的关税。从1月至9月，对墨西哥和中国的猪肉出口分别下降了31%和36%。自1月份以来，美国最大的出口农产品大豆的对华销量下降了98%（见图表）。“这是一个大问题。”在密歇根州耕作3800英亩土地的大卫·威廉姆斯（David Williams）说。他与一群急切想和中国进口商保持联系的大豆农在11月初飞往上海参加一个会议，希望贸易僵局尽快结束。与此同时，美国农业部预计今年农业收入将下降13%。预计农业债务资产比将升至2009年以来的最高水平。

这一切都让人想起上世纪80年代，当时美国暂停向苏联出售谷物，利率上升，收入下降，许多农民离开了这个行业。目前债务水平正在攀升，但仍可控。但这很大程度上取决于关税持续多久。等到贸易战结束时，它们可能已经造成了持久的伤害。

美国农民是国际商贸的巨头。从2000年到2017年，农产品出口额几乎增长了两倍。出口占农业产出的五分之一以上。其中谷物的出口量最大。随着全世界食用的肉类增加，畜牧业者需要更多的动物饲料，提升了对大豆的需求。其出口额去年达到了216亿美元，是第二大出口农产品玉米的两倍以上。

这些成功部分要归功于激励生产的政府补贴，例如在大宗商品价格下跌时，政府会增加对农补贴。据智库传统基金会（Heritage Foundation）称，这些补贴主要支持大型企业：2016年，收入在167,000美元以上的农场分走了大宗商品补贴的近七成。

提高生产率的措施也有帮助。例如，西姆斯现在使用产量数据来微调化肥用量。他用无人机检查庄稼是否遭虫害。农民经常在播种前给种子覆上涂层以抵御腐烂和害虫。环保主义者担心这会影响水质和生物多样性。但产量已迅速提升。

近年来这有助于降低玉米和大豆的价格，即使土地、肥料和种子仍然相对昂贵。因此，贸易战特别不合时宜。特朗普于3月宣布对进口钢铁和铝征收关税，并于5月将征税范围扩大至墨西哥、加拿大和欧洲。作为报复手段，美国猪肉的第二大进口国（按价值计算）墨西哥将关税提高至20%。中国对猪肉的关税高达70%，对大豆的关税达25%，令形势雪上加霜。

特朗普将于本月晚些时候在G20峰会上会见中国国家主席习近平，但两人都不会有太大让步。9月，特朗普同意了新的协议，以取代与加拿大和墨西哥的北美自由贸易协定。但它不会影响美国对钢铁和铝征收的关税，因此墨西哥的猪肉关税也继续实施。根据普渡大学的分析，加拿大和墨西哥的报复性关税抹去了新协议带来的小幅出口增长，导致农产品出口净损失18亿美元。

当一个出口市场关闭时，要把货物转移到其他地方可能会很难。例如，猪肉可以用冷藏卡车运到墨西哥。将其冷冻并飘洋过海的成本更高。

大豆农民担心需求和贸易流将发生永久性转变。如果肉类生产商降低猪饲料中的大豆蛋白质，或者如一些贸易商所担心的那样，政府敦促消费者改吃对大豆的需求比猪肉更低的鸡肉或牛肉的话，中国对进口的需求会降低。而仍然留存的这部分需求又可能日益被巴西和阿根廷满足。普渡大学的华莱士·泰纳（Wallace Tyner）估计，巴西还有900万英亩的农田可以相对较快地改种大豆。“我们在短期内面临的市场损失确实为竞争对手打开

了大门。”美国大豆出口委员会的吉姆·萨特（Jim Sutter）说。

与巴西豆类相比，美国大豆的价格现在已下降很多。许多农民必须接受比芝加哥期货交易所牌价更低的价格，因为谷仓塔难以储存和运输几乎没有买家的谷物。威廉姆斯不得不打折出售他的大豆。北达科他州以往会将大豆运往靠太平洋的西北地区装船，而如今一些谷仓塔已完全停止购货。

伊利诺伊大学的经济学家预计，伊利诺伊州中部的普通农场明年将损失7万美元。堪萨斯城联邦储备银行最近的一项调查发现，7月至9月的农业贷款比去年同期高出三分之一。增加的大部分不是为了购买新机器，而是为了支持基本农业业务。农民明年可能会多种玉米，少种大豆，但这不是永久性的解决方案。连续种植玉米而不是轮作的话会降低产量。

2015年，51%的产量来自销售额在100万美元以上的农场，而1991年时这一比例为31%。贸易争端可能会加速整合。较大的农场有更多的现金投资于提高产量的技术，并有规模从买家那里获得更好的条件。西姆斯是投资大型筒仓的众多大农户之一，这些设施可以储存农作物以等待更好的价格。

政府也可能更多地参与农业，而效果好坏不一。在扰乱全球贸易流动的同时，特朗普正在使用120亿美元的纳税人资金来补偿农民的部分损失。对他们的福利的关注可能会支持一项新的农业法案，但众议院共和党人青睐的版本将使更富裕的农民有资格获得补助。西姆斯希望特朗普能够为农民赢得更好的贸易条款。“我愿意扛过风暴。”他说。但是，等到总统达成协议——不管是什么样的协议——美国农业的竞争力很可能已经下降，而且变得更加扭曲。 ■



Buttonwood

Where the hurt is

Why house prices in global cities are falling

CENTRE POINT, a tower that looms over central London, was empty for so long in the 1970s that it lent its name to a homelessness charity. Recently it was converted from offices to flats. Half are yet to find buyers. So the developer has taken them off the market pending a clearing of the political fog over Britain. Its boss complained to Estates Gazette, a trade paper, of bids that were “detached from reality”. One-bedroom flats were on sale for £1.8m (\$2.4m).

Even flats with less hefty price tags have been hard to shift lately. Property prices in London are falling. Sellers are waiting for better prices. It is tempting to put all the blame on Brexit, but that would ignore the broader picture. House prices in big global cities increasingly move together. What happens in London has a growing influence on what happens in New York, Toronto and Sydney—and vice versa. And trouble is brewing in some of these other markets, too.

Property used to be thought of as an inflation hedge. But in recent years it has become a substitute for low-yielding Treasury bonds—a safe asset in which the globally mobile can store their wealth. After years of rapid price rises, houses in the most favoured markets are overvalued. Rising bond yields, tighter mortgage credit and shifting politics are now combining to push prices down.

The value of homes in the posher parts of global cities move in sync because they have become a distinct asset class. Private-equity firms and investment trusts, not just individuals, own them. Prices in such cities are explained

more by global factors, such as the yields on the safest government bonds, than by local conditions. This global influence is particularly marked in financial centres that are open to capital flows, such as London, New York, Toronto and Sydney. It has extended into smaller European cities, such as Amsterdam.

Demand from emerging markets such as China and Russia has been growing. Buyers are willing to pay steeply to secure a safe place for their savings—or a bolthole for themselves. Cristian Badarinza of the National University of Singapore and Tarun Ramadorai of Imperial College London have shown that political trouble in Russia, parts of Africa and the Middle East predicts a rise in the price of prime London property. The same sort of influence is also found in less ritzy neighbourhoods, says Mr Ramadorai. For instance, property prices in Hounslow and Southall, which have lots of settlers from South Asia, picked up in the early 2000s, a period of political tensions in India.

Foreign demand has spillovers. If an oligarch buys a house, it drives up the prices of smaller properties nearby. A paper by Dragana Cvijanovic of the University of North Carolina and Christophe Spaenjers of HEC Paris finds similar effects in Paris's property market. Foreign buyers, mostly from China, have been a force behind booms in the big cities of Australia and Canada.

But the tide has changed. Global cities look awfully dear. The rental yield on investment homes worldwide fell below 5% for the first time ever in 2016, according to MSCI IPD, a financial-information firm. House prices relative to incomes are well above their long-run average in Amsterdam, Auckland, London, Paris, Sydney and Toronto (see chart).

And prices are falling in some of the dearer cities, in response to a variety of forces. The yield on Treasury bonds, the world's benchmark safe asset,

is rising. A tightening of credit standards on mortgages in Australia and Canada has squeezed housing in cities there. Uncertainty about Brexit has made London a place of political risk rather than a refuge from it. Meanwhile, capital is moving less freely. Governments are charier of Russian money. China is shaking down its super-rich for taxes and is zealous in its policing of capital outflows.

A corollary of stronger links between global cities is a kind of “waterbed” effect. For instance, when taxes were levied on foreign homebuyers in Vancouver in 2016, the market cooled, but Toronto took off. There are buyers who will compare prices in, say, Mayfair in London and Park Avenue, New York. They look for value. But it is vanishingly scarce. The market is turning. Those who bought at the peak, or are hoping to sell, will slowly adjust to a new reality. ■



梧桐

伤在何处

国际大都市房价为何下跌

上世纪70年代，矗立在伦敦市中心的中心点大厦（Centre Point）因为长期空置，连名字都借给了一间游民慈善机构。近些年，它从写字楼改成了公寓楼，其中一半公寓还未卖出。于是开发商将它们从市场中撤出，等待英国政治的迷雾消散。它的老板向一家行业报纸《地产公报》（Estates Gazette）抱怨买家出价“与现实脱节”。一居室公寓售价为180万英镑（240万美元）。

即便是价格不那么高昂的公寓近来也难以出手。伦敦的房价正在下跌。卖家待价而沽。把所有责任都推到英国脱欧头上的确很省事，但这会让人看不到更普遍的趋势。国际大都市的房价走势越来越趋于一致。伦敦的情况对纽约、多伦多和悉尼的影响越来越大，反之亦然。而在其他一些市场中，麻烦也在酝酿。

房地产曾被认为是通货膨胀的对冲手段。但近些年，由于国债这种可供行走全球的人储存财富的安全资产的收益率走低，房产成了国债投资的替代品。在经过多年的房价快速上涨之后，在那些最受青睐的市场上房价都已被高估。目前债券收益率上升、抵押贷款收紧，以及政治格局的变化正在合力拖低房价。

国际大都市的高档住宅区房价涨跌同步，因为它们已成为一种独特的资产类别。不仅是个人，私募股权公司和投资信托公司也持有住房。影响这些城市房价的更多是全球因素，比如最安全的政府债券的收益率，而不是本地环境。这种全球影响力在伦敦、纽约、多伦多和悉尼等对资本流动开放的金融中心尤为明显，并且已经扩展到像阿姆斯特丹这样的小一些的欧洲城市。

来自中国和俄罗斯等新兴市场的需求一直在增长。买家愿意支付高价来为

自己的储蓄找一个避风港——或为自己留一处避难所。新加坡国立大学的克里斯蒂安·巴达林扎（Cristian Badarinza）和伦敦帝国理工学院的塔伦·拉马多利（Tarun Ramadorai）已经指出，俄罗斯、非洲部分地区和中东地区的政治问题预示着伦敦高档房地产的价格将上涨。拉马多利表示，在不那么豪华的社区也能看到这类影响。例如，拥有大量南亚移民的亨斯洛（Hounslow）和绍索尔（Southall）的房价在本世纪初出现回升，当时印度正处于政治紧张时期。

外来需求有溢出效应。如果一个大老板来买了套房子，就会推高附近较小房产的价格。北卡罗莱纳大学的德拉加娜·茨维亚诺维奇（Dragana Cvijanovic）和巴黎高等商学院的克利斯朵夫·斯巴尼尔斯（Christophe Spaenjers）在一篇论文中指出，巴黎的房地产市场也存在类似的情况。大多来自中国的外国买家推动了澳大利亚和加拿大的大城市的楼市繁荣。

但潮流已经改变。国际大都市的房价看起来贵得惊人。金融信息公司 MSCI IPD 的数据显示，2016年全球投资房的租金收益率首次跌破5%。在阿姆斯特丹、奥克兰、伦敦、巴黎、悉尼和多伦多，房价收入比远高于长期平均水平（见图表）。

而在各种力量的影响下，某些房价较高的城市正经历价格的回落。作为全球安全资产基准的国债收益率正在上升。澳大利亚和加拿大正在收紧抵押贷款的信贷标准，挤压了当地城市的房产市场。英国脱欧的不确定性让伦敦成为了一个政治风险的集中地而非避难所。与此同时，资本流动也不像以前那么自由。各国政府对来自俄罗斯的资金更加谨慎。中国正在加强对超级富豪征税，而且热衷于管制资本外流。

国际大都市之间的联系愈加紧密，其必然结果就是一种“水床”效应。例如，2016年温哥华对外国购房者征税，当地房产市场开始降温，但多伦多的房价却飙升了。有些买家会比较多个地区的房价，如伦敦的梅菲尔区（Mayfair）和纽约的派克大道（Park Avenue）。他们想要找到划算的房产。但这已极难实现。市场正在发生变化。那些在高峰期买进或希望卖出的人要慢慢适应新的现实。■



Currency design

Funny money

Who should appear on banknotes?

THERE ARE few things more controversial—and less consequential—than the design of a national currency. Just ask Mark Carney, the governor of the Bank of England. In 2013 he inherited a dispute over the replacement with Winston Churchill of Elizabeth Fry, a social reformer, on the £5 note. Previously, as governor of the Bank of Canada, he had to apologise after an Asian female scientist due to appear on the C\$100 bill was bumped by a white woman. In the same year a new C\$20 note was called “pornographic” for its depiction of scantily clad statues. So it must be with a sense of weariness that Mr Carney confronts the public debate on who should appear on the bank’s new £50 note.

It may hardly seem to matter. Cash accounts for just a third of retail purchases by volume in Britain. Within a decade it will be used for just 16%, according to UK Finance, a trade body. The £50 note is used least of all: there are more than twice as many tenners in circulation and six times as many twenties. Few cash machines dispense them. Shopkeepers distrust them. With the exception of crooks, the only group that uses £50 notes in any number is tourists, so the sensible thing may be to choose an ambassador easily recognisable by visitors. William Shakespeare, perhaps—or, since the Bard used to feature on the £20 note, maybe Peppa Pig.

Some countries avoid controversy by settling on a single unifying figure. India features only Mahatma Gandhi on every denomination, South Africa only Nelson Mandela, and China only Mao Zedong. Another solution is to avoid humans altogether. The Bank of Ireland, which issues sterling in Northern Ireland, a province with deep fissures, puts a whiskey distillery on

the back of every note except the £100, which has a university. Euro notes feature made-up bridges. Norway takes it to the extreme by pixellating its notes to such a degree that they resemble websites from 1993.

But since British passions have been aroused by a note that few ever use, why not simply produce more? An £84 note could feature George Orwell. A series of £60s could depict the Beatles. A note worth £9¾ might show Harry, Hermione and Ron. Postal authorities throughout the world produce novelty stamps. Central banks may as well follow suit.

These could be produced in such small quantities as to render them instant collectors' items, thereby reducing the problems of fraud and nuisance. (America's \$2 bill is rarely seen, partly because its unique design tempts people to hoard it.) The Bank of England might even toy with selling them at a premium. The European Central Bank allows the production of €0 notes as novelty items. In April the city of Trier produced such a note featuring its most famous son, Karl Marx. It cost €3. ■



货币设计

莫非是假钞

谁有资格被印上钞票？

几乎没什么比设计一国货币更富争议却也更无足轻重的事了。不信问问英国央行行长马克·卡尼（Mark Carney）。2013年他入职时就赶上了央行要把5英镑纸币上的社会改革家伊丽莎白·弗莱（Elizabeth Fry）改成丘吉尔而引发的争议。这之前他担任加拿大央行行长时，曾为了100加元上原定的亚裔女科学家头像被换成了白人女性而道歉。事发同一年，新版20加元因为印有衣着暴露的雕像被指“色情”。如今他又要面对关于谁该出现在新版50英镑纸币上的公众争论，想必他会感到“心好累”。

这似乎不是什么要紧的事。在英国，现金消费仅占零售总额的三分之一。行业组织英国金融（UK Finance）预计，十年内这一比例会萎缩至16%。其中50英镑面额的纸币用得最少：其流通量只有10英镑纸币的不到一半、20英镑纸币的六分之一。自动取款机很少提供50英镑纸币。商家觉得它们真假难辨。除了骗子，唯一大量使用50英镑纸币的就是游客了，因此明智之举可能是选一个游客容易认出的“大使”。或许可以是莎士比亚，不过这位大诗人曾经登上过20英镑纸币，所以或许还可以用小猪佩奇。

一些国家为避免争议，统一采用一位人物。比如，印度所有面额的钞票上都是甘地，南非只有曼德拉，中国只有毛泽东。另一个解决办法是完全避开人物。爱尔兰银行在分裂严重的英属北爱尔兰地区发行的英镑除了100英镑面额的背面是所大学外，其余纸币背面印的都是一家威士忌酒厂。欧元纸币的背面图案是虚构的桥梁。挪威更是登峰造极，它将纸币图案像素化，模糊程度都赶上1993年时的网站了。

但既然激起英国人热情的是一张鲜有人用的纸币，那为什么不干脆多出一些这类纸币呢？一张84英镑面额的纸币可以采用乔治·奥威尔的肖像。一套60英镑面额的纸币可以印上甲壳虫乐队。一张9¾英镑面额的纸币可以

印上哈利、赫敏和罗恩。全世界的邮政机构都在发行各种新奇的邮票，各国央行不妨也效仿下。

这些纸币的发行量可以很小，让它们一问世就成为人们的收藏品，从而减少造假和其他麻烦。（2美元纸币现在很少见，部分原因是它设计独特，吸引人们将它收藏起来。）英国央行甚至可以考虑溢价出售这些纸币。欧洲央行准许发行0欧元这样的新奇纸币。今年4月，德国特里尔市（Trier）就发行了这样一款纸币，上面印着当地最有名的人物——马克思。它售价3欧元。 ■



Gene drives

On the extinction of species

Research into gene drives should continue. But the worries they raise must be addressed

EXTINCTIONS ARE seldom cause for celebration. Humans are wiping out species at a frightening rate, whether hunting them into history or, far more threateningly, damaging the habitats on which they depend. But occasionally, the destruction is warranted. Smallpox was officially eradicated in 1980, and no one laments the fate of the virus that caused it; campaigns to save the virus that causes polio are thin on the ground. How, then, to think about a new technology that will make driving a species to extinction far easier?

That technology is known as a gene drive, so called because it uses genetic engineering to drive certain traits through a population. Those characteristics need not be deleterious: they might include greater resilience to disease among crops or, perhaps, greater tolerance to warming waters on the part of corals. But if the desired trait were harmful, gene drives could in theory make a species extinct. And if the species in question were the three types of mosquito responsible for transmitting malaria, proponents reckon it could save close to half a million lives a year, many of them children. The same approach could be used against other vector-borne diseases such as Lyme disease, Zika and dengue fever. Gene drives also offer conservationists a potential weapon against invasive species such as foxes, mice, rabbits and rats, whose proliferation threatens native species in some parts of the world. (Humans are unsuited to gene drives, which work best in species that reproduce quickly, with many offspring.)

Normally genes have a 50:50 chance of being passed on during

reproduction. Gene drives tilt the evolutionary scales. One area of research focuses on genes that can copy themselves to the second in a pair of chromosomes, ensuring that they will be inherited by all offspring. Biasing inheritance in this way is what makes it possible to push a desired mutation, whether harmful or beneficial, through a population—controlling its level, and potentially wiping it out altogether.

Like many technologies, however, gene drives may lead to bad outcomes as well as good. Opponents think the technology is simply too dangerous to contemplate using. Some worry about playing God—though discarding an opportunity to save millions of lives in order to defend a principle is itself unethical. Others warn that the technology could entrench the power of big agitech firms. But that is an argument for ensuring competition, not for ending research.

Three other concerns are less easily handled. One is practical: removing a species from the food chain could have unintended consequences, particularly if gene drives can move to a closely related species. Another relates to governance. Genetically modified crops can be kept relatively contained; animals carrying gene drives could be mobile and respect no borders. One country's decision to use gene drives will have consequences for its neighbours. A third worry concerns nefarious uses of the technology, and not only by states. A mosquito, engineered to inject toxins, could be used as a weapon.

Faced with such risks, some want simply to call a halt. An attempt to impose a moratorium on gene drives was rejected by governments in 2016 at a United Nations meeting on biodiversity. Another such meeting, which takes place this month, will debate proposals that could hinder field trials. But putting the brakes on research may impose real costs: not just the annual toll taken by malaria and other killers before an answer is found, but also slower progress towards making gene drives safer. Since the decision in

2016 researchers have made advances on drives that die out over time, for example. That sort of approach could go some way to solving the practical concerns. Given that it will be eight years or so before a gene drive is expected to be ready for field trials, more can be done in the interim to minimise its potential to cause harm.

That will require a more robust approach to governance, too. The ideal would be a set of norms for states and funders to adhere to. These might include rules on the mandatory registration of gene-drive trials; on stringent sequencing of gene-drive tests, as they progress from laboratory environments to field trials; on ways for neighbouring states to monitor standards in any country that wanted to use gene drives; and on agreed criteria for the approval of any release, such as the existence of an unmodified population in captivity.

Rules or not, rogue states and other malevolent actors may still want to use gene drives for malicious purposes. And, like many new technologies, gene drives do not require big organisations in order to be made to work. Prudent countries ought to plan accordingly. America's government, rightly, justifies some of its gene-drive research as a way to develop better defences against harmful uses. In the future, improved gene-sequencing technologies should make it easier to spot species carrying malevolent drives.

These risks underline why gene drives must be managed carefully. They ought not, however, to obscure the prize on offer if the technology can be made to work well. Humans are already radically and heedlessly reshaping the planet. Gene drives would further enhance humanity's ability to shape nature—but with the potential to do so precisely, efficiently and for the better. ■



基因驱动

物种灭绝

对基因驱动的研究应该继续下去。但这项技术引发的担忧也必须解决

物种灭绝很少值得庆祝。人类正以惊人的速度灭绝物种，不论是过度捕杀而让一些物种成为了历史，还是以破坏它们赖以生存的栖息地这种威胁更大得多的方式。但有些时候，毁灭是必要的。天花在1980年被正式消灭，没有人为天花病毒的命运哀叹；也没见人发起过什么运动拯救导致小儿麻痹症的病毒。那么，对于一项让人不用那么费力就可让物种灭绝的新技术，该持什么态度？

这项技术被称为基因驱动，因为它利用基因工程来驱动某些性状在某一生物群体中遗传率上升。这些性状不一定是对物种有损害的，它们可能让农作物具有更强的抗病能力，或者可能让珊瑚对水温上升有更大的耐受性。但如果受驱动的性状对物种有损害，那么基因驱动在理论上可以让一个物种灭绝。如果这个物种是传播疟疾的三种蚊子，基因驱动的支持者认为这一技术每年可以挽救近五十万人的生命，包括众多儿童。基因驱动还可用于对抗其他虫媒病，如莱姆病、寨卡病和登革热。基因驱动还为生态环保人士提供了潜在武器，以抵御狐狸、小鼠、兔子和大鼠等入侵物种，它们的扩散威胁到了世界上一些地区的本地物种。（基因驱动不适用于人类，它对繁殖速度快、后代多的物种效果最好。）

正常情况下，基因在繁殖过程中有一半的可能性被遗传下去。基因驱动打破了进化的天平。其中一个研究方向专注于可在一对染色体之间自我复制、从而确保遗传给所有后代的基因。这种偏向性遗传能让人们在某个种群中推动有益或有害的突变，从而控制其数量，并有可能完全消灭这个物种。

然而，与许多技术一样，基因驱动可能带来的结果有好有坏。反对者认为这项技术太过危险，根本不应予以考虑。有些人担心这是在“扮演上

帝”——尽管为了捍卫某种原则而放弃挽救数百万人生命的机会本身就是不道德的。其他人则警告说，这项技术可能会巩固大型农业科技公司的地位。但防止这一点需要的是确保竞争，而不是终止研究。

另外三个担忧不太容易解决。一个是实际问题：从食物链中移除一个物种可能会产生意想不到的后果，如果基因驱动可以转移进另一个紧密关联的物种中，就更是如此。另一个担忧涉及治理。转基因作物可以做到相对隔离，而携带基因驱动的动物可能会到处移动，不受边界限制。一国利用基因驱动的决定将对其邻国产生影响。第三个担忧涉及对该技术的恶意使用，而且不限于国家行为。一只受基因驱动放射毒素的蚊子可被用作武器。

面对这样的风险，有些人希望干脆喊停。在2016年联合国一次生物多样性会议上，与会政府拒绝了一项暂停基因驱动研究的呼吁。本月举行的另一次此类会议将讨论可能阻止野外试验的提案。但是，中止研究可能会带来切实的损失：在找到抗击疟疾和其他致命传染病的方法之前，它们每年还会继续夺取众多生命；而让基因驱动技术变得更安全的研究也会被拖慢。例如，自2016年否决了暂停基因驱动的呼吁以来，研究人员已经在能逐渐失效的驱动上取得进展。这种方法可以在某种程度上解决那些实际的顾虑。鉴于一种基因驱动预期要经过八年左右的时间才能进入野外试验，在此期间可以采取更多方法来尽量减少它带来危害的可能。

还需要更强有力的治理方法。理想的做法是建立一套国家和研究资助方都要遵守的规范。其内容可能包括以下几个方面的规则：基因驱动试验强制登记规度；随着基因驱动试验从实验室环境发展到野外，对基因驱动测试的严格测序要求；邻国对任何想要实施基因驱动的国家的实施标准开展监督的方式；以及关于在什么情况下可执行“特赦”的约定标准，例如保留某个种群中的部分不被改造基因，但被局限于在某个特定区域中存活。

不管有没有规则，流氓国家和其他图谋不轨的个人仍可能想利用基因驱动来为非作歹。并且，与许多新技术一样，基因驱动不需要通过大型机构发挥作用。谨慎的国家应该做出相应的计划。美国政府为自己开展的一些基

因驱动研究辩护说，这是为了开发出更有效的防御手段来抵制对这项技术的恶意应用。这是对的。未来，运用经过改进的基因测序技术，人们应该能够更容易地发现携带恶意驱动基因的物种。

这些风险是我们必须谨慎管理基因驱动的原因。但如果能够想办法让这项技术有效运作，那么就不该因为这些风险而无视我们能从中获得的好处。人类已经在无所顾忌地彻底重塑地球了。基因驱动将进一步增强人类塑造自然的能力，但我们有可能把这件事做得精准、高效、向好。■



Schumpeter

China v America

The careers of Hank Paulson and Wang Qishan illustrate the tensions in superpower relations

IF YOU WANT to understand the commercial relationship between America and China, it is worth tracking the paths of two powerful people who have dedicated their careers to it: Henry Paulson, a tough-as-nails former head of Goldman Sachs and former American treasury secretary, and Wang Qishan, a well-read banker and bureaucrat who is China's vice-president. Since the 1990s they have worked together, episodically, on reforming state-owned enterprises (SOEs), boosting trade and fighting the 2007-08 financial crisis. Now they are trying to bridge a deep divide.

The two appeared on November 6th and 7th in Singapore at the New Economy Forum—a gathering of business royalty organised by Michael Bloomberg, New York City's former mayor, designed to air trade tensions and look for a response to populism. With Henry Kissinger sitting in the front row, Mr Wang warned that the “polarisation of right-leaning populism” in the West was stoking anger and destabilising the global order. A day later Mr Paulson stood up and complained about China's misconduct and warned of a new “economic Iron Curtain” falling between China and America.

Messrs Wang and Paulson first worked together in 1996. Mr Wang was a high-flying reformer in charge of the giant China Construction Bank and was orchestrating the flotation of China Telecom, the first huge SOE to list in New York. Goldman was the underwriter. By 1997 he was an official in Guangdong province and asked Mr Paulson to help restructure Guangdong Enterprises, a crippled SOE. The two men ascended in parallel. In 2001 when

China joined the World Trade Organisation, Mr Paulson was running Goldman; Mr Wang guided China's economic-reform agency.

By the time Mr Paulson became treasury secretary in 2006 he had visited China 70 times. He led a new "strategic economic dialogue"—an almost continual bilateral discussion that covered everything from currency movements to pirated DVDs. Mr Wang became vice-premier three days after Bear Stearns was rescued in March 2008. When Lehman Brothers failed in September, the mesh of friendships and institutional links between the countries' leaders helped contain the crisis. China refused to dump Treasury bonds and stimulated its economy to offset America's slump.

In this golden era of superpower relations other executives formed strong relationships with China, too. Stephen Schwarzman, the head of Blackstone, a private-equity firm, sold 9% of it to a Chinese state fund in 2007 (it sold out in March of this year). Multinationals such as General Electric had close contact with China's leaders. One boss recalls his board huddling round Jiang Zemin, China's party chief between 1989 and 2002, for a group photograph.

A commercial edifice was then built on these relationships, although not the one that might have been expected. China has not opened up its financial industry—Goldman makes less money from Asia now than in Mr Paulson's last year in charge and has only 1% of its balance-sheet exposed to China. Still, in total USA Inc made \$450bn-500bn of sales from China last year. An elite of a dozen or so firms, including Apple and Boeing, make over \$1bn a year in profits. China exported \$500bn of goods to America. Measured this way the relationship is roughly in balance.

In private many American executives still view China as the world's most important market after their own. In public they have turned hawkish. This may reflect an intimidating political climate at home. On November 9th

Peter Navarro, a White House trade adviser, said that Wall Street bankers were acting as China's "unpaid foreign agents". But there is real disillusion among executives, too. They persuaded themselves that Chinese SOEs might metamorphose into private-sector firms, and the country would become a market economy with property rights and a level playing-field for foreign companies. It has disappointed on both counts. Mr Paulson says that American business has gone from "advocate, to sceptic and even opponent" of past American policies towards China.

A decade ago, whenever tensions arose they were defused with flurries of phone calls and red-eye flights. But the habit of frequent, intimate discussions has atrophied and trust has faded. In Singapore Mr Wang insisted that China is open for talks on trade, which may resume ahead of the G20 meetings on November 30th and December 1st. He is known as the Chinese leader with a deft touch with foreigners—unlike most of them, he talks off the cuff and makes jokes. Yet this time his punchlines did not raise a laugh. One American involved in the face-to-face negotiations says that for a year China has refused to budge on intellectual-property theft and state intervention. Mr Wang's visit was a "waste of jet fuel".

Just as business responded to China's opening up in the 1990s, so it is adjusting to a new, de facto cold war. Charles Li, the head of Hong Kong's exchanges, says the two economies are like saltwater and freshwater systems that meet but do not mix well. America's tariffs on Chinese goods are due to rise from 10% to 25% on January 1st. Multinationals are stockpiling inventories inside America. Logistics companies have plans to reconfigure aircraft fleets. Speculation swirls around the firms with the most global supply chains. On November 5th Apple revealed that it has bought 2,450 acres of land in America in the past year, prompting chatter that it might bring more production home.

If, in 1996, Mr Paulson and Mr Wang could have seen the world today, they

would have been awed by the scale of the commercial links between China and America, but worried by their fragility. Their personal instincts now sit uneasily with domestic politics. Mr Paulson is a Sinophile in a more nationalist America; Mr Wang is an economic reformer at the heart of an autocracy. But as they survey the dismantling of their 20-year project, these two masters of the long game might console themselves that the political tides can shift again, and that, in time, the attempt to find an accommodation between America and China may resume. ■



熊彼特

中美相争

从保尔森和王岐山的履历看两个超级大国之间的角力

若你想了解中美商贸关系，两位大人物的履历值得一探。他们整个的职业生涯都致力于改善这一关系：作风强硬的高盛前董事长、美国前财政部长亨利·保尔森（Henry Paulson），和学识渊博的银行家、官员、现任中国国家副主席的王岐山。自上世纪90年代以来，两人时有合作，共同改革国有企业，促进贸易发展，应对2007至2008年的金融危机。眼下，他们正尝试弥合一道深刻的分歧。

两人于11月6日至7日在新加坡举行的“新经济论坛”上露面。这是由前纽约市长迈克尔·布隆伯格（Michael Bloomberg）组织的商业大人物聚会，目标是探讨贸易紧张局势并寻求应对民粹主义的方案。面对坐在前排的美国前国务卿基辛格，王岐山在致辞中警告道，西方“右”的民粹思潮激化，煽动愤怒情绪，破坏全球秩序的稳定。一天后，保尔森登上讲坛，抱怨中国的不当行为，警告在中美之间将落下一道新的“经济铁幕”。

王岐山和保尔森于1996年首次合作。彼时王岐山是非常成功的金融业改革派，掌管规模庞大的中国建设银行，同时也在策划中国电信的上市——首例中国大型国有企业在纽约上市，而高盛是此次上市的承销商。到1997年，在广东省任职的王岐山请求保尔森协助重组陷入困境的国有企业粤海集团。两人同期晋升。2001年中国加入世贸组织时，保尔森是高盛的掌门人，王岐山是中国国务院经济体制改革办公室主任。

在2006年成为美国财政部长之前，保尔森已访问中国70次。他领导开展新的中美“战略经济对话”这一几乎不间断的双边讨论，主题从货币汇率变化到盗版DVD无所不包。2008年3月，在美国投资银行贝尔斯登（Bear Stearns）获救三天后，王岐山就任副总理。同年9月雷曼兄弟破产时，两国领导人之间的交情网络和机构间联系帮助控制了危机的影响。中国拒绝

抛售美国国债，并采取措施刺激本国经济以抵消美国经济衰退的影响。

在这个超级大国关系的黄金期，其他企业高管也与中国建立了强大的联系。私募股权公司黑石集团（Blackstone）董事长苏世民

（Stephen Schwarzman）在2007年向中国一家国有基金出售了黑石9%的股份（该基金已于今年3月清仓这些股份）。通用电气等跨国公司与中国领导人联系密切。一位企业老板回忆，他的董事会成员曾簇拥着江泽民（1989年至2002年任中共中央总书记）合影留念。

在这样的关系之上，一座商贸大厦拔地而起，尽管可能不是人们原本预期的模样。中国没有开放金融业，高盛如今在亚洲的收入比保尔森执掌时的最后一年还要少，其资产负债表中只有1%为中国业务。尽管如此，去年美国公司在中国的总销售额达4500亿至5000亿美元。包括苹果和波音在内的十几家精英企业每年赚取超过10亿美元的利润。而中国则向美国出口了5000亿美元的商品。这样来算的话，两国商贸关系大致处于平衡状态。

私底下，许多美国高管仍视中国为美国以外全球最重要的市场。但在公开场合，他们的态度变得强硬。这可能是因为美国国内令人生畏的政治气候。11月9日，白宫贸易顾问彼得·纳瓦罗（Peter Navarro）表示，华尔街的银行家们充当了中国的“无偿的外国代理人”。但是，高管们的确也感到了幻想的破灭。他们曾说服自己中国的国有企业可能会变成私营企业，中国会成为尊重产权的市场经济体并为外国公司提供公平的竞争环境。结果这两方面的希望都落空了。保尔森表示，美国企业已从“拥护”变为“怀疑甚至反对”美国过去的对华政策。

十年前，每当局势变得紧张，连番电话沟通和几趟红眼航班便能化解干戈。但是频繁密切对话的习惯已经萎缩，信任已渐消退。在新加坡，王岐山坚称中国对贸易谈判持开放态度。两国可能在11月30日至12月1日召开的G20会议之前重开会谈。众所周知，他与外国人打交道游刃有余——有别于大多数中国领导人，他擅长即兴发言，言语风趣。然而这次他的妙语并没有引来笑声。一位参与面对面谈判的美方人士说，一年来中国始终拒绝

在窃取知识产权和国家干预的问题上让步。王岐山的到访纯属“浪费飞机油料”。

正如上世纪90年代中国扩大开放时企业的迅速反应一样，商界正在调整适应新一场事实上的冷战。香港交易所行政总裁李小加表示，中美两个经济体就像是淡水系和咸水系，在一起交汇但无法融合。明年1月1日，美国对中国商品征收的关税将从10%上升到25%。跨国公司正加紧在美国境内囤积库存。物流公司计划重新配置货运航班。那些供应链最为全球化的企业引来揣测纷纷。11月5日苹果公司透露过去一年里已在美国购买了2450英亩土地，引发了苹果可能把更多生产转回美国本土的传言。

如果保尔森和王岐山在1996年能看到今天的世界，他们会为中美商贸联系的规模之大而惊叹，但也会为这些联系的脆弱而担忧。现在，两人各自的直觉倾向都与他们国内的政治环境不相契合。保尔森是身处一个民族主义抬头的美国的亲华派；王岐山是位居一个专制政体的核心的经济改革家。但是，眼看20年来两人努力共建的基业崩塌，两位持久战大师可能会自我安慰：政治潮流还会再次逆转，中美寻求和解的尝试有朝一日会再度启动。 ■



The new genetic revolution

Destiny's child

In "Blueprint" Robert Plomin argues that genes are by far parents' biggest influence on their children

HUBRIS WINDS through the history of genetics like a double helix. “We used to think our fate was in our stars,” James Watson, one of the scientists behind the discovery of DNA, declared in 1989. “Now we know, in large measure, our fate is in our genes.” The implications were clear. Unravelling the genetic code would bring an exquisite understanding of bodies and their afflictions but also of minds. After the completion of the human genome project, which Watson initially led, such hopes faded. Individuals’ physical or mental characteristics, and their susceptibility to diseases, turned out to be extraordinarily complex. Some of the swagger went out of genetics. Now it is back.

In “Blueprint” Robert Plomin, a psychologist and geneticist, explains the advances behind this resurgent optimism—and their consequences for the science of human behaviour and psychiatric illness. He is well placed to do so: for more than 30 years he has studied the interplay of genes and the environment and their effects on personality. But Mr Plomin’s enthusiasm for his subject—he calls himself a “cheerleader”—means the ramifications are not explored even-handedly. “Blueprint” is absorbing. For those with a disposition less sunny than Mr Plomin’s, it is also alarming.

For much of the 20th century, psychology was dominated by the idea that human nature is a blank slate embellished by upbringing and environment. “Blueprint” begins by describing how Mr Plomin and others have demonstrated that, on the contrary, behavioural differences are strongly influenced by genetics. Studies of adopted children indicate that in

disposition they more closely resemble their genetic parents than their adoptive ones. Even when they are reared apart, identical twins are more alike than the non-identical kind (who are as genetically different as any brother or sister).

Such research shows that, on average, DNA accounts for about half of the psychological differences between people, with the remainder due to environmental factors; the actual proportion varies with the characteristic in question. More recently scientists have combed through human genomes to identify thousands of genetic variants associated with particular traits, from height and weight to educational attainment and neuroticism. Tests costing less than £50 (\$65) can measure genetic propensity to different outcomes—to be overweight, or to go to university.

For those who imagine all that leaves enough wriggle room for benevolent parents or teachers to exert an influence, Mr Plomin has bad news: these environmental factors are themselves substantially influenced by genes. For example, his work shows that genes account for about a third of the differences between the television viewing habits of children. Worse, the remaining tranche of environmental influence appears to be mostly attributable to unpredictable events rather than, say, being brought up in a house full of books.

These findings, says Mr Plomin, imply that “parents don’t make much of a difference in their children’s outcomes beyond the genes they provide”; DNA is a “fortune teller” that “makes us who we are”. Environmental effects are “important”, but “there’s not much we can do about them”.

Mr Plomin insists that, armed with their genetic test scores, individuals can take action to counter or augment their innate proclivities; but they are hardly likely to succeed if their psychology is as delimited by genes as he suggests. An equally plausible possibility is that these scores will be used to

stigmatise genetic “have-nots” or to justify discrimination. This is the high road to eugenics, about which Mr Plomin is largely silent.

Instead he advocates the use of such scores when choosing between candidates for a job. Yet a person with high scores for traits associated with coding skills is not necessarily a good programmer—they merely have a higher likelihood of being one. A candidate who had demonstrated their aptitude for the job would feel rightly miffed to be passed over in favour of a genetically gifted incompetent. Likewise, though doctors may find it useful to know that a patient is genetically predisposed to be obese, the best way to establish their weight is to ask them to step on the scales.

These are problems of emphasis rather than accuracy. But in a field as ethically fraught as genetics, even that can be troubling. For instance, as Mr Plomin notes, the size of the genetic component of a particular trait—its “heritability”—varies between different populations. The heritability of educational attainment in Norway has increased since the second world war as the country widened access to health care and schools, flattening out environmental effects. That trend seems, worryingly, to have reversed in America in the 21st century. The irony is that the heritability of many traits rises if states do more to provide for all their citizens equally.

You might conclude that without broad measures to tamp down inequalities of opportunity, genes have fewer opportunities to shine. “Blueprint” instead touts the importance of DNA in shaping the individual. Hubris indeed. ■



新一轮基因革命

天命之子

罗伯特·普洛明在《蓝图》中提出，父母对子女的最大影响毫无疑问在于基因

狂妄自大如双螺旋一般贯穿遗传学的历史。“我们曾经认为我们的命运系于星象，”1953年，与其他科学家共同发现了DNA的詹姆斯·沃森（James Watson）宣称，“现在我们知道了，我们的命运很大程度上就隐藏在我们的基因中。”言外之意很明显：破解基因密码会让人们获得对人的身、心运作机制以及身心疾病的细致理解。然而，在最早由沃森牵头的人类基因组计划结束后，这种希望渐趋渺茫，因为研究显示个体的身心特征及它们对疾病的易感性极其复杂。遗传学界的不可一世有所收敛。如今它又故态复萌了。

心理学家兼遗传学家罗伯特·普洛明（Robert Plomin）在《蓝图》（Blueprint）一书中解释了这种复苏的乐观情绪背后所取得的种种进展，以及它们对研究人类行为和精神疾病的科学的影响。他很胜任这项工作，因为他花了长达30多年的时间研究基因与环境的相互作用以及它们对人格的影响。但他对于自己研究领域的热情——他自称“啦啦队长”——意味着他对于这些进展的探讨并非不偏不倚。《蓝图》引人入胜。但对那些性情不如普洛明乐观的人来说，这本书还是令人警觉。

上世纪大部分时间里，心理学都被这样一种观念所主导：人性是一块白板，后天的培养和环境在其上加以装点。而《蓝图》的见地正相反，开篇就描述了普洛明等人是如何证明了人的行为差异受基因的影响巨大。对领养儿童的研究表明，他们的性格更像其亲生父母而不是养父母。即使被分开抚养，同卵双胞胎也比异卵双胞胎在性情上更为相像（异卵双胞胎在基因上的差异性和普通的兄弟姐妹一样）。

这些研究显示，平均而言，人们的心理差异有约一半源于DNA，其余源自各种环境因素。实际比例因各种具体性状而异。更近些时候，科学家们在

梳理了人类基因组后，确认了与具体性状——从身高、体重，到学历和神经质——相关的成千上万种基因变异。花费不到50英镑（65美元）即可检测不同的遗传倾向，比如肥胖，或者能上大学。

有些人以为，仁爱的父母和老师还有足够的回旋余地来施加影响。普洛明给他们泼了盆冷水：这些环境因素本身就受到基因的重大影响。例如，他的研究表明，儿童在看电视的习惯上的差异有约三分之一是基因决定的。更糟糕的是，剩下的那部分环境因素中能够施加影响的似乎大多是不可预测事件，而不是在堆满书的屋子里长大这类确定的环境条件。

普洛明指出，这些发现说明“父母除了提供基因之外，对孩子的未来并没有太大影响”；DNA是“塑造我们”的“算命师”。环境影响是“重要的”，但“我们对它近乎无能为力”。

普洛明坚称，借助基因检测得分，个体可以采取行动来对抗或加强自己的先天倾向。但是，如果他们的心理如他所言也受基因的限制，这种努力就很难成功。同样可能的是，这些分数会被用来让某些基因缺陷蒙上污名，或让歧视正当化。这极易引向人种改良说，而普洛明对此基本缄口不言。

普洛明只说他主张在挑选求职者时使用这样的分数。然而，在编程能力相关性状上得分高的人并不一定就是优秀的程序员——他们只是更有可能成为这样的程序员。如果一个对这项工作已经展现出能力的求职者没被录用，反倒是一个在基因上有潜力却不能胜任的人入选，前者自然有理由恼火。同样，尽管对医生而言，知道病人在基因上有肥胖的倾向会有参考意义，但确定病人体重的最好方法还是让他们站到体重秤上去。

这些场景还只涉及孰轻孰重的问题，而不关乎对错。但在遗传学这样一个充满伦理风险的领域，就算这样也仍可能令人不安。例如，正如普洛明所指出的，某一特定性状受遗传影响的大小，即它的“遗传力”，在不同的人群中间有所不同。挪威自二战后扩大医疗保健和教育的覆盖面，该国民众在学历上的遗传力提高了，外部环境在这方面影响力相对减弱。在美国，这种趋势在进入21世纪后却似乎发生了令人担忧的逆转。一个悖论

是，如果各国采取更多措施来为所有公民提供平等的境遇，许多性状的遗传力就会上升。

读者可能由此得出这样的结论：如果没有广泛的举措来消减机会的不均等，基因大放异彩的机会就更少。而《蓝图》却吹捧DNA在个体塑造中的重要性。确实狂妄自大啊。 ■



The Chinese economy

Ten-year hangover

Excesses remaining from its 2008 stimulus limit the country's options today

THE CAREER of China's biggest property tycoon can be divided into two stages. Xu Jiayin started slowly, focusing on Guangzhou, a southern city. Then came the global financial crisis and the government's response, a giant economic stimulus, launched a decade ago this month. For Mr Xu it was a signal to become far bolder. His company, Evergrande, now has projects in 228 cities. Last year it completed enough floor space for 450,000 homes, up from 10,000 the year the stimulus began. It has bought a football club, built theme parks and entered the insurance business.

Yet expansion has come at a cost. Evergrande's debt has soared to nearly \$100bn. Short-sellers regularly target its stock. So far Mr Xu has defied the naysayers. But the market bears are taking another run at him. Evergrande's stock is down by more than a third this year. Last month it struggled to sell new bonds, until Mr Xu bought \$1bn worth with his own cash. As one of the richest people in China, a billionaire many times over, at least he can afford it.

For China as a whole, the government's decision in 2008 to rev up investment was also a dividing line. Growth rebounded, while it sputtered elsewhere. Before the crisis China had a 6% share of global GDP; today it is closer to 16%. Yet there was a big downside. The economy became much more reliant on debt.

On the tenth anniversary of its big stimulus, China is again confronted by flagging growth, as Mr Xu can see from a recent slowdown in housing sales. The government has started dropping hints that a new stimulus is on the

way. But the excesses from 2008 constrain it today. China knows it cannot afford another binge.

That caution reflects a change. Officials were almost uniformly positive in their initial verdict on the stimulus. Exports had plunged but growth was back to double digits within a year. In 2011 Wen Jiabao, the prime minister, said that not only had China been first in the world to recover from the crisis, but it had also laid a foundation for long-term growth. Now there is widespread recognition that the foundation was less solid than it appeared.

China's steep rise in total debt, from 150% of GDP in 2008 to more than 250% today, is the most obvious problem. Such increases in other countries have often presaged trouble. Much of the debt was channelled through institutions outside the formal banking system, which are less transparent and more lightly regulated. Though some borrowers, such as Evergrande, profited from easy money, many others struggled. Dozens of industries, from solar power to steel, are grappling with overcapacity. Bai Chong'en, a former adviser to the Chinese central bank, has argued that one consequence has been a permanent decline in productivity.

As a result, stimulus has almost become a dirty word in policy circles. Li Keqiang, Mr Wen's successor, has sworn off what he calls "flood-irrigation stimulus", a reference to the farming practice of soaking all the soil, not just the crops. Over the past couple of years the government has tried to mop up the mess. It has aimed to slow the rise in debt, closing shadow banks and curtailing excess capacity.

But the resolve to tackle financial risks was easier to summon when growth was strong. In recent months it has sagged. With investment sluggish and the trade war rumbling on, headwinds are getting stronger. Many analysts think growth will dip towards 6% next year, which would be China's weakest since 1990. For firms that had based their plans on sustained high-speed

growth, even a mild slowdown hurts. Corporate-bond defaults in China have reached nearly \$10bn this year, a record. Markets are braced for worse: borrowing rates for China's high-yield issuers of dollar bonds have almost doubled, to 11%. Evergrande was forced to offer 13.75% on its bond in October.

It is against this jittery backdrop that investors are speculating about a new stimulus. The government, despite its vows to be prudent, has form: besides the massive stimulus in 2008, it also propped up the economy when growth softened in 2012 and 2015. As a first step officials appear to be relaxing their campaign to clean up the financial system. After a quarterly meeting on October 31st, the Politburo omitted a prior pledge to reduce debt.

Simply describing this as a shift to stimulus is too crude. Larry Hu, an economist with Macquarie Securities, separates China's policy easing into three. First, fine-tuning, including doveish language. Second, more direct measures, such as interest-rate cuts. Third, all-out support, with infrastructure spending cranked up. Mr Hu reckons that China is now between the first and second, good for the stockmarket but not enough to stop the economy's slide.

Can China find a way to shore up growth without falling back on debt-fuelled stimulus? It does have options, though they are likely to provide less of an immediate boost. The central bank could reduce benchmark interest rates, which have stayed unchanged since 2015. The finance ministry has scope to cut taxes more aggressively, especially for companies. Where borrowing is the only option, it is trying to make it safer. It is making it easier for officials to pay for infrastructure via bonds rather than shadow banks. Xi Jinping, the president, could also take long-delayed steps to lessen the clout of state-owned companies, giving private firms more leeway to invest in sectors such as energy and finance.

One thing China is likely to avoid is a significant change to its property policies, a crucial part of the stimulus in 2008. Mr Xi has repeatedly said that homes are for living in, not for speculating on. A thicket of restrictions has cooled the market, slowing purchases and choking off loans to developers. If Mr Xu of Evergrande is upset, he is not showing it. In a speech published this year he credited his firm's success to government policies. Long a beneficiary, he has the sense not to turn critic. ■



中国经济

十年宿醉

2008年刺激措施带来过度扩张的遗留问题限制了这个国家现在的选择

中国房地产首富许家印的事业历程可分为两个阶段。他起步比较慢，一开始专注在南方城市广州。后来全球金融危机爆发，作为应对手段，中国政府于十年前的这个月推出了大规模的经济刺激措施。对于许家印来说，这是一个让他可以大胆出击的信号。如今，他的恒大集团旗下的项目覆盖228个城市。去年的楼宇竣工面积足够45万户家庭入住，而刺激计划刚启动那一年这个数字为一万户。恒大集团买下了一个足球俱乐部，建造了主题公园，还挺进了保险业。

但扩张有其代价。恒大的债务已飙升至近1000亿美元。卖空者经常瞄上恒大股票。到目前为止许家印还没遂这些人的愿。但市场空头正对他发起又一次冲击。今年恒大股价下跌超过三分之一。上月恒大出售新债券遭受冷遇，后来许家印不得不用私人资金认购10亿美元的债券。对于这位身家数百亿美元、在中国数一数二的巨富来说，要拿出这点钱至少还不是个问题。

就整个中国而言，政府在2008年加大投资的决定同样是个分水岭。中国经济增长因此回升，虽然此时世界其他地区都陷入疲软。危机前，中国在全球GDP中的占比为6%，今天占比接近16%。然而，这其中存在一大弊端：中国经济对债务的依赖大大增加。

在大规模刺激措施实施十周年之际，中国再次面对经济增长疲软，正如许家印从近期房屋销售放缓所看到的那样。政府已开始吹风将推出新的刺激措施。但是，2008年那一轮刺激导致的过度限制了政府今天的选择。中国明白自己无法担负又一场狂欢。

这种谨慎反映出一个变化。官员们最初几乎一致肯定刺激计划的作用。金融危机令出口大幅下滑，而刺激措施推出后增长率在一年内便回升至两位

数。2011年，时任总理温家宝表示，中国不仅率先从危机中复苏，还为自己的长期增长奠定了基础。现在，人们普遍认识到这基础不如表面看来那么坚固。

中国的债务总量急剧上升，成为最显著的问题。2008年总债务占GDP之比为150%，如今已超过250%。在其他国家，这种程度的增长往往是麻烦将至的先兆。这其中的大部分债务是通过正规银行系统之外的机构发放的，这些机构透明度较低，受到的监管更少。虽然恒大等借款人利用轻松的借贷赚了钱，其他许多借款人却陷入困境。从太阳能到钢铁等数十个行业都在努力应对产能过剩的问题。中国央行前顾问白重恩认为，后果之一是生产力永久下降。

结果，刺激措施在决策圈里几乎成了一个忌讳的字眼。温家宝的继任者李克强誓言不能再“大水漫灌”（借自农业灌溉中不仅浇灌农作物，也浸泡所有土壤的操作）。过去两三年里，政府一直试图收拾残局，减缓债务增长，关闭影子银行，削减过剩产能。

但是，经济增长强劲时才更容易鼓舞对抗金融风险的决心。最近几个月，这份决心已经松懈。投资低迷，加上贸易战持续，逆风越吹越猛。许多分析师认为，明年的增长率将下探6%，这将是中国自1990年以来的最低水平。对于那些基于经济持续高速增长的愿景作规划的公司，即使经济温和放缓也会令它们受损。今年，中国公司债券违约已接近100亿美元，创历史新高。市场预期前景更糟：中国高收益债券发行人的美元债券利率几乎翻了一番，达到11%。恒大10月发行的债券不得不给出了13.75%的利率。

正是在这种紧张不安的背景下，投资者猜测新的刺激措施将出台。中国政府尽管誓言谨慎行事，但也素有“前科”：除了2008年的大规模刺激外，还曾在2012年和2015年增长放缓时提振经济。作为第一步，官员似乎放松了清理金融系统的行动。在10月31日的一次季度会议后，中共中央政治局把之前减债的承诺略去了。

单凭这就说它转向了刺激措施，未免太过草率。麦格理证券（Macquarie

Securities) 的经济学家胡伟俊把中国的政策放宽举措分为三类。首先是微调，包括表态转向温和。第二，更直接的措施，如降息。第三，全力支持，伴随基础设施支出上升。胡伟俊认为，中国现在处于第一和第二类之间，对股市有利，但还不足以阻止经济下滑。

中国能否找到新方法来支撑经济增长，而不需要回到由债务驱动的刺激这条老路？它确实有一些选择，尽管很可能无法带来同样立竿见影的效果。央行可以调低自2015年以来一直保持不变的基准利率。财政部也有更大力减税的余地，特别是对企业。在举债是唯一选择的情况下，政府正在加强借贷保障。目前在政府基建支出方面，政策逐渐向发债借贷倾斜，使之比向影子银行借贷更方便。国家主席习近平也可以采取早该采取的措施，削弱国有企业的影响力，给予民营企业更大的空间来投资能源和金融等领域。

中国很可能会避免的一件事是对其房地产政策做出重大改变，房地产是2008年刺激计划的关键部分。习近平已经多次表示，房子是用来住的，不是用来炒的。一系列限制措施已使市场降温，购房减少，开发商贷款受限。恒大集团的许家印即使真为此不安，也没有表现出来。在今年发表的一次讲话中，他把公司的成就归功于政府政策。作为一个长期受益者，他还是有不唱反调的觉悟的。 ■



Academic research

Looking to beat the world

Tsinghua University may soon surpass America's institutions in science and technology subjects. In China, its rapid rise is not unique

TSINGHUA UNIVERSITY was born out of national humiliation. It was founded in the aftermath of the Boxer Rebellion—an anti-foreign uprising in 1900—and paid for with the reparations exacted from China by America. Now Tsinghua is a major source of Chinese pride as it contends for accolades for research in science, technology, engineering and maths (STEM). In 2013-16 it produced more of the top 1% most highly cited papers in maths and computing, and more of the 10% most highly cited papers in STEM, than any other university in the world, reckons Simon Marginson of Oxford University (see chart). The Massachusetts Institute of Technology (MIT) still leads in the top 1% of STEM papers, but Mr Marginson says Tsinghua is on track to be “number one in five years or less”.

Tsinghua and Peking University are modelled on Western research universities. The two are also neighbours and rivals, China’s Oxford and Cambridge. Tsinghua is the conventional, practical one—the alma mater of many of the country’s leaders, including the current one, Xi Jinping, and Hu Jintao, his predecessor. Peking University is the home of poets, philosophers and rebels; Mao Zedong worked in the library, and the university was at the forefront of the Tiananmen Square protests of 1989. Like other Chinese universities, the two foremost ones all but ceased to function during Mao’s Cultural Revolution of the 1960s and 1970s; rival Red Guard factions waged bloody struggles for control of Tsinghua. But both quickly rebounded. Tsinghua retained its scientific bent and became the principal beneficiary of the country’s boom in STEM research.

Since 1995 the central government has mounted a series of efforts, involving billions of dollars in spending, to turn China's best universities into world-class ones. First came Project 211, which aimed to improve around 100 institutions to make them fit for the 21st century. The latest incarnation of this scheme is the Double First Class Plan, which was launched in 2015. Its goal is to foster world standards in two groups, one consisting of leading universities and the other of select departments in a wider range of institutions.

Money is the lever. The funding system motivates universities to produce top-class research. Universities, in turn, give their academics an incentive to do so. A study by three Chinese researchers, published last year, noted that payments for getting a paper published had risen steadily from the \$25 that was offered nearly 30 years ago by Nanjing University, the first university to give such rewards. Now such bonuses range up to \$165,000—20 times the annual salary of an average academic—for a paper in *Nature*, depending on the institution. The system has responded. China's share of STEM papers in Scopus, the world's biggest catalogue of abstracts and citations, rose from 4% in 2000 to 19% in 2016, more than America's contribution.

Tsinghua creams off the best researchers. And, like China itself, when it comes to scoring, it benefits from its size. PhD students are the workforce of the research business. In 2017 the university awarded 1,385 doctorates (some recipients are pictured), compared with 645 conferred by MIT. But numbers are not the main reason for Tsinghua's success. Yang Bin, its vice-president, says "the most important moment in the development of Tsinghua" was in 1978, when Deng Xiaoping said China would send larger numbers of students abroad. "We need to send tens of thousands," Deng said. "This is one of the key ways of...improving our level of scientific education." Officials worried that few of them would return, but Deng insisted that enough would. He was right.

Forty years on, Tsinghua and the country's other top universities are reaping the rewards. The return flow of highly trained people is gathering pace. The government has provided extra resources to attract them. Tsinghua cannot match the best American packages, but it can offer six-figure dollar salaries—and the opportunity for young parents to bring up their children in their own culture. Qian Yingyi (Columbia, Yale, Harvard, Stanford, Berkeley and subsequently dean of Tsinghua's school of economics and management) and Shi Yigong (dean of Tsinghua's school of life sciences; previously at Johns Hopkins and Princeton) are among the star returnees who have transformed the university. "Those intellectuals played a very important role, changing the whole climate, raising standards," says Mr Yang.

Reforms in staff management have helped, too. In 2012, in the school of which he was dean, Mr Qian replaced a personnel system dominated by personal contacts and political clout with an American-style tenure track: six years of research, then a review of performance, mainly based on published work, after which academics were hired permanently or shown the door. This approach then spread through the university. The result, says Mr Yang, is that "people work terribly hard here: the lights are on all night, people work all weekend", hoping to get papers into leading journals. The speed with which their efforts have dragged Tsinghua up the rankings is astonishing. In 2006-09 the university was 66th in the maths-and-computing-research league table. Now it is top.

But there are worries about Tsinghua's direction—particularly among engineers, who used to dominate the university. Their applied skills have played a crucial role in China's modernisation, but because they produce relatively little cutting-edge theoretical research, they have been losing out under the new regime. Engineers complain that they struggle to get funding or promotion, and that the focus on research neglects their contribution to

society.

Others worry that the university is still not cutting-edge enough. “Many Japanese people have won Nobel prizes,” says Mr Yang. “People are saying: ‘Why not the Chinese?’” Mainland China has only one Nobel prize in science, awarded to Tu Youyou for discovering an anti-malarial drug in the 1970s. Japan has 23; America has 282. Mr Yang reckons that the pressure to publish is problematic. “It’s good for short-term results, but not for really big things, for unorthodox thinking. Too many people have the attitude of followers. They’re not entrepreneurial enough. I say: Start some new field. Don’t care too much about recognition from peers. Risk your whole career.” Persuading researchers to think radically instead of incrementally would mean changing the way the system incentivises them.

And while China’s universities forge ahead in the hard-science league table, they seem less likely to triumph in the social sciences. One problem is language. All the world’s leading journals are published in English. That matters less for hard scientists, who communicate mostly in symbols, than for social scientists, who use many more words. An academic in Tsinghua’s education department says Chinese social scientists complain that their best ideas are difficult to translate. “Writing papers for English-language journals is like competing in an exam that is set by the West,” she quotes them as lamenting.

The constraints on free speech, increasingly felt in universities, are another reason why China’s STEM triumph may not spread to other disciplines. In 2013 the government told universities that seven topics, including universal values, judicial independence and the past mistakes of the Communist Party, were off-limits. “At a great university,” says William Kirby, professor of China studies at Harvard, “there isn’t one thing that can’t be talked about, let alone seven.” ■



学术研究

矢志打败全世界

清华大学可能很快就会在理工学科上超越美国大学。在中国，它的迅速崛起并非绝无仅有

清华大学诞生于民族饱受屈辱之时。它创建于1900年“扶清灭洋”的义和团运动之后，建校费用来自美国向中国索取的赔款。今天，清华在科学、技术、工程和数学（STEM）研究领域争夺荣誉，成为中国人的大骄傲。牛津大学的西蒙·马金森（Simon Marginson）表示，2013至2016年，在引用率居前1%的数学与计算论文和引用率居前10%的STEM论文中，清华大学发表的论文数量列全球高校之最（见图表）。在引用率居前1%的STEM论文中，麻省理工学院仍然领跑，但马金森表示，清华有望“在五年或更短的时间内夺得第一”。

清华和北大都以西方研究型大学为模板。两所学校是近邻，又相互竞争，是中国版的牛津和剑桥。清华传统实干，是众多国家领导人的母校，包括现任国家主席习近平及其前任胡锦涛。北大是诗人、哲学家和反叛者的家园——毛泽东曾在北大图书馆工作，北大学生在1989年天安门广场抗议活动中冲在最前面。和其他中国大学一样，这两所最顶尖大学在上世纪六七十年代毛泽东发起的文化大革命期间几乎完全瘫痪，红卫兵中的敌对派系为控制清华发动了血腥的斗争。但两所大学很快都恢复了生机。清华保持了理工科优势，成为中国STEM研究蓬勃发展的主要受益者。

自1995年以来，中央政府为使中国一流大学变成世界一流大学采取了一系列措施，投入数百亿美元。首先是“211工程”，旨在提高约100所大学的水平，使之适应21世纪的发展需要。最新的项目是2015年推出的“双一流”计划，目标是发展出两个“世界一流”标准：一流大学，以及涉及更广泛院校的一批一流学科。

资金是杠杆。拨款制度激励大学产生一流科研成果，大学继而激励本校教师实现该目标。去年三位中国研究人员发表的一项研究指出，近30年前，

南京大学首次推出论文奖励，金额为25美元，自那之后奖励金额稳步上升。如今，在《自然》杂志上发表一篇论文在一些大学最高可以获得16.5万美元的奖励，是一般高校教师年薪的20倍。这种激励制度发挥了作用。在全球最大的摘要和引文目录Scopus中，中国的STEM论文数量占比已从2000年的4%上升到2016年的19%，超过了美国。

清华吸收了最好的科研人员。而且，就像中国本身一样，在排名的时候，清华凭借自身规模获得了优势。博士生是科研的主力军。2017年，清华颁发了1385个博士学位（照片中是部分学位获得者），而麻省理工学院共颁发了645个博士学位。但人多并不是清华成功的主要原因。副校长杨斌说，“清华发展最重要的时刻”是1978年，当时邓小平说中国要送更多学生出国留学。派遣留学生“要成千成万地派，”邓小平说，“这是.....提高我国科教水平的重要方法之一。”官员们担心留学生一去不回，但邓小平坚持说会有足够的人回来。他是对的。

40年过去了，清华和中国其他顶尖大学正在收获回报。训练有素的人才正在加速回归。为吸引这些人，政府提供了额外的资源。清华提供的条件无法匹敌美国最好的待遇，但已可以提供六位数美元的薪酬，而且年轻父母还有机会在自己的文化中抚养下一代。钱颖一（曾先后在哥伦比亚大学、耶鲁大学、哈佛大学、斯坦福大学、加州大学伯克利分校求学与任教，以及担任清华大学经济管理学院院长）和施一公（曾在约翰·霍普金斯大学、普林斯顿大学求学及任教，及担任清华大学生命科学学院院长）等明星海归都给清华大学带来了重大改变。杨斌说：“这些学者发挥了非常重要的作用，改变了整个学术氛围，提高了学术标准。”

人事管理方面的改革也有帮助。2012年，时任经管学院院长的钱颖一在该学院引入美国式终身教职制，取代了以人际关系和政治影响力为主导的人事制度：给教师六年时间做研究，然后对其绩效考核，主要考核指标是发表的论文，根据考核结果决定是长聘还是请其走人。后来这种方法在清华普及开来。杨斌说，结果是“大家在清华工作都非常努力：各院系常常彻夜灯火通明，大家周末都在工作”，希望能在顶尖期刊上发表论文。他们

的努力以惊人的速度提升了清华的排名。2006至2009年，清华的数学和计算研究排名为第66位，如今已登榜首。

但也有人为清华的发展方向担忧，特别是那些曾经主导这所高校的工程师。他们的应用型技能在中国的现代化建设中发挥了至关重要的作用，但由于他们的前沿理论研究相对较少，在新制度下已节节失利。工程师们抱怨他们很难获得拨款或晋升，学校对研究的看重也忽视了他们对社会的贡献。

其他人担心清华的科研仍然不够前沿。“日本人拿了很多次诺贝尔奖，”杨斌说，“人们都在说：‘为什么中国人不行？’中国大陆只获得过一个科学领域的诺贝尔奖，授予了在上世纪70年代发现一种抗疟疾药物的屠呦呦。而日本获得过23个，美国282个。杨斌认为，需要多多发表论文的压力是有问题的。“这对短期成绩有利，但不利于带来真正的‘大事物’，也不利于发展非正统思维。太多人都有从众心态，没有足够的企业家精神。要我说，要开创新领域。不要太在意同行是否认可。把你整个职业生涯都赌进去。”要说服研究人员大胆激进而非循序渐进地思考，意味着要改变激励他们的方式。

而虽然中国的大学在硬科学的排行榜上一路飙升，它们在社会科学领域胜出的可能性似乎更小。一个问题是语言。世界上所有顶级期刊都以英文出版。这对那些主要使用符号交流的硬科学家影响较小，对更多使用文字交流的社会学家影响更大。清华大学教育研究院的一名教师表示，中国的社会学家抱怨他们最好的想法难以通过翻译传达，他们曾哀叹：“为英语期刊撰写论文就像是参加西方设定的考试。”

中国的大学越来越多地感受到对言论自由的限制，这是中国在STEM领域的成就可能无法扩展至其他学科的另一个原因。2013年，政府要求高校教师“七不讲”，包括不讲普世价值、司法独立和党的历史错误。“在一所有伟大的大学里，”哈佛大学的中国研究教授威廉·柯比（William Kirby）说，“没有任何东西是不可以探讨的，更别说七个了。”■



Free exchange

Capitalising on competition

Superstar cities sweep all before them. How can the understudies get a lucky break?

IN THE END, Amazon disappointed everyone. A year ago the e-commerce giant said it would open a second headquarters, and solicited bids from cities keen on the 50,000 new jobs and \$5bn in investment it would bring. The gambit might have produced a fascinating experiment in urban development, and a departure from the concentration of top tech firms in a few favoured places. It did not. Though local governments wooed the firm with juicy incentives, no city nabbed the promised co-headquarters. On November 13th Amazon said it would split its new office between New York City and Arlington, a suburb of Washington, DC.

The decision to bring tens of thousands of high-paying jobs to two of America's richest metropolitan areas is a notable example of a broader trend. Another came a few days earlier, when the *Wall Street Journal* reported that Google planned a dramatic increase in hiring in New York City. Politicians interested in boosting the fortunes of places other than superstar cities have their work cut out.

Once, poor places caught up with richer ones. From 1940 to 1980 the gap between wages in rich cities and in poor ones closed at a rate of about 1.4% per year, according to recent work by Elisa Giannone of the University of Chicago. Then convergence halted. Behind cities' diverging fortunes is a change in the return to education. Wage convergence did not end for all workers after 1980, says Ms Giannone, but only for those with a college degree. That is because well-educated workers have done best in places where there are lots of them. The share of workers with a college education has risen most in cities where the population of graduates was already large.

This clustering has helped push incomes in different locations apart. Regional inequality has been worsened by restrictive development rules in thriving places. The resulting competition for pricey living space favours people with higher incomes and filters those of modest means out of superstar cities.

Those cities are vehicles for transmitting knowledge. Edward Glaeser and Matthew Resseger of Harvard University argue that higher pay in skilled cities is not merely a matter of sorting educated and uneducated people into different locations; rather, cities facilitate learning and boost the productivity of entrepreneurs. When access to them is rationed by dear housing, some workers and employers lose out. The economy as a whole suffers. In recent work Chang-Tai Hsieh of the University of Chicago and Enrico Moretti of the University of California, Berkeley, estimate that looser zoning rules in elite cities could increase GDP growth by a third.

Other attractions probably drew Amazon and Google. The interests of tech giants are different from those of startups. Entrenched technological leaders have little reason to love places that encourage entrepreneurship and the transfer of knowledge. They can gain access to rivals' innovations by buying them and would prefer their own proprietary technology to remain proprietary. It is possible that Amazon wants HQs 2 and 3 enmeshed in local tech ecosystems. But it is more likely to have had other benefits in mind.

Access to labour, for instance. Amazon cited the advantages of New York and Washington for its drive to attract "world-class talent"; each employs more knowledge workers than any other American metropolitan area. Large labour markets improve the quality of matches between workers with rare skills and the firms that need them, and cut the cost of economic disruptions (a sacked worker will more easily find a new job in a town with thousands of employers than one with just a handful). Amazon could probably attract applicants no matter where it is located. But some workers

are hard to find outside superstar cities. Only there can households with two high-powered earners be certain that both will have access to a wide range of lucrative jobs. Siting its offices in such places may be the only sure way for Amazon to fish in an elite labour pool. Moreover, it is households with two high incomes that can best cope with expensive housing. For them, and the elite firms that want to employ them, other places are a poor substitute.

New York and Washington also offer proximity to important customers. Though Amazon and Google look like consumer-facing businesses, their growing range of cloud-computing services means they are increasingly participants in business-service supply chains. Close contact between different supply chains helped produce the growth of cities during the Industrial Revolution; the high cost of moving bulky goods pushed manufacturers to cluster. Building and maintaining products in the cloud for multinational firms (and for the American government) might similarly require tech firms to operate cheek-by-jowl with business partners.

That, too, is disconcerting. Productivity growth across the developed world has been disappointingly weak in recent decades. Dan Andrews, Chiara Criscuolo and Peter Gal of the OECD, a rich-country think-tank, put the blame on the slow diffusion of productivity-boosting techniques from top firms to the rest of the economy. As long as realising the benefits of new technologies requires close co-operation with leading tech firms, this is unlikely to change. The payoff to developing bespoke AI solutions for a major multinational with headquarters in New York might be big enough to attract an Amazon or Google to site an office there. When the customer is a local bank in Topeka, Kansas, it is not.

Small cities are at a disadvantage, then. But co-operation might level the playing-field. Cities could collectively agree to stop competing to lure firms with piles of taxpayer cash—which could be better spent on productivity-enhancing public goods such as infrastructure and education.

Experimentation with promising but untested development strategies is badly needed, as a forthcoming paper from the Brookings Institution argues. Cities could work together to run pilots for such programmes and to share best practices. Then, if talented and ambitious workers grow weary of life in superstar cities, smaller ones might be ready to capitalise. ■



自由交流

善用竞争

超级明星城市风头无两。“替角”如何能时来运转？

到头来，亚马逊让所有人都失望了。一年前，这个电商巨头称将设立第二总部，并向各地发出竞标邀请。那些竞标城市对于将因此而来的五万个新增就业岗位和50亿美元投资分外眼馋。亚马逊这一策略原本可以促成一场有关城市发展的别开生面的试验，也能打破顶尖科技公司只集中在少数备受青睐的地点这种局面。但它没有。虽然各地政府开出了诱人的条件来争取这家公司，但亚马逊计划中的新总部没有花落其中任何一家。11月13日，亚马逊表示新的办公地点将一分为二，分别落脚纽约市和华盛顿特区的郊区阿灵顿（Arlington）。

亚马逊决定将数万个高薪岗位带到美国最富裕的两个大都会区，这凸显出一个更广泛的趋势。在那之前的几天还发生了另一个显著案例：据《华尔街日报》报道，谷歌计划在纽约市大幅增加职位。政客们如果想要改善超级明星城市以外地区的境遇，恐怕得下一番苦功了。

贫穷地区一度还能赶上较富裕的地区。芝加哥大学的艾丽萨·詹诺内（Elisa Giannone）近期的研究显示，从1940年到1980年，富裕城市和贫穷城市的工资差距每年约以1.4%的速度缩小。之后趋同进程中止。城市的命运出现差异，背后的原因是教育的回报发生了变化。詹诺内表示，1980年以后，并不是对于所有劳动者来说工资水平都停止了趋同，而是仅对拥有大学学历者而言。这是因为受过良好教育的劳动者在有众多同类聚集的地方过得最好。受过大学教育的劳动者数量增幅最大的地方是那些原本就已有大量大学毕业生的城市。这种集群效应帮助推动不同地方的收入水平发生分化。繁荣地区实行的限制性开发法规更是加剧了区域间的不平等。结果是促发了人们对昂贵居住空间的争夺。高收入人士在这场竞争中占据优势，那些收入不高的人被筛除出了超级明星城市。

超级明星城市是传播知识的载体。哈佛大学的爱德华·格雷泽（Edward Glaeser）和马修·雷赛格（Matthew Resseger）指出，技能型城市里更高的报酬不仅仅是将受过和没受过良好教育的人区分开来，并将他们输送到不同的地方那么简单。城市还会促进学习，提升创业者的生产率。如果要在城市中立足得看是否负担得起那里的高房价，那么一些劳动者和雇主就会失利，整个经济也会受损害。芝加哥大学的谢长泰和加州大学伯克利分校的恩里克·莫雷蒂（Enrico Moretti）近期的研究估计，在精英城市放宽区域规划限制，可能会使GDP增速上升三分之一。

这些城市吸引亚马逊和谷歌的原因却可能是另一些。科技巨头与创业公司的利益相关处有所不同。树大根深的技术领导者没什么理由青睐鼓励创业和知识传播的地方。它们可以通过收购来获取竞争对手的创新，也更愿意自己的专有技术继续由自己把持。亚马逊有可能是想让它的第二和第三总部融入地方科技生态系统，但更有可能是惦记着其他好处。

比如获取劳动力。亚马逊提到了纽约和华盛顿在努力吸引“世界一流人才”方面的优势。这两个城市雇用的知识型员工数量比美国其他任何大都会区都要多。规模庞大的劳动力市场能更好地匹配拥有稀缺技能的劳动者和那些需要他们的企业，还能削减经济动荡的损失（比起只有少量雇主的城市，被解聘的员工在拥有成千上万雇主的城市里更容易找到新工作）。亚马逊也许不管在哪里落户都会吸引应聘者。但有些员工在超级明星城市之外的地方很难找到。只有在这样的城市，有两个高收入劳动者的家庭才能确保两人都有各种各样薪水丰厚的工作可选。对于亚马逊来说，要想在精英劳动力资源中招揽人才，将办公室设在超级明星城市中也许是唯一稳妥的途径。再者，拥有两份高收入的家庭才最有能力地应对高昂的住房成本。对于这些劳动者以及想雇用他们的精英企业来说，其他地方差得很远。

纽约和华盛顿还能让企业贴近重要客户。虽然亚马逊和谷歌看起来像面向消费者的企业，但它们的云计算服务覆盖的范围不断扩展，意味着两家公司愈发深入参与商业服务供应链。在工业革命时期，不同供应链之间的紧密联系推动了城市的发展壮大。运输大件货物的高昂成本促使制造商们聚

集在一起。为跨国公司（还有美国政府）在云中打造和维护产品的科技公司也许同样需要和商业伙伴肩并肩地工作。

这一点同样令人不安。近几十年来，整个发达世界的生产率增长乏力，令人失望。富裕国家智库经合组织的丹·安德鲁斯（Dan Andrews）、基亚拉·克里斯库奥洛（Chiara Criscuolo）和彼得·盖尔（Peter Gal）认为，造成这一局面的原因是促进生产率提升的技术从顶尖公司向其他经济领域的扩散很缓慢。如果新技术的好处只能通过与科技巨头密切合作才能实现，那么这种局面就不大可能改变。为一家总部在纽约的大型跨国公司定制人工智能处理方案带来的收益也许足以吸引亚马逊或谷歌在纽约设立办公室。但如果客户是位于堪萨斯州托皮卡市（Topeka）的一家地方银行，就没有这样的吸引力了。

这样一来，小城市便处于不利地位。但合作也许能促进公平竞争。小城市之间或许可以达成共识，停止为吸引企业入驻而你争我抢，挥霍了纳税人的大把金钱。它们可以把这些钱花在基础设施和教育这类能够促进生产率的公共产品上。正如布鲁金斯学会（Brookings Institution）即将发表的一篇论文所提出的那样，城市亟需就那些有前景但未经验证的发展策略开展试验。它们之间可以合作开展这类策略的试点项目，共享最佳做法。到那时，如果那些有才干又有抱负的劳动者厌倦了超级明星城市的生活，小城市也许就能翻身了。■



Competition

The next capitalist revolution

To rebuild public faith in markets, restore competition

CAPITALISM HAS suffered a series of mighty blows to its reputation over the past decade. The sense of a system rigged to benefit the owners of capital at the expense of workers is profound. In 2016 a survey found that more than half of young Americans no longer support capitalism. This loss of faith is dangerous, but is also warranted. Today's capitalism does have a real problem, just not the one that protectionists and populists like to talk about. Life has become far too comfortable for some firms in the old economy, while, in the new economy, tech firms have rapidly built market power. A revolution is indeed needed—one that unleashes competition, forcing down abnormally high profits today and ensuring that innovation can thrive tomorrow.

Countries have acted to fuel competition before. At the start of the 20th century America broke up monopolies in railways and energy. After the second world war West Germany put the creation of competitive markets at the centre of its nation-building project. The establishment of the European single market, a project championed by Margaret Thatcher, prised open stale domestic markets to dynamic foreign firms. Ronald Reagan fostered competition across much of the American economy.

A similar transformation is needed today. Since 1997 market concentration has risen in two-thirds of American industries. A tenth of the economy is made up of industries in which four firms control more than two-thirds of the market. In a healthy economy you would expect profits to be competed down, but the free cashflow of companies is 76% above its 50-year average, relative to GDP. In Europe the trend is similar, if less extreme. The average

market share of the biggest four firms in each industry has risen by three percentage points since 2000. On both continents, dominant firms have become harder to dislodge.

Incumbents scoff at the idea that they have it easy. However consolidated markets become domestically, they argue, globalisation keeps heating the furnace of competition. But in industries that are less exposed to trade, firms are making huge returns. We calculate the global pool of abnormal profits to be \$660bn, more than two-thirds of which is made in America, one-third of that in technology firms (see Special report).

Not all these rents are obvious. Google and Facebook provide popular services at no cost to consumers. But through their grip on advertising, they subtly push up the costs of other firms. Several old-economy industries with high prices and fat profits lurk beneath the surface of commerce: credit cards, pharmaceutical distribution and credit-checking. When the public deals with oligopolists more directly, the problem is clearer. America's sheltered airlines charge more than European peers and deliver worse service. Cable-TV firms are notorious for high prices: the average pay-TV customer in America is estimated to spend 44% more today than in 2011. In some cases public ire opens the door to newcomers, such as Netflix. Too often, however, it does not. Stockmarkets value even consumer-friendly entrants such as Netflix and Amazon as if they too will become monopolies.

Rising market power helps solve several economic puzzles. Despite low interest rates, firms have reinvested a stingy share of their bumper profits. This could be because barriers to competition keep out even well-funded newcomers. Next, since the turn of the millennium, and particularly in America, labour's share of GDP has been falling. Monopolistic prices may have allowed powerful firms to eat away at the purchasing power of wages. The labour share has fallen fastest in industries with growing concentration. A third puzzle is that the number of new entrants has been

falling and productivity growth has been weak. This may also be explained by a lack of competitive pressure to innovate.

Some argue that the solution to capital's excesses is to beef up labour. Elizabeth Warren, a possible American presidential candidate, wants to put more workers on boards. Britain's Labour Party promises compulsory employee share-ownership. And almost everyone on the left wants to reinvigorate the declining power of unions (see Briefing). There is a role for trade unions in a modern economy. But a return to 1960s-style capitalism, in which bloated oligopolies earn fat margins but dole cash out to workers under the threat of strikes is something to be avoided. Tolerating abnormal profits so long as they are distributed in a way that satisfies those with power is a recipe for cronyism. Favoured insiders might do well—witness the gap between coddled workers and neglected outsiders in Italy. But an economy composed of cosy incumbents will eventually see a collapse in innovation and hence a stagnation in living standards.

Far better to get rid of rents themselves. Market power should be attacked in three ways. First, data and intellectual-property regimes should be used to fuel innovation, not protect incumbents. That means liberating individual users of tech services to take their information elsewhere. It also entails requiring big platforms to license anonymised bulk data to rivals. Patents should be rarer, shorter and easier to challenge in court.

Second, governments should tear down barriers to entry, such as non-compete clauses, occupational licensing requirements and complex regulations written by industry lobbyists. More than 20% of American workers must hold licences in order to do their jobs, up from just 5% in 1950.

Third, antitrust laws must be made fit for the 21st century. There is nothing wrong with trustbusters' remit to promote consumer welfare. But regulators need to pay more attention to the overall competitive health of markets

and to returns on capital. America's regulators should have more powers, as Britain's do, to investigate markets that are becoming dysfunctional. Big tech firms should find it much harder to neutralise potential long-term rivals, as Facebook did when it acquired Instagram in 2012 and WhatsApp in 2014.

These changes will not solve every ill. But if they drove profits in America to historically normal levels, and private-sector workers got the benefits, real wages would rise by 6%. Consumers would have greater choice. Productivity would rise. That might not halt the rise of populism. But a competition revolution would do much to restore the public's faith in capitalism. ■



竞争

下一场资本主义革命

要重建公众对市场的信心，必须重启竞争

过去十年里，资本主义的声誉遭受了一连串沉重打击。人们深感这一制度被操纵，不惜牺牲工人的利益来为资本所有者谋利。2016年，一项调查发现，超过一半的美国年轻人不再支持资本主义。信心丧失固然危险，但也事出有因。今天的资本主义确实存在一个大问题，不过不是贸易保护主义者和民粹主义者大谈特谈的那个。传统行业的一些公司日子变得太过安逸，而在新经济中，科技公司已迅速建立起市场势力。这确实需要一场革命——一场引发竞争的革命，迫使目前高得离谱的利润降下来，并确保创新能够在未来蓬勃兴盛。

各国过去都曾采取行动促进竞争。20世纪初，美国打破了铁路和能源业的垄断。二战后，西德把建立竞争性市场作为国家建设的核心任务。撒切尔夫人倡导的欧洲单一市场得以建立，撬开了各国沉闷的国内市场，向充满活力的外国公司开放。罗纳德·里根在美国经济的很多领域都促进了竞争。

今天也需要类似的变革。自1997年以来，美国三分之二的行业里市场集中度都有所上升。有些行业里四家公司控制了超过三分之二的市场，这样的行业构成了美国经济的十分之一。在健康的经济环境中，人们会期望通过竞争来降低利润。但现实情况是，美国公司的自由现金流相对于GDP比50年平均水平高出76%。欧洲也有类似趋势，只是没这么严重。自2000年以来，各行业最大的四家公司的平均市场份额上升了三个百分点。在美欧两个大陆，垄断企业的地位都已变得更难撼动。

对于他人认为自己身在安乐窝的想法，老企业嗤之以鼻。它们辩解说，无论国内市场变得多集中，全球化都在不断给竞争的熔炉添柴加火。但在那些受贸易影响较小的行业，企业正在赚取巨大的回报。《经济学人》估

算，全球超常利润的总额达6600亿美元，其中三分之二以上来自美国，而在美国的这些利润中，又有三分之一来自科技公司。

并非所有的经济租都显而易见。谷歌和Facebook为消费者提供免费的热门服务，但它们凭借对广告的控制，神不知鬼不觉地推高了其他公司的成本。好几个旧经济行业都在商业表象之下藏匿着高价与厚利：信用卡、药品经销和征信。当公众更直接地与市场垄断者打交道时，问题就更加明显了。美国受庇护的航空公司比其欧洲同行收费更高，服务却更差。有线电视公司的收费之高臭名昭著：据估计，现今美国付费电视用户的平均支出比2011年增加了44%。有时候，公众的怒火为Netflix这样的新来者制造了机会。然而这种情况少之又少。即使是Netflix、亚马逊等对消费者友好的行业新公司，股市对它们的估值也仿佛视其为未来的垄断者。

不断增强的市场势力有助于解开几个经济谜题。首先，即便利率很低，企业也只从丰厚的利润中拿出一小部分用于再投资。这可能是因为竞争壁垒的存在，即使资金充裕的新来者也被拒之门外。其次，自世纪之交以来，尤其是在美国，劳动收入占GDP的比重一直在下降。垄断价格可能让实力雄厚的公司蚕食了薪资购买力。在市场集中度持续上升的行业，劳动收入占GDP之比下降最快。第三个谜题是行业中新进公司的数量持续下滑，生产力增长一直疲软。这也可能是因为缺乏推动创新的竞争压力。

有人认为，解决资本过剩的办法是增强工人的力量。比如，可能成为美国总统候选人的伊丽莎白·沃伦（Elizabeth Warren）就希望有更多工人进入董事会。英国工党承诺强制让员工持股。几乎所有左翼人士都希望重振日益衰落的工会力量。工会在现代经济中还是能发挥一定的作用，但是要避免回到上世纪60年代的那种资本主义。那时，骄奢的寡头赚取丰厚的利润，却只在受到罢工威胁时才给工人发点钱。只要分配方式让有权利的人满意，离谱的高额利润就能被容忍，这将导致任人唯亲。受到优待的圈内人可能过得很滋润——在意大利，养尊处优的员工和被冷落的局外人之间的差距就是明证。但是，如果一个经济体满是安逸的既有企业，那它最终会在创新上陷入瘫痪，导致国家生活水平停滞不前。

去除经济租本身要好得多。应该采取以下三种方式打击市场势力。首先，数据和知识产权制度应被用来推动创新，而不是保护既有企业。这意味着让科技服务的个人用户能自由地将信息带到别处。这也势必要求大型平台将匿名海量数据授权给竞争对手。专利应该更少、期限更短，也更容易在法庭上发起专利挑战。

其次，各国政府应该拆除准入门槛，如竞业禁止条款、职业许可要求，以及行业说客撰写的复杂章程等。如今，超过20%的美国工人必须持证上岗，而1950年这一比例只有5%。

第三，必须让反垄断法适应21世纪的形势。反垄断官员负责提升消费者福利没什么不对，但监管机构需要更加关注市场整体的竞争健康度以及资本回报率。美国的监管机构应该像英国的那样，在调查逐渐失灵的市场方面拥有更大的权力。应该大大增加大型科技公司消除潜在的长期竞争对手的难度，就像Facebook在2012年和2014年分别收购Instagram和WhatsApp时所经历的变化。

这些变革并不能解决所有弊端。但是如果它们能把美国公司的利润推回到历史正常水平，而让私营部门的工人受益，那么实际工资将会上涨6%。消费者将有更多选择。生产率会提高。这未必能遏阻民粹主义的兴起。但一场重启竞争的革命会大大恢复公众对资本主义的信心。■



CP Group

A chicken in every pot

Thailand's largest private company outdoes its peers

A MYSTERIOUS THAI tycoon recently purchased Fortune, a business magazine that was formerly part of the Time Inc stable, for \$150m. The publication's title suits Chatchaval Jiaravanon, a member of the Clearavanont family, among Thailand's richest. The clan's wealth comes from the Charoen Pokphand Group (CP), a conglomerate it largely owns, which in turn presides over an agribusiness giant.

From a small seed shop opened in 1921 on the Song Wat Road in Bangkok, CP has grown to become one of Thailand's most enormous private firms, with holdings in more than 200 subsidiaries around the world, employing 300,000 people. Last year its revenues reached 1.8trn baht (\$54bn). It offers consumers everything from insurance contracts to juicy pork steaks, business flights to cars, and cloud-computing services to fancy property.

CP claims to embrace modern management methods, setting up a leadership institute and welcoming outsiders into its senior ranks. But there is no question where the power lies. At the company's pinnacle sits Dhanin Clearavanont, the patriarch, who started at the conglomerate over five decades ago. After a reshuffle last year he became CP's senior chairman; his eldest son became chairman and his youngest the chief executive.

The enormous empire underneath them has long enjoyed good relations with the public sector. There is an old joke in the Thai civil service, where levels of seniority were once graded from C1 to C11, that the next stage was CP. Given the country's unpredictable politics, former government officials and diplomats have proved to be desirable employees.

Work with governments in Thailand, China (where CP was the first foreign investor after China opened up in 1978) and elsewhere has often helped push the firm into new areas. Noppadol Dej-Udom, who oversees CP's sustainability and governance, notes that it got into telecoms in the first place because the Thai government needed help to install telephone lines to meet demand in the 1990s. On November 12th a consortium involving CP submitted a bid to build a \$6.8bn high-speed railway to link three of Thailand's busiest airports, part of a government plan to boost infrastructure.

Railways are certainly a far cry from CP's biggest business, food, which, together with its agri-industry business, accounts for 54% of revenues. Its vertically integrated poultry empire, one of the world's biggest, requires farmers to fatten chickens with CP's feed until they are large enough to enter one of its processing centres, often leaving as nuggets.

At CP Foods' Korat poultry-processing site, a few hours' drive north of Bangkok, vast quantities of birds a year are stunned, killed and then chopped up by machines. Korat produces about 36,000 tonnes of fresh meat each year and more than 65,000 tonnes of cooked products. Among other destinations, bread-crumbed chunks of chicken from the facility appear in British outlets of KFC, a fast-food chain. The birds' wings often go to Japan.

Chicken products also arrive in Thailand's 7-Eleven stores, part of an exclusive franchise in the country run by CP All, the group's retail wing (retail and distribution make up another 31% of CP's sales). The franchise has more than 10,000 outlets and controls 64% of the market for convenience shops, according to the Thai Retailers Association. As the proportion of modern grocery retail outlets, compared with informal markets and street-selling, is roughly two-thirds that of Singapore, thousands more 7-Eleven stores will appear in future. The group also runs CP Lotus, a large supermarket chain in China, as well as wholesale shops

under the Makro brand in Thailand and Cambodia. New opportunities in India and Vietnam may be next.

Not wanting to be left behind in the world's fastest-growing region of internet users, CP also boasts e-commerce platforms in Thailand such as wemall and weloveshopping.com. But these two are trifles in a market dominated by Chinese-linked giants such as Lazada, owned by Alibaba, and JD.com. CP's future hopes may lie instead in grocery delivery from its network of 7-Eleven stores, reckons one venture capitalist.

Nimble, single-business firms increasingly have the edge over giant conglomerates in the region, according to analysis by Bain, a consultancy. Yet CP bucks the trend. Several of its flagship firms are listed in Thailand, including CP Food, CP All and True, its big telecommunications firm, and the group's average annualised total shareholder returns, of 40% between 2007 and 2016, have been the best among South-East Asian and Indian conglomerates.

Yet while CP reaps rewards from its vast reach, it also runs risks. Proper oversight of its wide-ranging operations remains difficult, and a series of recent scandals have damaged the group's reputation. Four years ago it emerged that suppliers providing CP Food with fishmeal for its prawn-farming operations used slaves on their boats. The firm now buys pricier, certified fishmeal from Vietnam.

In 2015 an insider-trading furore at CP All erupted, leading to the creation of new governance structures. Internal investigations are going on into whether outside recruitment agents working for CP Food wrongly extracted fees from workers coming to the firm from Myanmar. "The extent of compliance with ethical recruitment principles across the different companies within the group remains inconsistent," says Andy Hall, a migrant-rights activist in Nepal. Mr Noppadol says CP's vast size helps to

make it an easy target for criticism. “If you ring the biggest bell, it makes the loudest noise,” he explains. ■



正大集团

正大真大

泰国最大的私营公司实力超群

最近，一位神秘的泰国大亨斥资1.5亿美元收购了时代公司（Time Inc）旗下商业杂志《财富》。这本杂志的名称倒是很符合谢展其人——他是泰国最富有的家族之一谢国民家族的成员。这个家族的财富来自它拥有大部分股份的企业集团正大集团（Charoen Pokphand Group），而正大控制着一家农业综合企业巨头。

正大从1921年开设在曼谷松瓦路（Song Wat Road）上的一家小种子店起家，如今已经发展成为泰国规模最大的私营企业之一，在世界各地拥有200多家子公司、30万名员工。去年，正大收入达1.8万亿泰铢（540亿美元）。它为客户提供各种商品和服务，从保险合同到美味的猪排，从商务航班到汽车，从云计算服务到高档房产。

正大声称采用现代管理方法。它设立了一个领导力学院，并欢迎外部人士进入公司高层。但是权归何处尽人皆知。担任公司最高领导的是家族老大谢国民，他50多年前开始在正大任职。去年公司重组之后，他成为资深董事长，其长子担任董事长，最小的儿子任CEO。

他们统治下的庞大帝国长期以来一直与公共部门保持着良好关系。过去泰国公务员的资历等级依次是从C1到C11，而公务员中流传着一个老笑话，说他们下一级会升到CP。鉴于泰国政治局势难以预测，前政府官员和外交官被证明是理想的雇员。

这家公司常常借助与政府合作挺进新领域，包括与本国政府、中国以及其他国家政府的合作（正大是1978年中国对外开放后第一个进入中国的外国投资者）。在正大负责可持续发展与治理的纳帕德尔·尤多姆（Noppadol Dej-Udom）表示，正大当初进入电信行业就是因为上世纪90年代泰国政府需要帮助来满足国内安装电话线的需求。11月12日，一个有正大参与的

财团投标建造68亿美元的高速铁路。该铁路将泰国最繁忙的三个机场连接起来，是政府推进基础设施建设计划的一部分。

铁路无疑与食品相去甚远。食品是正大的主营业务，它与其农业业务一起，贡献了正大收入的54%。作为世界最大的家禽帝国之一，正大垂直一体化的模式要求农民用正大的饲料喂养小鸡，小鸡长成后进入正大的加工厂，出厂时一般就是鸡块了。

从曼谷驱车向北几小时，就来到了正大食品的科拉特（Korat）家禽加工厂。每年这里都有不计其数的家禽被电击、宰杀，然后被机器切碎。科拉特每年生产约3.6万吨鲜肉和6.5万多吨熟肉制品。裹了面包糠的鸡排会出现在英国的肯德基门店等地。鸡翅常销往日本。

鸡肉产品还进入了泰国的7-11便利店。该便利店是正大集团旗下零售部门CP All在泰国特许经营权的一部分（零售和分销占正大销售额的31%）。根据泰国零售商协会的数据，正大拥有1万多家特许经营门店，控制着64%的便利店市场。泰国现代食品杂货零售店（区别于非正规市场和街头售卖）的比例约为新加坡的三分之二，所以未来还将有成千上万家7-11开业。集团在中国经营大型连锁超市卜蜂莲花（CP Lotus），在泰国和柬埔寨经营万客隆（Makro）批发超市。接下来还可能进军印度和越南市场。

身处世界上互联网用户增长最快的地区，正大不想落后于人。它在泰国还拥有wemall和weloveshopping.com等电子商务平台。然而在由阿里巴巴控股的来赞达（Lazada）和京东等有中国背景的巨头主导的市场上，正大这两个平台都还微不足道。一位风险投资家认为，正大未来的希望倒可能存在于依托7-11便利店网络形成的食品杂货配送上。

根据咨询公司贝恩的分析，灵活的单一业务公司在东南亚的优势日益超过大型企业集团。然而正大却逆势而上。它旗下的几家主要公司，包括正大食品、CP All以及大型电信公司True，都已在泰国上市。2007至2016年间，集团的平均年化股东总回报率为40%，在东南亚和印度的企业集团中首屈一指。

不过，尽管正大从其广泛的业务布局中获得回报，它也在冒险。要充分监督自己多样化的业务仍然很难，近年发生的一系列丑闻损坏了集团的声誉。四年前，为正大食品的对虾养殖企业提供鱼粉的供应商被曝出在船上使用奴工。如今，正大食品从越南购买价格较高但有认证的鱼粉。

2015年，CP All爆发了一场内幕交易风波，最后为此建立了新的治理架构。目前，集团内部还在继续调查正大食品雇用的外部招聘代理机构是否向招聘自缅甸的工人违规收费。“集团旗下不同公司在招聘时对道德准则的遵守情况仍然各不相同。”尼泊尔移民维权人士安迪·霍尔（Andy Hall）指出。纳帕德尔则表示正大是树大招风。他解释说：“敲最大的钟，发出的声响最大。”■



Mining in Guinea

Life on Mars

Guinea's bauxite boom is helping China but failing many of its people

IN THE SMALL village of Lasanayah, Mamadou Kalissa looks out over his ancestral home. Last year it was farmland but now bauxite mining has turned it into a Martian landscape that extends as far as the eye can see. Guinea's red gold is the main ore used to make aluminium. The Boké region in western Guinea has some of the world's richest reserves. A mining lorry rolls past, kicking up dust and causing Mr Kalissa to cough and spit saliva with a reddish tinge.

Every day hundreds of these lorries tear past the surrounding villages, bearing loads destined for China. There is nothing new about China's interest in African raw materials. Both Chinese and Western commodities companies have long looked to the continent's mineral wealth as a way to meet surging demand from China.

But difficulties building infrastructure and negotiating mineral rights have stymied many projects. As a result of years of squabbling over mining rights, for example, not one tonne of ore has been extracted from Simandou, a vast iron-ore deposit in south-east Guinea. Extracting Boké's bauxite has met with less resistance.

Bauxite is used in many things from power lines and planes to phones and cooking pots. China is by far the world's largest consumer. But in 2014, the country's aluminium giants ran into a big problem acquiring bauxite. Indonesia, a large producer, stopped exports because of the damage that mining causes—it requires stripping vast amounts of topsoil and battering the ground beneath. Two years later, Malaysia ended bauxite mining for the

same reason. Guinea, with the largest untapped iron and bauxite reserves in the world (see chart), offered an alternative.

In 2014 Winning Shipping, a Singaporean maritime firm, and UMS, a Guinean logistics firm, teamed up with Shandong Weiqiao, China's leading aluminium producer, in a joint venture called La Société Minière de Boké (SMB). Guinea's government also holds a 10% stake. SMB obtained rights to mine two areas in Boké, producing the first bauxite in 2015. SMB alone will produce 35m tonnes in 2018, almost double Guinea's total exports five years earlier. Everything goes to China; almost half of its bauxite imports come from Guinea.

"The stars were aligned," is how Frédéric Bouzigues, SMB's director-general, describes the firm's expansion. Other bauxite miners are based further inland and are constrained by a lack of railway lines to the coast. SMB's sites are less than 50km from the sea; the company built two ports and roads and transports everything by land on lorries.

The importance of Guinea to China is clear. The authorities in Beijing have promised the government a \$20bn loan—twice the country's GDP—to be paid to Guinea in instalments over 20 years, to secure access to its bauxite. But SMB's rapid expansion has come at a cost. A report published in October by Human Rights Watch, an international advocacy group, said that the Guinean government has allowed SMB to bypass environmental safeguards. "The focus on growth has been at the expense of the local peoples' environment and livelihoods," says Jim Wormington, one of the group's researchers. Although SMB employs more than 17,000 people directly or indirectly, many locals say the new job opportunities are not enough to compensate for the environmental damage. SMB says it has paid all its taxes and done the proper environmental checks.

The situation around the mines is nonetheless grim. SMB gave hundreds

of villagers a one-off payment for access to their land but many villages are perilously perched near wide roads over which lorries pass day and night. Many villagers say they lack proper access to clean water because the mining operations have blocked or polluted rivers. SMB says it builds wells for the villages, and supplies water in tankers until they are completed. But a government-commissioned audit in May 2018 said that SMB conducted “no monitoring of the environment” and that the consortium lacks equipment to monitor air or water quality.

There are some signs of improvement: SMB says that it began an environmental-monitoring programme this year. But little of the money SMB pays in charges and taxes is reinvested locally by the central government. Mr Bouzigues says that when the consortium built a health centre it took the government about two years to send a doctor to man it. In an interview with *The Economist* in April he admitted that SMB itself could do more to improve locals’ lives and that he personally wants to do better.

Guinea could in theory industrialise if it moved to processing bauxite instead of exporting it raw. SMB does have plans to build Guinea’s first refinery, by 2022. Whatever happens, Boké’s residents will find themselves at the mercy of the search for this prized material. “We can’t just leave. We have nowhere to go,” says Mr Kalissa, looking out over the red earth. ■



几内亚矿业

火星生活

几内亚的铝土矿开采热正让中国受益，却有负于自己的众多国民

在小村庄拉萨纳亚（Lasanayah），马马杜·卡利萨（Mamadou Kalissa）望向自己祖祖辈辈居住的家园。去年这里还是大片农田，而现在，铝土矿开采让目之所及都呈现出火星一般的地貌。几内亚的红色“黄金”是用于制造铝的主要矿石。该国西部的博凯地区（Boké）拥有一些世界上储量最大的矿区。一辆采矿卡车轰隆驶过，卷起滚滚尘土，卡利萨被呛得咳起来，喷出了微红的唾沫星子。

每天有数百辆这样的卡车疾驰着经过周围的村庄，载满运往中国的矿石。中国对非洲的原材料感兴趣并不是什么新鲜事。长期以来，中国和西方的大宗商品公司都诉诸于非洲大陆丰富的矿产资源来满足中国激增的需求。

但基础设施建设和采矿权谈判上的困难阻碍了许多项目的推进。例如，由于围绕采矿权的争议持续多年，几内亚东南部一个巨大的铁矿床西芒杜（Simandou）至今一吨矿石都没开采出来过。开采博凯的铝土矿遇到的阻力要小一些。

铝土矿用途广泛，从电线、飞机，到电话、烹饪锅具，等等。中国无疑是世界上最大的铝土矿消费国。但在2014年，中国的铝业巨头们遇到了铝土矿难求的大问题。主要生产国印度尼西亚因为采矿造成的破坏停止了出口——采矿过程需要剥离大量的上覆土层并凿开下面的岩层。两年后，马来西亚出于同样的原因也停止了铝土矿开采。几内亚拥有世界上最大的未开采的铁和铝土矿储量（见图表），提供了一个新的选择。

2014年，新加坡海运公司韦立航运（Winning Shipping）和几内亚物流公司UMS与中国铝生产龙头企业山东魏桥合作，成立了名为博凯矿业公司（SMB）的合资企业。几内亚政府也持有其中10%的股份。博凯矿业获得了博凯两个区域的采矿权，2015年开采出了第一批铝土矿。2018年，仅博

凯矿业就将生产3500万吨铝土矿，几乎是五年前几内亚出口总量的两倍。开采出的所有铝土矿都运往了中国；中国进口的铝土矿几乎一半都来自几内亚。

博凯矿业的总经理弗雷德里克·布齐格斯（Frédéric Bouzigues）在描述公司的扩张时说：“天时地利啊。”其他铝土矿公司都位于内陆，因通往海岸的铁路线太少而发展受限。博凯矿业的矿山距海边不到50公里；该公司建造了两个港口，还修了相连的道路，所有开采出的铝土矿都经陆路用卡车运往港口。

几内亚对中国的重要性显而易见。为确保可获得几内亚的铝土矿资源，中国政府向几内亚政府承诺，在20年内向其分期提供200亿美元的贷款（相当于几内亚GDP的两倍）。但博凯矿业的快速扩张是有代价的。国际维权组织人权观察（Human Rights Watch）10月发表的一份报告称，几内亚政府让博凯矿业绕过了环保监管。该组织的研究员吉米·沃明顿（Jim Wormington）说：“一味关注增长是以当地民众的环境和生计为代价的。”尽管博凯矿业直接或间接雇用了1.7万多名员工，但许多当地人表示新的工作机会不足以弥补对环境的破坏。博凯矿业则表示已支付所有税款并完成了恰当的环境验收。

尽管如此，矿区周遭的情况不容乐观。博凯矿业为获得土地使用权而向成百上千村民支付了一次性费用，但许多村庄都挨着大路，卡车日夜穿梭，安全隐患很大。许多村民说他们缺乏清洁用水，因为采矿作业堵塞或污染了河流。博凯矿业表示在为村庄修建水井，并在水井完工之前用水罐车供水。但于2018年5月完成的一项政府部门委托审查称，博凯矿业“没有对环境进行监测”，而且缺乏监测空气质量或水质的设备。

有一些改善的迹象：博凯矿业表示今年已实施了环境监测项目。但中央政府并没有把博凯矿业支付的费用和税金在当地进行再投资。布齐格斯说，博凯矿业建了一个卫生所，政府花了两年时间才安排了一位医生去工作。在4月接受本刊采访时，他承认博凯矿业本身可以做更多事来改善当地人的生活，并且他个人也希望能做得更好。

从理论上讲，如果几内亚不再出口铝土矿资源而是转而自己加工，是可以实现工业化的。博凯矿业确实有计划在2022年之前建造几内亚首座铝土矿精炼厂。但无论如何，博凯当地居民的命运都会受制于对这种珍贵原材料的追寻。“我们没法一走了之。我们无处可去。”卡利萨望着眼前的红土地说。 ■



Ageing in Japan

Demographic warrior

Shinzo Abe outlines his plans to boost the workforce and trim spending on the elderly. But will they be enough?

“THE DECLINE of the birth rate and the ageing of Japanese society is accelerating at unprecedeted speed,” warns Shinzo Abe, Japan’s prime minister. Given the scale of the problem, he told *The Economist* last month, the government must push for “impactful policies” to tackle it right away. He mentions a series of reforms, intended to boost the workforce and reduce the cost of supporting the elderly. The Diet is currently debating a government proposal to admit 345,000 foreign workers over five years, for instance.

That sounds dramatic, but the demographic decline is even bigger. There are 400,000 more deaths than births each year. Life expectancy is 84 years—the highest in the world. Over 28% of the population is older than 65, compared with 21% in Germany, 15% in America and 6% in India. The country has 69,785 centenarians, a seven-fold increase on two decades ago.

The welfare state has become unaffordable. Public debt is 250% of GDP. And Japan is suffering from an acute labour shortage. There are already 1.6 jobs for every job-seeker, and the workforce is predicted to shrink from 67m last year to 58m in 2030.

One obvious solution is immigration. Only 2% of the workforce is foreign-born, compared with 17% in America. But the government has been surreptitiously admitting more foreign workers, mostly in the guise of students and trainees. The plan before the Diet aims to attract blue-collar workers in 14 industries, including construction, shipbuilding and caring for the elderly. They will receive visas of no more than five years, at least

initially, and will not be able to bring their families. All must have some proficiency in Japanese.

Mr Abe plays down the idea that he is doing anything momentous. In debates he is at pains to stress that the new arrivals are not permanent immigrants, but guest workers. Moreover, he portrays foreign workers as a last resort, to fill gaps while the government tries to get more Japanese to work. During his six-year tenure, 2m more women have joined the workforce, lifting the female participation rate above America's. He has increased the number of nurseries and made big companies document their efforts to promote female workers. From next year nurseries will be free. Over half of women return to work after having a child, compared with 38% in 2010. "We have tried to make a society that enables more women to be active, advanced and empowered," he says.

Mr Abe also wants people to "remain active without retirement throughout their lives". His government is likely to raise the retirement age for civil servants from 60 to 65, and to encourage companies to do the same. As it is, many companies have raised their retirement ages or taken to rehiring retired workers, often on a part-time basis. Fully 23% of over-65s work; they constitute a much bigger share of the workforce than in other rich countries (see chart). Mr Abe plans to bolster this trend by increasing the public pension for those who agree to start drawing it later than they are currently entitled to. In the long run, the prime minister hopes, robots and artificial intelligence will help ease the labour shortage. "I do think that we will need fewer jobs because of higher productivity."

Getting older people to work for longer is especially beneficial to the government's finances, since it leads both to higher tax revenue and lower spending on pensions. Mr Abe's tweaks are the latest in a series of changes intended to make the pension system more affordable. But the government

is always playing catch-up, as the ageing of the population and shrinking of the workforce accelerate. It reckons social-welfare costs will rise by more than half by 2040, from ¥121trn (\$1.06trn) to ¥190trn.

Mr Abe appears to be planning sweeping changes to put the welfare state on a firmer footing. “There will be an overall social-security reform, including health and medicine, pension and others,” he says. “We are trying to create a society and community where people can remain healthy and active...and find meaning in staying alive and living long.”

Yet in practice Mr Abe is being cautious. Even after the retirement age increases, it will still be lower than in many other rich countries. Moreover, the current system discourages those over 65 from working more than part-time since their pension is reduced if their income from it and their salary exceeds 460,000 yen (\$4,039) a month. It is not clear whether this will change. The government has modified but not eliminated a tax quirk that discourages married women from earning more than a relatively lowly amount. By the same token, the share of medical expenses that patients must pay under the public health-care system falls as they get older, imposing a big burden on the state. There are various ways the government could reduce its health-care bill, including increasing premiums for the public insurance scheme, raising patients’ co-payments for treatments and excluding some expensive procedures from the scheme.

Yet Mr Abe only hints at the need for any of this. “We are not thinking about immediately raising the co-payment for medical and health services,” he says. “But there must be a careful review of the balance between the contribution and benefit.” Those who take action to prevent illness, such as regular exercise, could be rewarded. “We would like to think about the incentives—what should be done to the contributions that have to be paid by the people who adopt habits to prevent diseases,” he says.

This caution is excessive. Pushing back the retirement age is not as controversial in Japan as elsewhere. A government poll conducted in 2017 found that 42% of people aged 60 or more who work want to continue to do so. Although some politicians fret about foreigners bringing crime and disturbing social harmony, the majority of the population approves of Mr Abe's plans to admit more foreign workers.

Mr Abe wants Japan to be a model for other ageing societies. He has done more than his predecessors to prepare for a smaller, older population. The danger is that Japan will become an example of a country that has done too little, too late. ■



日本老龄化

人口斗士

安倍晋三勾勒了增加劳动力和削减养老支出的计划。足够了吗？

“日本社会的出生率下降和老龄化正以前所未有的速度加剧。”日本首相安倍晋三警告道。上月他告诉本刊，鉴于问题的严重性，政府必须推动“有力的政策”来立即着手处理这个问题。他提到了一系列改革，旨在增加劳动人口和降低养老成本。例如，日本国会正在讨论一项政府提案，计划在五年内接纳34.5万名外国劳工。

这听起来真是大动作，但人口衰退的幅度更大。每年死亡人数比出生人数多40万。人口预期寿命为84岁——世界最高。65岁以上人口的占比超过28%，相比之下，德国为21%，美国为15%，印度为6%。日本有69,785名百岁老人，比20年前增加了七倍。

这个福利国家已无力承担。公共债务占GDP的250%。而日本正面临严重的劳动力短缺。求职者人数与工作岗位数量之比已是1: 1.6，预计劳动力还将从去年的6700万人减少到2030年的5800万人。

一个明摆着的解决方案是移民。日本只有2%的劳动力是在国外出生的，而美国有17%。但政府其实一直在偷偷地接收更多外国劳工，主要是打着留学生和研修生的幌子。提交国会的计划意在吸引建筑、造船和老年看护等14个行业的蓝领工人。他们将获得不超过五年的签证（至少一开始是如此），不能携家人同行，且必须都掌握一定程度的日语。

安倍努力不让人们认为他正在做出任何重大举措。在国会讨论中，他竭力强调新来的劳动力并非永久移民，而只是外来劳工。此外，他将引入外籍劳工描述成不得已而为之的手段，只是为了在政府努力增加日本本国就业人口期间填补缺口。在他六年的任期内，200多万名女性加入了劳动力大军，让日本的女性劳动参与率超过了美国。他增加了托儿所的数量，并让大公司提交文件以证明它们努力增加和晋升女员工。从明年开始托儿所将

免费。如今日本女性在生育之后有超过半数会重返工作岗位，2010年这一比例为38%。安倍说：“我们要努力建立一个让更多女性能积极参与、发展自我和获得力量的社会。”

安倍还希望人们“终身不退休”。他的政府很可能会将公务员退休年龄从60岁提高到65岁，并鼓励企业效仿。实际上，许多公司已经提高了员工的退休年龄，或开始返聘退休员工，通常是以兼职的形式。65岁以上的日本人中多达23%还在工作；与其他富裕国家相比，他们占劳动人口的比重要大得多（见图表）。为加强这一趋势，安倍想给那些同意推迟领取养老金的人支付比按时领取更高的金额。而更长远来说，安倍希望机器人和人工智能会帮助缓解劳动力短缺的问题。“我确实认为，由于生产率提高，我们需要的工作岗位会减少。”

让老年人延长工作年限对政府财政尤为有利，因为这既可以增加税收，又能降低养老金支出。安倍的这次调整是一系列旨在为养老金系统减压的变革措施中最新的一轮。但由于人口老龄化和劳动力萎缩在加速，他的政府总是疲于应付。据估计，到2040年日本的社会福利成本将增加一半以上，从121万亿日元（1.06万亿美元）升至190万亿日元。

安倍似乎正在规划全面改革以让福利国家的根基更为稳固。“未来将开展包括健康医疗、养老金等在内的全面社会保障改革，”安倍说，“我们正在努力创造让人们可以保持健康和活跃的社会和社区……让他们找到活着和长寿的意义。”

然而在实践中，安倍行事谨慎。即使退休年龄延后了，也仍将低于其他许多富裕国家。此外，目前的制度并不鼓励65岁以上的人全职工作，因为如果他们的养老金和返聘工资总计超过46万日元（4039美元），养老金就会减少。目前尚不清楚这项政策会不会变。政府已经修改了一项古怪的税收规定，但并未完全撤销，该政策不鼓励已婚妇女的收入超过一个相对较低的水平。同样，公共医疗系统中患者的自付部分随着年龄的增长而下降，这给国家带来了沉重的负担。政府可以有多种方式来减少医疗支出，包括

增加公共医疗保险计划的保费、提高患者的自付额，以及从保险计划中去除一些昂贵的手术。

而安倍仅仅是暗示需要做出这些调整。“我们并未考虑立即提高医疗服务的自付额度，”他说，“但我们必须仔细考量缴费与福利的平衡。”那些采取经常锻炼等方式来积极预防疾病的人可能会受到奖励。安倍说：“我们想考虑一下可以采取哪些激励措施——对于那些养成良好习惯来预防疾病的人们，该如何调整他们需要缴纳的费用。”

这就太过谨慎了。在日本，推迟退休并不像在其他国家那样具有争议性。2017年的一项政府民意调查发现，仍在工作的60岁或以上的老人中，有42%的人希望继续工作。虽然一些政客担心外籍劳工会带来犯罪和扰乱社会和谐的问题，但大多数人都认可安倍接纳更多外籍劳工的计划。

安倍希望日本成为其他老龄化社会的典范。面对人口的减少和老化，他做的工作比他的前任们更多。但危险在于，日本可能成为一个措施不力、行动迟缓的反面典型。 ■



Conservation and deep-ocean mining

The seas are lovely, dark and deep

Soon, human machinery will open Davy Jones's locker and begin extracting the mineral riches therein. What will that mean for existing denizens of the abyss?

DIVA AMON, a researcher at the Natural History Museum in London, spotted her first whale skull in 2013, during an expedition to the Clarion Clipperton Zone (CCZ) in the tropical Pacific. It sat on beige silt, some 4,000 metres beneath the sea's surface, and was entirely covered in a black coating. Her find was twice notable. First, the skull's coating meant it was millions of years old, for it was made of the same slowly accumulating metallic oxides as the potato-like ore nodules that are drawing miners to the area. Second, the discovery highlighted how little is known about the deep ocean. Dr Amon's whale skull, and others like it, raise questions about the trade-offs between the economic gains of mining the seabed and that mining's environmental consequences.

Those involved in deep-sea mining hope it will turn into a multi-billion dollar industry. Seabed nodules are dominated by compounds of iron (which is commonplace) and manganese (which is rarer, but not in short supply from mines on dry land). However, the nodules also contain copper, nickel and cobalt, and sometimes other metals such as molybdenum and vanadium. These are in sufficient demand that visiting the bottom of the ocean to acquire them looks a worthwhile enterprise. Moreover, these metals seldom co-occur in terrestrial mines. So, as Kris Van Nijen, who runs deep-sea mining operations at Global Sea Mineral Resources (GSR), a company interested in exploiting the nodules, observes: "For the same amount of effort, you get the same metals as two or three mines on land."

Though their location several kilometres beneath the ocean surface makes

the nodules hard to get at in one sense, in another they are easily accessible, because they sit invitingly on the seabed, almost begging to be collected. Most are found on parts of the ocean floor like the CCZ, outside the 200-nautical-mile exclusive economic zones of littoral countries. They thus fall under the purview of the International Seabed Authority (ISA), which has issued 17 exploration licences for such resources. All but one of these licences pertain to the CCZ, an area of about 6m square kilometres east-south-east of Hawaii.

The licensees include Belgium, Britain, China, France, Germany, India, Japan, Russia, Singapore and South Korea, as well as several small Pacific island states. America, which is not party to the United Nations Convention on the Law of the Sea that established the ISA, is not involved directly, but at least one American firm, Lockheed Martin, has an interest in the matter through a British subsidiary, UK Seabed Resources. And people are getting busy. Surveying expeditions have already visited the concessions. On land, the required mining machines are being built and tested. What worries biologists is that if all this busyness does lead to mining, it will wreck habitats before they can be properly catalogued, let alone understood.

The first task, therefore, is to establish what exactly lives down there. At first glance, the CCZ's abyssal plain does not look of much interest. It is a vast expanse of mud, albeit littered with nodules. But, though life here may not be abundant, it is diverse. Craig Smith, an oceanographer at the University of Hawaii, Manoa, who studies the ocean's abyssal plain, says that the CCZ contains a greater variety of species than the deep seas off the coasts of California and Hawaii.

Some of the CCZ's creatures stretch the imagination. There is the bizarre, gelatinous, yellow "gummy squirrel" (pictured), a 50cm-long sea cucumber with a tall, wide tail that may operate like a sail. There are galloping sea

urchins that can scurry across the sea floor on long spines, at speeds of several centimetres a second. There are giant red shrimps, measuring up to 40cm long. And there are “Dumbo” octopuses, which have earlike fins above their eyes, giving them an eerie resemblance to a well-known cartoon elephant.

Every expedition brings up species that are new to science, many of them belonging to biological families that are also novel. At a conference in Monterey, California, in September, Dr Smith presented results of a biodiversity survey carried out in the British concession, which sits at the eastern end of the CCZ. Of 154 species of bristle worms the surveyors found, 70% were previously unknown. Dr Smith says the concession may be part of a biodiversity hotspot, one which would not be represented in the nine protected areas of environmental interest that have been set aside in the CCZ. He therefore argues for the establishment of a tenth such area, on the margins of the concession.

The ocean’s largest inhabitants may also be visitors to the CCZ. This summer Leigh Marsh of Britain’s National Oceanography Centre, in Southampton, described more than 3,000 large depressions in the mud there. These formed a series of curved tracks. Similar tracks elsewhere have been linked to whales scraping themselves against the seafloor. Dr Marsh and her colleagues suggest that deep-diving whales may be foraging on the CCZ seafloor, using it as a giant loofah to scrape parasites from their skins or even ingesting the nodules as ballast. If true, this would significantly extend the depth to which whales are known to dive.

The only direct evidence of whales in the CCZ, though, comes in fossil form. In Monterey, Dr Amon set the audience buzzing when she presented preliminary data suggesting that the region contains large deposits of fossil whale bones. Such fossils were first noted by the *Challenger* expedition, a world-spanning investigation of the deep ocean conducted in the 1870s by

a British naval research vessel. Dr Amon's find back in 2013 prompted her and her colleagues to go through tens of thousands of images gathered by various exploration submarines. These recorded 548 cetacean fossils from a range of species. Among the oldest was *Choneziphius*, an extinct animal that lived more than 10m years ago.

Although this work was a study of photographs, rather than of the remains directly, which could cast doubt over some of the identifications, the metallic-oxide coating of many of the bones gives a sense of how old they are. Because of the density of fossils, Dr Amon says the CCZ may be a previously undiscovered, and rare, submarine fossil bed.

Why whale fossils would accumulate in this particular spot is unknown. Possibly, those elsewhere are simply buried. The CCZ sits beneath the ocean's clearest waters, so its sediments accumulate extremely slowly. But it may be that some as-yet-unknown physical process is keeping the fossils and the (equally old) nodules at the surface of the silt. Indeed, why the nodules are exposed is one of the great mysteries of the region. Regardless, Dr Smith, Dr Amon and others hope the bones' presence will be taken into account as the ISA drafts the rules and regulations for exploitation of the CCZ.

Whale fossils, sea cucumbers and shrimps are just the stuff that is visible to the naked eye. Adrian Glover, one of Dr Amon's colleagues at the Natural History Museum, and his collaborators spent weeks peering down microscopes, inspecting every nook and cranny of the surfaces of some of the nodules themselves. They discovered a miniature ecosystem composed of things that look, at first sight, like flecks of colour—but are, in fact, tiny corals, sponges, fan-like worms and bryozoans, all just millimetres tall. In total, the team logged 77 species of such creatures, probably an underestimate.

Inevitably, much of this life will be damaged by nodule mining. The impacts are likely to be long-lasting. Deep-sea mining technology is still in development, but the general idea is that submersible craft equipped with giant vacuum cleaners will suck nodules from the seafloor. Those nodules will be carried up several kilometres of pipes back to the operations' mother ships, to be washed and sent on their way.

The size and power of the submersibles means that they will leave large tracks in their wake. These are likely to persist for a long time. Evidence for this comes from various decades-old disturbance experiments. In 2015 an exploratory expedition by IFREMER, a French government agency responsible for oceanography, noted that even mobile animals like sea urchins were 70% less abundant within 37-year-old experimental tracks than outside them.

The largest disturbance experiment so far was carried out in 1989 in the Peru Basin, a nodule field to the south of the Galapagos Islands. An eight-metre-wide metal frame fitted with ploughs and harrows was dragged back and forth repeatedly across the seabed, scouring it and wafting a plume of sediment into the water. In 2015 a research vessel returned to the site. Down went the robots, samplers and submarines with their scanners and cameras. The big question was, 26 years after the event, would the sea floor have recovered? The answer was a resounding "no". The robots brought back images of plough tracks that looked fresh, and of wildlife that had not recovered from the decades-old intrusion.

Another concern, in the wake of the Peru Basin experiment, is sediment. This will be both stirred up during collection, as the robots crawl across the sea floor and hoover it, and washed off the nodules at the surface when they are cleaned. Ideally, a second pipe would deliver those washings directly back to the seabed, in order to keep disruption in the water column to a minimum. In practice, dumping silt overboard will be much easier. Decades

of failure to police overfishing demonstrate how hard it is to regulate activity on the high seas.

If silt were dumped in this way it could be disastrous. A steady stream of the stuff raining down from the surface would affect everything along the way, especially filter-feeding animals such as sponges and krill, which make their livings by extracting small particles of food floating in the water. The effect both in the water column and on the sea floor might not be so great in other parts of the oceans, say biologists, but life in the crystalline CCZ is wholly unadapted to murky waters.

All of this needs to be balanced against the impacts of mining the equivalent amounts of minerals on land, however. The CCZ covers about 2% of the deep ocean. A 20-year operation within it would affect of the order of 10,000 square kilometres—about a six-hundredth of its area—according to Mr Van Nijen. And, unlike mining developments in virgin areas of dry land, which tend to bring other forms of development in their wake by creating transport links that encourage human settlement, no one is going to follow the nodule-hoovers and actually live on the abyssal plain.

In the end, the only way to measure how mining would change the bottom of the ocean may be to conduct small-scale pilot operations. The first will take place next April, when GSR will lower *Patania II*, an enormous green tractor, to the bed of the CCZ. *Patania II* is a prototype nodule collector. It will clear areas roughly 300 by 100 metres, leaving them nodule-free, so that future expeditions can return and study recolonisation rates. An array of sensors suspended in the nearby water will monitor the resultant silt plume, which the company's models suggest could travel up to 5km—not the hundreds of kilometres that some have suggested.

To scrutinise this trial independently, JPI Oceans, an intergovernmental research body, has paid for the *Sonne*, a German research vessel, to sail

alongside GSR's. As Mr Van Nijen puts it, "We need to validate our equipment, but from an environmental perspective, the world's first mining test at depth is a unique opportunity for scientists to study the impacts. If we don't do this in a transparent manner, it will go nowhere." That sounds like a promising start. But however careful the miners are, life for the inhabitants of the CCZ is about to get a lot less peaceful than it has been for millions of years. ■



环境保护和深海采矿

幽深迷人的海

很快，人类的机器将撬开海神的宝库，拿走里面的矿藏。这对海底原住民们意味着什么？

二〇一三年，伦敦自然历史博物馆研究员迪娃·阿蒙（Diva Amon）在考察位于热带太平洋的克拉里昂-克利珀顿区（CCZ）时收获了她的第一块鲸鱼头骨。它躺在海面下约4000米一处浅褐色的淤泥上，完全包覆在一层黑色之下。这一发现有两个值得注意的地方。首先，头骨的覆层意味着它已有数百万年的历史。这是因为，和那些吸引采矿者来到该区域的形同马铃薯的矿物结核一样，这层覆盖物也是由金属氧化物缓慢积聚而成。其次，这项发现凸显了人们对深海的了解极其有限。阿蒙这一块以及其他类似的鲸鱼头骨引发了对如何权衡海底采矿的经济效益和环境影响的追问。

那些参与深海采矿的人们期冀它变成一个价值数万亿美元的产业。海底结核主要是铁的化合物（常见）和锰的化合物（罕见，但来自陆地矿井的供给充足），但也含有铜、镍和钴，有时还含有钼和钒等其他金属。对这些金属的需求足够大，所以到海底去探寻它们看起来是值得的。而且这些金属很少在陆地矿井中共存。因此，在有意开采这类海底结核的全球海洋矿产资源公司（以下简称GSR），负责深海采矿项目的克里斯·范尼琼（Kris Van Nijen）说：“花费同样的力气，你得到的金属种类和陆地上两三个矿井一样多。”

从一个角度来看，位于海面以下几千米使得这些结核难以获取，但从另一个层面来说却又是容易的，因为它们一动不动地躺在海床上，几乎是等着被人采集。大部分结核位于像CCZ这类在沿海国家200海里专属经济区以外的海底区域，它们因而属于国际海底管理局（以下简称ISA）的职责范围。该局已为这类资源颁发了17份勘探许可。其中除了一份许可外，其余都在CCZ这个位于夏威夷东南偏东约600万平方公里的区域。

获得许可的国家包括比利时、英国、中国、法国、德国、印度、日本、俄罗斯、新加坡和韩国，以及几个太平洋小岛国。美国不是创立了ISA的“联合国海洋法公约”的签署国，所以没有直接参与其中，但至少有一家美国公司洛克希德·马丁通过其英国子公司英国海底资源公司（UK Seabed Resources）而有利益牵涉。人们已经开始行动起来。勘测队伍已到访了各自的特许区域。所需的采矿器械正在陆地上建造和开展测试。生物学家担心，如果所有这番忙碌最后真的都走到了采矿这一步，那么这些海底生物的栖息地还没来得及被妥善编目记载就会被毁掉，更别说要了解它们了。

因此，第一步是要确定到底什么东西在那里生活。乍一看，CCZ的深海平原并不是很有趣。这是一片广阔的泥土，虽然上面散布着结核。但是，虽然这里的生物数量可能不大，却很多样化。夏威夷大学马诺阿校区的海洋学家克雷格·史密斯（Craig Smith）专门研究深海平原，他说CCZ里的物种要多于加利福尼亚和夏威夷沿海的深海区域。

CCZ里的一些生物超出人们的想象。有一种奇异的、凝胶状的黄色“软糖松鼠”（如图）。这是一条50厘米长的海参，它高而粗的尾巴可能有类似船帆的作用。有一种“高速”海胆，用它的长刺在海床上游移，速度达每秒几厘米。有长达40厘米的大红虾。还有“小飞象”章鱼，它们的眼睛上方有耳状鳍，所以和那头著名的卡通象有一种奇异的相似。

每次考察都会带来让科学家耳目一新的物种，其中有许多属于同样全新的生物科属。在9月于加州蒙特雷举行的一次会议上，史密斯博士介绍了在位于CCZ东端的英国特许勘探区开展的一项生物多样性调查的结果。在勘测人员发现的154种鬃毛虫中，有七成从前不为人知。史密斯说，这个特许勘探区可能属于一个生物多样性热点区域，而CCZ预留的九个环境保护区并不能代表它。他因而主张在该特许区域的边缘地带建立第十个保护区。

体型最大的海洋居民可能也是CCZ的访客。今年夏天，位于南安普敦的英国国家海洋学中心的利·马尔什（Leigh Marsh）描述了CCZ的泥地中存在

3000多处大洼地。它们组成了一系列弯曲的轨道。在其他地方发现的类似轨道已被认为与鲸鱼在海床上刮蹭“除虱”有关。马尔什博士和她的同事们认为，深潜的鲸鱼可能在CCZ的海底觅食，并把海床当作一条巨大的丝瓜络，从自己的皮肤上刮下寄生虫，甚至还把矿结核吞下，充当“压舱物”。如果真是这样，已知鲸鱼潜水的深度将显著增加。

不过，CCZ中有鲸鱼出没的唯一直接证据是其化石。在蒙特雷的会议上，阿蒙博士展示的初步数据显示该区域有大量鲸骨化石，引来了听众议论纷纷。人类首次发现这类化石是在19世纪70年代，当时一艘英国海军科研船展开了名为“挑战者探险”的全球深海调查。阿蒙在2013年的那项发现促使她和同事浏览了各种探险潜艇收集的几万张图像，它们记录了548批鲸类化石，分属若干物种。其中最古老之一是夏恩喙鲸（*Choneziphius*），这种已经灭绝的动物曾生活在1000多万年前。

这项研究只查阅了照片，而非直接观察遗骸，因而某些鉴定结果可能存在疑。不过，许多骨头上的金属氧化物覆盖层透露了它们的年龄。阿蒙指出，鉴于这些化石的密集度，CCZ可能是一个以前未被发现的罕见的海底化石层。

鲸鱼化石为何会在这个特定的地点积聚尚未可知。也有可能其他地方的鲸鱼化石只是被埋在泥地里了。CCZ位于海洋中最清澈的海域之下，因此海水中的沉积物积累的速度极慢。但或许是一些未知的物理过程使得化石和（同样古老的）结核保持在了淤泥的表面。事实上，结核为何暴露在外的確是该区域的重大谜团之一。无论如何，史密斯和阿蒙等人希望，ISA在起草有关开发CCZ的规范时能把这些骨化石的存在考虑进去。

鲸鱼化石、海参和虾都还只是肉眼可见的东西。阿蒙在伦敦自然历史博物馆的同事阿德里安·格洛韦尔（Adrian Glover）和他的合作者花了几周时间，用显微镜查看一些结核表面的角角落落。他们发现了一个微型生态系统，其组成物乍一看好像是斑块，实际上却是微小的珊瑚、海绵、扇形蠕虫和苔藓虫，全部都只有几毫米高。该团队一共记录了77个物种，可能还是低估的。

开采这些结核无可避免地会破坏这个生态系统的大部分。影响很可能会持续很久。深海采矿技术仍处于开发阶段，但总体思路是配备巨型吸管的潜艇将从海底吸走结核，再用几公里长的管道把结核向上输送到整个采矿作业的母船，再在船上进行清洗并运往目的地。

潜艇的体积和大功率意味着它们将在自己身后留下大型轨迹。这些轨迹可能会存在很长的时间。各种持续几十年之久的干扰实验提供了这方面的证据。2015年，海洋学研究政府机构法国海洋开发研究院（IFREMER）的一次探险考察指出，在37年历史的实验轨迹内，即便是海胆等会动的生物，其数量都比轨迹外区域少了70%。

到目前为止最大的干扰试验是1989年在加拉帕戈斯群岛以南富含结核的秘鲁盆地进行的。一个装配了犁和耙的八米宽金属框在海床上反复地来回拖动，“刷地”的同时在水中扬起一条泥沙流。2015年，一艘科研船回到这里。机器人、采样器和潜艇带着扫描仪和摄像头下水。一大疑问是，那次侵扰的26年后，海底恢复了吗？答案是一个响亮的“不”。从机器人带回的图像看，犁地后的轨道仿佛刚刚形成，野生生物在被入侵几十年后仍没有恢复过来。

秘鲁盆地实验引发的另一个担忧关乎淤泥。这不仅仅是因为机器人在海床上移动吸矿时搅动了淤泥。在船上清洗结核时，结核表面的泥沙被冲刷掉。理想情况下，这些冲洗下来的淤泥会经由第二根管道被直接送返海床原址，以把对这段垂直海水区域的生态破坏降至最低。但在实践中，把淤泥直接抛进海里要轻松得多。而从几十年来管制过度捕捞失败可见，要规范人们在公海上的行为非常困难。

如果淤泥以这种方式倾倒，就可能带来灾难性后果。从海面源源不断冲下来的淤泥流会影响它沿途的一切，特别是海绵和磷虾这类滤食性动物，它们靠觅食漂浮在水中的小颗粒食物维生。生物学家说，在其他海域，这对垂直海水层以及海床的影响可能不会太大，但生活在清澈的CCZ中的生物完全不适应浑浊的水体。

然而，所有这些影响都需要与在陆地上开采等量矿物的影响做比较。CCZ 约占深海面积的2%。据范尼琼说，在CCZ内部开展一项20年期采矿将影响约一万平方公里的面积，约为其总面积的六百分之一。而且，陆地上的处女地采矿项目往往会创建交通运输路径，吸引人类在沿途居住，从而带来其他形式的发展。与之不同的是，没有人会一路跟在开采结核的机器人的后头，真的住到深海平原上。

到最后，衡量采矿将如何改变海底世界的唯一方法可能是开展小规模试点作业。首个这类试点将在明年4月启动，届时GSR公司将把一台巨大的绿色拖拉机“帕塔尼亚二号”（Patania II）降落到CCZ的海床上。这是一台采集结核的原型机，它将把一个大约300乘100米大小的区域里的结核一扫而空，这样日后考察队就可以返回这里调查生物重新聚居的情况。悬浮在附近水域的一系列传感器将监测过程中产生的淤泥流。该公司的模型显示淤泥流可能长达五公里，而不是一些人指出的几百公里。

为让这项试点作业得到独立监督，政府间研究机构JPI Oceans已经雇用了德国太阳号（Sonne）深海研究船与GSR的船结伴而行。范尼琼说，“我们需要验证我们设备的效果。但从环境的角度来看，全球首个深海采矿测试是科学家们研究其影响的独一无二的机会。如果我们不是公开透明地做这件事，它将无法实现这个作用。”这听起来是一个光明的开端。但是，无论采矿的人们多么谨慎行事，CCZ居民们延续了几百万年的平静生活即将被打破。 ■



Tourism

Wish you weren't here

The number of holidaymakers is booming. Too many are visiting the same places

Ever since the fall of the Venetian Republic in 1797, locals have complained that Venice, its former capital, is being overrun by visitors. Having spent decades trying to attract tourists, the city council is now rethinking its approach. In May it erected pedestrian gates across the historic neighbourhood's main entrances. When crowds get too thick, the police will close them, limiting access to locals who possess a special pass. Although this will restrict the number of visitors, the idea of ticketed entry has upset some locals. "It's the last step to becoming Disneyland," sighs one of the city's urban planners.

It is not only Venetians who think there are too many tourists. In Amsterdam locals are fed up with stag parties, unused to mixing alcohol and cannabis, leaving a trail of litter and vomit. In July protesters attacked tourist buses in Valencia, Palma de Mallorca and Barcelona (where one piece of graffiti read: "tourists go home, refugees welcome"). The newest word to enter the travel industry's lexicon is "overtourism", which was coined to describe the consequences of having too many visitors.

Governments are starting to react. In March President Rodrigo Duterte of the Philippines banned tourists from the popular island of Boracay for six months, because too many visitors and too few sewers had made it a "cesspool". On October 10th the Thai government restricted overnight stays on the Similan islands. And cities throughout Europe are beginning to investigate ways to crack down on overcrowding, home-sharing websites and anti-social behaviour.

This backlash might seem odd. The World Travel and Tourism Council, a trade body, says that tourism directly accounts for nearly 3% of the world's GDP. The industry employs 5% of the world's workforce. McKinsey, a consultancy, reckons that one in five new jobs are generated by tourism.

Policymakers also like its economic effects on poorer countries. Whereas oil drilling and mining employ relatively few people, tourism employs legions. And it can help the rest of the economy to develop, since policies designed to attract tourists, such as easy visas and good policing, also lure foreign investors.

The growing backlash against tourism has coincided with extraordinary growth in visitor numbers. According to the World Tourism Organisation, an agency of the United Nations, the number of international visitors making overnight stays grew to 1.3bn in 2017. That is twice the number in 2000, and more than four times the level in 1980. Even so, the rise in numbers is not the real problem, says Alex Dichter of McKinsey. "People in 99% of countries in the world are crying out for more, not fewer, tourists," he explains. The problem is that these extra tourists are converging on the same places.

This has surprised many in the travel industry. The spread of the internet was meant to disperse tourists by making less well-known places easier to find. Why has the opposite happened? Analysts at Skift, a travel website, attribute it to the rise of "bucket lists". Popularised by a film of the same name in 2007, which featured a "list of things to do before I kick the bucket", these internet lists direct tourists to the same "must see" places. The desire for the perfect Instagram snap has a similar result.

Mr Dichter also points to several other reasons for the shift. When flag carriers ran air travel as a cartel, flights cost a fortune—over £200 (\$230) for the 300-mile jaunt between London and Dublin in the mid-1980s, for

instance. But low-cost carriers like Ryanair (whose average fare was €40, or \$46, last year) have transformed the industry. The rise of services like Airbnb, that allow locals to rent their homes to visitors, means that a place's capacity for overnight stays is no longer limited by the number of hotel rooms.

Partly as a result, the share of tourists who are making their first trips has soared. Newbies often want to visit famous landmarks. In Amsterdam almost all first-time visitors head for the Van Gogh museum and Anne Frank's house, says Geerte Udo of its tourist authority. Meanwhile tourists from China and India often dislike tanning and therefore skip beach destinations, adding to the crowds in a handful of popular cities.

Such overcrowding brings costs, which are borne by local residents. City dwellers find that pavements, roads and cycle lanes are clogged. In party towns, like Amsterdam and Prague, residents must put up with late-night hooliganism. Island resorts suffer from litter-strewn beaches and polluted water.

If tourist dollars push up the cost of living, locals may be priced out. Analysts at Islandsbanki, a bank, estimate that 1,225 properties in Reykjavik, Iceland's capital, were listed on Airbnb in the peak season of 2017—more than the number of new homes that were built that year. The local population in Venice has roughly halved over the past 30 years. So, over the past two decades, has that of Dubrovnik in Croatia, an old walled city best known as King's Landing in "Game of Thrones". Academics now worry that services for ordinary residents, such as cheap cafés and doctors' surgeries, will collapse if populations continue to fall.

Local authorities are cobbling together strategies to cope. An extreme reaction is to ban tourists entirely (as Mr Duterte did in Boracay) or to cap visitor numbers (as Easter Island has done). Many ports, including Venice,

limit the number of cruise ships, and there are calls for cities to limit parking spaces for tourist coaches. Both ships and coaches bring tight-fisted visitors. A study in the British city of Cambridge found that the average coach day-tripper spends just £3.

A more subtle approach is to fiddle with taxes and charges, so that they better reflect the costs tourists impose. Tourists staying in hotels in central Amsterdam pay a higher tax rate than those staying farther away. In Edinburgh councillors are reportedly considering a tourist tax, revenues from which would be spent on rubbish collection or improving infrastructure.

Thordis Gylfadottir, Iceland's tourist minister, says another part of the answer is to spread visits out. In 2010 half of the country's tourists arrived during the summer. Thanks to marketing campaigns and better infrastructure for travel during winter months, now only a third do. Ms Gylfadottir hopes that new direct flights from Britain to northern Iceland will provide additional relief to Reykjavik and allow undiscovered sites to scoop up welcome tourist revenues.

Many cities are also tackling bad behaviour. Paola Mar, Venice's tourism chief, thinks a change in the type of tourists has led to more problems. In the 1970s and 1980s most were from western Europe, America or Japan. They came to eat in traditional restaurants and visit art museums. Today tourists are often day-trippers from Italy's resorts, or are on their first trip abroad from Asia. They crowd the pavements with packed lunches rather than spend money in shops and restaurants. Locals call them "munch and flee" visitors.

The maturing taste of Chinese tourists may reassure Venetian locals. A recent survey by McKinsey finds that they increasingly dislike coach tours, group visits and seeing the main landmarks. First-time tourists travel in

tour groups, but more experienced ones prefer independent travel. Nearly three-quarters of the Chinese tourists polled by Oliver Wyman, another consultancy, said they had mostly planned their trips by themselves in 2016, up from 49% the year before.

Venice is currently designing a plan to encourage tourists to stay longer by nudging them to visit more than just the main sights. Another option would be to improve its infrastructure. A study by the University of Venice in 1988 found the city could hold at most 20,750 visitors a day. That is around a quarter of traffic today. The increased demand has not been met by building better public transport.

Traditionalists may object to any new infrastructure in beautiful old cities. But Venice has already built a motorway and a railway station over the past two centuries. More links could benefit residents and tourists alike. One Chinese tourist jostling to see the Rialto Bridge told your correspondent he thought this was a good idea. “I might be able to see more of the history that way,” he explained. ■



旅游业

多希望你不在

度假客激增，而太多人扎堆在同一处

自1797年威尼斯共和国灭亡起，其前首都威尼斯的居民就抱怨这座城市游客过多。几十年来，该市议会一直在努力吸引游客，不过现在正在反思自己的立场。5月，它在这座古城的主要出入口设置了闸门。当游人变得太过拥挤时，警察便会关闭闸门，只有持有特殊通行证的当地人才能进出。尽管此举会限制游客的数量，但这种凭票入内的做法还是引发了一部分当地人的不满。“走到这一步，就离变成迪士尼乐园不远了。”一名城市规划者叹道。

觉得游客太多的不止威尼斯人。在阿姆斯特丹，参加男士派对的人们不习惯混用酒精和大麻，结果留下一路的垃圾和呕吐物，当地人对此已忍无可忍。7月，巴伦西亚、马略卡岛的帕尔马、巴塞罗那的抗议者攻击了游客乘坐的大巴（在巴塞罗那，一处涂鸦写着：“游客回家，欢迎难民”）。进入旅游业辞典的一个最新名词是“过度旅游”（overtourism），表达了游客太多带来的后果。

各地政府已开始行动。3月，菲律宾总统杜特尔特宣布广受欢迎的长滩岛（Boracay）封岛半年，原因是岛上游客太多而排污管道太少，已成“化粪池”。10月10日，泰国政府对在斯米兰群岛过夜作出限制。欧洲各地的城市也开始研究办法来严格管制过度拥挤、民宿网站以及反社会行为。

这种抵制看上去似乎有些奇怪。行业组织世界旅游理事会（World Travel and Tourism Council）表示，全球GDP有近3%是旅游业直接贡献的。全世界劳动力有5%受雇于旅游业。咨询公司麦肯锡估计，新增岗位中有五分之一是旅游业创造的。

政策制定者也乐于看到旅游业为较贫穷国家带来经济效益。石油钻探和采矿雇用的人员相对较少，而旅游业从业者人数众多。而且旅游业还能推动

经济体中其余部门的发展，因为旨在吸引游客的政策——如便捷的签证和良好的治安——也会吸引外国投资者。

抵制游客的呼声变大发生在游客数量高速增长之时。联合国组织机构世界旅游组织（World Tourism Organisation）的数字显示，2017年，在旅游地过夜的国际游客数量增至13亿人，是2000年的两倍，1980年的四倍多。虽如此，真正的问题还不在于数字增长，麦肯锡的艾利克斯·迪西特（Alex Dichter）表示。“全世界99%的国家的人们都迫切想要吸引更多游客，而不是更少。”他解释说。问题在于这些多出来的游客都一窝蜂地去了相同的地方。

这让旅游业的许多从业者惊讶。按理说，随着互联网的普及，人们会更容易找到那些不太出名的地方，也就会分散出行。结果为何正相反？旅游网站Skift的分析人士将原因归结于“遗愿清单”的兴起。2007年上映的同名电影提到了一份“去世前要做的事的清单”，推动了那些“此生必去之地”的清单在网络上风行，进而把游客都导向了相同的地点。想拍出完美照片上传到Instagram上的愿望也有类似的影响。

迪西特还指出了造成这种转变的另几个因素。当航空公司以联合垄断的形式经营航空业务时，人们坐飞机要花好多钱。例如，上世纪80年代中期，伦敦到都柏林300英里的短途飞行要花费超过200英镑（230美元）。但瑞安航空（Ryanair，去年该公司的平均机票价格为40欧元，或46美元）这样的廉价航空公司彻底改变了航空业。像爱彼迎这样让当地人能够向游客提供住宿的服务兴起后，一个地方接纳住宿游客的能力就再也不受酒店房间数量的限制了。

这在一定程度上导致首次出门旅游的游客人数飙升。新手游客通常都想游览著名的标志性景点。在阿姆斯特丹，几乎所有初次旅游的人都直奔梵高美术馆和安妮·弗兰克之家，当地旅游管理部门的吉尔特·乌都（Geerte Udo）说。而中国和印度的游客不愿意日光浴，因此会跳过海滩景点，结果那些为数不多的热门城市便愈加拥挤了。

这样的过度拥挤带来了代价，且由本地居民承担。城市居民发现人行道、马路和自行车道被堵得水泄不通。在阿姆斯特丹和布拉格这样的派对盛地，居民只能忍受玩乐的人胡闹到深夜。海上度假村则面对海滩垃圾遍地和海水被污染的问题。

如果游客的消费推高了生活成本，本地人可能就会因为无力负担而被挤出自己的家园。冰岛银行（Islandsbanki）的分析师估计，2017年旺季时，冰岛首都雷克雅未克有1225处房产登记为爱彼迎房源，比当年新建成住房的数量都多。威尼斯的本地人口在过去30年里大概减少了一半。克罗地亚的杜布罗夫尼克（Dubrovnik）过去20年也经历了同样的变迁。这个有着古老城墙的城市因化身《权力的游戏》中的君临城而闻名。学者们如今担心，如果本地人口持续减少，面向普通居民的服务如实惠的咖啡馆和诊所将无以为继。

各个地方政府正在仓促做出应对。极端的做法是完全将游客拒之门外（像杜特尔特关于长滩岛的决定）或设置游客人数上限（像复活节岛那样）。包括威尼斯在内的许多港口限制了游船的数量，另外还有人呼吁各地城市限制提供给旅游大巴的停车位。乘坐游船和大巴的游客花钱时手很紧。在英国剑桥市开展的一项研究发现，乘坐大巴参加一日游的游客平均仅消费三英镑。

一个更含蓄的做法是在收税和收费上耍些手段，好让它们更好地反映游客带来的成本。住在阿姆斯特丹市中心酒店的游客交的税会比住在较远地段的游客高。据说爱丁堡的议员正在考虑征收一项游客税，由此带来的收入将用于垃圾回收或改善基础设施。

冰岛旅游部长索迪斯·吉尔法多提（Thordis Gylfadottir）说，分散游客是另一个解决途径。2010年，该国一半的游客是在夏季前来。后来由于营销活动的作用，加上为冬季到访改善基础设施，如今夏季游客只占到游客总数的三分之一。吉尔法多提希望，新开的英国到冰岛北部的直飞航线能进一步缓解雷克雅未克的压力，并让那些未被发掘的地方也能大把赚取旅游收入。

许多城市也在想办法对付游客的坏习惯。威尼斯的旅游事务负责人宝拉·玛尔（Paola Mar）认为，游客类型的改变导致了更多问题。上世纪七八十年代，大多数游客都来自西欧、美国或日本。他们去老餐馆吃饭，参观艺术博物馆。如今来威尼斯的往往都是来自意大利度假胜地的一日游游客，或者首次出国旅游的亚洲游客。他们挤在人行道上吃着自备的午餐，并不去商店和餐馆消费。当地人管他们叫“啃完就跑型”游客。

中国游客的品味日渐成熟，这也许能让威尼斯本地人安心些。麦肯锡近期一项研究发现，中国游客越来越不喜欢大巴游和团体游，也不再满足于游览标志性景点。旅游新手会参团，但经验更丰富的游客更喜欢自由行。另一家咨询公司奥纬（Oliver Wyman）面向中国游客开展了一项调查，近四分之三的受访者表示他们在2016年的出游大多是自己规划的，2015年的这一比例为49%。

威尼斯目前正在设计一项计划，引导游客多走走看看，而不仅仅是去主要景点，以此鼓励他们多停留些时间。还有一个选择是改善其基础设施。威尼斯大学在1988年开展的一项研究得出，威尼斯一日最多可接纳20,750名游客。这大致是今天游客流量的四分之一。当地并没有建设出更好的公共交通来满足业已增长的需求。

崇尚传统的人可能会反对在那些美丽的古老城市兴建任何基础设施。但在过去两个世纪里，威尼斯已经建成了一条高速公路和一座火车站。交通线路增加会让居民和游客都受益。一名挤在人群中参观里亚托桥（Rialto Bridge）的中国游客告诉本文作者，他认为这是个好主意，“这样我或许能看到更多的历史了。”■



Bartleby

Crossed lines

Nokia's saga is a tale of management hubris and a weak board

IT IS A tale that might have been written by Shakespeare. It features hubris, nemesis and partial redemption, as well as clashing personalities and losses in the billions of dollars. And it all takes place in the most unlikely of dramatic settings: a Finnish boardroom.

Risto Siilasmaa is the chairman of Nokia, which is today a very different and much smaller company than in 2008 when he joined its board as a non-executive director. His book* recounts the gripping saga of how Nokia was driven out of the mobile-phone business it dominated, and had to reinvent itself.

When Apple launched the iPhone in 2007, Nokia at first seemed to view it as a niche competitor with a high price-tag that would capture only a small slice of the market. After all, Nokia's phones appeared to have all the bells and whistles needed to succeed. Users could download music and listen to the radio; they could use their phones to take photos and videos; they could send and receive email; and even use maps.

Mr Siilasmaa had a front-row seat for the drama that ensued when he first joined the firm, but very little real influence. As he explains, board members have limited access to limited quantities of important company information. With his software background, however, he quickly perceived the firm's big problem. Its devices could rival the iPhone mechanically, but the operating system could not compete. Nokia's Symbian system was cumbersome for users, who had to send confirmations whenever any function was added to the phone.

Nokia also had a wide range of devices with different operating requirements, making it difficult for app developers to customise their offerings. Apple, by contrast, had only one platform and enjoyed the benefit of being able to design a system from scratch.

Increasingly concerned about these problems, Mr Siilasmaa wrote a strategy document suggesting that the company should consider embracing the Android operating system for phones, which was rapidly gaining market share. He sent it straight to Nokia's chairman, Jorma Ollila.

Every good play needs a villain, and this book casts Mr Ollila in that role. Before becoming chairman, he had been Nokia's chief executive from 1992 to 2006, the years of its rise to dominance. He did not seem to appreciate a non-executive director putting his oar in. Mr Siilasmaa writes that "with a sharp-tongued and thin-skinned chairman at the helm, intent on maintaining iron authority, raising questions can be close to mutiny". He tried again, this time sending his memo to the chief executive and other board members, but says his concerns were never addressed in board meetings.

Mr Ollila, now 68, has described Mr Siilasmaa's claims as exaggerated or not true. But Nokia's performance deteriorated sharply during his last years in charge, and nothing he did was able to stop it. The company did team up with Microsoft to launch a Windows-based phone, the Lumia. But by 2012, when Mr Ollila left the board, Nokia's market value had fallen by 92% since Apple's iPhone was launched and the firm was making a loss.

The mutineer was then obliged to move to centre-stage. Mr Siilasmaa came in as the new chairman when the company's fortunes seemed to be at rock-bottom. Instead, the news got worse: the Lumia phone received good reviews but failed to gain market share.

So Mr Siilasmaa acted. In 2013 Nokia sold the phone business to Microsoft and struck out in a different direction. The company bought out the share of Siemens in a joint venture called NSN and acquired Alcatel-Lucent. Now Nokia offers “end-to-end” digital infrastructure, supplying network equipment and software to telecoms operators. It is profitable, but its share price has barely moved in the past five years and future success is dependent on a wave of spending on 5G telecoms networks, which may come slowly.

Nokia was already a classic example of the perils of disruptive innovation for industry leaders. Mr Siilasmaa’s account underlines how little influence board members often have when faced with an entrenched management team. He insists that a board’s role must be to challenge management. Bosses must have an attitude of “paranoid optimism”, always on the lookout for potential threats. Nokia’s story shows why.

* “Transforming Nokia: The Power of Paranoid Optimism to Lead Through Colossal Change” ■



巴托比

越界

诺基亚的傲慢管理层与弱势董事会之间的传奇故事

这则故事完全有可能出自莎士比亚之手。其中有傲慢、报应、尚未完成的救赎，还有人物冲突和数十亿美元的损失。而这一切都发生在一个最意想不到的戏剧场景——芬兰的一间董事会议室里。

里斯托·席拉斯玛（Risto Siilasmaa）是诺基亚的现任董事长。他于2008年作为非执行董事加入公司董事会。与那时相比，今天的诺基亚已截然不同，规模也小得多。席拉斯玛的著作*讲述了这家公司一段扣人心弦的历史：如何被逐出它曾经称霸全球的手机业务，从而不得不重塑自我。

当苹果在2007年推出iPhone时，诺基亚起初似乎只把它看作是一个小众市场对手，其高售价最多只能分去一小块市场。毕竟，当时诺基亚的手机似乎已经拥有了成功所需的所有花哨功能。用户可以下载音乐、收听广播；可以用手机拍照片和视频；可以收发电子邮件；甚至还可以使用地图。

随之而来的戏剧性变化在席拉斯玛加入公司时上演。他坐在观众席的前排，却没有什么实际影响力。他解释说，董事会成员只能有限地接触到有限的公司重要信息。不过，因为自己的软件背景，他很快意识到了公司存在的大问题。诺基亚的手机从硬件上可与iPhone媲美，但操作系统却完全不是对手。诺基亚的塞班系统用起来十分繁琐，每次手机添加任何新功能都需要发送确认信息。

诺基亚的手机型号五花八门，操作要求也各不相同，这使得应用程序开发人员难以给诺基亚定制产品。而苹果只有一个平台，而且它享受了从头开始设计一个系统的好处。

席拉斯玛越来越担心这些问题，于是写了一份战略文件，建议公司考虑采用安卓手机操作系统，当时该系统的市场份额正在迅速扩大。他把它直接

发送给了诺基亚时任董事长约尔玛·奥利拉（Jorma Ollila）。

每一部好剧都需要一个坏人，这本书就让奥利拉扮演这个角色。在成为董事长之前，奥利拉在1992年至2006年担任诺基亚的CEO，公司正是在这段时期崛起为手机业霸主。奥利拉似乎并不喜欢一个非执行董事来插手公司业务。席拉斯玛写道：“当一位言语尖刻、脸皮又非常薄的董事长在掌舵，意图维持他的铁腕统治时，提出问题可能近似于叛变。”他又试了一次，这次把备忘录发送给了CEO和其他董事，但他说董事会议上从没有讨论过自己担忧的问题。

现年68岁的奥利拉说席拉斯玛的说法有的夸大，有的不实。但诺基亚的业绩在他执掌的最后几年里急剧恶化，而他所做的无一能力挽狂澜。公司后来确实与微软合作推出了一款基于Windows操作系统的手机Lumia。但到2012年奥利拉离开董事会时，诺基亚的市值已比苹果推出iPhone时下跌了92%，而且公司在亏损。

接下来，叛变者不得不来到舞台中央。席拉斯玛出任董事长，此时公司的命运似乎已处于最低谷。没想到，更糟糕的消息传来：Lumia手机获得了良好的风评，却没能赢得市场份额。

于是席拉斯玛行动了。2013年，诺基亚把手机业务卖给了微软，改变了出击方向。它买下了西门子在双方的合资企业诺基亚西门子网络公司（NSN）中的股份，还收购了阿尔卡特朗讯。现在，诺基亚提供“端到端”数字基础设施，为电信运营商提供网络设备和软件。这个业务有利可图，但其股价在过去五年中几乎没有变化，而未来的成功要取决于它在5G电信网络上的连番投资，这一天的到来可能很缓慢。

诺基亚已经成为颠覆性创新将行业领头羊置于死地的经典案例。席拉斯玛的叙述凸显了董事会成员在面对地位牢固的管理团队时常常影响力甚微。他坚持认为，董事会的角色必须是挑战管理层。企业老板们必须抱持“偏执乐观”的态度，始终警惕潜在的威胁。诺基亚的故事给出了理由。

* 《变革诺基亚：用偏执乐观的力量领导巨变》 ■



Chaguan

Respecting their elders

Japan's expertise in old-age care becomes a source of soft power in China

AMID THE stress and sadness of choosing an old-age home for her husband, it took Li Wangke, a retired academic, a while to realise why one facility was so good at reawakening his playful, chatty side. She had visited other homes that had fine food and lavish amenities, reflecting the affluence of the couple's southern Chinese home town, Guangzhou. But one newly opened home stood out for easing—at least somewhat—the symptoms of the disease ravaging his brain. Rather than pampering her 83-year-old husband, its staff assessed his rare neuro-degenerative illness, then with warmth and firmness pushed him to do as much for himself as possible. They cajoled him to talk, exercise and even play ping-pong. He seems a “different person”, says Ms Li.

After several visits she discovered that the home's methods had been imported from Japan, a former wartime foe that older Chinese are commonly thought to detest. Her husband, also a retired academic, moved in full-time in late October. “It's from here that I learned that Japan takes really good care of its elderly,” she says.

The home is a joint venture between a Chinese state-owned investor and Medical Care Service (MCS), Japan's largest operator of dementia-care homes. MCS opened its first Chinese facility in Nantong, a city near Shanghai, in 2014. A third opened in the northern port of Tianjin in October. It has plans for more in Beijing, Xi'an and even in Nanjing, the site of a Japanese wartime massacre, memories of which plague the relationship to this day.

China's needs are vast. Degenerative brain diseases are too often confused with mental illness. Sufferers are shut away in family homes with unskilled helpers, typically migrant women from the countryside. Some families share guilty tales of sending relatives to psychiatric wards, where they are strapped to beds and fed pills. More than 10m Chinese are estimated to have some form of dementia. "That is a big, almost frightening number," says Akira Wate, the general manager of MCS's home in Guangzhou.

By 2030 China is projected to have 23m dementia sufferers—almost the population of Australia. During a visit to China in October by Shinzo Abe, Japan's prime minister, the two governments named old-age care as an area for co-operation. China and Japan are trying to edge closer in these stormy, Trumpian times. One bond involves demographics. With almost one in nine citizens over 65, China is at the point on the ageing curve that Japan hit in 1987. It has a lot to learn from its Asian rival's experience.

Chinese old folk and Japanese care-home operators have discovered revealing things about each other. MCS was full of confidence when it opened its 106-bed home in Nantong. Half a year later, just six beds were filled. For Asian neighbours that revere the old, China and Japan turn out to differ—a lot. Notably, China is an exceptionally low-trust society. But bonds of family duty are stronger than in Japan, say MCS's bosses, noting the frequency of visits and the solicitude of residents' children.

In orderly Japan, entering a home is straightforward, says Mr Wate. An older person shows signs of dementia, facilities are recommended, their child might visit one, admission follows. In China, suspicion is the starting-point, with the domestic news full of stories of fatal fires or bullying at nursing homes. Unprompted, Ms Li relates how her daughter, a banker, warned her against taking private firms' promises at face value.

Chinese customers worry constantly about being ripped off. When it

entered China, MCS set its prices high and built single-bed rooms to Japanese standards, offering the privacy and calm that pensioners in Japan demand. But Chinese clients wanted company and the lively din known as *renao*, relates Grace Meng, MCS's boss in China. They questioned the emphasis on doing things for themselves, grumbling that, "I paid money, so you have to do everything for me," Ms Meng says. Her firm changed its model, building shared rooms, lowering prices and offering day rates to demonstrate its methods. The home in Nantong is now profitable.

Historical distrust of Japan has not been a big problem. MCS neither boasts of nor hides its origins. As well as a Chinese scholar's study and mahjong tables, its home in Guangzhou has a Japanese roof garden with benches, stone lanterns and an artfully trained pine. A few residents refuse to speak to visiting Japanese executives, admits Mr Wate, who is of mixed Chinese and Japanese ancestry. Most are pragmatic, associating Japan with good service.

Family dynamics cause more headaches than nationalism. In Japan, generous government insurance covers most care-home costs, giving old folk much autonomy. In China many in need of care must either sell property or ask children for help. Average monthly fees at MCS's home in Guangzhou are 14,000 yuan (\$2,224)—more than a typical pension. That makes entering a home a collective decision by as many as four or five family members. The elderly also need convincing. Many want to preserve their savings to help the young. Because trying to stay at home is the norm, the average age of MCS's residents in China is 85, about a decade older than at its dementia-related facilities in Japan.

Still, China is quicker to embrace change than outsiders might suppose. Ms Li recalls the traditional line: "Raise children to care for you when you get old." But her children have demanding jobs, and she hates asking them to take too much time off. Nor are hired helpers the solution. When her

husband loses control of his bowels, no hired helper will clean him, she says matter-of-factly. Such helpers are “very impatient”. The Chinese once believed that only bad children send their parents to care homes, she concedes. “We don’t think that way anymore.”

Rather few Chinese will ever be able to afford Japanese-style homes, it is true. That does not make their expertise irrelevant. If China’s old enemy can raise the profile of kindly, attentive dementia care, that alone would be a historic, neighbourly act. ■



茶馆

及人之老

日本在老年照护方面的专业技能助其在中国展现软实力

在为丈夫挑选养老院的过程中，退休高校教师李望珂（Li Wangke，音译）被压力和悲伤笼罩。过了好一会儿她才明白过来，为什么其中一家养老院特别能唤起老伴活泼、爱说笑的一面。她也去看过其他地方，它们伙食好、设施豪华，把两人的家乡广州的富庶展露无遗。但这家新开的养老院却与众不同，因为它缓解了（至少是稍微缓解了）大脑严重受损的丈夫的病情。这里的员工并不为她83岁的丈夫代劳一切，而是先对他罕见的神经退行性疾病做评估，然后温和而坚定地鼓励他尽量自己动手。他们哄着他说话、锻炼，甚至还打乒乓球。李女士说，他看上去像“变了一个人”。

去过几次之后，她发现这家养老院的照护方法是从日本引进的。因为战争年代留下的宿怨，一般认为老一辈中国人都痛恨日本。去年10月底，同为退休高校教师的丈夫全天住进了那里。“在这儿我了解到，日本真是把老年人照顾得很好。”她说。

这家养老院由中国的一家国有投资机构和日本最大的老年痴呆护理院运营商——美邸养老服务公司（MCS）——合办。美邸于2014年在南通开设了它在中国的首个护理院，今年10月在天津开设了第三家。它还计划扩展到北京、西安，甚至南京（南京大屠杀的记忆至今仍深深影响着两国关系）。

中国的需求巨大。脑部退行性疾病常被误认为精神病。患者被关在家里，由基本上来自农村、未经护理培训的外来务工妇女照顾。一些家庭讲述了把亲人送进精神病院、目睹他们被绑在床上和强喂药片的经历，深感内疚。估计有超过1000万中国人患有某种类型的痴呆症。“这是一个大到简直吓人的数字。”在美邸的广州养老院担任总经理的和手明（Akira Wate）说。

预计到2030年中国将有2300万名痴呆症患者——几乎相当于澳大利亚的总人口。10月日本首相安倍晋三访华时，两国政府指出可在养老领域开展合作。在眼下特朗普掀风作浪的时期，中国和日本正尝试拉近彼此的距离。其中一个纽带关乎人口构成。中国65岁以上人口几乎占到九分之一，如今，中国在老龄化曲线上处在日本在1987年达到的位置。中国能从这个亚洲对手的过往学到很多经验。

中国的老人和日本的养老院运营者都对彼此有了新的认识。美邸开在南通的护理院有106张床位，刚开业时它信心满满。半年后，只有六张床位睡了人。虽然两个亚洲邻国都敬老尊老，中国和日本实则差异很大。突出的一点是，中国是个信任度极低的社会。但美邸的老板们在看到子女们探望父母的频率和对父母的关切后认为，在中国，家庭责任的羁绊要比日本更深。

和手明说，在秩序井然的日本，入住一家养老院很简单。老年人显现出痴呆症状后，会有人给老人及其家人推荐养老院，子女们可能会挑一家前往看看，然后院方办理接收。在中国，人们一上来就先怀疑，毕竟国内新闻充斥着养老院失火致死或虐待老人的报道。李女士就主动提到，她在银行担任要职的女儿提醒过她，对于私营企业说的话不能只听表面。

中国消费者无时无刻不在担心被坑。刚进入中国时，美邸按照日本的标准设置了较高的价格和单间，提供日本退休老人要求的隐私和安静。但中国老人却希望有人作伴，喜欢热闹，美邸的中国区老板格蕾丝·孟(Grace Meng)说。她说，他们质疑美邸强调自理，抱怨说，“我花了钱，你得帮我都做好啊。”美邸后来改变了模式，设置了多人间，降低了价格，并推出了日付费来让人们感受其方式。南通的护理院现在已实现盈利。

中国人对日本由来已久的不信任倒没有成为一个大问题。美邸既不夸耀也不隐瞒自己的出身。它在广州的护理院除了中式书房和麻将桌外，还有一个日式的屋顶花园，布置了长凳和石灯，还有一棵造型雅致的松树。有着中日两国血统的和手明承认，一些入住者拒绝与来访的日本高管说话。但大多数人更讲求实用主义，觉得日本代表良好的服务。

由家庭状况引发的难题可比民族主义要多。在日本，慷慨的政府保险覆盖了大部分养老院费用，这给了老年人很大的自主权。在中国，很多有照护需要的人要么需要卖房，要么得向子女张口。美邸的广州护理院平均一个月的费用为1.4万元，高于一般的退休金水平。这样一来，入住养老院就成了需要四五个家庭成员共同做出的决定。此外还得给老年人做思想工作。很多老人都想把攒下的钱留着帮衬小辈。尽量在家养老是常态，因此美邸中国护理院里的老人平均年龄为85岁，比它在日本的痴呆症相关养老院里的老人年长10岁左右。

尽管如此，中国人拥抱变化的速度可能还是快过外界预想。李女士记得一句老话：“养儿防老。”但孩子们工作很忙，她很不愿意要他们为自己抽出空来。雇人照顾也不是个办法。如果丈夫大便失禁，没有保姆会帮他清理，她很直接地说。那些保姆“非常没耐心”。她承认，中国人曾经认为只有不孝顺的子女才会把父母送进养老院。“我们再也不那么想了。”

诚然，能住得起日式养老院的中国人少之又少。但这并不表示日本在这方面的专业技能就不相干了。如果中国的宿敌能让和善、悉心的痴呆症照护方式受到更多关注，那么这本身就将是具有历史意义的睦邻友好之举。■



Blockchain and stock exchanges

Settling for more

Stock exchanges find novel uses for blockchain

BLOCKCHAIN, THE technology underlying bitcoin and other cryptocurrencies, was designed with an ideological aim: to sidestep central authorities and governments. But many people have become intrigued by its practical uses, such as updating back-office processes. And few institutions have shown more interest in such applications than financial exchanges.

Although stock trades are often made in milliseconds by algorithms, completing them involves co-ordinating payment and delivery among a mess of databases and then reconciling the records. In big financial centres trades take two full days to settle. Some stock exchanges wonder whether blockchain's distributed, tamper-proof ledgers and immutable and transparent transaction records could speed up and simplify the process.

Exchanges from America and Australia to Switzerland and Singapore are studying the concept. Australia's stock exchange, the ASX, has moved furthest towards using blockchain to replace its main clearing and settlement platform. It has been testing technology from Digital Asset, an American firm, and will go live in mid-2021. And on November 11th SGX, Singapore's stock exchange, and the Monetary Authority of Singapore (MAS), its central bank, announced a prototype using blockchain for delivery, payment and settlement of assets.

These projects are strikingly unlike the vision of blockchain enthusiasts. ASX's, for example, uses ledgers but remains quite centralised. A single counterparty, ASX itself, must approve participants (which removes the need for energy-intensive verification and updating of records, as with

bitcoin). Though open to all, only some banks and brokers will opt for direct access. Everyone else must trade through them. In contrast to the complete transparency of the bitcoin ledger, market participants will not have access to the whole dataset (for legal reasons, but also so they do not have to give away their positions). And settlement will not be in real time.

Why, then, bother? Kelly Mathieson of Digital Asset says her firm's purpose-built programming language, DAML, which enables financial contracts to be automated, will make further innovation easy. The tedious processes of reconciliation, she says, will be drastically simplified.

As soon as next year investors will be able to see the result of another, smaller experiment. SIX, the owner of the Swiss stock exchange, will launch a separate digital platform for trading assets, such as stocks and bonds, in "tokenised" form—that is, in a format blockchain can handle. Tokenising will eliminate minimum trade sizes, says Thomas Zeeb of SIX. It will also make a much wider range of assets tradable. Mr Zeeb has already been approached by a museum that wants to tokenise its art collection, as a novel source of funding. Investors would gain exposure to the value of the art going up or down through such tokens, which they could trade.

All these projects have, or plan to obtain, official blessing; after all, exchanges are highly regulated. But the Singaporean project shows the value of seeking more than a nod of approval. MAS's involvement meant the prototype did not limit itself to stock trading or settlement, but also looked at digital currency issued by the central bank. Quite a turnaround for a technology designed to circumvent governments. ■



区块链和证交所

结算更多

证券交易所找到了区块链的新用途

作为比特币和其他加密货币背后的技术，区块链的设计中有一个意识形态目标：绕开中央当局和政府。但其实际用途，例如更新后台流程，激起了很多人的兴趣。没有几个机构对此类应用展现出的兴趣比金融交易所更多了。

虽然股票交易通常是用算法以毫秒为单位进行的，但要完成交易涉及协调一大堆数据库之间的支付和交割，然后再对账。在大型金融中心，交易需要两个整天才能结算完成。一些证券交易所在想，区块链的分布式、防篡改分类账，以及不可变且透明的交易记录是否可以加速和简化流程。

从美国和澳大利亚到瑞士和新加坡，各大交易所正在研究这一概念。澳大利亚证券交易所ASX在采用区块链来取代其主要清算和结算平台方面最为领先。它在测试美国数字资产（Digital Asset）公司的技术，并将于2021年中期正式上线。11月11日，新加坡证券交易所（SGX）和该国央行新加坡金融管理局（MAS）公布了一个原型，使用区块链进行资产交割、支付和结算。

这些项目与区块链狂热者的愿景大相径庭。例如，ASX使用分类账，但仍非常中心化。唯一的交易对手——ASX自身——必须批准参与者（这就无需像比特币那样进行消耗大量能源的验证和记录更新）。虽然对所有人开放，但只有一些银行和经纪人会选择直接进入。其他人必须通过它们进行交易。与比特币分类账的完全透明相反，市场参与者将无法访问整个数据集（这是出于法律原因，但也因此不必透露其头寸）。结算也不会是实时的。

那为什么要费这个事呢？数字资产公司的凯利·马蒂森（Kelly Mathieson）表示，她公司的专用编程语言DAML可以使金融合同实现自

动化，这将使进一步创新变得容易。她说，繁琐的对账流程将大大简化。

明年投资者将能够看到另一个较小实验的结果。瑞士证券交易所的母公司 SIX将推出一个单独的数字平台，以“代币化”形式亦即区块链可以处理的格式来交易股票和债券等资产。SIX的托马斯·齐布（Thomas Zeeb）表示，代币化将消除最小交易规模。它还会让可交易的资产类型变得广泛得多。已有一家博物馆联系齐布，希望将其艺术收藏品代币化，作为一种新的融资手段。投资者可以通过可交易的代币来接触到艺术品价值的涨跌。

所有这些项目都已经或计划获得官方批准，毕竟交易所受到高度监管。但新加坡的项目展现出不仅仅寻求官方批准的重要性。MAS的参与意味着该项目的原型并不局限于股票交易或结算，还会涉及这家央行发行的数字货币。对于一种旨在规避政府的技术来说，这可真是180度大转弯啊。■



Outdoor advertising

Sign of the times

Innovations from online advertisers are being adapted to billboards

PEDESTRIANS STROLLING down 8th Avenue in Manhattan's Hell's Kitchen neighbourhood will be struck by the cast-limestone façade of the Hearst Magazine Building. Commissioned by William Randolph Hearst in 1926, the 40,000-square-foot (3,716-square-metre) art deco building is adorned with fluted columns and statues and topped by a 600-foot (183-metre) glass and steel skyscraper. Another conspicuous feature is a vast digital screen transmitting advertisements from BuzzFeed, ESPN and Vice. This blend of history and modernity is emblematic of the outdoor-advertising business itself, which, despite being one of the world's oldest forms of marketing is embracing digital technologies.

Most forms of conventional advertising—print, radio and broadcast television—have been losing ground to online ads for years; only billboards, dating back to the 1800s, and TV ads are holding their own (see chart). Such out-of-home (OOH) advertising, as it is known, is expected to grow by 3.4% in 2018, and digital out-of-home (DOOH) advertising, which includes the LCD screens found in airports and shopping malls, by 16%. Such ads draw viewers' attention from phones and cannot be skipped or blocked, unlike ads online.

Billboard owners are also making hay from the location data that are pouring off people's smartphones. Information about their owners' whereabouts and online browsing gets aggregated and anonymised by carriers and data vendors and sold to media owners. They then use these data to work out when different demographic groups—"business travellers", say—walk by their ads. That knowledge is added to insights into traffic,

weather and other external data to produce highly relevant ads. DOOH providers can deliver ads for coffee when it is cold and fizzy drinks when it is warm. Billboards can be programmed to show ads for allergy medication when the air is full of pollen.

Such targeting works particularly well when it is accompanied by “programmatic” advertising methods, a term that describes the use of data to automate and improve ads. In the past year billboard owners such as Clear Channel and JCDecaux have launched programmatic platforms which allow brands and media buyers to select, purchase and place ads in minutes, rather than days or weeks. Industry boosters say outdoor ads will increasingly be bought like online ones, based on audience and views as well as location.

That is possible because billboard owners claim to be able to measure how well their ads are working, even though no “click-through” rates are involved. Data firms can tell advertisers how many people walk past individual advertisements at particular times of the day. Advertisers can estimate how many individuals exposed to an ad for a Louis Vuitton handbag then go on to visit a nearby shop (or website) and buy the product. Such metrics make outdoor ads more data-driven, automated and measurable, argues Michael Provenzano, co-founder of Vistar Media, an ad-tech firm in New York.

As the outdoor-ad industry becomes more data-driven, tech giants are among those to see more value in it. Netflix recently acquired a string of billboards along Hollywood’s Sunset Strip, where it will start advertising its films and TV shows. Tech firms, among them Apple and Google, are heavy buyers of OOH ads, accounting for 25 of the top 100 OOH ad spenders in America.

The outdoor-ad revolution is not problem-free. The collection of mobile-

phone data raises privacy concerns. And criticisms of the online-ad business for being opaque, and occasionally fraudulent, may also be lobbed at the OOH business as it becomes bigger and more complex. The industry is ready to address such concerns, says Jean-Christophe Conti, chief executive of VIOOH, a media-buying platform. One of the benefits of following the online-ad trailblazers, he notes, is learning from their blunders. ■



户外广告

时代的标志

网络广告商的创新正被应用到户外广告牌上

当行人漫步在曼哈顿中城八大道位于地狱厨房这一段，会被赫斯特杂志集团大楼（Hearst Magazine Building）的混凝土石灰石外立面震撼。这栋大楼由威廉·伦道夫·赫斯特（William Randolph Hearst）于1926年委托设计，3716平方米的装饰艺术风格建筑带有凹槽柱和雕像。在它上面是一栋183米高的玻璃和钢结构大厦。它的另一个突出特点是一块巨型数字屏幕，不断播放着来自BuzzFeed、ESPN和Vice的广告。这种历史与现代的混合是户外广告业务本身的典型特征。尽管这种广告是世界上最古老的营销形式之一，但它正在拥抱数字技术。

多年来，印刷、广播和无线电视等大多数传统广告形式面对网络广告的兴起节节败退，只有可追溯至19世纪的广告牌以及有线电视广告仍然坚守阵地（见图表）。户外广告（OOH）预计将在2018年增长3.4%，而包括机场和购物中心液晶显示屏在内的数字户外广告（DOOH）将增长16%。这类广告把受众注意力从手机上吸引过来，而且不能像网络广告那样可被跳过或屏蔽。

广告牌公司也在积极利用从人们的智能手机上得到的大量位置数据。有关手机用户的行踪和在线浏览的信息由运营商和数据供应商汇总并做匿名处理，再出售给媒体所有者。然后它们利用这些数据计算出不同的人口群体（比如“商务旅客”）何时经过它们的广告牌。把这些信息添加到对交通、天气和其他外部数据的洞察中，就可以生成高度相关的广告。DOOH供应商可以在天气寒冷时播放咖啡广告，在炎热时打出碳酸饮料广告，还可以给广告牌编程，让它们在空气中满是花粉时播放抗过敏药物的广告。

这种定向广告在与“程序化”广告方法结合时尤为有效。程序化广告就是利用数据来实现广告的自动化及改进。过去一年里，清晰频道（Clear

Channel) 和德高集团 (JCDecaux) 等广告牌公司推出了程序化广告平台，让品牌和媒体买家按分钟选择、购买和投放广告，而不是按天或按周。行业支持者表示，户外广告会越来越像网络广告那样，根据受众、观看次数以及位置来购买。

这是有可能的，因为广告牌公司声称，即使没有“点击率”信息，它们也能衡量广告的效果。数据公司可以告诉广告商有多少人在一天中某段时间里走过某个广告牌。广告商可以估计出在看到一则路易威登手提包广告后立即到附近一家商店（或网站上）购买的人数。纽约广告科技公司Vistar Media的联合创始人迈克尔·普罗温扎诺（Michael Provenzano）认为，这些指标让户外广告更多由数据驱动、更自动化，其效果也更易测量。

随着户外广告行业变得更多由数据驱动，科技巨头也更多地看到了它的价值。Netflix最近收购了好莱坞日落大道上的一排广告牌，准备开始宣传它制作的影视节目。包括苹果和谷歌在内的科技公司是OOH广告的重要买家，美国前100大户外广告客户中有25家是科技公司。

然而户外广告革命并非没有问题。收集手机数据引起了对隐私问题的担忧。而随着OOH广告业务规模越来越大、越来越复杂，对网络广告业务不透明、有时涉嫌欺诈的批评也可能指向OOH业务。媒体采购平台VIOOH的首席执行官让-克里斯托夫·孔蒂（Jean-Christophe Conti）表示，业界已准备好处理这些问题。他指出，追随网络广告开拓者的好处之一就是从它们的错误中学习。 ■



Underwater mining on land

Waste not, want not

A new robot system will reopen abandoned, flooded mineral workings

THE IDEA of underwater mining is not restricted to the ocean floor (see article). High water tables submerge many terrestrial deposits, too. At minimum, this means doing a lot of pumping to make them workable. Sometimes, it makes those deposits altogether inaccessible. Flooding also adds to the cost of re-opening closed mines. The team behind VAMOS hopes to do something about this.

The Viable Alternative Mine Operating System, to give its full name, is being developed by a consortium of 16 European firms and research institutes. It is currently on trial at Silvermines, Ireland—which, as its name suggests, was once home to workings for silver and other metals. They are now closed and flooded. But one of them, a source of baryte, the principal ore of barium, has been repurposed as VAMOS's test bed.

The core of VAMOS is a pair of remotely controlled vehicles. These are floated on-board a special platform into place over the site to be mined, and then dropped through the water (to a depth of 57 metres in this case) by a crane.

The larger vehicle is a 25-tonne tracked robot (pictured) with a powerful rock-cutting head at one end and, at the other, a hydraulic gantry that can carry tools such as drills and grabs. Crushed ore-bearing rock is pumped to the surface through a flexible pipe, and a cable carries power and data between the robot and an onshore control centre.

The smaller vehicle is called EVA. It has neutral buoyancy and swims around the mining site. It was designed at the Institute for Systems and Computer

Engineering, Technology and Science, in Portugal. EVA first makes, and then continually updates, a 3D map of the area—transmitting this cartography to the main vehicle, to assist navigation.

Both vehicles use sonar, cameras and laser rangefinders to work out where they are. They send these data to a pilot in the control centre, who sees them displayed on a multi-screen console of the sort gamers can only fantasise about. A future version may also be able to analyse the ore spectroscopically as it is mined, enabling rich seams to be pursued and poor ones abandoned. ■



陆地水下开采

无遗珠，不匮乏

一个新的机器人系统将会被用来重新开采遭水淹的废弃矿场

水下采矿的概念并不局限于海底。高地下水位也淹没了许多陆相沉积物，要开采的话至少也要抽走大量的水。有时候，高水位使得这些沉积物完全无法开采。淹水也增加了重开已关闭旧矿的成本。一个新系统VAMOS的研发团队希望能提供解决方案。

由16家欧洲公司和研究机构组成的一个联营企业正在开发的VAMOS全称“可行性替代采矿作业系统”（Viable Alternative Mine Operating System），目前正在爱尔兰的锡尔弗迈恩斯（Silvermines）开展试验。顾名思义，这里曾经开设银矿和其他金属矿场。现在这些矿场处于关闭状态，并且淹没在水里。但其中一个重晶石（钡的主要矿物）矿场已被重新用作VAMOS的试验场。

VAMOS的核心是一对载运工具。它们被装在一个漂浮的专用平台上，运到拟开采区域的上方，然后用起重机吊降到水中（在这项试验中是降到57米的深度）。

其中大一些的那台载运器是一个25吨重的履带式机器人（如图所示）。它的一端是个大功率岩石切割头，另一端是可以携带钻头和抓斗之类工具的液压龙门架。粉碎的含矿岩石通过一根柔性管被泵到地面，一根电缆在机器人和陆上控制中心之间传输动力和数据。

较小的那台载运器叫EVA。它具有中性浮力，在矿场里四下游动。它是由葡萄牙的计算机与系统工程研究所（Institute for Systems and Computer Engineering, Technology and Science）设计。EVA首先绘制出一幅该地区的3D地图，之后持续更新，并将该地图传送给大载运器以协助导航。

两台载运器都使用声纳、摄像头和激光测距仪来自我定位。它们将相关数

据发送给控制中心的引航员。引航员通过一个会让游戏玩家艳羡的多屏幕控制台查看这些数据。未来这套系统或许还能在开采过程中就对矿石做光谱分析，根据分析结果来进一步深挖富矿层而放弃贫矿层。■



Mount Everest

A mountain of waste

Tourism causes unsavoury problems at 18,000 feet

“Take only memories, leave only footprints” is more than a clichéd hiking motto at the Sagarmatha National Park in Nepal. The large box of rocks sitting next to the metal detector at the local airport is a testament to that: tourists departing from Mount Everest have to dispose of material they have collected before stepping onto the dauntingly short runway. Fulfilling the second half of this mantra, however, is harder. Tens of thousands of tourists leave more than just footprints. They have created a mountain of faeces, which is becoming an environmental problem.

In 2017, 648 people reached Everest’s summit, more than seven times the number two decades ago. Many more make it to base camp. Currently, toilet waste is carried and dumped into pits near the town of Gorakshep, an hour’s walk down the mountain. The amount of waste is increasing fast, says Budhi Bahadur Sarkhi, a porter who has been carrying poo from base camp to these pits for 12 years. When Mr Sarkhi started there were seven porters hired for the job. Now there are 30.

Dumping sites are filling up quickly, and the run-off is infiltrating the region’s water channels, some of which feed into wells that supply drinking water. When tests were done at nine water sources in the region, seven were contaminated with significant levels of E. coli. The presence of human by-products in the water, like nicotine and sunscreen, suggests that the contamination came from human faeces, rather than that of the many local yaks.

One innovative solution could help. The Mount Everest Biogas Project, led

by two mountaineers, hopes to install a biogas reactor in Gorakshep at the start of next year. All of the faeces from base camp would then be converted into two by-products: fertiliser and methane gas, possibly for cooking. In which case the mountain would be a little less brown and a little more green. ■



珠穆朗玛峰

屎山

在1.8万英尺的高度，旅游业带来了令人作呕的问题

“只带走回忆，只留下脚印。”在尼泊尔的萨加玛塔国家公园（Sagarmatha National Park），这不再只是一句登山客常常会看到听到的陈词滥调。在当地机场，金属探测器旁边一个装满了石头的大箱子就是证明：离开珠峰的游客必须先处理掉他们在山上采集的物品，才能走进那短得令人畏惧的机场跑道。然而，这条标语的后半句实现起来更难。成千上万的游客留下的不仅仅是脚印。他们还留下了满山的粪便，这正在成为一个环境问题。

2017年有648人登顶珠峰，是20年前的七倍多。到达大本营的人就多得多了。目前，人类排泄物被运送到步行一小时之遥的戈瑞克夏普

（Gorakshep）镇附近的垃圾坑道里。背夫巴迪·巴哈德尔·萨克利（Budhi Bahadur Sarkhi）过去12年一直从大本营往镇上徒步扛送粪便，他说粪便的量正在迅速增加。他刚开始干这个活时共有七名背夫，现在有30名。

坑道正被迅速填满，垃圾径流正向该地区的水道渗透，其中一些水道通往饮用水水井。对该地区九个水源的检测发现其中七个受到大肠杆菌严重污染。水中存在的尼古丁和防晒霜等人类代谢副产物表明污染来自人类粪便，而不是当地众多牦牛的粪便。

一个创新的解决方案也许会发挥作用。由两名登山家带头的珠峰沼气项目（Mount Everest Biogas Project）希望能在明年初在戈瑞克夏普镇安装一个沼气反应装置。届时，来自大本营的所有粪便都将转化为两种副产品：肥料和或许可用来做饭的甲烷。如此，珠峰将少一点棕色，多一点绿色。





Facebook's future

The new Yahoo?

This year has been the most painful in Facebook's history. It could get even worse

“BIG TOBACCO” is what the bosses of several large technology firms have started calling Facebook in private and in public. The company has spent the past year fending off critics who claim it is addictive, bad for democracy and overdue for a regulatory reckoning. Being compared to the tobacco giants is one of the business world’s more toxic insults, but it is not the only unflattering analogy circulating. A lower blow is the suggestion that Facebook may become like Yahoo, the once high-flying internet firm that plunged.

Even a year ago the idea would have been unthinkable. The social-networking giant, which runs Instagram, WhatsApp and Facebook Messenger as well as its own core service, was thriving. But since January it has become mired in a series of controversies, misjudgments and missteps. It became clear that it had done too little to stop Russian interference in America’s election in 2016. It had to admit that it had shared the personal data of 90m users with outside firms without permission. It later suffered a data breach affecting 50m users.

The past weeks have brought more bad news. Mark Zuckerberg, Facebook’s chief executive, has been forced onto the airwaves to defend his second-in-command, Sheryl Sandberg, after the *New York Times* on November 14th published a report alleging that they had tried to downplay the extent of Russian electoral interference to the firm’s board of directors, and hired lobbyists and the kind of “opposition-research” firms commonly used in political campaigns, to deflect blame onto other firms and to tarnish critics. The revelations have cemented the idea that Facebook is “grossly

mismanged”, says an advertising executive. Its shares have fallen by 27% since the start of the year.

The comparison to Yahoo is imperfect. Even at its peak Yahoo never boasted a business as large and profitable as Facebook’s. And the competitive landscape was different. One of the main reasons Yahoo declined is because it lost out to a powerful rival, Google, in online search; Marissa Mayer, its boss from 2012 until its sale to Verizon last year, was unable to restore advertisers’ or employees’ confidence as users left. Today there is no company that truly competes with Facebook’s suite of apps, partly because it has hoovered up competitors such as Instagram, the wildly successful photo app that is at the centre of its future plans.

But people who watched Yahoo’s collapse see ominous similarities. Executive turnover was a leading indicator of its decline; before Ms Mayer was hired it went through four chief executives in three years. Mr Zuckerberg, who controls the majority of Facebook’s voting shares, is not leaving, but many top executives are. This year several have announced their departures, including Instagram’s founders; the boss of Oculus, a virtual-reality acquisition; a co-founder of WhatsApp; and Facebook’s general counsel and its chief security officer. “The number of senior people who have left publicly and denounced the company going out the door is unprecedented. This is Yahoo pre-Marissa Mayer,” says a senior digital-advertising executive.

In another echo, the run of negative headlines is harming employee morale. “Horrible” is how one employee describes the atmosphere at Facebook on Blind, an app where people discuss work. That raises two risks. Star performers may leave to work at less controversial companies, and Facebook could end up paying dearly for mediocre employees to stay on (as its share price falls, it has to hand out more in stock-based compensation to keep people).

How might things play out? Facebook is still strong but it is precariously balanced at the top of the industry, facing several big challenges in the coming year. Above all, it must grapple with the changing ways that people use its products, which could have a huge impact on its profits. Adults over the age of 18 are spending 31% less time on Facebook's core social network compared with two years ago, which will translate into fewer opportunities to sell ads.

A big part of Facebook's answer to this is Instagram, which executives see as a saviour. It is quickly ramping up the number of adverts users see there. Disagreements about how strongly to push advertising on Instagram are part of the reason that the photo app's founders unexpectedly departed in October. Now ads are around one-fifth of all posts that users see on Instagram, which is probably double what it was a year ago. This could irk people, who may choose to spend less time on Instagram in future, just as they have done with Facebook itself.

Already users are spending more time on products that do not offer the same opportunities for advertising. "Stories", the concept of posting sequential photos and videos of users' days and experiences that Snap, a messaging app, pioneered and Facebook copied, are popular both on Instagram and on Facebook. But there is less space for advertising within people's personal "stories" than there is on the conventional landing pages (called "newsfeeds") where people scroll through posts and ads are interspersed.

Messaging apps such as WhatsApp are also growing in popularity but currently lose money. Facebook will inevitably roll out ads (which is again the reason why WhatsApp's co-founders left), but it knows that it needs to be cautious about introducing ads in an environment where people go for private communication.

This transition away from public consumption of content on social networks to more private interactions is a substantial vulnerability for Facebook's business. Mr Zuckerberg has acknowledged as much, comparing this transition to Facebook's earlier shift from desktop computers to mobile and predicting that making money from stories and messaging "will take some time, and our revenue growth may be slower". It is unproven whether these new products can ever be as lucrative as Facebook's core offerings.

Facebook's political controversies have not yet dented advertisers' enthusiasm for its platforms but that may also change in the coming year. Many advertisers have long felt that Facebook is arrogant. Marketers with massive budgets are told to travel to its headquarters in Menlo Park, rather than staff volunteering to come to them, as is typical in the ad-sales world.

Such gripes aside, the marketing industry has two principal complaints. One is that Facebook is not working as well for them as it used to in terms of users engaging with their ads (even though it is raising its prices). The second is that it misleads its customers. Brian Wieser of Pivotal Research in New York, for example, has pointed out to the company that it was incorrectly promising advertisers that it could reach more 18-34-year-olds in America than actually exist there. Facebook has still not removed the claim, despite a class-action lawsuit against the firm for allegedly padding its audience numbers.

A senior marketer for a large American bank says Facebook has made mistakes on measuring engagement, reach, views and other data for no fewer than 43 products. All of the mistakes, he notes, worked in the social-networking giant's favour. "If these were true errors, wouldn't you expect at least half to benefit marketers?" he asks. He expects to reduce how much his firm spends on Facebook and predicts that other marketers will do the same next year.

At the same time that advertisers' faith in Facebook has been shaken, politicians in Washington are running out of patience with the company. It seems unlikely that a new law will be introduced that significantly curbs Facebook's activities. But lawmakers' scrutiny of the firm is causing it to be more cautious about how it uses data for targeting advertisements and about what information it makes available to outsiders. That will further diminish its attractiveness in the eyes of marketers.

Mr Zuckerberg and Ms Sandberg are under pressure to prove to users and advertisers that Facebook is not only trustworthy but worthy of their time and money. If they cannot do so, and the company's share price continues its slide, it is possible that Ms Sandberg will be replaced in the next year. Mr Zuckerberg controls the majority of voting shares and is unlikely to go. He will doubtless have thoughts about Yahoo's sorry tale. The onus is on him to show employees, advertisers and shareholders that Facebook won't repeat it. ■



Facebook的未来

下一个雅虎？

今年是Facebook有史以来最痛苦的一年。情况还可能变得更糟

一些大型科技公司的老板们在私下里和公开场合都开始管Facebook叫“烟草大亨”。过去一年里，Facebook一直在努力抵挡飞向它的子弹：“让用户上瘾，对民主不利，监管部门插手太晚。”把一家公司比作烟草巨头在商业界是比较恶毒的一种侮辱，但还不是流传中对Facebook唯一的充满贬损的类比。更不公道的攻击是Facebook可能变成下一个雅虎——一家曾经非常成功却彻底倾覆的互联网公司。

仅仅在一年前，这种说法还是无法想象的。那时，这家除自己的核心社交平台业务外还运营着Instagram、WhatsApp和Facebook Messenger的巨头呈现蓬勃发展之势。但自今年1月以来，一系列争议、误判和失策让它身陷泥潭。已经变得明确的一点是，这家公司在阻止俄罗斯干预2016年美国大选方面无所作为。它被迫承认在未经用户许可的情况下与外部公司共享了9000万用户的个人数据。之后它又发生数据泄露，影响了5000万名用户。

近日又爆出了更多坏消息。在11月14日《纽约时报》刊出一篇报道后，Facebook首席执行官马克·扎克伯格被迫接受电视采访，为公司二把手谢丽尔·桑德伯格（Sheryl Sandberg）辩护。《纽时》的报道称，Facebook的高管们曾试图向董事会淡化俄罗斯干涉选举的程度，并聘请说客和那些一般在政治活动中才会用到的“对手研究”公司，好将责任推卸给其他公司，抹黑批评人士。Facebook一位广告主管表示，这些披露更让人们确信Facebook“严重管理不善”。自今年年初，Facebook的股价下跌了27%。

把Facebook比作雅虎不太恰当。即使在鼎盛时期，雅虎的规模和利润也无法与Facebook相比。而且它们所处的竞争格局也不同。雅虎衰败的一个主要原因是它在网络搜索方面输给了强大的竞争对手谷歌；从2012年到公司

于去年被Verizon收购期间担任CEO的玛丽莎·梅耶（Marissa Mayer）没能挽回广告主及员工因用户流失而丧失的信心。而今天没有一家公司能真正与Facebook的一系列应用抗衡，原因之一是它吞并了像Instagram这样的竞争对手。Instagram是一个非常成功的照片应用，是Facebook未来发展计划的核心。

但是，目睹了雅虎帝国崩塌的人看到了不祥的相似之处。高管频繁变动是雅虎衰败的主要迹象：在聘请梅耶之前，雅虎在三年内换了四位CEO。手握Facebook多数投票权的扎克伯格没有要走，但很多高管纷纷离职。今年已有几个高管宣布辞职，包括Instagram的创始人、Facebook收购的虚拟现实技术公司Oculus的老板、WhatsApp的联合创始人，以及Facebook的总法律顾问和首席安全官。一位资深数字广告高管说：“公开离职并在离开时谴责公司的高层员工之多前所未见。玛丽莎·梅耶上台之前的雅虎就是这个样子。”

另一个相似点是不断爆出的负面新闻打击了员工士气。一位员工在讨论工作的应用Blind上用了“恐怖”一词来描述Facebook内部的氛围。这增加了两方面的风险。优秀的雇员可能选择跳槽去争议较少的公司，而Facebook最终可能会支付高薪来挽留平庸的员工（由于股价下跌，它必须提供更多股权激励以留住人才）。

情况会如何演变？Facebook仍然强大，但它在行业顶端的位置岌岌可危，未来一年将面临几个重大挑战。最重要的一点是，它必须努力应对人们使用其产品的方式的变化，这种变化可能对它的利润产生巨大的影响。与两年前相比，18岁以上的成年人在Facebook核心社交网络上花的时间减少了31%，意味着卖广告的机会也会减少。

对此，Facebook的一大杀手锏是Instagram，高管们视其为救星。Facebook正在迅速增加用户在Instagram看到的广告数量。Facebook内部对在Instagram上推广告的力度意见不一，这也是这款照片应用的创始人在10月意外离职的原因之一。现在，用户在Instagram上看到的所有帖子中约有五分之一是广告，大概是一年前的两倍。这可能会让用户恼火，他

们未来可能会因此减少上Instagram的时间，就像他们减少使用Facebook那样。

用户已经把更多时间花在没那么多广告的产品上。由消息应用Snap首创、Facebook效仿的功能“故事”（Stories）把一系列照片和视频拼接在一起播放，呈现用户一整天的经历，在Instagram和Facebook上都很受欢迎。但是，在用户的个人“故事”里刊登广告的空间不像在常规“消息流”着陆页上那么多。人们在主页面上看帖子时，广告会穿插在其中出现。

像WhatsApp这样的消息应用也愈发流行，但仍处于亏损阶段。Facebook不可避免地会在WhatsApp上推广告（这同样是WhatsApp的联合创始人离开的原因），但它知道，在人们的私密交流环境中引入广告需谨慎。

用户从在社交网络上公开消费内容转向更私密的互动，这对Facebook的业务而言是一个显著的问题。扎克伯格也承认了这一点，并把这种转变比作Facebook早先从台式电脑向移动终端的转变，预测说从“故事”和即时消息中盈利“需要一些时间，我们的收入增长可能会放慢”。这些新产品有朝一日是否会像Facebook的核心产品那样盈利仍未可知。

Facebook在政治方面的争议尚未影响广告主对其平台的热情，但在未来一年这也可能会发生变化。许多广告主长期以来都觉得Facebook居高自傲。它让手握大笔预算的客户营销人员上门拜访它在门洛帕克（Menlo Park）的总部，而不是像广告销售业中通常的操作那样让它的员工主动拜访客户。

抛开这类抱怨不提，营销行业对Facebook有两大不满。一是Facebook用户与广告的互动变少了，所以推广告的效果不如以前（而Facebook还在不断提高价格）。二是它误导客户。比如纽约市场研究公司Pivotal Research的布莱恩·维瑟尔（Brian Wieser）指出，Facebook向广告主做出了不实承诺，夸大了它可覆盖的18至34岁美国用户数量。尽管Facebook因涉嫌夸大受众数量而遭到集体诉讼，它仍没有从平台上删除这样的承诺。

一家大型美国银行的高级营销人员表示，Facebook在至少43种产品的用户

参与度、覆盖度、浏览次数等数据的统计存在错误，而所有这些错误都对Facebook自己有利。他问道：“如果这些真的都是无心之过，是不是应该至少有一半错误会对营销人员有利呢？”他预期会减少其所在银行在Facebook上的投入，并预测明年其他企业的营销部门也会如此。

广告主对Facebook信心动摇之时，华盛顿的政客也已对该公司失去了耐心。看起来他们不太可能引入一条新法律来显著限制Facebook的行为。但立法者对这家公司的高度关注让它在利用数据推出定向广告以及与外界共享信息时变得更为谨慎。这将进一步削弱它在营销人员眼中的吸引力。

扎克伯格和桑德伯格面临压力，需要向用户和广告主证明Facebook不仅值得信赖，而且值得他们投入时间和金钱。如果做不到这一点，而公司的股价也继续下滑，那么桑德伯格有可能在明年被替换掉。扎克伯格控制着大多数有表决权的股份，不太可能离开。他无疑会想到雅虎的不幸结局。他有责任向员工、广告主和股东证明Facebook不会重蹈覆辙。■



Schumpeter

The indispensability problem

Many firms depend too much on one individual, as Carlos Ghosn's downfall shows

FEW CHIEF executives experience as hard a fall as Carlos Ghosn just has. On November 16th he was the long-standing chairman of Renault, Nissan and Mitsubishi Motors, three car firms, and famed for his Napoleonic manner. By November 20th he was in police custody in Japan, having been accused by Nissan of under-reporting his pay to regulators by around \$45m over five years. At least Mr Ghosn can console himself with a different set of figures about how much he is worth. After the news broke the three car firms' combined market value dropped by \$5bn, or 7%. Investors fret that he is the only mortal who can manage the complex alliance between the three companies. Mr Ghosn is at once disgraced and probably impossible to replace.

Key-person risk occurs when an individual's presence, absence or behaviour disproportionately affects a firm's value. It might seem counter-intuitive amid the spread of artificial intelligence and a tendency for bosses to be more self-effacing, but this risk is rife. The Renault-Nissan-Mitsubishi alliance is just one of several examples this year. Shares of WPP, the world's largest advertising firm, have sunk by 27% since the acrimonious exit of Sir Martin Sorrell, its founder, in April. Tesla's shares fell by 14% on September 28th after regulators said Elon Musk, its boss and co-founder, had made misleading statements on Twitter.

Of the world's 20 most valuable firms, Schumpeter reckons that eight have key-person risk, including Amazon, Berkshire Hathaway and JPMorgan Chase. Some 66% of firms in the S&P 500 would be materially harmed if their chief executive, or in some cases other key executives, were hit by

a bus, according to the statements of risks that they file with American regulators each year.

It wasn't meant to be this way. In the 1960s and 1970s the corporate king was heading for extinction, replaced by bland executives like those in the film "The Graduate", who thought the key to life was "one word...plastics". In 1967 John Kenneth Galbraith, an economist, published "The New Industrial State", arguing that American industry was run by a faceless, benign technocracy. Modern finance theory emerged, seeing managers as functionaries who could be controlled using incentives.

In the 1980s the individual came roaring back. In "Wall Street", a film released in 1987, a fictional tycoon bends firms to his will. By 2000 the imperial chief executive, typified by Jack Welch at General Electric and Sandy Weill at Citigroup, was in his pomp. Then came crises at WorldCom and Enron, and later at Lehman Brothers and Bear Stearns, showing the danger of firms run by charismatic bosses. Governance gurus urged boards to limit executive power.

As a matter of etiquette, contemporary bosses are expected to rein in their swagger and talk up their team. Some, like Satya Nadella at Microsoft, even project vulnerability, not invincibility. Yet despite this, key-person risk has risen. The tech boom means that lists of the largest firms are full of founder-led companies—six of the biggest 20 fall into this camp. The governance revolution only went so far—only 28% of S&P 500 firms have independent chairmen. And after a decade of rising profits and share prices, CEOs are more entrenched. Last year outgoing bosses at S&P 500 firms had run things for an average of 11 years, up from seven in 2009.

The resulting key-person risk comes in three flavours. The hardest to swallow is when a flawed individual has near-absolute power owing to their control of a firm's voting rights. This is the predicament Facebook finds

itself in after multiple scandals, with Mark Zuckerberg out of his depth but unwilling to appoint more effective subordinates or a credible board. With its share price down by 37% since July, investors may not be reassured by his suggestion on November 20th that he would be in office “for decades”.

A second flavour is when a firm is judged to be so complex that only one maestro can keep all the plates spinning. Mr Ghosn is an example. Renault, Nissan and Mitsubishi are linked by cross-shareholdings and by an opaque, jointly owned venture that manages bulk purchases and co-ordinates collaboration, which he is chairman of. Masayoshi Son, the head of SoftBank, a Japanese conglomerate that invests in telecoms and tech, has created a financial structure that is so indebted and complex that were he to leave suddenly, investors would panic even though Mr Son has given them poor returns for half a decade.

The most benign kind of key-person risk is when a boss is excellent at their job. At Apple Tim Cook has thrived at the nearly impossible task of succeeding Steve Jobs, while JPMorgan Chase is the world’s best-performing big bank over the past decade in no small part thanks to its boss, Jamie Dimon. Yet even this kind of dependence can be uncomfortable—how long will the magic last? Mr Dimon has gone to lengths to promote plausible successors such as Marianne Lake, the bank’s finance chief. But he says he plans to remain at the helm until 2023, which would be a 17-year reign.

Several lessons on dealing with key-person risk emerge. When firms have unequal voting rights, investors should demand a discount to buy their shares as compensation for the risk that the individual in control starts making bad decisions. Financial complexity is a trap, allowing managers to become hard to remove even when they are not performing well. And lastly, even the best-performing chief executives must be subject to an expiry date.

It is here that the past 24 months have presented some good news as well

as bad. On September 10th Jack Ma announced that he would step down in 2019 as the chairman of Alibaba, the e-commerce firm he co-founded. In the private-equity industry, not famed for its humility, three of the largest listed firms, Blackstone, KKR and Carlyle, have each put in place plans for their founders to take a more back-seat role. Mr Ghosn might look at Renault's and Nissan's share prices as evidence that he is indispensable. But the best bosses do not regard that as an achievement. ■



熊彼特

不能没有你

卡洛斯·戈恩的垮台显示，许多公司过分依赖一位领导人

少有首席执行官会遭遇卡洛斯·戈恩（Carlos Ghosn）刚刚遭遇的滑铁卢。11月16日，他还是雷诺、日产和三菱这三家汽车公司在位许久的董事长，并以拿破仑式的行事风格闻名。到了20日，他被日本警方拘留，日产指控他在五年内向监管机构瞒报个人薪酬约4500万美元。戈恩至少可以用另一组显现了自己价值的数字来寻求自我安慰：消息传出后，这三家汽车公司的总市值下跌了7%，蒸发了50亿美元。投资者担心他是人间唯一有能力管理这三家公司形成的复杂联盟的人。戈恩名誉扫地，但他可能又是无法取代的。

当某个人的存在、缺席或行为会极大地影响公司价值，就存在“关键人物风险”。在人工智能不断普及、企业掌舵人愈趋低调的时代，这种风险的存在似乎有悖我们的直觉，但实际上却很普遍。雷诺-日产-三菱联盟只是今年发生的这方面的几个例子之一。4月，全球最大的广告公司WPP的创始人马丁·索瑞尔爵士（Sir Martin Sorrell）与公司不欢而散，自那之后该公司股价已跌去27%。在监管机构表示特斯拉的老板兼联合创始人伊隆·马斯克在推特上发表了误导性言论后，特斯拉的股票在9月28日下跌了14%。

本专栏认为，市值居全球前20的公司中，有八家存在这种关键人物风险，包括亚马逊、伯克希尔·哈撒韦和摩根大通。根据企业每年向美国监管机构提交的风险陈述，标普500指数中约66%的公司会在首席执行官（有些是其他关键高管）因故离职的情况下受到重大损害。

情况本不该如此。上世纪六七十年代，企业里的国王式领导人已渐式微，取而代之的是电影《毕业生》里那种平淡乏味的高管，他们认为生活的关键“就一个词……塑料”。1967年，经济学家约翰·肯尼斯·加尔布雷思（John

Kenneth Galbraith) 出版了《新工业国家》(The New Industrial State)一书，认为美国工业是由缺乏个性、为人温和的技术专家掌控的。现代金融理论逐渐形成，将管理者视作可通过激励手段加以控制的职能人员。

到了80年代，“强人领导”再度崛起。在1987年上映的电影《华尔街》中，一位虚构的大亨执意按自己的意愿经营公司。到2000年，以通用电气的杰克·韦尔奇(Jack Welch)和花旗集团的桑迪·威尔(Sandy Weill)为代表的那种至高无上的首席执行官风头无两。之后世通公司和安然公司爆发了危机，然后是雷曼兄弟和贝尔斯登，显现出企业依赖明星领导人的危险。企业治理大师们敦促董事会限制高管的权力。

在行为姿态上，人们觉得当今的老板们应该别那么趾高气扬，而要强调团队的作用。微软的萨蒂亚·纳德拉(Satya Nadella)等一些领袖非但坚不可摧，甚至还表现得柔弱忍让。尽管如此，关键人物风险仍在加剧。科技热潮让大型企业中出现了许多由创始人控制的公司——全球最大的20家公司中有六家属于这种情况。企业治理革命的影响力有限——标普500指数公司中只有28%拥有独立的董事长。而在经历了十年的利润和股价上涨后，CEO们的地位更是难以撼动。去年，离任的标普500指数公司的老板平均执掌公司11年，而2009年时为7年。

由此产生的关键人物风险有三类。最麻烦的一类是有缺陷的人物因为控制着公司的投票权而拥有接近绝对的权力。Facebook在发生多次丑闻后就陷入了这样的困境。马克·扎克伯格在公司治理上力有不逮，但又不愿意任命更有力的下属或组建可信赖的董事会。Facebook的股价自7月以来下跌了37%，而扎克伯格在11月20日暗示自己还将在位“几十年”，这可能不是能让投资者放心的消息。

第二类是一家公司被认为结构过于庞杂，只有一位大师能完成高难度的“杂耍”。戈恩就是这样一例。雷诺、日产和三菱通过交叉持股以及一家不透明的合资公司连成一体。这家合资公司管理大宗采购和协调合作，由戈恩担任董事长。投资电信和科技业的日本企业集团软银的董事长孙正义创建的金融结构非常复杂且债务沉重。要是他突然离任，投资者会惊慌失

措，即便这五年来投资回报一直不尽人意。

最良性的那类风险是老板非常胜任自己的工作。在苹果公司，接替乔布斯似乎是难于上青天的重任，而蒂姆·库克至今表现不俗。摩根大通是过去十年中全球业绩最佳的大型银行，其首席执行官杰米·戴蒙（Jamie Dimon）在其中立下了汗马功劳。然而，即便是这种依赖也会让人感到不安——他们的魔法能持续多久？戴蒙大力提拔有潜力的继任者，比如该银行的首席财务官玛丽安·雷克（Marianne Lake）。但他表示将继续掌舵至2023年，届时他已在位17年。

在应对关键人物风险上，有几个经验教训。如果一家公司存在投票权不均等的情况，那么投资者在购入其股票时应要求折扣，作为对最高掌权者决策错误的风险补偿。财务复杂性是个陷阱，它使得管理者即便表现不佳也难以被轰下台。最后，即使是表现卓越的首席执行官也必须有一个限定的任期。

正是在这最后一点上，过去24个月里既有好消息也有坏消息。9月10日，马云宣布将于2019年卸任他共同创办的电商企业阿里巴巴的董事局主席一职。在一向作风高调的私募股权行业，三家最大的上市公司黑石（Blackstone）、KKR和凯雷（Carlyle）已分别制定计划，推动其创始人退居幕后。戈恩可能会以雷诺和日产的股价变化证明自己对公司不可或缺。但最优秀的企业领袖是不会以此为功的。■



Private education

Testing the waters

The first privately run research university is a risk for its founder

HANGZHOU, A CITY south-west of Shanghai, is freighted with meaning for Shi Yigong. His grandmother, a Communist, was jailed there by the Nationalist government in the 1930s and died 18 days after giving birth to his father in prison.

Personal links drew Mr Shi to Hangzhou when he chose a location for the first private research university in China. He called it Westlake, after the scenic body of water for which the city is famed. The local government's enthusiasm also helped. Hangzhou, though rich and historic, compares unfavourably with Beijing and Shanghai in terms of its intellectual endowment. Keen to host a top-class university, it offered Mr Shi tempting terms. In October he presided over Westlake's founding ceremony. The university's first cohort of research students is around 140 strong. It hopes, eventually, to have thousands of students, including undergraduates.

China already has around 700 private institutions among its 3,000-or-so universities, but most are vocational colleges which do not aspire to compete with the research universities at the top of the global tree. Westlake University does. Mr Shi, who was a former professor of molecular biology at Princeton and held senior posts at Tsinghua, a leading university in Beijing, has Caltech as his model. "This is the first ever research university supported by both government and the private sector in the People's Republic of China," he says. "We're making history."

Westlake, for now in temporary premises, will move into a grand purpose-built campus (its design is pictured) in three years' time. It is private in

two ways. One is its governance. Mr Shi stresses that the Communist Party will have a big role in the university. Three of the 21 seats on the managing council are taken by party officials who will play a “significant” part in decision-making. But the idea is that, unlike in other universities, the board of governors will have ultimate authority. Westlake is also partly privately financed. Although the local government is paying to build the new campus, the university also has private donors, including Pony Ma, the founder of Tencent, a tech giant, and Wang Jianlin, the founder of Dalian Wanda, a property-based conglomerate.

The point of Westlake is in part to carry out more ambitious research than happens in state universities. “I was very moved by Shi Yigong’s dream,” says Hongyun Tang, a researcher who previously worked in America. “The academic culture is like the States. We’re all dreaming of doing something big.” His colleague, Xu Li, another returnee from America, says of other Chinese universities: “They are chasing good publications but not meaningful research.” Mr Li says Westlake’s founder wants researchers “not to focus on small things, but to make big discoveries.”

Mr Shi’s ambitions reach beyond the bounds of the university. His aim is to make China more innovative by adding a dimension to the current educational system. Mr Shi laments that China’s contribution to science and technology in the past 400 years has been vastly below what it could have achieved. “There’s something etched into our brains: by the time we get to college, students have lost a major portion of their innovative potential,” he says. Mr Shi believes that if elite universities select students on the grounds not just of their test scores, but also of their intellectual maturity and social responsibility, this will influence the way pupils are taught at school, and change the way they think. “Westlake is the first such elite university in China. Our future success will result in the establishment of many more.”

As the former dean of a department at Tsinghua—as high up the Chinese

academic ladder as you can go—Mr Shi has a lot to lose if Westlake does not work. In his favour is the explicit endorsement of the venture by China's leader, Xi Jinping. Mr Xi has form in allowing experiments in higher education. From 2002-07 he was the party boss of Zhejiang province, of which Hangzhou is the capital. During that time Mr Xi invited an American college, Kean University in New Jersey, to Zhejiang. Its campus is now up and running. Mr Xi wants China to become an intellectual power as well as an economic one. Against Mr Shi is the rivalrous nature of academia and China's tradition of conservatism. "Everybody is watching him to see if he succeeds or fails," says a colleague. "It's a big risk." ■



民办教育

西湖试水温

中国第一所民办研究型大学对其创立者而言是一场冒险

位于上海西南方向的杭州对施一公来说意义重大。他的奶奶是一名共产党员，上世纪30年代被国民党政府在杭州投入监狱，在狱中生下他父亲18天后去世。

在这种缘分的牵引下，施一公将中国首所民办研究型大学的校址定在了杭州。他以令这座城市扬名四方的湖泊——风景优美的西湖——为这所大学命名。当地政府也为其成立提供了大力支持。杭州经济发达、历史悠久，但在整体学术力量方面还难以媲美北京和上海。该市对于打造世界一流大学很感兴趣，向施一公开出了非常有吸引力的条件。10月他主持了西湖大学的成立大会。该校首批研究生大约有140人，它希望最终会接收包括本科生在内的数千名学生。

中国大概有3000所高校，其中民办大学已有约700所，但大部分都是高职院校，无意与全球顶尖的研究型大学一较高下。西湖大学则不然。施一公曾是普林斯顿大学的分子生物学教授，随后又在位于北京的名校清华大学担任要职，他把加州理工学院作为自己的模板。“这是中华人民共和国历史上第一所由社会力量举办、国家重点支持的研究型大学，”他说，“我们正在创造历史。”

西湖大学目前的校区是临时的，三年后会搬到专门修建的非常气派的新校区（配图为效果图）。其民办性质体现在两方面。首先是管理。施一公强调共产党将会在该校扮演重要角色。21人组成的创校校董会中，中共官员占据三席，且将在决策方面起到“重大”作用。但与其他高校不同的是，该校的宗旨是董事会拥有最高权力。其次，西湖大学部分由社会资金赞助。虽然新校区的建设是由杭州市政府出资，但也有私人捐助者向西湖大学慷慨解囊，包括科技巨头腾讯的创始人马化腾和基于房地产的企业集团万达

的创始人王健林。

成立西湖大学的目的之一是开展比公立大学更宏伟艰巨的科研项目。“施一公的梦想非常打动我，”曾在美国工作的研究员唐鸿云说，“这里的学术氛围就像美国。我们都梦想着干一番大事业。”他的同事李旭也是来自美国的海归，在他看来，其他中国高校“只追求好的发表结果，却不想着做有意义的研究”。李旭说，西湖大学的创办者希望研究人员“不要专注在小事情上，而要有大发现”。

施一公的雄心并不止于办学。他的目标是通过为现行教育体系增加一个维度，让中国更具创新力。他感叹，过去400年中国对科学技术的贡献远低于它本应达到的水平。“我们一直有这样一种看法：等到学生进入大学时，他们已经失去了很大一部分创新潜能。”他说。他认为，如果精英大学不仅仅依据考试分数来录取学生，而是还考量其智识的成熟度和社会责任感，那么就会影响中小学的教学方式，进而改变孩子们的思维方式。“西湖大学是中国第一所这样的精英大学。我们未来的成功将会鼓励众多后来者出现。”

如果西湖大学不成功，曾在清华大学担任学院院长（算是在中国的学术阶梯上能达到的最高位置了）的施一公会付出很大的代价。对他有利的一点是，国家主席习近平对这一项目明确予以支持。习近平之前就曾准许在高等教育领域开展试验。2002到2007年间他担任浙江省委书记期间，曾邀请位于美国新泽西州的肯恩大学（Kean University）来浙江办学。如今，温州肯恩大学运转良好。习近平希望中国不仅成为经济强国，还会成为一个智力强国。对施一公构成挑战的是学术界的彼此较劲以及中国的保守主义传统。“所有人都在看他会不会成功，”一名同事说，“这是一场大冒险。”■



Cat grooming

Groovy

How the microscopic structure of a cat's tongue helps keep its fur clean

T.S. ELIOT'S MYSTERY cat, Macavity, besides being a criminal mastermind able to evade the combined ranks of British law enforcement, had a coat that was "dusty from neglect". Criminality is one thing, but this truly strains the imagination. Real cats are champion groomers.

Of the ten hours a day that a domestic cat deigns to remain awake, it spends a quarter licking dirt, fleas, blood and loose hairs from its fur. Cats' tongues, specialised for this task, are covered in hundreds of backward-facing keratin spines. But exactly how these cone-shaped protuberances, called filiform papillae, work to give the animals such mastery over their cleanliness has remained unknown until now.

To crack the mystery Alexis Noel and David Hu, a pair of engineers at the Georgia Institute of Technology, in Atlanta, examined the grooming mechanisms of six feline species—from domestic pets and bobcats to snow leopards and lions. Studying the activity of tongues inside the mouths of living creatures proved tricky, so instead Dr Noel and Dr Hu built an automated grooming machine fitted out with tongues and furs from animals whose lives had ended at places such as the Tiger Haven in Tennessee, a sort of retirement home for rescued big cats. They attached the tongues to a mechanical arm and made them "lick" the furs. High-resolution cameras and scanners took pictures.

The two researchers found that the filiform papillae were shaped not, as had previously been thought, like solid cones. Rather, they resembled tiny scoops. Each had a small groove—named a cavo papilla by the team—at its

tip.

This structure permits surface tension to wick saliva from a cat's mouth and release it into the farthest recesses of the animal's fur. During each lick, about half of the saliva on the tongue is so transferred. Saliva serves as a multi-purpose cleaning agent and the cavo papillae also assist the absorption, for the return journey, of any dirt or blood that needs removing. The cat's tongue therefore "acts like a loofah and a sponge at the same time", says Dr Hu.

The pair's findings, just published in the *Proceedings of the National Academy of Sciences*, could inspire new ways to clean complex hairy surfaces. The authors themselves demonstrated one such application, which they call the tongue-inspired grooming (TIGR) brush. To make this they employed 3D printing to create structures, shaped like cat papillae, attached to a silicone base. The TIGR brush pulled on cat hairs and fur with less force than existing brushes, and was easier to clean. Such a brush could also be used to spread medicines deep into a cat's fur or onto its skin, without the usual distressing practice of having to shave the animal first. ■



猫猫美容

绝妙的勺子

猫科动物舌头的微观结构如何帮助它们保持皮毛洁净

T.S.艾略特（T.S. Eliot）笔下神秘的猫咪麦卡维蒂（Macavity）除了是个能够逃脱英国执法部门联合行动的犯罪大师，还有一身“因疏于清洁而脏兮兮”的皮毛。它的犯罪行径倒还能理解，脏皮毛着实让人难以想象。真正的猫可都是美容专家。

在家猫每天屈尊醒着的十个小时中，有四分之一花在清理身上的污垢、跳蚤、血和脱落的猫毛上。在专门负责清洁任务的猫舌上，覆盖着成百上千个角蛋白倒刺。但直到现在，人们才弄明白这些被称为丝状乳突的锥状突起究竟是如何赋予了猫科动物如此精通清洁的本领。

为了解开谜底，亚特兰大佐治亚理工学院的工程专家亚历克西斯·诺埃尔（Alexis Noel）和胡立德（David Hu）探究了家猫、短尾猫、雪豹和狮子等六种猫科动物的清洁梳理机制。研究活体动物的舌头在口腔内的活动难度太大，所以两人打造了一台自动梳理机，装上了猫科动物的舌头和皮毛。这些器官的主人已经在田纳西州的老虎安息所（Tiger Haven）等收容大型猫科动物的养老院里去世。两人把舌头装到机械臂上，让它们去“舔”毛皮，并用高分辨率相机和扫描仪拍下照片。

两位研究人员发现，丝状乳突并非像人们以前所想的那样是实心锥体，而是形似微小的勺子。每个丝状乳突的顶端都有一个小沟槽，研究团队将其命名为腔乳突。

这种结构通过表面张力将唾液从猫嘴中吸出，并将其释放到皮毛最深处。每舔一次，就会转移走舌头上约一半的唾液。唾液起到多用途清洁剂的作用。而在舌头收回时，腔乳突还能帮助吸收任何需要去除的污垢或血。因此，猫的舌头“兼具丝瓜络和海绵块的作用”，胡立德说。

两人的研究结果刚刚发表在《美国科学院院刊》上，可能会启发人们研究出清洁复杂多毛表面的新方法。两位研究人员自己展示了这类应用的一种，他们称之为TIGR刷（Tongue-inspired Grooming brush，即“仿猫舌清理刷”）。他们用3D打印制造出形似猫舌乳突的结构，嵌在硅胶基垫上。TIGR刷梳理猫毛时拉扯猫皮毛的力度比现有的刷子更轻，也更容易清洁。这种刷子还可以将药物涂抹在猫的皮毛深处或皮肤上，也就避免了通常需要先剃掉猫毛这个叫人烦恼的操作了。■



Trade and technology

Chip wars

America cannot afford to ignore China's semiconductor ambitions. It cannot easily tame them, either

THE TRADE disputes President Donald Trump relishes have an old-fashioned feel. Tariffs are the principal weapons. Old-economy markets, from cars to steel, are the main battlefields. Farmers and factories preoccupy the president. And his personal chemistry with other powerful men can make or break deals. Hence the focus on the meeting between Mr Trump and Xi Jinping at the G20 summit took place last week.

Yet the trade conflict that matters most between America and China is a 21st-century fight over technology. It covers everything from artificial intelligence (AI) to network equipment. The fundamental battleground is in semiconductors. The chip industry is where America's industrial leadership and China's superpower ambitions clash most directly. And whatever Messrs Trump and Xi said at the G20, this conflict will outlast them both.

That is because computer chips are the foundations of the digital economy and national security. Cars have become computers on wheels. Banks are computers that move money. Armies fight with silicon as well as steel (see Briefing). Firms from America and its allies, such as South Korea and Taiwan, dominate the most advanced areas of the industry. China, by contrast, remains reliant on the outside world for supplies of high-end chips. It spends more on semiconductor imports than it does on oil. The list of the top 15 semiconductor firms by sales does not contain a single Chinese name.

Well before Mr Trump arrived on the scene, China made plain its intention to catch up. In 2014 the government in Beijing announced a 1trn yuan

(\$150bn) investment fund to improve its domestic industry. Semiconductors feature prominently in “Made in China 2025”, a national development plan issued in 2015.

China’s ambitions to create a cutting-edge industry worried Mr Trump’s predecessor. Barack Obama blocked Intel from selling some of its whizziest chips to China in 2015, and stymied the acquisition of a German chipmaker by a Chinese firm in 2016. A White House report before he left office recommended taking action against Chinese subsidies and forced technology transfer. Other countries are alarmed, too. Taiwan and South Korea have policies to stop purchases of domestic chip firms by Chinese ones and to dam flows of intellectual property.

Although the chip battle may have pre-dated Mr Trump, his presidency has intensified it. He has made a national champion of Qualcomm, blocking a bid for it from a Singaporean firm for fear of Chinese competition. Earlier this year an export ban on selling American chips and software to ZTE, a Chinese telecoms firm in breach of sanctions, brought it to the brink of bankruptcy within days. Startled by the looming harm, and (he says) swayed by appeals from Mr Xi, Mr Trump swiftly backtracked.

Two things have changed. First, America has realised that its edge in technology gives it power over China. It has imposed export controls that affect on Fujian Jinhua, another Chinese firm accused of stealing secrets, and the White House is mulling broader bans on emerging technologies. Second, China’s incentives to become self-reliant in semiconductors have rocketed. After ZTE, Mr Xi talked up core technologies. Its tech giants are on board: Alibaba, Baidu and Huawei are ploughing money into making chips. And China has showed that it can hinder American firms. Earlier this year Qualcomm abandoned a bid for NXP, a Dutch firm, after foot-dragging by Chinese regulators.

Neither country's interests are about to change. America has legitimate concerns about the national-security implications of being dependent on Chinese chips and vulnerable to Chinese hacking. China's pretensions to being a superpower will look hollow as long as America can throttle its firms at will. China is destined to try to catch up; America is determined to stay ahead.

The hard question is over the lengths to which America should go. Protectionists in the White House would doubtless like to move the semiconductor supply chain to America. Good luck with that. The industry is a hymn to globalisation. One American firm has 16,000 suppliers, over half of them abroad. China is a huge market for many firms. Qualcomm makes two-thirds of its sales there. Trying to cleave the industry into two would hurt producers and consumers in America. And it would be a bluntly antagonistic act, which would make no distinction between unfair and genuine competition.

In the long run it may be futile, too. Today America has the edge over China in designing and making high-end chips. It can undoubtedly slow its rival. But China's progress will be hard to stop. Just as Silicon Valley's rise rested on the support of the American government, so China blends state and corporate resources in pursuit of its goals. It has incentive programmes to attract engineering talent from elsewhere, notably Taiwan. Firms like Huawei have a proven ability to innovate; blocking the flow of Intel chips in 2015 only spurred China on to develop its domestic supercomputing industry.

Moreover, China's bid to become a global semiconductor powerhouse is propitiously timed. For decades the chip industry has been driven forward by Moore's law, under which the capabilities of a chip of a given size double every two years. But Moore's law is reaching its physical limits. As everyone jumps to new technologies, from quantum computing to specialised AI

chips, China has a rare chance to catch up.

The right approach for America, therefore, has three strands. The first is to work with its allies in Europe and Asia to keep pushing back against unfair Chinese practices (such as forced tech transfer and intellectual-property theft) at the World Trade Organisation, and to screen out inward Chinese investments when security justifies it. The second is to foster domestic innovation. More government funding is already going into chip research; greater openness to talent is needed. And the third is to prepare for a world in which Chinese chips are more powerful and pervasive. That means, among other things, developing proper testing procedures to ensure the security of Chinese-made products; and tightening up on data-handling standards so that information is not being sprayed about so carelessly. Measures such as these will not make the headlines at the G20. But they will do more to shape the world in the years ahead. ■



贸易与技术

芯片战

对美国来说，中国发展半导体的雄心壮志不容忽视，但也不易打压

特朗普钟爱的那种贸易战充满了老旧气息。主要武器是关税。主战场是从汽车到钢铁的旧经济市场。农民和工厂最叫他牵挂。而他与其他国家领导人之间私交的好坏深浅会左右谈判的成败。这是为何特朗普与习近平近日在G20峰会上的会晤如此吸引眼球。

不过，中美贸易冲突中最重要的部分是一场21世纪的科技战。战火遍布从人工智能（AI）到网络设备等各个领域。根本战场是半导体。在芯片产业，美国的行业领导地位与中国的超级大国野心之间的冲撞最为直接。无论特朗普和习近平在G20峰会作何表态，这一冲突都会是超越两人任期的持久拉锯。

这是因为计算机芯片是数字经济和国家安全的根基。汽车已经变成了带轮子的计算机；银行是调配资金的计算机；军队不仅用钢铁武器也用硅芯片作战。美国及其盟友（如韩国和台湾）的企业主导着该行业的尖端领域。相比之下，中国仍依赖外部供应高端芯片。中国在进口半导体上的支出比进口石油更大。销售额最高的15家半导体公司中没有一家是中国大陆的企业。

在特朗普上任之前很久，中国就已清楚表明追赶的意图。2014年，中国政府宣布成立规模以万亿元人民币计的投资基金以促进国内半导体产业发展。在2015年颁布的国家发展规划《中国制造2025》中，半导体产业占据突出地位。

中国打造尖端产业的雄心令特朗普的前任奥巴马感到担忧。2015年他阻止英特尔向中国出售部分最新型芯片，并在2016年阻碍中国公司收购德国的一家芯片制造商。他离任前的一份白宫报告建议采取行动反对中国的产业补贴和强制性技术转让。其他国家和地区也加紧提防。韩国和台湾制定了

政策，阻止中国大陆企业收购本地芯片公司，并防止知识产权外流。

芯片战也许在特朗普上任前就已打响，但他上台后加剧了战事。因为担心来自中国的竞争，他阻止了一家新加坡公司收购高通，把高通变成了一家代表国家利益的企业。今年早前，美国因中国通讯企业中兴违反美国制裁规定而下令禁止对其出口美国芯片和软件，几天之内就将中兴逼至破产边缘。但惊觉此举可能招致自损，加上（他自称）受习近平的呼吁影响，特朗普迅速收手。

两个方面已经发生了变化。首先，美国已意识到可凭借技术优势牵制中国。美国已对另一家被指控窃取机密的中国公司福建晋华实施了出口管制措施。白宫正在考虑围绕新兴技术推出更广泛的禁令。第二，中国在半导体领域自力更生的动力飙升。在中兴事件后，习近平大谈特谈核心技术。中国的科技巨头纷纷响应：阿里巴巴、百度和华为正大举投资研制芯片。中国已显示自己可以牵制美国公司。今年早些时候，在中国监管机构的阻挠之下，高通放弃了对荷兰公司恩智浦的收购计划。

两国的利益立场都不会改变。美国有正当理由担心依赖中国芯片会产生国家安全以及被中国黑客攻击的风险。只要美国能随意扼杀中国企业，中国超级大国的自我标榜就是一句空话。中国必然要奋力追赶，而美国决意保持领先。

难题在于美国的动作该多大。白宫的保护主义派无疑希望将半导体供应链转移到美国。祝他们好运。半导体行业可谓全球化的一曲赞歌。一家美国公司就拥有16,000家供应商，其中超过一半位于海外。中国对许多公司而言都是一个巨大的市场。高通三分之二的销售额来自中国。试图把该行业一分为二将损害美国的生产者和消费者。这还是一种公然的对抗行为，会把不公平竞争和真正的竞争混为一谈。

长远来看，这可能也徒劳无功。目前美国在设计和制造高端芯片方面优于中国，无疑可以拖慢竞争对手的发展。但中国的进步难以阻挡。正如硅谷的崛起有赖于美国政府的支持，中国政府也在综合国家和企业的资源来实

现自身目标。政府推出激励计划吸引其他地方的工程人才，特别是台湾。像华为这样的公司已经证实了自己的创新能力；2015年的对华禁售芯片之举结果只激励了中国加紧发展自己的超级计算产业。

此外，中国要成为全球半导体强国的努力顺应天时。几十年来，芯片行业的发展一直遵循摩尔定律（既定尺寸的芯片的性能每两年翻一番）。但摩尔定律正在接近物理极限。随着所有人都转向从量子计算到专用AI芯片等新技术，中国有了难得的赶超机会。

因此，美国的正确应对方式应从三方面入手。首先是与欧洲和亚洲的盟友合作，继续在世贸组织反对中国的不公平做法（例如强制性技术转让和窃取知识产权），并把确实会危害美国国家安全的中国对美投资阻挡在外。其次是促进国内创新。已有更多的政府资金投入芯片研究，而美国还需要更加开放地引进人才。第三是要做好准备，应对更强大、更流行的中国芯片。也就是说，除其他措施外，美国还需制定适当的测试程序以确保中国产品的安全性，此外还要提高数据处理标准，防止信息被随意泄露。这类措施不会在G20峰会上成为头条新闻，但会在未来几年塑造世界格局上发挥更大的作用。 ■



The history of blood

Liquid of life

In “Nine Pints” Rose George explores its science and mystery

EVERY THREE seconds someone in the world receives a transfusion of a stranger’s blood. The journey of a pint, roughly the amount in a typical donation, from a donor’s vein to the recipient is intricate and fascinating. So is the history of blood science, from the existence of different types to the medicinal use of leeches (now employed in the niche business of alleviating blood congestion in plastic surgery), to lifesaving treatments for major injuries. In “Nine Pints”—the quantity of blood in the human body—Rose George surveys the trials, errors and happenstance that shaped blood’s role in modern medicine.

Her narrative is a lively mélange of stories about people, culture and science, recounted in sparkling prose. Ms George tours places as varied as Europe’s biggest blood-processing facility (near Bristol), an operating theatre in London, an HIV-ridden slum in South Africa and remote villages in Nepal where women are banished to outdoor sheds when they menstruate.

The book’s characters come from all walks of life. They include ardent volunteers such as Percy Oliver, a civil servant in London, and his wife Ethel, who in 1921 set up the first register of voluntary blood donors in their home. Their recruits dashed to hospitals when someone needed a transfusion. Sporting pearls and a fashionable hat, Lady Dunstan, an elderly aristocrat, drove an ice-cream van during the Blitz, packed with blood-filled milk bottles—a cog in the wheels of one of the world’s first national blood banks. More recent heroes include Arunachalam Muruganantham, a school dropout from rural India. He invented a low-cost manufacturing process

for sanitary pads, which women in developing countries often struggle to afford. To test his prototypes, he carried a balloon filled with goat's blood under his clothes.

There are villains, too. They include the bureaucrats who ignored warnings about risky, paid blood donors in the 1970s and 1980s, when tens of thousands of haemophiliacs were infected with HIV and Hepatitis C from tainted plasma, the protein-rich yellow liquid left after red blood cells are sifted out. A page-turning chapter delves into the workings—and ethics—of the plasma business, which is dominated by four companies. America, which has been called “the OPEC of plasma”, earns nearly as much from exporting it as from medium-sized cars. That is largely because, unlike most other countries, it allows people to be paid for the stuff. Many donors are desperately poor.

Much about blood remains a mystery. The purpose of blood types, for example, is still unknown; likewise why menstruation is monthly, a frequency that seems inefficient. At the same time blood is becoming even more of a centrepiece in medicine. “Liquid biopsies”, which can diagnose cancers and other diseases with a simple blood test, are among the most promising recent medical developments.

“Our knowledge of blood is wide yet unfinished,” concludes Ms George. “Nine Pints” is a superb tour of what is already known about the wondrous liquid that pulses through each body, and what still awaits discovery. ■



血液的历史

生命之液

萝丝·乔治在《九品脱》中探讨了有关血液的科学发现和谜团

每三秒钟世界上就有一个人接受陌生人的血液。一次捐献的血量通常是一品脱左右，这些血液从捐献者的静脉转移到接受者体内，经历了复杂而迷人的旅程。血液科学的历史也是如此，不管是不同血型的存在，还是水蛭的医学用途（目前用于在整形手术中缓解充血这一利基业务），抑或重大创伤的救治。在《九品脱》（即人体血液总量）一书中，萝丝·乔治（Rose George）调查了血液在承担它在现代医学中的角色之前所经历的种种试验、错误，以及巧合。

她的讲述将有关人、文化和科学的故事生动地糅合在一起，读来妙趣横生，引人入胜。乔治游历过的地方多种多样，既有欧洲最大的血液处理厂（在布里斯托附近）和伦敦的手术室，也有南非艾滋病肆虐的贫民窟，还有尼泊尔的偏远村庄，那里的妇女在月经来潮时会被赶到户外的棚屋里。

书中人物来自各个阶层。其中包括热心的志愿者，比如伦敦的公务员珀西·奥利弗（Percy Oliver）和他的妻子埃塞尔（Ethel）。1921年，他们在自己家中首次为自愿献血者登记造册。当有人需要输血时，在册的成员就会赶到医院。在1940至1941年间德国对英国城市的大空袭中，年迈的贵族邓斯坦夫人（Lady Dunstan）戴着时髦的帽子和珍珠项链，开着一辆冰淇淋车，车上摆满了装着血液的奶瓶。她是为世界上首批国家血库之一服务的人群的一份子。年代较近的英雄有来自印度农村、早早辍学的阿鲁纳恰拉姆·穆鲁甘南塔姆（Arunachalam Muruganantham）。发展中国家的女性往往用不起卫生巾，是他发明了一种低成本的卫生巾生产工艺。为了测试样品，他在自己的衣服里面塞了一个装满山羊血的气球。

书里也有坏人。像是在上世纪七八十年代，有些官僚无视关于高危有偿献血者的警告，导致数万名血友病患者因输入了受污染的血浆而感染艾滋病

和丙肝。血浆是一种富含蛋白质的黄色液体，是将血液中红细胞过滤筛除后余下的部分。书中有一章深入探讨了由四家公司主导的血浆行业的运作方式和道德规范，读来让人不忍释卷。美国被称作“血浆欧佩克”，它从出口血浆中获得的收入几乎等于从出口中型汽车获得的收入。这在很大程度上是因为，与大多数其他国家不同，美国允许人们有偿献血。许多捐血者都是一贫如洗。

血液在很多方面仍然是个谜。例如，血型的作用仍然不明；同样，为什么月经是每月来一次，这个频率似乎效率低下。与此同时，血液正在成为医疗界的重头戏。液体活检可以通过简单的血液测试诊断癌症和其他疾病，是近来最有前途的医学发展之一。

乔治总结说：“我们对血液的认识虽然广泛，但尚不彻底。”读《九品脱》是一次很棒的旅行。它让我们明白，关于这种流动在每个人身体里的奇妙液体我们已经知道了什么，还需要探索什么。 ■



Post-Soviet farming

Good times in Grainville

Russia has emerged as an agricultural powerhouse

THE DISTRICT of Zernograd, or Grainville, in Russia's southern Rostov region has many hallmarks of a depressed post-Soviet backwater. Decaying villages dot dusty roads; grey apartment blocks fill sleepy cities. Yet thanks to its namesake crop, times for many here have never been better. Take Yuri and Aleksandr Peretyatko. When the brothers launched their grain farm in the early 1990s, "we didn't even have bicycles," says Aleksandr. Now they own 1,500 hectares and cruise around in new white Lexus SUVs. Their children, Aleksandr boasts, "ride Range Rovers".

The Peretyatko brothers embody the optimism in Russian agriculture, a booming sector in an otherwise sluggish economy. Production has increased by more than 20% in the past five years, despite a broader recession and now stagnation. "That's what's called a breakthrough," President Vladimir Putin gushed as he discussed the upbeat figures at a recent meeting with farmers. Export revenues from agriculture—which reached over \$20bn in 2017—now exceed those from typically strong earners such as armament sales. Grain has been the star. In 2016 Russia became the world's leading exporter of wheat for the first time since before the Russian revolution (see chart). "Grain is our second oil," said Aleksandr Tkachev, the agriculture minister at the time.

This roaring output is the result of a confluence of short- and long-term factors. Since the Soviet Union's collapse, farming has undergone a gradual transformation from "a fantastically ineffective collective model to effective capitalism", says Andrei Sizov, head of SovEcon, an agricultural consultancy in Moscow. Although the state's overall role in Russia's economy has grown,

agriculture has largely remained in private hands, fuelling competition. The devaluation of the Russian rouble in 2014 and bans on agricultural imports from countries that sanctioned Russia that year have provided additional boosts.

Tsarist-era Russia was a big agricultural exporter, but Bolshevik collectivisation wiped out farming traditions and created an inefficient collective system that by the 1970s left the Soviet Union importing grain and other foodstuffs. In the post-Soviet era, farmers had to learn how to run competitive enterprises. The Peretyatkos travelled to Europe to study best practices. “We went to see what private ownership meant, to see how people work for themselves,” Yuri recalls. Over the ensuing decades, investments in machinery, land and supplies accumulated; the government made agriculture a national priority, offering subsidies and support. Recognising the newfound strength of local competitors, in October an American trade group, US Wheat Associates, closed its Moscow office after 26 years of operations.

The rouble’s devaluation has been a particular boon for exporters in recent years. Amid a global glut in grain, Russians have sucked up market share in Africa and the Middle East, leveraging their advantages in geography and weather over competitors in America, while undercutting prices. Grain traders have also begun targeting more distant markets such as Indonesia and even Mexico. Bans on agricultural imports from Western countries have also cleared space for local producers, though at the cost of higher inflation. Although Russia still imports more food than it exports, steps have been made towards the government’s goals of feeding itself: in the past five years, for example, Russia has become self-sufficient in pork and poultry.

The future also looks bright owing to global trends. As populations grow, so too should food consumption, especially in some of Russia’s largest export markets, such as Turkey. Rising temperatures and improving technologies

mean longer growing seasons, higher crop yields and wider swathes of arable land in much of Russia. “Everyone is moving north,” says Yuri. His son has started farming in the Belgorod region, closer to Moscow.

Russia also has latent agricultural potential. Millions of hectares of land abandoned after the Soviet collapse could be reclaimed. Investments in digital technologies, where Russia lags, would lift productivity; downstream food manufacturing is underdeveloped. But tapping these possibilities would need infrastructure improvements. Grain terminals have struggled to cope with record harvests. Outside the fertile south, much farmland sits far from ports. Some also worry about competition as concentration in the hands of giant agro-holding firms increases.

Yet none of that can dampen the mood of those like the Peretyatkos who have seen the sector’s turnaround first-hand. “When we started, we had big doubts about whether it would work out at all,” says Aleksandr. Now, as Yuri puts it, “You could say that Zernograd is returning to its name.” ■



后苏联时代的农业

谷子镇的好日子

俄罗斯已崛起为农业强国

泽尔诺格勒地区（Zernograd）位于俄罗斯南部的罗斯托夫州

（Rostov），又叫“谷子镇”（Grainville），那里带有许多后苏联时代衰落地区的印记。尘土飞扬的道路两旁散布着破败的村庄，灰色的公寓楼填满了寂静的城市。不过，托了地名里“谷子”二字的福，谷物种植让这里许多人的日子前所未有地红火。以尤里·佩莱特科（Yuri Peretyatko）和亚历山大·佩莱特科（Aleksandr Peretyatko）两兄弟为例。亚历山大说，上世纪90年代初他们兄弟俩开办粮食农场时，“连辆自行车都没有”。现在他们拥有1500公顷的土地，开着崭新的白色雷克萨斯SUV四处兜风。亚历山大自豪地说，他们的孩子“开的是路虎揽胜”。

佩莱特科兄弟体现了俄罗斯农业的乐观情绪，这个行业在经济低迷的情况下仍蓬勃发展。尽管整体经济经历了广泛的衰退，目前又陷入停滞，但过去五年里农业生产却增长超过20%。俄罗斯总统普京近期在一次与农业生产者的会议上谈到这些上升数据时赞叹说：“这才叫突破。”农业出口收入在2017年突破200亿美元，目前已经超过了军工等传统出口大户。谷物是其中的明星。2016年，俄罗斯自俄国革命以来首次成为世界上最大的小麦出口国（见图表）。时任农业部长亚历山大·特卡乔夫（Aleksandr Tkachev）说：“谷物是我们的另一种石油。”

产量猛增是短期和长期因素共同作用的结果。莫斯科农业咨询公司SovEcon的负责人安德烈·西佐夫（Andrei Sizov）表示，自苏联解体以来，农业经历了一场渐进的转型，从“一种效率极其低下的集体模式转变为高效资本主义模式”。尽管政府在俄罗斯经济中的整体作用有所增强，但农业在很大程度上仍掌握在私人手中，这加剧了竞争。2014年俄罗斯卢布贬值，加上同年政府严禁从制裁俄罗斯的国家进口农产品，都起到了额

外的推动作用。

沙皇时代的俄罗斯是一个农业出口大国，但布尔什维克的集体化摧毁了农业传统，建立起一个效率低下的集体主义体系，到上世纪70年代，苏联开始进口谷物和其他食品。苏联解体后，农民不得不学习如何经营有竞争力的企业。佩莱特科兄弟前往欧洲学习最佳实践。“我们去那儿看看私有制是怎么一回事，看看人家怎样为自己工作。”尤里回忆说。随后的几十年里，机械、土地和农资方面的投资不断累积；政府把农业列为国家重点产业，提供补贴和支持。意识到当地竞争对手的新实力后，美国贸易团体美国小麦协会（US Wheat Associates）在去年10月关闭了已运营了26年的莫斯科办事处。

近年来卢布贬值对出口商来说尤其有利。在全球谷物供过于求的情况下，俄罗斯利用它在地理和天气方面相比美国竞争对手的优势，抢占了非洲和中东的市场份额，同时压低了价格。谷物贸易商还开始瞄准印尼甚至墨西哥等更遥远的市场。禁止从西方国家进口农产品也为当地生产商创造了空间，尽管代价是通胀上升。虽然俄罗斯进口的食品仍多于出口，但已朝着政府设定的自给自足的目标迈进，例如，过去五年里，俄罗斯在猪肉和家禽方面已实现了自给自足。

就全球趋势看来，未来也很光明。随着人口增长，食品消费应该也会增长，尤其是在一些俄罗斯最大的出口市场，如土耳其。气温上升和技术改进意味着在俄罗斯大部分地区，生长季变得更长，农作物产量增加，可耕地面积扩大。“大家都在往北搬。”尤里说。他的儿子已经开始在离莫斯科更近的贝尔哥罗德（Belgorod）地区经营农场。

俄罗斯还有未挖掘的农业潜力。苏联解体后废弃的数百万公顷土地可以重新开垦。投资俄罗斯落后的数字技术领域会提高生产率；下游食品制造业发展尚不充分。但要利用这些可能性就需要改善基础设施。创纪录的收成让谷物码头不堪重负。除了富饶的南方，许多农田都远离港口。一些人还担心，随着农业市场日益集中到大型农业控股公司手中，竞争会减少。

不过所有这些因素都无法影响像佩莱特科兄弟这些人的好心情，他们亲眼目睹了这个产业的好转。亚历山大说：“刚开始的时候，我们很怀疑干这行到底行不行。”而现在，正如尤里所说：“你可以说‘谷子镇’又实至名归了。”■



Television in America

The end of channel surfing

TV's golden age is real. But for every "Breaking Bad", more shows are just bad

IN 2011 ALEXIS PICHARD, a French academic, declared that American television was enjoying a “new golden age”, marked by vast improvements in cinematography and storytelling. Although critics disagree over when TV emerged as a serious art form, there is consensus that shows like “The Wire” and “Breaking Bad” have brought new sophistication to the small screen.

The picture that emerges from viewers—or at least those who post reviews on IMDb, an online database—is a bit fuzzier. Among dramas from the 1970s with at least 100 ratings, the median show that aired in America had an average score of 7.85 out of ten. In the 1990s, this figure was the same. And since 2010, it has risen to 8.17—a tiny gain. If you were to choose at random one drama from the 2010s and one from the 1990s, the modern one would score worse than the older one 37% of the time.

Does this paltry pace of progress mean that the much-touted golden age of television is much ado about nothing? Not necessarily. In IMDb users’ opinions, far more great TV is made today than ever before. Since 2010, 73 different seasons of dramas have exceeded an average rating of 9.0. In the 1990s, only 11 did. The reason why the average has barely budged is that the onslaught of new shows includes plenty of rubbish. For every brilliant “Game of Thrones”, chronic disappointments like “The Night Shift”, a mediocre medical drama, are only a few clicks away.

Fortunately for audiences, streaming platforms make avoiding such duds far easier. These services’ recommendation systems guide viewers to content they are likely to enjoy. Sure enough, the highest-rated shows now

get the most reviews. From 1993 to 2013, the average IMDb rating of a typical show rose by just 0.26 points. But the average weighted by the number of ratings climbed much more, by 0.89 points. That suggests viewers are finding shows they like far more often today than in the past.

This upward trend may also result from changes in the reliability of the data. Most dramas reviewed on IMDb are modern, and many ratings of older ones were posted years after the shows aired. Yet even if TV's golden age is over-hyped, the medium is still viewers' best bet. IMDb users give the average film drama a rating nearly as bad as those of the worst dramas on TV. ■



美国电视业

无需转台

“电视黄金时代”的说法没错。但每部《绝命毒师》的出现都伴随着一堆绝对烂剧

法国学者亚历克西斯·皮沙尔（Alexis Pichard）在2011年宣称，美国电视正经历“新的黄金时代”，其标志是摄制技术和叙事手法的巨大进步。尽管评论人士对电视何时成为了一种严肃的艺术形式各执一词，但他们却一致认为，像《火线》（The Wire）和《绝命毒师》（Breaking Bad）这样的剧集让小荧屏呈现出了高水准。

而电视观众（或者说至少是那些在互联网数据库IMDb上发布评论的人）反映的情况就没那么清晰了。那些自上世纪70年代起在美国播出、至少获得100次评分的电视剧中，中位剧集的平均得分为7.85（满分10分）。90年代的这一得分没有变化。2010年之后，这一得分小幅上升到8.17。如果分别从本世纪10年代和上世纪90年代的电视剧中随机选择一部，新剧得分低于老剧的概率为37%。

这种微不足道的进步是否表示受到大肆鼓吹的电视黄金时代言过其实了？未必。在IMDb的用户看来，如今上乘的电视剧集远多于以往任何时候。自2010年以来，各种电视剧共有73季的平均得分超过9.0。而上世纪90年代只有11季达到这个水平。平均得分变化甚微，原因是纷至沓来的新剧中夹杂着大量烂剧。令人大失所望的剧集和每一部精彩作品如影随形，从《权力的游戏》（Game of Thrones）切换到平庸的医务剧《夜班医生》（The Night Shift），只是点几下鼠标的事。

幸运的是，流媒体平台让观众更容易绕开这些烂剧。流媒体的推荐系统将观众引向他们可能喜欢的节目。不出所料，如今得分最高的节目得到的评论也最多。从1993年到2013年，一部电视剧代表作在IMDb上的平均分仅上升了0.26分，但是经过评分次数加权的平均分上升幅度就大得多了——0.89分。这表明如今观众观看自己喜欢的节目的几率远高于过去。

这种上升趋势也可能和数据可靠度的变化有关。IMDb上被评论的大多是新剧，很多老剧是在播出多年后发布得分。然而，即使电视黄金时代的说法确实夸大其词，电视这种媒介仍然是观众的最佳选择。质量平平的电影在IMDb上的得分几乎和最烂的电视剧一样低。 ■



Extractive industries

In a hole

Glencore's attempt at reinventing mining has run into trouble

FROM THE edge of the Kamoto Copper Company's pit, it is hard even to see the mechanical diggers toiling dozens of tiers below. The 280-metre hole on the southern edge of the Democratic Republic of Congo is deeper than Africa's tallest building is tall. Lorries take the best part of an hour to crawl out from its heart. The greenish ore they lug is given its hue by copper but much of its value by cobalt nestled within. Usually driven to South Africa, then often shipped to China, the cobalt will emerge from a series of factories as the priciest component of a battery powering a smartphone or, increasingly, an electric car.

A sign at the mine indicates it is 1,320km to Kinshasa, the capital, half a week's drive away. Another arrow points to a less likely destination: Baar, a sleepy suburb of Zurich, 6,600km away at the foot of the Swiss Alps. Located in a business park there are the headquarters of Glencore, the company that ultimately controls the Congolese mine. Once a commodities trader that merely bought and shipped stuff others dug out of the ground, in recent years Glencore has gatecrashed an august club of global mining companies, such as Rio Tinto and Anglo American, whose histories stretch back to colonial times.

Its transformation has not been problem-free, however. Glencore's dealings in Congo have landed it in a hole as deep as Kamoto. Authorities in America, Canada and Britain are probing whether its executives, known in the industry for their sharp suits and elbows, deployed even sharper business practices to get ahead. Investors have started to question the firm's prospects; its share price has slumped. Mining firms once encouraged to

emulate Glencore's aggressive culture now wonder whether their old-fashioned approach might not have more merit after all.

Glencore is to mining what Goldman Sachs is to high-street banking: nominally in the same trade but in a turbo-charged way. Like the Wall Street stalwart, it thrived first as a private partnership, set up in 1974 as Marc Rich + Co. Its eponymous founder gained fame as a consummate trader, and infamy for evading American authorities irked by his busting of sanctions and dodging of taxes. (He was ousted from the firm in 1993, after which the company was rechristened Glencore.)

When the firm listed its shares in London in 2011, it was the first in a generation to be propelled straight into the blue-chip FTSE 100 index. Its top brass, particularly Ivan Glasenberg, a brusque South African who joined in 1984 and who has been chief executive since 2002, were lauded as visionaries in a staid field. At least five senior executives were revealed to be billionaires—almost unheard of for employees rather than founders of any company, whatever the industry. Around 40 top traders held shares valued at over \$200m each.

Bosses of mining firms are mostly engineering types, as comfortable down a mineshaft as in a boardroom. An accountant by training, Mr Glasenberg's spiritual home is the trading floor. Unlike hedge funds, commodities-traders do not make money on fluctuating prices, but by working out how to get the best price for whatever they can source. The job is more logistics than speculation. A wrinkle in markets might mean a pile of high-quality coal and a low-quality one are worth more if blended together into a medium-quality grade. Access to natural resources is vital, and tricky. In recent years, Glencore has made loans to "state-owned" oil firms in Libya and Iraqi Kurdistan, for example, to be repaid in barrels. (That trick works so long as the "state" in question keeps control of the oilfields.) Glencore handles over 90 commodities, from soyabeans to aluminium.

Trading is a fabulously lucrative business. Returns on equity at Glencore's operation can top 40% a year. But there are limits to how big it can get. So Glencore branched out. Instead of just securing the offtake of mines, it wanted to own them. With little in-house engineering nous, it has mostly bought facilities set up by others (or so sniffy rivals decry). Its transformation was complete when in 2013 it took full control of Xstrata, a big coal venture.

Glencore is now overwhelmingly a mining group—around two-thirds of its \$8.6bn in adjusted operating profits last year came from stuff coming out of the ground. But its DNA is still that of a trader's. Sometimes it cuts its own production to support prices: a sort of one-firm OPEC. It is nimbler than rivals, and more opportunistic. "Glencore has a different culture to other miners. They are quick, they trust their own judgment," says Paul Gait of Sanford C. Bernstein, a research firm.

The superlatives are less frequently heard now than they were at the time of listing. Investors who bought Glencore shares at the time have lost 48% of their money since 2011—a worse return than any of its big FTSE mining peers except for Anglo American (see chart). Mr Glasenberg failed to spot a commodities-price wobble coming in 2015. A humbling \$2.5bn capital infusion was required to fix the balance-sheet. After recovering, its shares have slipped again since the start of 2018 and trade at just 7.3 times this year's estimated earnings.

Many people in mining think Glencore's buccaneering business model is now haunting the firm rather than helping it. Mr Glasenberg's strategy has been not so much contrarian as actively seeking out opportunities others shun. His firm has snapped up coal mines that rivals have been all but forced to divest by environmental activists: it is now the world's biggest seaborne exporter of thermal coal, for example. Peers might panic at being

exposed to Vladimir Putin's Russia; Glencore has stakes in Rosneft and Rusal, two firms active in oil and aluminium respectively, both battling American sanctions.

Most worrisome to investors has been its investment in Congo, a country avoided as too risky by Glencore's big rivals. Tricky conditions have necessitated \$7bn in investment to improve its mines there. At first the payoff seemed worth it, especially given a surge in the price of cobalt, a by-product that was a mere afterthought when Glencore had first invested in 2007.

But just as production has been ramping up, the political landscape has worsened. Old agreements to freeze royalties paid by Glencore have been all but torn up by the government. Remitting profits abroad is harder. Under duress, in June Glencore wrote off \$5.6bn it loaned to a joint venture with a government-owned miner, in exchange for equity. To add to its woes, in November cobalt at Kamoto was found to be contaminated with uranium. Sales are suspended until a plant to remediate the radiation can be built.

Yet even radioactivity is not Glencore's biggest problem in Congo. Since first investing a decade ago, it has relied on a deep-seated alliance with Dan Gertler, a controversial Israeli businessman who started in the diamond trade. According to a UN report, after arriving in 1997 Mr Gertler won favour with the ruling Kabila family by offering \$20m to finance the purchase of arms, which the current president's father used to win a bloody civil war. That gained him a perch as an unavoidable middle man to just about anyone looking to dig something from the ground in Congo. Mr Gertler is said to be the inspiration for the film "Blood Diamond" (presumably not for the hero). Through a spokesman, Mr Gertler declined to comment but reiterated claims of having committed no impropriety.

American authorities now have Mr Gertler in their sights. Under "Global

Magnitsky” sanctions first enforced to target Russian wrongdoing, in December 2017 he was among 13 kleptocrats and their cronies placed under sanction for egregious breaches of human rights and for corruption—a problem for Glencore, whose boss once described Mr Gertler as “a supportive shareholder” in a joint venture in Congo. It has found it hard to cut ties with him.

Glencore might have known from the outset of Mr Gertler’s sulphurous reputation. The UN report that outlines his past was written in 2001. In the wake of an American hedge fund facing scrutiny for allegedly dealing with him in 2016, before he was sanctioned, Glencore bought him out from its mines, including Kamoto, for \$534m. But the deal entitled its erstwhile partner to further royalty payments in the region of over \$20m this year and \$100m in 2019. When Glencore at first refused to make these payments, citing the sanctions, Mr Gertler filed a lawsuit and, in essence, threatened to close down Glencore’s Congolese operations. Keen to avoid that outcome, Glencore decided to pay him.

Glencore has insisted it did not violate American sanctions, largely by means of having paid Mr Gertler his dues in euros, and outside America. It has made the case to American and Swiss authorities that penalising it would be tantamount to self-inflicted industrial sabotage: Congo is the source of two-thirds of the world’s cobalt, an element which is crucial to modern electronics (see next article). If it were to leave the place, Glencore has argued, Chinese miners already active there would send ever-more precious cobalt straight to China (as Glencore itself often does, too).

Whatever its merits, this argument seems to have fallen on deaf ears. Three weeks after Glencore paid part of this year’s dues to Mr Gertler, on July 3rd, it announced it had received a subpoena from America’s Department of Justice (DOJ) in respect to compliance with the Foreign Corrupt Practices Act; its activities in Congo, as well as in Venezuela and Nigeria, were cited.

Britain's Serious Fraud Office is also reported to be investigating Glencore on matters relating to Congo, as is the Ontario securities regulator in Canada.

"Paying Gertler was a blatant finger in the eye of US authorities," says a senior executive at a rival firm. "You can't do that and hope to get away with it, even if you are Ivan Glasenberg." Worse, the matter is not even fully resolved: Glencore has yet to publicly announce whether it intends to pay Mr Gertler the money he is entitled to in 2019 under existing agreements. (The company declined to comment.)

Glencore's market value fell by \$5bn on the news of the DOJ investigation—an amount more than five times greater than the biggest fine ever meted out under the relevant statute. That reflects investors' fear not only of a large penalty, but also that American authorities could in effect force a change of direction at the company.

The miner is hardly unique in the corporate world in having faced the attention of American authorities. But Glencore's case stands out. Other American investigations have mostly been against firms where the alleged wrongdoing was peripheral to their activities, where the top brass could blame underlings and where the problem was not seen as indicative of wider culture. Yet some analysts estimate that Congo, at least before its current woes, represented around a quarter of Glencore's market value (now at \$51bn). Mr Glasenberg is reported to be a regular visitor. And the DOJ investigation targets three countries, suggesting it is investigating a pattern of problems.

Analysts have fretted about Glencore itself coming under "secondary sanctions" for its relationship with Mr Gertler. That seems unlikely. But even the slightest whiff that Glencore is abetting sanctions-busting will jangle the nerves of the compliance department of its banks. Commodities

trading is fuelled by ample and cheap bank financing; Glencore has \$33bn in bonds and loans outstanding.

Mr Glasenberg has had to reassure analysts about this. “He knows that if banks start worrying about getting caught up in sanctions stuff just by doing business with Glencore, that would be a terminal issue,” says one. It was worried banks that pushed Mr Rich from his perch in 1993. Given its supportive shareholders—30% are Glencore employees, and the Qatari sovereign-wealth fund has a further 8.5%—the firm’s lenders are the most likely source of pressure on its business model.

Some industry executives worry that Glencore is turning mining into the new banking: a sector aggressively pursued by American authorities, with the power to dictate fresh faces at the top of firms they deem to fall short. “The DOJ worries about sectors that don’t take compliance seriously. Industries only wake up after one of them is hammered, like HSBC in Mexico,” says one industry figure. The bank’s money-laundering of cartel drug money earned it a \$1.9bn fine in 2012, along with five years of intense monitoring, prompting wider change in the banking industry’s culture.

How and when the Glasenberg era ends is what investors are most curious about now. Aged 61, he has already started indicating to investors he won’t be around for more than three to five years—as it happens, roughly the time frame of a DOJ investigation of the scale Glencore faces. None of his lieutenants are in line for promotion; even in the gossipy world of mining, no one has any idea who will succeed him. Once, the obvious choice would have been a swashbuckling trader willing to win at all costs and to plough on in the face of criticism. Less so, now. ■



采矿业

身陷巨坑

嘉能可企图重塑采矿业，但遇到了麻烦

站在卡莫托铜矿公司（Kamoto Copper Company）的矿坑边上，几乎看不清在下面几十层处作业的挖掘机。这个位于刚果民主共和国南部边陲的矿坑深280米，超过非洲最高建筑的高度。卡车从矿坑的中心处开出坑需要大半个钟头。车上装载的矿石因含铜而泛绿色，但其价值主要在于其中所含的钴。这些矿石通常先运往南非，然后多数再转运到中国，经过几家工厂加工后，钴就变身为电池中最昂贵的部分，用于智能手机，也越来越多地用于电动汽车。

矿坑的一个路标显示这里距离首都金沙萨（Kinshasa）1320公里，开车要三四天。另一个箭头指向一个和矿坑关系不大的目的地：巴尔（Baar）。这是苏黎世郊区的一座宁静小镇，坐落于距矿坑6600公里之遥的瑞士阿尔卑斯山脚下。嘉能可（Glencore）公司的总部位于这里的一个商业园区，这家公司掌握着这个矿坑的最终控制权。嘉能可曾经只是个大宗商品交易商，买下他人从地下挖出的矿产再运至别处。近年来，它已闯入了一个高贵的全球矿业公司俱乐部，成员包括力拓（Rio Tinto）和英美资源集团（Anglo American），这些公司的历史可以追溯到殖民时期。

然而，嘉能可的转变并非一帆风顺。它在刚果的交易就让自己跌进了一个大坑，深度堪比卡莫托矿坑。嘉能可的高管们在业内以衣着讲究、手段强硬而知名，美国、加拿大和英国当局正在调查他们是否为取得领先而采取了不正当的商业手段。投资者已经开始质疑公司的前景，导致公司股价暴跌。一些矿业公司曾被鼓励仿效嘉能可咄咄逼人的文化，现在不免会寻思自己的老办法是不是可能更好。

嘉能可在采矿业的地位就像高盛在零售银行业的地位：名义上是同一行业的，但却是涡轮增压版的。嘉能可成立于1974年，和华尔街老店高盛一

样，最初发家时是私人合伙公司，当时名为马克·里奇公司（Marc Rich + Co）。其同名创始人因高明的交易手段而闻名业界，又因违反制裁令和逃税惹恼了美国政府而遭通缉，在逃避通缉中声名扫地。（他于1993年被逐出公司，之后公司改名为嘉能可。）

嘉能可于2011年在伦敦上市时，是20多年来首家甫上市就跻身富时100指数蓝筹股的公司。外界盛赞其高管层身在一个古板的行业却具远见卓识，尤其是伊凡·格拉森伯格（Ivan Glasenberg）。格拉森伯格是个直率的南非人，1984年加入公司，自2002年以来一直担任首席执行官。据披露，嘉能可至少有五位高管身家过十亿。无论是在哪个行业，公司创始人之外的雇员有如此巨大的财富几乎都是闻所未闻的。约40位顶级交易员每人持有的股票价值超过2亿美元。

矿业公司的老板大多有工程背景，在井下和在董事会会议室里一样自在。格拉森伯格是会计专业出身，他的精神家园是交易大厅。与对冲基金不同，大宗商品交易商不利用价格波动来赚钱，而是研究如何为可买到的任何商品谋取最佳价格。这项工作更多关乎物流，而非如何投机。市场上的一丝动静可能意味着一批优质煤炭和一批低质煤炭如果混成中等品质的煤炭会更值钱。获取自然资源至关重要，也很复杂。近年来，嘉能可向利比亚和伊拉克库尔德斯坦（Iraqi Kurdistan）的“国有”石油公司提供贷款，对方以石油偿还。（只要所涉“国家”能继续控制油田，这招就管用。）从大豆到铝，嘉能可交易的大宗商品超过90种。

交易业务非常有利可图。嘉能可业务的股本回报率每年可高达40%。但业务规模受到限制。因此嘉能可开始拓展业务，不仅想确保获得矿石，还想直接拥有矿山。由于自身缺乏工程能力，它主要是买下已由其他公司建好的设施（至少嗤之以鼻的竞争对手是这么贬损它的）。2013年，嘉能可完全控制了大型煤炭企业斯特拉塔（Xstrata），至此完成转型。

现在的嘉能可绝对算是一个矿业集团——去年其调整后的营业利润总计86亿美元，其中约三分之二来自矿业。但它骨子里仍是个交易商。它有时会为了支撑价格而削减自己的产量——就像个只有一家公司的欧佩克。它比

竞争对手更敏捷，也更机会主义。研究公司盛博的保罗·盖特（Paul Gait）说：“嘉能可的文化与其他矿业公司不同。嘉能可的人动作迅速，相信自己的判断。”

与上市时相比，现在对嘉能可的褒奖之词没那么多见了。在其上市时购买了股票的投资者自2011年以来已经损失了48%，回报率比富时指数中除英美资源集团以外的其他任何大型矿业公司都低（见图表）。格拉森伯格未能预见2015年的大宗商品价格波动，为此不得不以注入25亿美元资本这样难堪的举措来修复资产负债表。恢复元气之后，其股价自2018年初以来再次下滑，今年的市盈率仅为7.3倍。

许多矿业人士认为，嘉能可不惧风险的商业模式现在非但帮不了它，反而徒增困扰。格拉森伯格的策略算不上逆势而为，而是积极寻找别人避之不及的机会。他的公司抢购了数座煤矿，基本上都是竞争对手迫于环保主义者的压力而不得不出售的资产，比如嘉能可现在已经是世界上最大的热煤海运出口商。其同业可能会对与普京治下的俄罗斯打交道感到惶恐不安，嘉能可却持有俄罗斯石油公司（Rosneft）和俄罗斯铝业（Rusal）的股份，两家公司在各自的行业里都很活跃，也都在对抗美国的制裁。

最让投资者担忧的是它在刚果的投资。嘉能可的主要竞争对手都因风险太大而避开这个国家。由于采矿条件恶劣，嘉能可需要投资70亿美元来改善刚果的矿山。起初这些投入看起来很划算，尤其是因为钴价飙升了——2007年嘉能可启动首轮投资时并没有注意到这件副产品。

但就在产量逐步增加之时，政治局面恶化了。冻结嘉能可支付的特许权使用费的旧协议几乎被政府撕毁。向境外汇出利润变得更加困难。迫于无奈，嘉能可在今年6月勾销了它提供给与刚果一家国有矿业公司的合资企业的56亿美元贷款，换成了股权。雪上加霜的是，11月卡莫托的钴矿被发现受到铀污染。在治理辐射的工厂建成之前，销售暂停。

然而，就算是放射性污染也说不上是嘉能可在刚果的最大问题。自从十年前首次投资刚果以来，它一直依赖与备受争议的以色列商人丹·格特勒

(Dan Gertler) 的深度联盟。格特勒从钻石贸易起家，据一份联合国报告所述，自1997年来到刚果之后，他向统治该国的卡比拉(Kabila)家族提供了2000万美元用于购买武器，现任刚果总统的父亲用这些武器在血腥的刚果内战中赢得了胜利。格特勒因而受到卡比拉家族的青睐而地位尊崇。不管是谁要在刚果采矿，他都是一个无法绕过的中间人。据说格特勒是电影《血钻》(Blood Diamond)的灵感来源（但应该不是主角的原型）。格特勒通过发言人表示拒绝发表评论，但重申自己没有任何不当行为。

美国当局现在盯上了格特勒。根据《全球马格尼茨基人权问责法案》(Global Magnitsky)，一开始是针对俄罗斯的不当行为实施制裁)，格特勒在2017年12月入列13名腐败官员及其亲信，因严重侵犯人权和腐败行为而受到制裁。这对嘉能可来说是个麻烦，因为其老板曾将格特勒描述为在刚果一家合资企业中“持支持态度的股东”。嘉能可很难和他一刀两断。

嘉能可或许从一开始就知道格特勒的恶名。联合国概述此人过往经历的报告是于2001年撰写的。2016年，一家美国对冲基金因涉嫌与他打交道而受到审查，从这以后到格特勒受到制裁的期间，嘉能可以5.34亿美元买下了格特勒在包括卡莫托在内的多个矿山的股份。但根据双方协议，嘉能可还需在今年和明年分别向这位前合伙人支付超过2000万美元和一亿美元的特许权使用费。嘉能可一开始以制裁为由拒绝支付这些款项，格特勒随即提起诉讼，实质上就是威胁要停止嘉能可在刚果的业务。为避免这种结果，嘉能可决定给钱。

嘉能可坚称没有违反美国的制裁规定，主要理由是对格特勒的付款是在美国以外以欧元进行的。它试图让美国和瑞士当局相信，惩罚它将无异于自毁工业长城：刚果供应了全球三分之二的钴，而钴对现代电子产品至关重要。嘉能可辩称，如果它撤出刚果，已经活跃在那里的中国矿业公司将会把越来越多珍贵的钴直接运往中国（嘉能可自己也经常这样做）。

无论是否有其道理，这种说法似乎并未被采信。7月3日，也就是嘉能可向

格特勒支付了今年的部分特许权使用费的三周后，公司宣布收到了美国司法部就《反海外腐败法》（Foreign Corrupt Practices Act）合规问题发出的传票，调查涉及它在刚果以及委内瑞拉和尼日利亚的业务。据报道，英国重大诈骗案检察局（Serious Fraud Office）和加拿大安大略省的证券监管机构也都在调查嘉能可涉及刚果的操作。

“给格特勒付钱就是公然和美国政府对着干，”竞争对手公司的一位高管表示，“谁也不能这么干还指望能平安无事，哪怕你是伊凡·格拉森伯格。”更糟糕的是，格特勒的事甚至还没彻底解决：嘉能可尚未公开宣布是否打算根据现有协议在2019年向格特勒付款（公司拒绝就此发表评论。）

被美国司法部调查的消息一出，嘉能可的市值蒸发了50亿美元——这个数字是根据相关法规所能给出的最高罚款金额的五倍多。这反映了投资者不仅担心嘉能可会遭到巨额罚款，还担心美国当局此举实际上可能会迫使这家公司改变发展方向。

嘉能可并非企业界受到美国当局关注的唯一公司，但这家矿业公司的案例引人注目。其他被美国调查的企业大多是非核心业务涉嫌存在不法行为，企业高层可以将责任推给下属，这些问题也不会被认为代表了整个企业的文化。然而，一些分析师估计，至少在嘉能可陷入目前的困境之前，刚果就已占据其市值（目前为510亿美元）的四分之一左右。据报道，格拉森伯格是刚果常客。美国司法部此次重点调查三个国家，表明它正试图查明一种问题模式。

分析师担心嘉能可本身会因为与格特勒的关系而受到“次级制裁”。这似乎不太可能。但即使有一点点风声暗示嘉能可同谋违反制裁，都会牵动向其提供贷款的银行的合规部门的神经。大宗商品交易依靠大量廉价的银行融资，嘉能可共有330亿美元的未偿债券和贷款。

格拉森伯格需要打消分析师在这方面的疑虑。“他知道，如果银行开始担心只是因为和嘉能可做生意就会卷入制裁问题，那么对嘉能可就很要命。”一位分析师说。1993年将里奇推下尊贵之位的就是心生不安的银

行。鉴于嘉能可的股东总体对公司持支持态度——其中30%是公司员工，另外8.5%是卡塔尔主权财富基金——那些向该公司提供贷款的银行最有可能对其商业模式施加压力。

一些业内高管担心嘉能可正在把矿业变成又一个银行业：受到美国当局的密切关注，且当局有权在它认为有问题的公司中指派新高管。一位业内人士表示：“司法部对那些不认真对待合规问题的行业不放心。各个行业只有在其中一员受到重罚之后才会重视，就像汇丰银行墨西哥分行的情况那样。”这家银行因为为贩毒组织洗钱而在2012年受到19亿美元的罚款，还要在五年内接受严密监控，这件事促使银行业文化发生了广泛的变化。

投资者现在最好奇的是格拉森伯格时代会如何以及在何时终结。现年61岁的格拉森伯格已经开始向投资者表明自己在三到五年内就会离任——正好是嘉能可面临的这种规模的司法部调查大致所需的时间。他的副手都不在接班之列，即使在采矿业的八卦圈里也没有人知道谁会接替他。曾几何时，显而易见的选择是一个愿意不惜一切代价打胜仗、面对反对声披荆斩棘的勇士型交易员。现在看来，这不大行得通了。■



Segway-Ninebot

Torque of the town

How a Chinese robotics company has made Segway (almost) cool

THE TESTERS zip past boxes of desiccants, packing crates and mounds of small rubber wheels, wearing helmets and pads on their knees and elbows. They drive the latest batch of electric kick-scooters past the assembly lines and into a pen surrounded by protective nets and multicoloured bunting, over speed bumps and cobblestones, down steps and up ramps. One rider tests around 450 e-scooters a day.

Once each has clocked up 1km doing laps of the 1,200-worker factory in Changzhou, a city in Jiangsu province, they are shipped. On a recent visit three models, each with small customisations, rolled off conveyor belts. One was for Xiaomi, a domestic maker of smartphones and gadgets. The two others were for Bird, an American app-based rental service for scooters which was valued in June at \$2bn; and Grin, a new scooter-sharing startup in Mexico. Soon production will begin on a similar fleet for SEAT, a Spanish car company.

Ninebot, which owns the factory, claims to have made over nine-tenths of the e-scooters now gliding through American cities. These scooters carry sleek designs with bright colours (green for Lime, orange for Spin, two other thriving firms) and minimalist four-letter names (Goat and Skip). But thanks to Ninebot, most also bear an older brand on their handlebars—“powered by Segway”.

Set up in 1999, Segway invented the over-engineered self-balancing scooter of the same name. It languished under its initial owners (one of whom died after riding the two-wheeler off a cliff). But Segway has been rallying under

the direction of Ninebot, which acquired it in April 2015 for an undisclosed sum—shortly after Segway sued it for patent infringement.

It took Segway a decade to hit its initial 13-month target to sell 100,000 units of its original two-wheeler. In 2018, just three years into production, Segway-Ninebot will sell 1m scooters, up from sales of 600,000 last year. Ninebot's factory in Changzhou builds over 5,000 scooters a day. The firm's backers, which include Xiaomi, valued it at \$1.5bn in its latest funding round.

At its headquarters in the tech hub of Zhongguancun in Beijing, scooters are propped up against desks and helmets are strewn about. Still, Gao Lufeng, its chief executive, says the booming scooter-sharing business is only “a fraction” of Ninebot’s work. Its scooters account for one-fifth of its total revenue, almost all of which comes from its range of personal transporters, which include self-balancing unicycles (one is pictured) and e-skates, using Segway-Ninebot’s balancing technology.

Mr Gao has especially high hopes for delivery businesses. In five years’ time he wants unmanned delivery vehicles called Loomo, currently being trialled by its robotics arm with Meituan-Dianping, an online-services giant, to account for over half of Ninebot’s total revenue. Using artificial intelligence Loomo can wheel goods from the gate of a compound into lifts then up to office doors, and, as costs come down, could take them straight to workers’ desks, says Mr Gao.

The new venture gives a sense of Ninebot’s ambition. It launched its first scooters within months of buying Segway, but the idea was older. Although Ninebot insists it developed its own self-balancing technology before the merger, Segway brought with it over 400 patents. Importantly, the acquisition let Ninebot drive its cheaper, sleeker products into an American market from which Segway had hoped to bar it. “Segway is like

Lamborghini,” says Mr Gao, “and Ninebot is like Volkswagen”, the owner of the luxury carmaker.

The Segway brand has helped Ninebot expand beyond America, too. It expects competition in the scooter-rental business to heat up next year, as the likes of Bird and Lime battle with local contenders in Europe and elsewhere. Spin (bought last month by Ford for \$100m) and Lime say they will design and build their own scooters, though Ninebot doubts they will match its production costs in the near future. Mr Gao thinks electric scooters may “disrupt even the old bicycle, because they appeal to our lazy nature”. Ninebot, at least, will not be standing still. ■



赛格威-纳恩博

飞车之王

一家中国机器人公司如何让赛格威变得（几近）火爆

戴着头盔、护膝和护肘的测试人员从一箱箱干燥剂、板条箱和成堆的小橡胶轮边疾驰而过。他们骑着“新鲜出炉”的电动滑板车，穿过装配线，进入一个由防护网和彩旗环绕的围栏，再骑过减速带和鹅卵石路面，下台阶，上斜坡。每名骑手一天测试大约450辆电动滑板车。

在江苏常州这家拥有1200名员工的工厂里，每辆车在发货前都会绕厂跑满1公里。记者最近走访时有三款车型下线，都根据客户的需求略有定制。其中一款是为国内智能手机及小设备制造商小米定制。另外两款分别供应美国的Bird和墨西哥的Grin，前者是一家通过APP提供滑板车租赁服务的公司，今年6月估值20亿美元，后者是一家共享滑板车创业公司。工厂很快将开始为西班牙汽车公司西雅特（SEAT）生产一批类似的滑板车。

拥有这家工厂的公司纳恩博声称，目前滑行于美国各大城市的电动滑板车中超过九成都是由其生产。这些滑板车设计时尚，色彩亮丽（其中绿色和橙色分别为另外两家新兴公司Lime和Spin制造），以极简的四字母单词命名（如Goat和Skip）。不过，感谢纳恩博的仁慈，这些滑板车上大多还印有一个老品牌的名字——把手上写着“赛格威动力”（powered by Segway）的字样。

创立于1999年的赛格威发明了与公司同名的过度设计的自平衡滑板车，但在公司最初的所有人（其中一人在骑这台双轮车时坠崖身亡）领导下日渐衰落。2015年4月，也就是赛格威起诉纳恩博专利侵权之后不久，纳恩博收购了赛格威，交易金额未对外披露。归入纳恩博麾下后，赛格威已开始重振旗鼓。

赛格威最初的目标是用13个月销售10万辆其最初设计的那种双轮车，结果却用了十年。而2018年，仅仅投产三年的赛格威-纳恩博预期会将滑板车

的销量从去年的60万辆增加到100万辆。纳恩博的常州工厂日产滑板车5000多辆。在最新一轮融资中，包括小米在内的投资者对其估值15亿美元。

在纳恩博位于北京中关村科技园的总部，一张张办公桌边都靠着滑板车，头盔也随处可见。不过公司首席执行官高禄峰表示，蓬勃发展的滑板车共享业务只是纳恩博业务的“一小部分”。滑板车只占公司总收入的五分之一，而公司总收入几乎全部来自各类个人交通工具，包括自平衡单轮车（如图）和采用赛格威-纳恩博平衡技术的电动平衡轮。

高禄峰对送货业务尤其寄予厚望。他希望一款名为路萌（Loomo）的无人送货车五年后能贡献纳恩博总收入的一半以上。目前公司的机器人部门正与在线服务巨头美团点评联合测试路萌。高禄峰表示，利用人工智能，路萌可将货物从店家的门口送进电梯，然后送到办公室门口。随着成本降低，它还可以直接将货物送到员工的办公桌边。

这个新项目让人们感受到纳恩博的雄心壮志。纳恩博在收购赛格威之后的几个月内推出了第一批滑板车，但想法由来已久。尽管纳恩博坚称在并购前就开发了自己的自平衡技术，但赛格威带来了400多项专利。重要的是，此次收购让纳恩博将其更便宜、更时尚的产品推向美国市场，而赛格威之前一直想将纳恩博挡在这个市场之外。“赛格威就像兰博基尼，”高禄峰说，“纳恩博就像大众。”兰博基尼这家豪华汽车制造商现在归大众所有。

赛格威的品牌也帮助了纳恩博在美国以外的地区扩张。纳恩博预计，随着Bird和Lime等公司与欧洲等地的本土对手展开竞争，明年滑板车租赁业务的竞争将升温。Spin（上月被福特以1亿美元收购）和Lime表示，它们也将设计和制造自己的滑板车，尽管纳恩博认为它们的生产成本在短期内还不能与自己匹敌。高禄峰认为电动滑板车“甚至可能冲击老式自行车，因为它们迎合了人们懒惰的天性”。至少，纳恩博不会停在原地。 ■



Prosthetic limbs

Ghost busters

Experience of phantom limbs lets amputees control real replacements

IN THE EARLY 16th century a knight called Gottfried von Berlichingen spent decades marauding and feuding on behalf of the Holy Roman Empire. He conducted most of his career singlehandedly—the other having been blown off by a cannonball. To replace it he had a metal duplicate made, with spring-loaded fingers that could hold a sword, shield or the reins of his horse. This early prosthetic device gave him the nickname “Götz of the Iron Hand”.

Prostheses have come a long way since Götz’s day. A technique called targeted muscle re-innervation (TMR) permits surgeons to take the nerves that once controlled a missing limb and attach them to muscles in a patient’s chest or back. The redirected nerves grow into their new muscular homes. These then act as signal amplifiers: a muscle’s electrical activity reflects that of the nerves supplying it, but is far more powerful and therefore easier to detect using external electrodes. That activity, duly interpreted by computer, can be used to drive motors within the prosthesis to make it do what its wearer wants.

For this to happen, though, the patient must spend weeks, or even months, learning to twitch the re-innervated muscles in particular ways to achieve particular outcomes. That is frustrating and tedious. Nor is the re-innervating surgery itself without risk. A better way to control prosthetic limbs would be welcome. And one may now be on offer.

Some amputees feel the presence of a phantom limb where the real one was. Often, they feel that phantom to be under their control. If it were possible

to use these feelings to direct the behaviour of a prosthesis, TMR might be made redundant. Nathanael Jarrassé of the Sorbonne and Jozina de Graaf of Aix Marseille university, both in France, have begun working on how to do this.

In their latest study, just published in *Frontiers in Bioengineering and Biotechnology*, Dr Jarrassé and Dr Graaf stuck six electrodes onto the arm stumps of two volunteer amputees who had each lost that limb above the elbow. (The loss of the elbow joint as well as the wrist greatly complicates the task of interpreting the signals and controlling the prosthesis.) These half-dozen electrodes read activity coming from the arm's remaining muscles as the volunteer thought about moving the missing limb.

The trick was that the learning needed to manipulate the prosthesis was done not long-windedly, as in TMR, by the patient, but rapidly, by a computer algorithm. This recognised within minutes the different patterns of electrical activity that corresponded to different actions of the phantom limb as imagined by the volunteer, such as opening or closing the hand, or moving the wrist. It then directed motors to replicate such actions in the prosthetic arm. Both patients were thus able to use the device intuitively—successfully grasping, placing and releasing objects.

The new system is not perfect. At the moment the algorithm recognises only the type of movements the phantom limb is making in the patient's mind, not their speed or their amplitude. It also takes half a second or so to process the electrodes' signals. This delay between intention and execution means the user does not yet experience the prosthesis as if it were part of the body. These imperfections are, though, things that might be overcome in the future. And if they can be, the phenomenon of phantom limbs will have been turned from something that is often distressing to those experiencing it, into something of great benefit. ■



假肢

变幻为真

幻肢感让被截肢者得以控制真实的替代装置

十六世纪初，一位名叫戈特弗里德·冯·贝利欣根（Gottfried von Berlichingen）的骑士为神圣罗马帝国征战了几十年。他戎马生涯的大部分时间都是靠一只手冲锋陷阵，因为另一只手被炮弹炸飞了。他请人用金属做了一只假手，手指上装有弹簧，可以握剑、持盾或抓马缰绳。这个早期的假体装置为他赢得了“铁手戈茨”的绰号。

自戈茨的时代以来，假肢已经取得了巨大进展。一种名叫“目标肌肉神经分布重建”（TMR）的技术让外科医生可以将原本控制失去的那部分肢体的神经取出，附加到患者胸部或背部的肌肉上。重新定向的神经在新的肌肉里安家落户。之后，这些肌肉就充当了信号放大器——肌肉的电活动反映的是提供信号的神经的电活动，但却强有力得多，因此更容易被外部电极检测到。这种电活动经过计算机适时的分析解读，可以用来驱动假肢内的电动机，让假肢完成主人想做的动作。

但要做到这一点，断肢者必须花上数周甚至数月的时间，学习特定方法让新植入了神经的肌肉能够活动，以达到特定效果。这个过程非常艰难且枯燥。而且神经移植手术本身也并非毫无风险。人们期盼一种更好的操控假肢的方法。也许目前就有这么一种。

一些被截肢者感觉断肢处有幻肢存在。他们还经常感到自己能控制幻肢。如果能够利用这种幻肢感来控制假肢的活动，TMR可能就会被淘汰。法国索邦大学（Sorbonne）的纳塔内尔·贾拉斯（Nathanael Jarrassé）和艾克斯-马赛大学的约吉娜·德·格拉夫（Jozina de Graaf）已经开始着手这方面的研究。

《生物工程与生物技术前沿》杂志（Frontiers In Bioengineering and Biotechnology）刚刚发表了贾拉斯和格拉夫的最新研究。他们挑选了两

名肘部以下小臂残缺的志愿者，将六个电极植到志愿者的残臂上。（手腕及肘关节的缺失极大增加了解读信号和控制假肢的难度。）当志愿者想着要移动缺失的肢体时，这六个电极就检测到了残臂肌肉的电活动。

关键在于，操控假肢所需的学习不是像TMR那样由患者耗时费力地完成，而是由计算机算法快速完成。算法在几分钟内就能识别不同的电活动模式，这些模式与志愿者想象的幻肢的不同动作相对应，比如张开手、握拳或活动手腕。然后，算法指示电动机在假肢内重现这些动作。由此两名患者都能凭借直觉使用该设备，比如成功地抓紧、放置以及松开物品。

这个新系统还不够完善。目前，算法只能识别患者头脑中幻肢所做的动作类型，而不能识别动作的快慢或轻重。它还需要半秒左右的时间来处理电极信号。这个从“想做”到“做到”之间的时间差让使用者不能有假肢与自己融为一体的感觉。不过，这些缺陷未来有可能被完善。如果真会这样，幻肢感就会从常常让当事人感到困扰的事转变成一件大有裨益的事。■



Bartleby

Working for a purpose

An academic calls for an overhaul of the conventional company

THE MODERN company has morphed into a “money monster” enslaved to the doctrine of shareholder value. That is the thesis of a new book* by Colin Mayer, a professor at the Saïd Business School in Oxford. It is the latest challenge to the principle enunciated by Milton Friedman, an economist: namely, that “there is one and only one social responsibility of business—to use its resources and engage in activities designed to increase its profits so long as it stays within the rules of the game.” An influential paper** by Oliver Hart and Luigi Zingales last year argued that profitability is not the only criterion that should apply and that shareholders’ welfare is affected by a broad range of factors, including social and environmental conditions.

Mr Mayer takes a similar line, arguing that companies have relationships with many more people than just shareholders. As well as financial capital, they use several other types—human, intellectual, material (buildings and machinery), natural (the environment) and social (public goods like infrastructure).

He also notes that the original conception of a firm was quite different from now. The *societas publicanorum* were Roman bodies that performed public functions such as tax-collecting or maintaining buildings. They raised finance from shareholders and their shares were traded. The medieval idea of a company revolved around a family business. The founders were people who took bread together (hence the term *cum panis*). In the early-modern era, firms such as the Dutch and English East India Companies were set up in order to pursue national trade objectives.

This mix of family and state-linked businesses still exists in many developing nations. The countries with a really narrow focus on shareholder value are America and Britain, and this is where Mr Mayer concentrates his criticism.

Mr Mayer thinks that companies should find a purpose that is broader than the amassing of profits. They should be “doing well by doing good”. With that principle in place, the law should then require firms to demonstrate how their governance, leadership and incentives are organised so that purpose can be realised. Financial accounts should be redrawn to reflect the company’s effect on human, social and natural capital, as well as its financial performance. He also proposes (along with other proponents of “long-term” capitalism) that interest payments on debt should no longer be tax-deductible and that the voting rights of shareholders should reflect the length of time that they have owned their certificates.

Mr Mayer’s riposte to the charge that his ideas are overly idealistic is that the current system is simply not working according to conventional measures of economic success. Britain has a corporate model that is very friendly to investors, with dispersed share ownership, an active takeover market and strong creditor rights. The result, he posits, has been a poor national record on investment, productivity and innovation.

He also notes that firms which pursue approaches that come under the heading of “sustainability” or “social responsibility” enjoy higher returns, lower risks and lower costs of capital. (A recent paper by Robert Eccles, Ioannis Ioannou and George Serafeim showed as much.***)

Yet this line of reasoning also raises some objections to the author’s broad thesis. If sustainability is profitable, then shareholders should push more companies in that direction without the need for an overhaul of the current system.

And the change of financial accounting that Mr Mayer recommends would create all sorts of headaches. Social and environmental costs would be tricky to calculate. Financial profits form the basis for corporate taxation and for the distribution of dividends. It is hard to see a new, lower figure being used for tax purposes (government receipts would fall) or dividend calculation (cash would pile up on companies' balance-sheets). So the main use of the number would be as a benchmark for incentive plans. And that would give scope to senior executives to game the new measure. Mr Mayer's prescriptions may be laudably virtuous overall, but there would be lots of devils in the details.

* "Prosperity: Better Business Makes the Greater Good", Oxford University Press

** "Companies Should Maximise Shareholder Welfare Not Market Value", *Journal of Law, Finance and Accounting* 2017

*** "The Impact of Corporate Sustainability on Organisational Processes and Performance", *Management Science*, Vol 60, No 11 ■



巴托比

志当存高远

一位学者呼吁全面改革传统企业

现代企业已变身为一头“金钱怪兽”，受股东价值这一信条的左右。牛津大学赛德商学院教授科林·梅耶（Colin Mayer）的新书*便是围绕这一主题展开。该书对经济学家米尔顿·弗里德曼阐释的准则发起了最新一轮挑战。在弗里德曼看来，“企业有且只有一个社会责任，那就是在遵守游戏规则的前提下，利用手中的资源从事一切助其利润增长的活动。”去年，奥利弗·哈特（Oliver Hart）和路易吉·津加莱斯（Luigi Zingales）发表了一篇有影响力的论文**，指出不应仅采用盈利能力这一项衡量标准，而且股东福利会受到包括社会及环境条件在内的一系列因素的影响。

梅耶也持类似观点，指出企业除股东外还与其他许多人存在关系。除金融资本外，企业还要运用其他几种类型的资本：人力的、智力的、物质的（建筑和机械）、自然的（自然环境）和社会的（基础设施之类的公共产品）。

梅耶还指出，公司最初的概念已与现在相去甚远。古罗马时期的“公共社团”（*societas publicanorum*）是履行征税和建筑物维护等公共职能的团体。它们向股东筹集资金，并出售自己的股份。到了中世纪，公司的概念主要与家族事业有关。公司的创立人即为共享面包的人（这就是*cum panis*即“与面包在一起”的由来）。到了现代的开端，为实现国家的贸易目标，荷属和英属东印度公司这样的公司被创立起来。

至今在很多发展中国家仍旧既有专注家族事业的公司，也有为国家效力的企业。真正非常狭隘地专注于股东价值的国家是英美两国，梅耶的炮火主要就集中在此。

梅耶认为，企业应该寻觅一个比积聚利润更高远的目标。它们应该“靠做好事成功”。等到大家都开始遵循这一准则，法律就应要求公司说明它们

为了实现这样的目标要如何安排管理、领导层以及激励机制。财务账目应重新规划，使其除公司财务绩效外，还能反映公司对人力、社会及自然资本的影响。他还建议，债务利息偿付应取消抵扣税，股东的表决权也应视其持有股票时间的长短而定（其他“长期”资本主义的拥护者也持这样的意见）。

有人批评梅耶的想法过于理想化。对此他巧妙地反驳道，以衡量经济成就的常规指标看，现有体系根本就不奏效。英国企业模式的特点是股权分散，接管市场活跃，债权人权益强大，这使得该模式对投资者来说非常友好。他推断，其结果就是英国在投资、生产率和创新方面成绩不佳。

他还指出，那些贯彻“可持续性”或“社会责任”这类行动指针的企业回报更高，风险和资本成本也更低。（罗伯特·埃克尔斯[Robert Eccles]、扬尼斯·约安努[Ioannis Ioannou]和乔治·塞拉芬[George Serafeim]近期的一篇论文也有同样发现。***）

然而，这一论证也引发了一些针对其总论点的异议。如果可持续性能带来利润，那么股东们就应推动更多公司沿这个方向前进，而用不着全面改革现有体系了。

而且，梅耶建议的财务会计方面的改变也会引发各种麻烦。社会及环境成本会很难计算。财务利润构成了公司税和分红的基础。很难想见企业会在纳税或估算红利时采用一个新的、更低的数字，前者会令政府收入下降，后者会造成企业资产负债表上现金堆积。因此，这样的数字主要还是会用作企业激励计划的基准。而这又会让那些高级主管有机会钻新标准的空子。梅耶建议的解决之道也许总体来说是值得赞赏的德行，但在细节中也暗藏着诸多困难。

* 《繁荣：更好的企业创造更大的利益》，牛津大学出版社

***“公司应最大化股东的福祉而非市场价值”，《法律、金融及会计杂志》，2017年

***“企业可持续性对组织程序及绩效的影响”，《管理科学》，第60卷，第11期 ■



The IT industry

The opening Dell

Having turned his creation into the world's largest private technology firm, Michael Dell plans to take it public again

THERE ARE two ways to make money selling technology, goes an old industry saying: unbundling and bundling. Thanks to the spectacular rise in recent years of cloud-computing services from Amazon and Microsoft, many firms have shifted chunks of software, data and applications previously stored on in-house servers to the new “public cloud” infrastructure. Customers can now access a dizzying array of software and hardware offered as unbundled, cloud-based services.

Dizzying—but also bewildering. The typical chief technology officer (CTO) of a big firm, under pressure to take advantage of every computing advance from data-analytics to artificial intelligence to the internet of things (IoT), is faced with a mish-mash of information-technology options. The next big opportunity should therefore lie in simplifying this balkanised mess.

That insight lies at the heart of Michael Dell's vision for the future of Dell Technologies, a giant IT firm based in Texas. The billionaire founded Dell in his college dorm room at the University of Texas in 1984 and by the age of 27 he became the youngest-ever boss of a Fortune 500 company (Mark Zuckerberg was nearly 29 when Facebook first made the list, in 2013). Mr Dell revolutionised the business of personal computers (PCs) by selling directly to customers, adopting just-in-time manufacturing and lean, global supply chains that undercut rivals.

Now Mr Dell is pushing forward his next revolution. He is trying to save the ageing PC manufacturer from commoditisation by dramatically expanding its software and cloud offerings. He took Dell private in 2013 helped by Silver

Lake Partners, a Californian private-equity firm, in a deal worth \$24.4bn. At the time, Dell's revenues and profits were tumbling as the PC market was squeezed by the rise of mobile devices and low-cost Asian manufacturers. Its prospects were rapidly darkening.

Away from the scrutiny of public markets, Mr Dell invested heavily (\$13.6bn in research and development since 2013) to strengthen Dell's capabilities in cutting-edge software and cloud integration. He pulled off the largest-ever tech acquisition, gobbling up EMC, a big American provider of data-storage devices and cloud-computing software, for \$67bn in 2016.

Very few firms have been able to pull off a corporate transformation, says Michael Cusumano of the MIT Sloan School of Management, but he thinks Mr Dell's labours are starting to produce results. As a result of both ongoing investment and accounting charges related to the purchase of EMC, Dell continues to make losses (see chart) but its growth engine is at last fired up. On November 29th its quarterly results included a surge in revenues of 15%. The firm's cashflow from operations leapt from \$2.4bn in the fiscal year ending in February 2017 to \$7.7bn in the four quarters to November 2nd 2018; losses fell.

On its current trajectory, Dell looks set to achieve annual revenues this year of just over \$90bn, up from roughly \$80bn last year. Dell's hope is that its investments in cloud computing and software, which offer far higher margins than the PC business, will soon return it to profitability.

A good example is Dell's crown jewel: VMware, a pioneer in virtualisation software, which allows software to run on multiple machines seamlessly. It is a publicly traded and profitable entity with a hip campus in Palo Alto, California. Since Dell got hold of most of VMware through the EMC acquisition, investors have been able to own a piece of Dell itself through

DVMT, a special tracking stock that is meant to reflect Dell's ownership stake in VMware.

Soon they will be able to buy into all of Dell directly. Shareholders gathered on December 11th in Round Rock, Texas, at Dell's unpretentious headquarters, to vote on a complex proposal that would allow the firm to pull off something resembling a reverse merger (the acquisition of a listed firm by a privately held one that is keen to go public without the hassle of a conventional initial public offering).

This plan, announced in July, involves converting DVMT shares into new Dell shares to be publicly traded. DVMT investors could accept the new Dell shares at a given conversion ratio or cash out (though a cap on cash available means those choosing the latter may have to receive a mix). VMware said then that it would pay out a special one-time dividend of \$11bn, with Dell to use its share of the dividend (about \$9bn) to help fund the transaction. In an initial proposal, Mr Dell and Silver Lake offered a deal that implied a value for DVMT of about \$22bn, including \$9bn in cash.

After noisy objections from Carl Icahn, an activist investor (who also made trouble back in 2013 about the price at which Dell went private), they revised the terms last month to reflect a value of some \$24bn for DVMT, some \$14bn of it in cash. The resolution were approved by shareholders, meaning Dell would soon trade on the New York Stock Exchange.

The real challenge begins after the vote. Mr Dell's plan to emphasise software in future contains three bets. The first is to be the best all-in-one provider of bundled IT. That may not be easy. Norman White of the NYU Stern School of Business observes that combining a commoditised hardware business with an innovative software business is particularly hard to do. And IBM's \$34bn acquisition in October of Red Hat, a provider of open-source software, which it plans to sell alongside hardware, could make

Big Blue a potent rival.

Still, Dell's transformation is welcomed by many beleaguered IT managers. The chief information officer of a big British bank that spends over \$50m a year on Dell kit says he values its ability to provide "converged infrastructure" that bundles multiple IT components such as servers, data-storage units, networking switches and the software to make all this gear work together, into a single package. Cheekily, Mr Dell promises customers to be the "one throat to choke" in case things go awry.

Mr Dell's second big bet is on the rise of a "hybrid" cloud which allows customers to blend their out-of-house and in-house IT. Companies are growing nervous about putting all of their sensitive customer and business data on third-party clouds. Lonne Jaffe, a former IBM man now at Insight, a venture-capital company, insists that hybrid clouds are the future.

The public cloud promoted by Amazon and Microsoft will remain a force to reckon with. Dell cannot invest as much in innovation, and is sure to face ruthless price competition from Amazon. Still, Dell may be catching a wave big enough to carry several firms. Last year Gartner, a consultancy, predicted a "massive shift toward hybrid infrastructure", with 90% of companies using hybrid clouds by 2020.

A third bet is on "edge" computing. As countries roll out 5G networks and firms put smart sensors into everything, the IoT should arrive. Mr Dell says it will make demands that the public cloud cannot satisfy. If an autonomous vehicle (AV) senses it is about to hit a deer on a country road, he asks, must it wait for software housed in a distant public cloud to give it permission to stop? It is an unlikely scenario but one Dell is using to promote its IoT division.

One of Dell's big customers says the answer is obvious. "Decisions must be

taken absolutely in real time, a car is a data centre on wheels," says Simon Bolton, chief information officer of Jaguar Land Rover (JLR), an Indian-owned carmaker. The answer is edge computing, which allows the car to have a lot of computing power in the boot. JLR has long used Dell desktop computers, EMC storage devices and VMware software. Now it is using other bits of the firm's kit (cyber-security software, for example) as it develops edge-computing systems.

Last year, Dell created a new division devoted to the IoT. It has promised to invest \$1bn in research and development over three years. Its venture-capital arm has invested in Graphcore, a British startup developing AI processors and software. Its super-fast chip, which enjoys very low latency (the time it takes for data to get to their destination), is ideal for use in AVs. Graphcore is bringing these AI chips to market by putting them into Dell hardware, which the latter's legions of salesmen will promote to big corporate customers normally out of a startup's reach.

In the end, the success of Dell's new strategies depends greatly on the person at the top. Sceptics wonder if he is yesterday's man. Others worry that his firm's recent growth spurt may be unsustainable, and question how long it will take for him to return the firm to profitability. It remains to be seen if he can blend the aggressive sales culture at Round Rock with a softer, innovation-focused ethos in Palo Alto.

Mr Dell is confident that his bets will pay off. He notes that a public listing would "absolutely give us an acquisition currency," one that he intends to put to use as Dell shoots toward \$100bn in annual revenues. He has managed to defy naysayers in the past. In 2015, Meg Whitman, then the boss of HP Enterprise, a rival IT firm, predicted that the takeover of EMC would prove an "enormous distraction" to Dell. In a headline the same year, *Wired*, a magazine, said the PC was dead and not coming back—Dell's PC sales have been rising. Accepting the scrutiny of Wall Street again will doubtless mean

plenty more such provocations. Over to you, Mr Dell. ■



IT行业

开放的戴尔

在将自己创建的戴尔变成世界最大的私营科技公司后，迈克尔·戴尔计划让公司重新上市

IT行业里有句老话：卖技术赚钱的方式有两种——拆分和捆绑。得益于亚马逊和微软近年来云计算服务的迅猛发展，许多公司已将之前存储在内部服务器上的大量软件、数据和应用程序转移到新的“公共云”基础设施上。如今客户可以享受到各种非捆绑的、基于云计算的软件和硬件服务，数量之多令人眼花缭乱。

不仅眼花缭乱，简直是晕头转向。大公司的首席技术官通常都必须利用好数据分析、人工智能、物联网等每一次计算技术的进步。面对杂七杂八的信息技术方案，他们深感压力。因此，下一个重大机遇应该是简化这种破碎割裂的混乱局面。

这一洞察正是迈克尔·戴尔（Michael Dell）对戴尔科技（Dell Technologies）这家总部位于得克萨斯州的IT巨头未来构想的核心。1984年，这位日后的亿万富翁在得克萨斯大学的宿舍里创立了戴尔公司。27岁时，他成为了《财富》500强企业有史以来最年轻的老板（2013年Facebook首次上榜时，扎克伯格将近29岁）。戴尔通过向客户直销、采用实时生产系统以及精益的全球供应链降低成本，以低价赢得竞争，彻底改变了个人电脑（PC）业务。

如今戴尔正在推进他的下一场革命。他大幅扩大软件和云服务，试图以此让这家垂垂老矣的PC制造商渡过电子硬件平价化的难关。2013年，在加州私募股权投资公司银湖资本（Silver Lake Partners）的帮助下，他将戴尔私有化，交易价值244亿美元。当时，由于移动设备以及低成本亚洲制造商的兴起挤占了PC市场，戴尔的收入和利润大幅下滑，公司前景迅速黯淡。

不用再受公开市场审视的戴尔开始大举投资。自2013年起，他已在研发上投入136亿美元，以增强戴尔在尖端软件和云整合方面的实力。2016年，他以670亿美元吞并了美国数据存储设备和云计算软件大型供应商EMC，完成了史上最大的一宗科技收购案。

麻省理工斯隆管理学院（MIT Sloan School of Management）的迈克尔·库苏马诺（Michael Cusumano）表示，很少有公司能够实现转型，但他认为戴尔的努力正在开花结果。由于不间断的投资和收购EMC产生的会计费用，戴尔公司持续亏损（见图表），但它的增长引擎最终得以启动。11月29日，它的季报显示收入激增15%。公司的经营性现金流从2017财年（截至2017年2月）的24亿美元骤增至最近四个财季（截至2018年11月2日）的77亿美元，亏损减少。

按照目前的发展轨迹，戴尔今年的收入应该会突破900亿美元，去年约为800亿美元。戴尔公司希望它在利润远高于PC业务的云计算和软件领域的投资很快会让自己恢复盈利。

作为戴尔拳头部门的VMware就是一个很好的例证。VMware公司是虚拟化软件的先驱，虚拟化可以让软件在多台机器上无缝运行。VMware是一家盈利的上市公司，在加州帕罗奥多（Palo Alto）拥有一个时尚的园区。自从戴尔通过收购EMC获得VMware大部分股权之后，投资者就可以通过购买DVMT股票拥有部分戴尔的股份。DVMT是一种特殊的追踪股票，能够反映戴尔在VMware中的股权。

投资者很快就能直接购买戴尔的全部股份。12月11日，股东们聚集到戴尔位于得州朗德罗克（Round Rock）的外表朴实无华的总部，就是否允许实施一项类似于反向收购的复杂提案进行表决。反向并购是指一家想要上市、但又不想经历常规IPO种种麻烦的私有公司收购一家上市公司的行为。

该计划于今年7月宣布，内容涉及将DVMT股票转换为即将公开交易的新戴尔股票。DVMT的投资者可以按规定的换股比率接受戴尔的新股票，也可

以套现（不过，由于用于交易的现金有限，选择后者的投资者可能得接受两种方式的组合）。VMware当时表示将派发110亿美元的一次性特别股息，戴尔正好可以用因此获得的大约90亿美元做为支付这笔交易的资金。在最初的提案中，戴尔和银湖给出的协议对DVMT定价约为220亿美元，其中包括90亿美元现金。

这一提案遭到了维权投资者卡尔·伊卡恩（Carl Icahn）的强烈反对（他在2013年就曾因戴尔私有化的价格找过戴尔的麻烦）。戴尔和银湖为此于上月修改了条款，将DVMT的价值定为约240亿美元，其中140亿美元为现金。在11日的会议上股东们通过了该决议，戴尔将很快在纽约证券交易所挂牌交易。

真正的挑战开始于表决之后。戴尔侧重于软件的前景规划包括三大赌注。首先是成为最佳的整合IT服务一站式供应商。这可能并非易事。纽约大学斯特恩商学院（NYU Stern School of Business）的诺曼·怀特（Norman White）指出，将已大众商品化的硬件业务与创新的软件业务结合起来尤其困难。此外，今年10月，IBM以340亿美元收购开源软件供应商红帽（Red Hat），计划将其软件和自己的硬件一起出售，这可能会使IBM这个蓝色巨人成为戴尔强有力的竞争对手。

尽管如此，许多焦头烂额的IT经理还是对戴尔的转型表示欢迎。有一家英国大银行每年都要在戴尔的成套产品上花费5000多万美元，其首席信息官表示，他看重的是戴尔公司提供“融合基础设施”的能力。这些基础设施可以将服务器、数据存储设备、网络交换机，以及让这些设备协调工作的软件捆绑在一起，组成一整套解决方案。戴尔不无戏谑地向客户保证，如果出了问题，他们“找准戴尔这一个出气筒就行了”。

戴尔的第二大赌注押在了“混合”云的兴起上。混合云可以让客户将公司外部和内部IT系统结合起来。如今企业对于将敏感的客户和业务数据全部存储在第三方云上越来越担心。曾供职于IBM、目前在风险投资公司Insight工作的郎恩·贾菲（Lonne Jaffe）坚称混合云是未来的发展方向。

亚马逊和微软主推的公共云仍将是一支不容忽视的力量。戴尔在创新上的投入不可能与之匹敌，而且肯定会面临来自亚马逊的残酷的价格竞争。不过，戴尔可能正赶上一个足以推动多家公司起飞的大风口。去年，咨询公司Gartner预测会有一场“向混合基础设施的巨大转变”，到2020年90%的公司将使用混合云。

第三个赌注是“边缘”计算。随着各国推出5G网络，加上各个公司把智能传感器装到各类产品上，物联网时代将会到来。戴尔表示，物联网会产生公共云无法满足的各种需求。如果一辆无人驾驶汽车感应到自己快撞要上乡间道路上的一头鹿，非得等安装在遥远公共云上的软件允许才能停下来吗？他问道。这种情形不太可能发生，不过戴尔在宣传自己的物联网部门时喜欢用这个例子。

戴尔的一个大客户称答案是显而易见的。印度汽车制造商旗下的捷豹路虎的首席信息官西蒙·博尔顿（Simon Bolton）表示：“决策必须是绝对实时的，汽车就是车轮上的数据中心。”答案就是边缘计算，它让汽车后备箱拥有强大的计算能力。捷豹路虎是戴尔台式电脑、EMC存储设备和VMware软件的长期客户。如今它在开发边缘计算系统，也开始使用戴尔的其他配套产品，如网络安全软件。

去年，戴尔新成立了一个专门的物联网部门。公司承诺，未来三年将在研发上投入10亿美元。公司的风险投资部门已经投资了开发AI处理器和软件的英国创业公司Graphcore。它的超高速芯片具有极低的延迟（数据到达终端所需的时间），非常适用于无人驾驶汽车。Graphcore将这些AI芯片推向市场的方法是把它们安装到戴尔的硬件里，而戴尔的销售大军将把这些硬件推销给那些创业公司通常无法接触到的大企业客户。

戴尔公司的新战略成功与否，归根结底在很大程度上取决于处在公司最高层的戴尔本人。有人怀疑他是过时了的老一代。还有人担心公司近期井喷式的增长可能难以为继，并质疑他需要多久才能使公司恢复盈利。他能否将朗德罗克闯劲十足的销售文化与帕罗奥多更温和且注重创新的精神融合起来，还有待观察。

戴尔相信他的赌注会有回报。他指出，公开上市“绝对会给我们带来非现金收购的本钱”，他打算在戴尔年收入飙升至1000亿美元时将其投入使用。过去，他成功顶住了反对者的质疑。2015年，戴尔的竞争对手、IT公司惠普当时的老板梅格·惠特曼（Meg Whitman）曾预测，收购EMC将给戴尔带来“巨大干扰”。同年，《连线》（Wired）杂志在一篇头条文章中宣称PC已死，再无复生可能。然而，戴尔的PC销量却持续上升。再次接受华尔街的审视无疑将会面临更多此类挑衅。看你的了，戴尔老哥。■



The anniversary of reform

Seeking salvation

Forty years ago China began to reverse Mao's disastrous economic policies. It still debates what should replace them

THOUGH IT DOES not believe in saints, the Communist Party of China came close to canonising its former paramount leader, Deng Xiaoping, back in 2004. On the centenary of his birth, Deng—who died in 1997—was hailed as the immortal “chief architect” of reforms that had made China prosperous and strong. The eulogies had some basis. Thanks to his support for policies dubbed “reform and opening up”, Deng can take credit for a secular miracle: the greatest economic recovery in history.

With cunning and pragmatism, Deng and his aides dismantled a broken economy and dystopian society left behind by Mao Zedong. They re-awoke the country’s slumbering genius for capitalism and found a way to call it socialism, albeit “with Chinese characteristics”. By 2004 the economy was 44 times larger than it was on December 18th 1978 (see chart 1). It was on that date that party leaders began a meeting that is now officially called the start of the era of *gaige kaifang*. Though growth has been slowing of late, the trend has been impressive. As China prepares to mark the 40th anniversary of the opening of the conclave, the country’s GDP is more than five times larger than it was in 2004.

Like many who endured the Mao era, Deng was also something of a martyr. That story is hidden in the architecture of a museum that was opened in 2004 by the party’s then boss, Hu Jintao. It lies next to a black-and-white farmhouse that was Deng’s boyhood home in rural Sichuan province. The museum has a roof made of three sloping planes rising to a spire. It symbolises how Deng was repeatedly purged under Mao before recovering

each time and finally rising “as high as heaven”, a guide explains.

On opening day, 14 years ago, few would have predicted that Deng might be purged again, or at least lose his central place in the Communist pantheon. Yet Deng and his reformist aides are being sidelined during this anniversary. This should be a time for swagger and confidence. After all, the past 40 years have seen hundreds of millions of Chinese lift themselves out of poverty, and China become a global power. Instead the anniversary is being observed by an odd smallness of spirit and by semi-public squabbling among the country’s secretive elites. Official propaganda is playing down the achievements of past leaders, to focus on extolling the “new era” announced in late 2017 when President Xi Jinping secured a second term as party leader. Image-makers are also promoting a specific vision of reform and opening that casts private business in an important but supporting role, with state enterprises dominating the most sensitive and advanced sectors.

The largest anniversary exhibition, at the National Museum in central Beijing, devotes vastly more space to Mr Xi, and to what he has done since he came to power in 2012, than to the achievements of all previous Chinese leaders combined. In its halls, packed on a mid-week afternoon with school groups, workplace delegations and squads of soldiers in uniform, “reform” is treated as a synonym for progress and modernity, rather than as an economic programme of tearing down barriers to free competition and trade. In chest-swelling displays about China’s space programme, aircraft-carriers and high-speed trains, state firms are the champions. Private firms and self-employed entrepreneurs are praised too, but as a “complement” to the economy, with special strengths in innovation and job creation.

When Mr Xi visited the exhibition, the state press did—to be fair—record him inspecting inscriptions by Deng dating from 1984, urging more rapid development of coastal cities earmarked as “special economic zones”, or pilot areas for experimenting with market forces. But the reports quickly

moved on to the important point: that Deng's inscriptions reminded Mr Xi of his own arrival as deputy mayor in one such zone, Xiamen, in 1985.

To China's liberal intelligentsia—an embattled band including free-market economists, reformist lawyers, retired officials and some business executives—such propaganda stokes fears that Mr Xi is only paying lip service to reform while harking back to the bad old days under Mao, when dogma trumped pragmatism.

Thinkers who suffered in the Mao era express horror at the revival of Maoist slogans. They recall that economic debates had always been tolerated in the reform era, even after the crushing of pro-democracy protests in June 1989. Now speaking out even on technical subjects can be perilous. Unirule, an independent economics think-tank founded in 1993, recently lost its business licence. It has suspended public activities. Its apparent offences include criticising state-backed monopolies and calling for changes in the tax system.

A longtime advocate of reform describes how Chinese rulers fit onto two axes: one representing the extent of their power and the other the quality of their thoughts. The worst, like Mao, are strong with bad ideas. The best, like Deng, are strong with good ideas. He calls Mr Xi a strong leader whose philosophy remains unclear. Yet he fears that the party chief was marked, durably, by his upbringing during the Cultural Revolution, leaving his ideas “perhaps more aligned with Mao’s”.

Outsiders may find that outlandish. After all, in Maoist times those accused of capitalist tendencies lost property and even their lives. Today, billionaires can be party members, and—if they toe the line—feted as patriots. Mr Xi's chief economic adviser and deputy prime minister, Liu He, is a reformist who is trusted by business leaders. Mr Xi has gone out of his way to promise support for private firms as the economy slows (see Schumpeter).

But this is a divisive anniversary. After all these years of reform and opening there is surprisingly little consensus about why *gaige kaifang* has worked. The period can be divided into stages. First came a break with Mao and a return to common sense, prudence and respect for expertise. That led to experimentation: “crossing the river by feeling the stones”, as Deng put it. Farmers were allowed to manage their own smallholdings. Villages and townships opened businesses. Entrepreneurs began to build private empires. At the same time, state-owned firms (while contributing less to the economy, see chart 2) continued to enjoy unique privileges, such as cheap land and other subsidies. They faced unique burdens too, from price controls to demands to provide welfare for employees. Finally, in the early 1990s, something like a market economy began to emerge.

The lessons of each stage remain contested. Pro-market reformers think that China has grown rich despite state meddling in the economy. A rival camp, which liberals fear has Mr Xi’s ear, thinks that China has prospered because officials temper and guide the forces of capitalism.

Other big disputes divide the camps. Liberals believe that Deng enjoyed public backing because he symbolised a break with failed Maoist policies. They hold that Team Deng’s great idea was to distance the party from the government, then get both out of businesses’ affairs. Liberals are convinced that only further reforms, including political opening, can see China through the transition to an advanced middle-income nation, after relatively easy decades of catch-up growth.

A rival, statist camp is strikingly reluctant to criticise Mao, seeing him as a source of the party’s legitimacy. To this group, state firms stand for strength and control. They see a “China model” that outshines free-market capitalism. Shunning political opening, they put their faith in party discipline, not external accountability.

There are hints of tension among princelings, or the heirs of early Communist leaders. In September Deng Pufang, Deng's eldest son, defended his father's legacy in a speech to the China Disabled Persons' Federation, of which he is the honorary chairman (he was paralysed during the Cultural Revolution). Mr Deng said that reforms introduced by his father were "irreversible", and had won support because of the public's loss of faith after the chaos of Mao's era. In October Mr Xi visited Shenzhen, on the border with Hong Kong. Many Chinese associate the city with the "southern tour" in 1992 by Deng, then retired, which led to a dramatic revival of economic reform after a prolonged attack on his policies by hardliners. But during his recent trip, Mr Xi did not even mention Deng's name publicly. Other officials have gone further, using the anniversary to promote the role of Mr Xi's father, Xi Zhongxun, who helped to launch Shenzhen as a hub for foreign-funded manufacturing.

On November 23rd Mr Xi led party commemorations to mark 120 years since the birth of Liu Shaoqi, a head of state who was deposed by Mao and died in prison during the Cultural Revolution. Mr Xi gave a speech commending Liu for his loyalty to the party, while managing not to mention his purging or Mao's excesses. By contrast, on the centenary of Liu's birth in 1998, China's then leader, Jiang Zemin, blamed Liu's death on wrongs committed by Mao's acolytes. Well-connected Beijingers note that Liu's son, Liu Yuan, an old friend of Mr Xi's, told a memorial event in Hunan province on November 24th that China should not ignore the lessons of historic tragedy—a line some saw as a rebuke of the president (accounts of Mr Liu's speech were later censored on social media).

So far this year almost 3m people have visited the park in Deng's birthplace, Paifang. On a chilly, overcast morning, some of them explained that they had come to remember "Uncle Deng" for putting "money in our pockets". The gift shop's best-selling item is a wooden plaque bearing a gilded character for "prosperity" (in Deng's calligraphy, staff say), which

businessmen buy to put on their office desks.

Deng's last living close relative in Paifang, Dan Wenquan, still helps at a restaurant opened by his children in 2004. A recent lunchtime found him sorting chopsticks at a round table. Mr Dan's father and Deng's mother were siblings. Those ties brought violent persecution during the Cultural Revolution, a time he now calls "quite challenging". An 81-year old ex-farmer who never went to school, Mr Dan offers a definition of reform and opening that his powerful cousin would have recognised: a social contract that stresses nationalism and material prosperity, rather than theoretical "-isms". China must become technologically advanced to be rich and powerful, says Mr Dan. "Once your science is powerful, others won't bully you. When the country is prosperous, people are happy, and the people trust the government."

Different views can be found in fields outside Paifang. The changes that began in 1978 produced winners and losers. Many industrial workers were laid off as the planned economy was dismantled. Ordinary Chinese associate reforms with rising living standards, but also with rampant corruption. On Paifang's fringes, a gaggle of ageing farmers heatedly share a tale of officials taking land without promised compensation. Asked about reform and opening, one scoffs: "The opening's for officials, us common folk are still common folk."

Corruption divides elites, too. An anti-corruption drive led by Mr Xi has netted more than 100,000 officials. The campaign is wildly popular with the public, but is blamed by some officials for paralysing the work of government. Some in policy circles murmur that Mr Xi is far less supportive of private enterprise than he claims to be, and that he believes his beloved party is being poisoned by bribes from privilege-seeking private firms. Reformers retort that bribery exists because officials wield excessive power over business. In the 1980s and 1990s the best officials used to be

entrepreneurial risk-takers, says one veteran of those times. They sought powerful positions in order to do the right thing for the country. Now, he sighs, too many officials think like bureaucrats, merely concerned with doing things the “correct” way.

A handful of entrepreneurs are willing to speak out. In late November Sun Dawu, whose firm owns large egg farms and other rural operations, hosted a scholarly forum on land rights and private enterprise at his spa and hotel complex near Baoding, two hours’ drive from Beijing. Attendees included liberal economists, lawyers and businessmen. “The real corruption is at state enterprises,” says Mr Sun. “The biggest crime private enterprises can commit is providing bribes. It is the people demanding bribes who are detested. The party doesn’t like private entrepreneurs because they don’t do as they are told.”

Happily for Mr Xi, some in business welcome his approach. Zhang Huamei, a button and clothing-accessories trader from Wenzhou, was the first person in China to be granted a self-employed business licence, back in 1980. She was 19. At a time when private trading was still illegal she began supplementing her family’s meagre income by selling cheap goods from a stand in front of her home. When officials told her of a scheme to grant trading licences, she applied, sick of having to run and hide whenever she saw anyone in authority. “After we got the initial licence we would go out there knowing the government had our back,” she said in an interview at her small shop in central Wenzhou. Ms Zhang is proud that Wenzhou is famous for daring and canny traders, who have founded businesses worldwide. Some might hear her tale as an example of the government getting out of the way. But she is deferential to the state that protected her in 1980. On her shop’s walls, button samples jostle for space with pictures of her attending official gatherings and meeting the prime minister, Li Keqiang. A copy of her original licence is on display at the National Museum in Beijing. Without

government support, it is hard for any business to survive, Ms Zhang avers. Private businesses can seek out new markets. But they cannot be compared to state-owned champions making advances in science and technology, she says. “If China did not have these big state-owned enterprises to grow, how would we be this well off?”

Deng might have liked Ms Zhang. Though missed by economic reformers today, he was no liberal. He had faith in technocrats and was willing to delegate authority to them. He saw the power of material incentives to drive efficiencies and progress. But he saw a role for a scientific, modern state too, in common with the leaders of such Asian tigers as South Korea or Singapore.

Most important, Deng bequeathed China a lopsided version of reform, in which economic freedoms were not matched by political opening. That explains problems today, says Mao Yushi, a free-market economist and outspoken critic of Mao Zedong’s poisonous influence on Chinese society. He speaks with some authority, having been purged in the 1950s as a “rightist” and whipped during the Cultural Revolution. Mr Mao, who is the honorary chairman of the Unirule think-tank, recalls the 1980s as “the most democratic time in Chinese politics”, until progress was “stopped by the shots fired on June 4th [1989]”. Deng, he says, “contributed greatly to the marketisation of the Chinese economy, but he interrupted the political advancement of China. That was his big mistake.” Today Mr Mao sees China’s development being threatened by a tightening of curbs on free speech which he says is stifling badly needed debate about policy. Many economists, including those within the government, privately agree. But at the age of 89, he is unusually able to speak without fear.

In this moment of doubt and dissent, many Chinese liberals put their faith in a surprising champion: President Donald Trump. They hope that pressure from Mr Trump will force Mr Xi to keep promises made in recent

speeches—to open markets further to foreign investors, better protect intellectual property and encourage fair competition. By way of precedent, such optimists cite beneficial foreign pressure on China when it entered the WTO. Not all are so confident. “People want political change. I think getting political change through a trade war is hard,” says Mr Mao, drily. China’s liberals do not exactly admire Mr Trump. It is more that they hope he will prove a bigger bully than Mr Xi. On this somewhat gloomy anniversary, reformers will take what help they can get. ■



改革开放40周年

寻求救赎

40年前，中国开始扭转毛泽东灾难性的经济政策。现在它仍在争论应该以什么政策取而代之

中国共产党并不信奉圣人，但在2004年几乎将其前任最高领导人邓小平封圣。那一年邓小平诞辰一百周年（他于1997年逝世）之际，他被誉为带领中国走上繁荣富强之路的改革“总设计师”，有不朽之功。这样的赞颂并非凭空而来。正是在邓小平的支持下，中国实施了一系列被称为“改革开放”的政策，实现了史上最大规模的经济复苏，堪称人间奇迹。他值得受到赞誉。

本着精明和务实的态度，邓小平及其幕僚拆解了毛泽东遗留的破碎的经济系统和反乌托邦的社会。他们重新唤醒了这个国家沉睡的经营资本主义事业的才智，并设法冠之以社会主义的名号——尽管是“具有中国特色”的社会主义。到2004年，中国的经济规模已是1978年12月18日时的44倍（见图表1）。正是在那一天，中共领导人召开了十一届三中全会，如今官方称这次会议拉开了改革开放的序幕。虽然近年来增长放缓，但中国的发展趋势令人赞叹。而今中国迎来十一届三中全会召开40周年之际，其GDP已是2004年的五倍多。

和许多经历了毛时代的人一样，邓小平也可说是个殉道者。他的故事就隐藏在邓小平故居陈列馆的建筑设计之中，该馆于2004年由时任总书记胡锦涛主持开放。陈列馆毗邻一间白墙黑瓦的农舍，那是邓小平在四川农村的童年故居。陈列馆的屋顶由三个坡型屋面组成，三叠三起，一起比一起高，最后耸起一堵高墙。一名导游解释说，这象征着邓小平在毛泽东手下的三起三落，最终升至“齐天高位”。

14年前陈列馆开馆那天，没有人预料到邓小平可能会再“落”一次，或者至少失去他在共产主义神殿中的中心位置。然而在此次40周年庆中，邓小平

和他的改革派幕僚却靠边站了。这理应是中国炫耀成就、展示自信的时候。毕竟，过去40年里，数亿中国人摆脱了贫困，中国崛起为全球大国。然而，此番却未见大肆庆祝，同时中国那些神秘精英们正在半公开地争论纷纷。官方宣传正在淡化过往领导人的成就，专注于颂扬2017年末习近平主席第二次当选共产党领导人时提出的“新时代”。影像资料的制作者也在宣传一种有关改革开放的特定视角，其中民企的作用重要但只是配角，而国有企业才是最敏感和最先进领域的主导。

位于北京市中心的国家博物馆举办了规模最大的40周年纪念展，其中大量展示了习近平的事迹以及他于2012年上台后的成就，所占篇幅远远超过对以往所有中国领导人的展示总和。一个周中的下午，展厅里挤满了学生队伍、企业代表团和身穿制服的士兵分队。“改革”被用作了进步和现代化的代名词，而非拆除自由竞争和贸易的壁垒的一种经济方案。在关于中国太空计划、航空母舰和高速铁路的傲人展示中，国企是领头羊。民企和个体户也得到了赞扬，但只是被称作经济的“补充”，在创新和创造就业方面具有特殊优势。

公平地说，习近平参观展览时，官方媒体确实拍下了他仔细查看1984年系列邓小平题词的镜头，题词内容是敦促被划为“经济特区”（即市场机制的试点地区）的沿海城市加速发展。但是报道很快就转向了重点：邓小平的题词让习近平想起他本人在1985年到厦门经济特区担任副市长的时光。

对于中国处境艰难的自由派知识分子（包括自由市场经济学家、改革派律师、退休官员和一些企业高管）而言，这种宣传令人担忧。他们担心习近平对于改革只是口头上支持，心里想的是重回毛时代教条压倒务实的糟糕日子。

在毛时代备受煎熬的思想家们对再度喊起的毛主义口号感到惊惧。他们回忆说，在改革时期，经济辩论一直是被容忍的，即使在1989年6月的民主抗议活动遭到镇压之后。现在，就算在技术问题上直言不讳也是非常危险的。成立于1993年的独立经济智库天则经济研究所几年前被吊销了营业执照，已停止公开活动。其明显的逾矩之举包括批评受国家支持的垄断企业

和呼吁改革税收制度。

一位一向拥护改革的人士用两个轴线来描述中国的领导人：一条轴线代表他们的权力大小，另一条代表他们思想的优劣。最糟糕的领导人权力大但想法糟，如毛泽东。最英明的领导人权力大而想法好，如邓小平。他称习近平是一位强有力地领导者，但其思想体系仍看不清楚。不过，他担心这位总书记在“文化大革命”期间的成长经历给他留下了持久的印记，他的想法“也许与毛泽东更加一致”。

局外人可能会觉得这样的说法匪夷所思。毕竟，在毛时代，那些被指控有资本主义倾向的人被剥夺了财产，甚至丢了性命。而现在，亿万富翁也可以成为党员，得到爱国人士的礼遇（如果他们循规蹈矩的话）。习近平的首席经济顾问兼副总理刘鹤就是一位受商界领袖信赖的改革派。随着经济放缓，习近平不遗余力地承诺支持民企发展。

但这是一个分裂性的周年日。经过这么多年的改革开放，人们对于其奏效的原因却莫衷一是，共识之少令人惊讶。改革开放可分为几个阶段。第一阶段是与毛时代决裂，回归常识、审慎和对专业知识的尊重。由此导向了试验——用邓小平的话来说就是“摸着石头过河”。农民被允许包产到户，村庄和乡镇开设了企业，企业家开始打造私营企业帝国。与此同时，国企（虽然对经济的贡献减少，见图表2）继续享有如廉价土地和其他补贴等特权。它们还面临从价格控制到要为职工提供福利等独有的负担。最后，在上世纪90年代初期，类似于市场经济的体制开始出现。

每个阶段得到了什么教训仍然存在争议。支持市场的改革派认为，尽管政府干预经济，中国还是富裕了。而对立阵营（自由派担心习近平还是比较听得进这些人的看法）则认为，中国得以繁荣是因为官员能够缓和并引导资本主义力量。

造成阵营分裂的还有其他重大分歧。自由派认为，邓小平获得民意支持是因为他象征着对失败的毛主义政策的弃绝。他们认为，邓小平及其追随者的一个重大想法是让党政分开，然后让两者都不要再干预企业事务。自由派

相信，只有进一步推动包括政治开放在内的改革，才能让中国继在过去几十年里相对轻松地实现了追赶型增长之后，逐步成为一个发达的中等收入国家。

对立的国家主义阵营非常不愿意批评毛泽东，认为他是共产党合法性的源头。对于这个阵营而言，国企代表着力量和控制。他们眼中有一个优于自由市场资本主义的“中国模式”。他们拒绝政治开放，崇信党纪而非外部问责。

有迹象显示太子党（中共元老的子女及亲属）之间关系紧张。9月，邓小平的长子、中国残联名誉主席邓朴方（他在文革中瘫痪）在残联发表讲话时为父亲的遗产辩护。他表示，他父亲所开启的改革是“不可逆”的，改革因为公众在经历了毛时代的混乱后信仰丧失而赢得了支持。10月，习近平视察了毗邻香港的深圳。许多中国人将这座城市与1992年邓小平“南巡”联系在一起，当时邓小平已退休，在强硬派长期攻击他的政策后，那次南巡掀起了经济改革的巨大复苏。但在近期这次深圳之行中，习近平甚至没有公开提及邓小平的名字。其他官员更甚，他们利用40周年纪念来宣传习近平的父亲习仲勋的作用，他曾推动深圳成为外资制造业的中心。

11月23日，习近平带领全党纪念刘少奇诞辰120周年。刘少奇曾任国家主席，文革期间被毛泽东罢免并死于狱中。习近平发表讲话，赞扬刘少奇对党的忠诚，同时避而不谈他被打倒或毛泽东的极权行为。相比之下，1998年刘少奇诞辰一百周年之际，当时的中国领导人江泽民将刘少奇的死归咎于毛泽东追随者犯下的错误。消息灵通的北京人注意到习近平的老朋友、刘少奇之子刘源11月24日在湖南省的一个纪念活动中说，中国不应该忽视历史悲剧的教训——有些人认为此话是在指责习近平（有关刘源演讲的内容随后在社交媒体上被禁）。

今年到目前为止，已有近300万人参观了邓小平的出生地牌坊村。在一个阴冷的早晨，一些游客解释说来这里参观是为了记住是“邓伯伯”把“钱放进了我们的口袋里”。纪念品店里最畅销的商品是刻有镀金字“福”（工作人员说是邓小平的书法）的木牌，商人们买来摆在办公桌上。

邓小平在牌坊村最后一位在世的近亲是淡文全，他还在孩子们于2004年开的一家农家乐里帮忙，近日一次午饭时间他在一张圆饭桌边摆筷子。淡文全的父亲是邓小平的舅舅。这层关系让他们在文革期间遭到了暴力迫害，现在他说那个时候“挺不容易的”。以前一直务农的淡文全今年81岁，从没上过学，他提出了一个改革开放的定义，他的伟人表哥应该会认同：那是一个强调民族主义和物质繁荣的社会契约，而不是理论上的什么“主义”。淡文全说，中国要实现繁荣富强，必须得有先进的科技。“你科技强大了，别人就不会欺负你。国家繁荣昌盛了，人民就幸福了，也会信任政府。”

在牌坊村外的田地里可以听到不同的观点。自1978年改革以来，有赢家也有输家。废除计划经济后，许多产业工人下岗了。普通中国人认为改革提高了人民生活水平，但也造成腐败猖獗。在牌坊村边上，一群年迈的农民激动地谈论着一桩官员们占用土地而没有支付承诺的补偿的事件。在被问及对改革开放的看法时，有人嗤之以鼻：“开放都是让当官的得好处，我们老百姓还是老百姓。”

腐败也分裂了精英阶层。习近平领导的反腐运动已经让超过10万名官员落网。该运动极受群众欢迎，但也有一些官员指责它导致政府工作瘫痪。一些决策圈内部人士私下抱怨说，习近平对民企的支持远不如他对外宣称的那样，并且他还认为民企为寻求特权而行贿，毒害了他爱戴的共产党。改革派反驳说，之所以存在行贿，就是因为官员对企业过度干预。一位经历了上世纪八九十年代的资深人士表示，那时最优秀的官员像企业家一样勇于承担风险。他们寻求高位是想为国家做些正事。而现在，他叹了口气说，太多的官员都是官僚思维，只关心以“正确”的方式做事。

少数企业家愿意大胆直言。孙大午的公司拥有大型养鸡场和其他农牧业务，11月末，他在他位于保定（距北京两小时车程）附近的温泉酒店举办了一场关于土地权与民企的学术论坛。与会者包括自由派经济学家、律师和商人。“真正的腐败在国企，”孙大午说，“私营企业能犯的最大罪行就是行贿。索贿的人才令人厌恶。党不喜欢私营企业家，是因为他们不听

话。”

不过能让习近平欣慰的是，有些商界人士赞同他的路线。做纽扣及服装辅料生意的温州人章华妹是中国第一个获得个体工商户营业执照的人。那是在1980年，当时她19岁。在私人经营仍属非法的时候，她就开始在家门口摆摊出售廉价小商品，补贴家庭微薄的收入。当政府工作人员告诉她政府开始颁发营业执照时，厌倦了和执法人员打游击的章华妹申请了一个。“领了执照，我们知道有了政府的支持，就可以光明正大地做生意了。”章华妹在自己位于温州市中心的小店铺接受采访时说。温州以精明大胆、生意遍布全球的商人闻名，章华妹以此为傲。有些人可能会把她的故事看作政府放松管制的例子。但她对在1980年给了她保护的政府毕恭毕敬。她店铺的墙上除了满满的纽扣样品，还贴着她参加官方活动以及与总理李克强见面的许多照片。她最初营业执照的副本在北京的国家博物馆展出。章华妹坚称，没有政府的支持，任何企业都难以生存。民企可以开拓新市场，但它们没法和在科技方面取得进步的国有领军企业相提并论。“如果中国没有这些大型国企的发展，我们怎么能过上这样富裕的生活呢？”

邓小平如果还在世，可能会喜欢章华妹。虽然在今天备受经济改革者的怀念，但邓小平并非自由派。他对技术专家有信心，愿意放权给他们。他看到了物质激励在提升效率和推动进步上的作用。但他和韩国或新加坡这样的“亚洲四小龙”国家的领导人一样，也看到了讲求科学管理的现代政府的作用。

最重要的是，邓小平留给中国的是一种不平衡的改革，政治开放的程度与经济自由不相匹配。自由市场经济学家茅于轼认为这解释了如今出现的问题。茅于轼一直对毛泽东对中国社会的毒害直言不讳。他讲话有一定权威，上世纪50年代曾被打成“右派”，文革期间还被人用皮带抽打。作为天则经济研究所的名誉理事长，茅于轼回忆说，上世纪80年代是“中国政治上最民主的时期”，但“（1989年）6月4日的枪声中断了”进步。他说，邓小平“为中国经济的市场化做出了巨大贡献，但他打断了中国的政治进步。这是他的严重错误。”今天，茅于轼认为中国的发展正受到加强限制言论自由的威胁，他说这会抑制急需的政策辩论。包括政府内部经济学家在内

的许多经济学家私下里都认同这种看法。但89岁高龄的茅于轼是少有的敢于直言的人。

在这个充满质疑和异议的时刻，许多中国自由主义者将信心寄托在一个令人意外的斗士身上：美国总统特朗普。他们希望来自特朗普的压力能迫使习近平履行近期讲话中做出的承诺——进一步向外国投资者开放市场，加强保护知识产权，鼓励公平竞争。这些乐观主义者以中国加入世贸组织时受到的对中国有利的外国压力为例，来说明其中的好处。并非所有人都如此有信心。茅于轼冷淡地说：“人们想要政治变革。但我认为很难通过贸易战实现政治变革。”中国的自由派并不真的钦佩特朗普。他们更多是希望特朗普比习近平更霸道。在这个有些令人沮丧的改革开放40周年纪念之际，不管是谁能帮上点忙，改革派都愿意接受。 ■



Underwear

Going for bust

Victoria's Secret is struggling to keep abreast of changes in the lingerie market

SEX SELLS, and it sells few things better than lingerie. Nowhere is that more evident than the Victoria's Secret fashion show. Befeathered models, known as “angels”, shimmy down a runway to promote America’s biggest underwear retailer. In 2011 more than 10m people watched it on television. But on December 2nd just 3.3m viewers tuned in (see chart).

Victoria's Secret has around a tenth of a global lingerie market worth \$78bn, according to Euromonitor International, a research firm. It shows all the signs of a tired brand struggling to keep up with customer tastes. In America its market share has plunged from almost 33% two years ago to around 24% today, as social media and e-commerce make it easier for new brands to enter the market. Shares in L Brands, its parent company, were worth \$100 three years ago; today they go for \$30. Newcomers are disrupting every part of retail, but Victoria's Secret has made its woes worse.

When Roy Raymond started the firm in 1977, he wanted shops where men could comfortably buy lingerie for their wives and girlfriends. Velvet sofas and silk drapes made them look more like boudoirs than places for women to find supportive undergarments. Leslie Wexner, L Brands’ boss, who bought the firm in 1982, added soft lighting and floral prints to give it more appeal to women, his main customers. Once its chief asset, the brand’s sexiness now looks like a liability. “The way people dress has changed,” says Serena Rees, a stalwart of the industry whose most recent project is a brand of unisex underwear. “People don’t want boobs up under their chin or things pressed or pushed in.”

A slew of competitors, promoting comfort and inclusivity, have taken that message to heart. Aerie, the underwear arm of American Eagle Outfitters, commands just 3% of the American market but has increased its sales by an average of 11% each year since 2016, compared with an average 9% annual decline for Victoria's Secret over the same period, according to Euromonitor. Thirdlove, an online brand which has sold over 3m bras since its launch in 2013, is growing at around 300% a year.

The newcomers have tweaked the old formula. Michelle Cordeiro-Grant left Victoria's Secret, where she was a senior merchant, and went on to found Lively, an online underwear brand. She argues that what makes women sexy is confidence, meaning an emphasis on comfort: 70% of the bras sold by Lively are wireless.

They are eager to emphasise inclusivity, too. According to Mintel, a research firm, over half of consumers in Britain, France, Germany, Italy and Spain reckon fashion retailers should use more realistic models. Thirdlove's ads feature models in their 60s, or who are breastfeeding. Since 2014 Aerie has eschewed digital retouching for photos. The response has been overwhelmingly positive, says Stacey McCormick, an executive at Aerie. When Rihanna, a pop star, launched her Savage x Fenty line of underwear in May, the models were every size and shape. People queued for hours online to buy the products.

Victoria's Secret looks out of touch by comparison. In November Ed Razek, a company executive, dismissed suggestions that its show should have transgender and plus-size models, insisting it was meant to be a "fantasy" (he had to apologise). The show does the brand a disservice, reckons Randy Konik, an analyst at Jefferies, an investment bank, and one of Victoria's Secret's knockers.

Focusing on the need for comfort rather than male taste is good business;

women purchase the vast majority of female underwear. “The repeat business is in basics,” says Heidi Zak, Thirdlove’s founder, not lacy luxuries. Some 12m women have used Thirdlove’s “fit finder” to determine which bra to buy. Easy returns alleviate customers’ worries about buying online.

Victoria’s Secret is not about to go bust. The firm’s scale is such that with the right rebranding, it could bounce back. In November it replaced its chief executive, Jan Singer, with John Mehas, formerly of Tory Burch, a fashion retailer. Following that rejig Victoria’s Secret has held off on big announcements. “Everything is on the table,” said one executive on an earnings call last month. But in the wake of the #MeToo movement, it will have to tread carefully.

Women’s underwear has always been controversial. Fifty years ago, as the sexual revolution took off, a protest at the Miss America pageant cemented the incorrect notion that feminists burn their bras (they actually threw them in a “freedom trash can”). Marks & Spencer, Britons’ favourite underwear seller, was attacked on social media last month for its advertising of “fancy little knickers” as a must-have for her next to “outfits to impress” for him. It is in this tricky environment that retailers such as Victoria’s Secret operate. ■



内衣

胸无成竹

维多利亚的秘密难以跟上内衣市场的变化

性是个卖点，这一点在内衣销售上体现得最为淋漓尽致。最突出的例子就是维多利亚的秘密（Victoria's Secret）时尚秀。被称作“天使”的模特戴着羽毛翅膀在T台上款款走过，为这家美国最大的内衣零售商做宣传。2011年，超过1000万人在电视上观看了维密秀。但12月2日的这场只有330万名观众（见图表）。

研究公司欧睿国际（Euromonitor International）的数据显示，维密目前在全球780亿美元的内衣市场的占比约为十分之一。它显现出一个过气品牌难以跟上顾客口味的种种迹象。在美国，随着社交媒体和电子商务让新品牌更容易进入市场，维密的市场份额已从两年前的近33%骤降至如今的24%左右。其母公司L Brands三年前的股价为100美元，今天只有30美元。新进者正在颠覆零售的每个环节，而维密却让自己雪上加霜。

罗伊·雷蒙德（Roy Raymond）在1977年创办这家公司时，他想打造出一家让男士可以轻松自在地为妻子或女友买内衣的商店。天鹅绒沙发和丝绸窗帘让店面看起来更像闺房，而不是女性寻找衬托身形的内衣的地方。1982年，L Brands的老板莱斯利·韦克斯纳（Leslie Wexner）收购了这家公司。他增添了柔和的灯光和花卉图案，以更加吸引女性——这是他的主要客户群体。性感曾经是该品牌的主要资产，现在看来却更像是一种负担。业内资深人士瑟琳娜·里斯（Serena Rees）最近在做一个无性别内衣品牌的项目，她说：“人们的着装方式已经变了，她们不想把胸托高到下巴底下，也不想塞点什么或是硬挤出点什么来。”

许多提倡舒适和包容的竞争对手已将这一点牢记于心。欧睿的数据显示，美鹰傲飞（American Eagle Outfitters）旗下内衣品牌Aerie在美国市场的占有率为3%，但自2016年以来，其销售额平均每年增长11%，而同一时期

维密的销售额却平均每年下降9%。网络内衣品牌Thirdlove自2013年推出以来销量已超过300万件，目前正以每年约300%的速度增长。

新进者调整了老配方。米歇尔·科代罗-格兰特（Michelle Cordeiro-Grant）曾是维密的一位高级商品总监，离开维密后她创立了在线内衣品牌Lively。她认为让女性性感的是自信，这意味着要注重舒适：Lively销售的胸罩中有70%是无钢圈的。

新进者也积极倡导包容性。根据研究公司Mintel的调查，在英国、法国、德国、意大利和西班牙，超过一半的消费者认为时尚零售商应该使用更真实的模特。Thirdlove的广告使用了60多岁或是哺乳期的模特。2014年以来，Aerie已经不再对照片做后期处理。Aerie的高管斯泰西·麦考密克（Stacey McCormick）表示，反馈绝对正面。流行歌星蕾哈娜在今年5月推出Savage x Fenty系列内衣时，使用了各种身材和尺码的模特。人们在网上排了几个小时的队来买这些产品。

相比之下，维密就显得落伍了。11月，该公司高管埃德·拉泽克（Ed Razek）拒绝了维密秀应该有跨性别和大码模特的建议，坚称维密秀就应当是个“梦幻秀”（他后来不得不道歉）。投资银行杰富瑞（Jefferies）的分析师兰迪·科尼克（Randy Konik）是一直批评维密的人之一，他认为维密秀给这个品牌帮了倒忙。

专注于对舒适的需求而非男性的喜好，这对生意有利，毕竟购买女性内衣的绝大多数还是女性。Thirdlove的创始人海蒂·扎克（Heidi Zak）表示，“做回头客的生意要靠基本款”，而不是奢华的蕾丝款。大约有1200万女性用Thirdlove的“合身仪”（fit finder）来决定买哪款胸罩。便捷的退货减轻了顾客对网上购物的担忧。

维多利亚的秘密不会马上破产。公司规模很大，如果品牌重塑得当，还是有可能东山再起。11月，维密的首席执行官简·辛格（Jan Singer）离职，由曾供职于时尚零售商Tory Burch的约翰·梅哈斯（John Mehas）接任。此后维密没有发布什么重大消息。“桩桩件件都还有待讨论。”一位高管在上

月的一次业绩电话会议上表示。但随着#MeToo运动的兴起，它将不得不谨慎行事。

女性内衣一直备受争议。50年前，随着性别革命的兴起，发生在美国小姐选美比赛上的一场抗议活动强化了一个错误的印象，就是女权主义者会烧掉她们的胸罩（实际上她们是把胸罩扔进了一个“自由垃圾桶”）。上个月，英国人最喜欢的内衣销售商玛莎百货在社交媒体上受到抨击，因为它在一项广告宣传中将“让人眼前一亮”的必备男装与女士必备的“别致小短裤”并列展示。像维密这样的零售商面对的正是如此棘手的经营环境。 ■



Monetary policy

Needed: a Powell doctrine

The Federal Reserve needs a new strategy if it is to get out of a tight spot

Jerome Powell, chairman of the Federal Reserve, says “basically everything” keeps him up at night. As well it might. The fiscal stimulus from President Donald Trump’s tax cuts, which in 2018 has shielded America from a global economic slowdown, will soon begin to subside. The president’s trade war is sapping confidence. The S&P 500 index has fallen by almost 10% in a little over two months as growth expectations have ebbed. The difference between yields on short-term and ten-year bonds, which typically turns negative before recessions, has fallen close to zero, spooking investors. To cap it all, the president has been attacking the central bank for raising interest rates, which it has done three times this year to try to ward off inflation.

Mr Powell seems to have wavered under the pressure. In October he hinted that investors should expect many more rate rises before the Fed’s work was complete; in November he suggested that hardly any more are needed. Mr Powell is rooting around for a doctrine because the one he inherited when he took over the job in February, which calls for monetary policy to tighten roughly once a quarter, is becoming obsolete. A rate rise remains likely at the Fed’s upcoming meeting, which concludes on December 19th. But it will probably be the last on a predictable schedule. In 2019 a fresh course will be needed—one that is fit for a new phase in the economic cycle.

The Powell doctrine should be centred on humility. The Fed’s rate-setters have for years justified rate rises with predictions that America’s jobs boom would soon turn inflationary. Yet even with unemployment at just 3.7%, core inflation—the measure that matters most—is slightly below target and

falling. Headline inflation is on target, but may soon be dragged down by a falling oil price. Inflation expectations have fallen slightly. As the horizon darkens, rate rises will need weightier justification than an inflation risk that has been perennially exaggerated.

The central bank has a record of dangerous complacency late in economic cycles. Before the past two recessions it raised rates, pointing to low unemployment, despite signs in bond markets of a coming slowdown. Optimists explained away traders' apparent pessimism using arguments that have started to crop up again today. In reality, markets were ahead of policymakers, as they probably will be the next time trouble strikes. Economists typically fail to predict downturns until they are imminent (see Graphic detail).

The Fed's poor forecasting record has implications for monetary policy. Rate-setters should rely less on predictive models and more on realised economic and financial data. They should also abandon their insistence that unemployment is already unsustainably low, a claim that is at odds with the evidence and which will lead the central bank to hit the brakes too hard. And the Fed should state that it expects to hold rates steady in 2019 unless circumstances change materially.

Mr Powell may well worry about overreacting to bad news. Growth will surely slow as fiscal stimulus wears off, so softening economic data, in the housing market say, do not justify panic. Mr Powell may also need to signal that he will not kowtow to Mr Trump. (Though the president would struggle to remove the Fed chairman over policy disagreements, it may be possible.) Central banks do not exist to prop up stockmarkets—which can fall for reasons, such as waning euphoria, that are mostly unrelated to the objectives of monetary policy.

The right balance can be found by raising rates now while signalling a

change of course for 2019. The American economy can cope with another rate rise. But if the central bank continues to tighten monetary policy at the current pace, it is likely to make a costly mistake before long. To avoid that fate, Mr Powell must develop his own doctrine for the Fed. ■



货币政策

亟需“鲍威尔主义”

要走出紧缩困局，美联储需要一套新策略

美联储主席杰罗姆·鲍威尔（Jerome Powell）表示，“基本上所有情况”都让他夜不能寐。可能的确如此。总统特朗普的减税措施带来的财政刺激让美国在2018年免受全球经济放缓的牵连，但它们的功效很快就会开始减退。特朗普发动的贸易战正在削弱市场信心。随着增长预期下降，标普500指数在两个月多一点的时间内下跌了近10%。短期债券和十年期债券之间的收益率差在经济衰退前夕通常会变为负值，而目前这一差值已降至接近零，令投资者不安。更糟糕的是，特朗普一直在抨击美联储的加息举措。为控制通胀，美联储今年已三次加息。

鲍威尔似乎在压力下摇摆不定。10月他提到，在美联储完成计划目标之前，投资者应预期还会有多次加息；11月，他又暗示不大需要加息。他正在寻找一套新原则，因为今年2月他接任时所继承的那套方法（要求货币政策约每季度收紧一次）正变得过时。美联储于今天结束的会议仍可能决定再次加息。但这应该是可预测的时间表里的最后一次。2019年将需要一条适应经济周期新阶段的全新路线。

鲍威尔的新原则应以谦逊为核心。多年来，美联储利率制定者加息的理由一直都是预计美国的就业热潮很快将引发通胀。然而，即使失业率仅为3.7%，核心通胀（最重要的衡量指标）仍略低于目标，且还在下降。整体通胀水平有望达到目标，但可能很快因油价下跌而降低。通胀预期已经略微降低。随着经济前景变暗淡，如果再加息，必须要有更合理的理由，而非仅仅是一直被夸大的通胀风险。

美联储往往会在经济周期的后期抱持危险的自满情绪。在过去的两次经济衰退发生之前，尽管债券市场显出放缓将至的迹象，央行仍以低失业率为由加息。乐观派用种种论据消解交易者的明显悲观情绪，现在这些说法又

再次抬头。实际上，在过去，市场反应先于政策制定者，下一次危机爆发时可能也会如此。经济学家通常无法预测经济衰退，直到危机迫在眉睫。

美联储糟糕的预测记录带来了货币政策方面的教训。利率制定者应减少对预测模型的依赖，而更多考虑现实的经济和金融数据。他们还应放弃坚称失业率已低至不可持续的水平，因为该说法与现实证据相抵触，且会导致美联储刹车过急。美联储还应声明，除非情况发生重大变化，否则预计在2019年利率将保持不变。

鲍威尔可能很担心市场对坏消息反应过度。随着财政刺激措施的效果消退，增长肯定会放缓，因此不需要为房地产市场等领域的经济数据疲软而恐慌。鲍威尔也可能需要表明他不会对特朗普唯命是从。（虽说总统难以因政策分歧换掉美联储主席，但可能性还是有的。）央行的存在不是为了支撑股票市场，股市下跌的原因（如乐观情绪减退）大多与货币政策目标无关。

要实现正确的平衡，美联储可在现在加息的同时暗示2019年会改变政策走向。美国经济尚可以应对再一次加息。但如果美联储继续以目前的速度收紧货币政策，可能很快会犯下代价高昂的错误。要避免这种命运，鲍威尔必须为美联储制定出一套他自己的指导原则。 ■



Flight prices

Prepare for landing

Fares have plunged on long routes, but are now in a holding pattern

IF YOU HAVE booked a flight recently and been surprised by how cheap your ticket was, you are not alone. Airfares have been falling for years. Between 1995 and 2014 they halved in real terms, according to the International Air Transport Association (IATA). But in 2014 that descent became a nosedive. In the following two years, the average airfare dropped by nearly a quarter.

Curious passengers will find no public record of average prices paid on international routes. However, Expedia, a bookings firm, has given *The Economist* data for tickets sold on its platform for some popular itineraries. The biggest price falls have been on lengthy journeys. Routes longer than 5,000km (3,100 miles) have generally seen price drops of 30% on economy-class seats, approaching 50% on some transatlantic tickets. Fares on most trips shorter than 5,000km have fallen by less than 10%.

What explains the sharp drop on long flights? One factor has been the price of jet fuel, which makes up a higher share of costs on such routes. It fell from \$0.81 per litre to \$0.22 between 2014 and 2016.

But falling costs alone do not always lead to lower prices. The fuel slump coincided with increasing long-haul competition from low-cost carriers. Budget airlines swarmed onto regional routes in Europe and America 20 years ago. Now, with help from more fuel-efficient planes, they have turned their sights on longer journeys that were once out of reach. On transatlantic routes, Norwegian has crammed customers into sparkly new Boeing Dreamliners, offering return tickets from London to New York for as little as £260 (\$330). Incumbents have had to cut their prices to protect their market

share.

In Asia state-owned Chinese carriers have also undercut their rivals, because of hefty subsidies and a threefold increase in passengers in the past decade. Those cheap tickets mean that China is starting to rival the Gulf as a convenient hub for European visitors flying on to the rest of Asia.

But the downward spiral has stalled. Despite a recent sell-off, fuel prices have doubled since early 2016. Other costs are rising by 5% a year, notes Chris Tarry, a consultant. IATA expects profits to fall by 11% in 2018. That gives airlines less scope to cut fares, which have been flat for a year. After a long descent, prices have levelled out. ■



机票价格

准备着陆

一度暴跌的长途航线票价如今趋于平稳

最近订机票时发现票价便宜得惊人的不止你一个。多年来机票价格一直在下跌。根据国际航空运输协会（IATA）的数据，1995至2014年间，机票价格实际下跌了一半。到了2014年，这种下跌更是变成了暴跌。之后的两年里，平均机票价格降低了近四分之一。

关于国际航线平均票价的记录不会向好奇的乘客公开。不过，订票公司Expedia向本刊提供了其平台上一些热门线路的机票销售数据。票价跌幅最大的是长线航班。超过5000公里（3100英里）的航班的经济舱票价普遍下跌了30%，一些跨大西洋航班票价跌幅更是接近50%。而大多数5000公里以下航班的票价跌幅不到10%。

长线航班票价骤降的原因何在？其中一个因素是在长途航线成本中占比较高的航空燃油的价格。2014年至2016年间，油价从每升0.81美元跌至0.22美元。

但单是成本下降并不总会带来票价降低。燃油价格暴跌的同时，长途航线上来自廉价航空公司的竞争也日趋激烈。20年前，廉价航空公司涌入欧美的区域航线。如今，低油耗的飞机增多让廉航将目光投向了曾经遥不可及的长途航线。在跨大西洋航线上，挪威航空崭新的波音梦想飞机（Boeing Dreamliners）里塞满了乘客，从伦敦到纽约的往返机票只需260英镑（330美元）。老企业不得不通过降价来保住自己的市场份额。

在亚洲，由于巨额补贴和过去十年里增长了三倍的客运量，中国国有航空公司也以低价与对手竞争。这些廉价机票意味着中国已经开始成为欧洲游客飞往亚洲其他地区的便利枢纽，可与海湾国家相媲美。

但暴跌已经暂停。尽管近期原油遭到抛售，但自2016年初以来燃油价格已

经翻了一番。咨询师克里斯·塔里（Chris Tarry）指出，其他成本正以每年5%的速度增长。IATA预计，航空公司2018年的利润将下降11%。这使得一年来一直持平的票价的下调空间变小。票价经过长时间的下跌后已经趋于平稳。 ■



Free exchange

Tall tales

A central-banking memoir invites a reconsideration of the battle to contain inflation

PAUL VOLCKER'S legend is almost as grand and imposing as his physical personage, all six feet and seven inches of it. In 1979 President Jimmy Carter chose him to run the Federal Reserve and tackle America's high inflation. Mr Volcker acted with grim determination, tightening monetary policy even as the economy sank into deep recession and beleaguered Americans pleaded for relief. Eventually he not only routed inflation, but also won a hard-earned credibility for the Fed that would help successors keep inflation stable. Mr Volcker himself recounts the story in a new memoir, "Keeping At It", which calls on central banks to resist the siren song of loose money. But the book also invites readers to reconsider his legacy, and to ask whether central bankers have drawn the right lessons from the legend of Chairman Volcker.

The recessions and disinflation of the early 1980s proved a watershed both for macroeconomics and the practice of central banking. On the eve of Mr Volcker's tenure the academic field was riven by arguments over why inflation crept ever higher and what should be done about it. The monetarist disciples of Milton Friedman argued that inflation was "always and everywhere a monetary phenomenon", reflective of changes in the money supply that could be managed by the central bank. Economists of a Keynesian bent thought tighter money could reduce inflation, but only by inducing a severe depression. Other camps doubted monetary policy mattered much. Some economists thought inflation was rooted in cost pressures that required structural remedies, such as reforms to weaken monopolies and labour unions. Those of the rational-expectations school—which argued that policy must contend with people's rapidly

shifting views of the future—doubted that monetary policy could affect the real economy at all.

Mr Volcker's disinflation settled several disagreements at a stroke. Among all but a few holdouts it put to rest the notion that monetary policy was powerless. It showed that tight money could indeed bring inflation down. Though the economy did shrink, the downturn was milder than Keynesians had feared. Monetary policy worked in part through its influence on people's expectations of price rises. Once the Fed's actions persuaded people that future inflation would be lower, workers moderated their wage demands, and firms their price rises, without being forced to do so by a 1930s-style slump.

A new academic synthesis arose from this experience. Central banks should stabilise the economy by anchoring policy to some nominal variable (most ended up targeting a low rate of inflation). When a boom or a slump pushed inflation away from the target, they should act to prevent that deviation from influencing expectations and leading to higher inflation or unemployment. The more trusted the central bank, the easier the task.

Mr Volcker's memoir suggests the chairman saw his inflation-fighting efforts in a very different light, however. He was familiar with the debates progressing within academia: he had studied economics extensively (though he never finished his PhD, for which he blames his penchant for procrastination). He was also a seasoned economic policymaker: he had run the Federal Reserve Bank of New York and served in the Treasury department under three presidents. Even so, he lacked strong intellectual commitments. Mr Volcker's career at the Fed suggests monetarist sympathies; he launched his war against inflation by announcing that policy would operate through limits to money-supply growth rather than changes to interest rates. But those limits were soon abandoned. And his writing reveals an eclectic view of inflation: he blames fiscal incontinence

for fuelling price increases, for instance, and credits another president, Ronald Reagan, for helping to subdue wage and price growth by reining in trade unions.

Moreover, his distaste for inflation seems rooted in a surprisingly moralistic view of the economy. Of economists' support for a low but positive rate of inflation he asks: "[W]hat was the economic purpose, and for that matter the morality, of the government...intentionally debasing the nation's currency a little every year? My mother would see through that." Instead, he reckoned, the "fundamental responsibility of monetary policy" is to maintain confidence in the stability of the currency. Courting even a little inflation in an effort to boost growth risks eroding that confidence, forcing future central bankers to re-fight the disinflationary war Mr Volcker won in the early 1980s. Central banking is a test of character, he seems to suggest, in which resorting to the expediency of higher inflation is a sign of weakness.

Although central banks today are filled with top monetary economists, Mr Volcker's intuitive approach to monetary policy often seems as influential as the academic orthodoxy his tenure helped inform. He worries that economists favour reforms that would free central banks to court higher inflation during downturns. Although many do, central banks have very conspicuously declined to make such changes. They would view years of above-target inflation as a dangerous threat to their credibility, and easing policy in the face of such inflation an unforgivable sign of weakness. But years of below-target inflation in the aftermath of the global financial crisis did not generate a corresponding panic. Indeed, the Fed began raising interest rates while inflation remained below its target, unfazed by the risk that this would undermine public faith in its ability to boost the economy when the next recession strikes.

Mr Volcker writes that, time and again, governments accept "a little inflation" only to find themselves beset by spiralling prices. But the more

time passes, the more the 1970s look like an inflationary aberration book-ended by decades of modest inflation. Inflation is a danger, but one among many. It is the strength of Mr Volcker's character that deserves emulation rather than his response to a specific, bygone set of economic circumstances. ■



自由交流

高人传奇

一部央行行长的回忆录引发了人们对遏制通胀之战的再思考

保罗·沃尔克（Paul Volcker）身高足有六英尺七英寸（约为2米），而他的传奇经历几乎与他的身高一样令人仰视。1979年，沃尔克被卡特总统任命为美联储主席，着手解决美国的高通胀问题。尽管当时经济陷入深度衰退，困境中的美国人也祈盼能松一口气，沃尔克还是坚定不移地收紧货币政策。最终他不仅战胜了通胀，还为美联储赢得了难得的信誉，从而帮助其几任继任者保持通胀的稳定。沃尔克在他新近出版的回忆录《坚持到底》（Keeping At It）中讲述了这段往事，呼吁各国央行抵制宽松货币的诱惑。但这本书也引发读者重新思考他的经验传承，并追问央行行长们是否从沃尔克的传奇中吸取了有益的教训。

回头看来，上世纪80年代初的经济衰退和通货紧缩对宏观经济学和央行的政策操作都是个转折点。在沃尔克上任之前，学术界就通胀为何愈演愈烈以及应采取何种对策争论不休，闹得四分五裂。米尔顿·弗里德曼

（Milton Friedman）的货币主义信徒们认为，通胀“无论何时何地都是一种货币现象”，它反映了货币供应的变化，而央行可以调控货币的供应。而凯恩斯主义倾向的经济学家认为，紧缩的货币政策可以降低通胀，但必定以引发严重的萧条为代价。其他阵营则怀疑货币政策的重要性。一些经济学家认为，通胀源于成本压力，而成本压力的改善靠的是结构性补救措施，比如旨在削弱垄断和工会的改革。理性预期学派认为，政策必须应对人们对未来瞬息万变的看法。他们从根本上怀疑货币政策能够影响实体经济。

沃尔克通货紧缩的做法一举解决了多个纷争。除了少数坚持己见者，这一做法平息了大部分人认为货币政策无用的观念。它表明，紧缩的货币政策确实能降低通胀率。尽管经济确实萎缩了，但衰退的程度并不像凯恩斯主义者担心的那么剧烈。货币政策之所以发挥了作用，部分原因是它影响了

人们对物价上涨的预期。一旦美联储的措施让人们相信未来通胀率会下降，工人们就会降低对工资的要求，企业也会放缓价格上涨，不用上世纪30年代萧条期的人们那样被迫做出妥协。

这段抗通胀经历催生出一套新的学术理念。各国央行应该根据某个名义变量（多数央行最终以低通胀为目标）制定政策，从而稳定经济。当经济繁荣或衰退使通胀偏离目标时，央行应该采取行动，防止这种偏差影响预期及导致通胀或失业率上升。越受信任的央行越容易完成这项工作。

然而，沃尔克的回忆录显示，当时这位美联储主席看待自己的抗通胀之举时视角截然不同。沃尔克对学术界愈趋激烈的辩论非常熟悉——他全面学习过经济学（尽管没有读完博士，他将此归咎于自己的拖延症）。他还是一位经验丰富的经济政策制定者——曾经执掌纽约联邦储备银行，并在三位总统任内供职于财政部。即便如此，他并没有某种强烈的观念立场。沃尔克在美联储的经历显示他是货币主义的支持者——他宣布将通过限制货币供应量的增长而不是改变利率来实施货币政策，如此打响了他的反通胀战争。但这些限制很快又被取消了。而他的回忆录揭示出他对通胀抱持一种折衷的观点。例如，他指责财政上的无节制助长了价格上涨，同时也赞扬里根总统通过限制工会权力帮助抑制了工资和价格上涨。

而且，沃尔克对通胀的反感似乎源于一种不可思议的经济道德观。在谈到经济学家支持较低的正通胀率时，他问道：“政府每年都故意让货币略微贬值……其经济目的是什么？这样做的道德准则又是什么？我母亲都能识破它。”他倒是认为，“货币政策的基本责任”是保持对货币稳定的信心。为促进经济增长而追逐哪怕一点点通胀都有可能削弱这种信心，迫使未来的央行官员重打一场他曾在上世纪80年代初赢得的反通胀战。沃尔克似乎认为，央行的政策是对品行的一种考验，采取提高通胀这种便利的方法是无能的表现。

尽管如今各国央行内顶尖货币经济学家云集，但沃尔克对货币政策的直觉方法似乎与他的任期所催生的那套正统学术观念一样具有影响力。他担心经济学家偏爱的改革会在经济衰退期任由央行追逐高通胀。尽管许多经济

学家确实有此偏爱，但各国央行却非常明显地拒绝了这样的改革。他们会认为多年高于目标的通胀是对信誉的巨大威胁，而面对这种通胀采取宽松的货币政策是不可原谅的无能表现。但全球金融危机带来的多年来低于目标的通胀却并未引发相应的恐慌。实际上，美联储在通胀仍低于目标的情况下开始加息，并不担心此举可能会在下一轮衰退来袭时削弱公众对其提振经济之能力的信心。

沃尔克在回忆录中写道，各国政府一次又一次地接受“一点点通胀”，结果却发现自己被物价暴涨所困扰。然而，久而久之，上世纪70年代越发像是一段通胀的反常期，其前后都有几十年的温和通胀。通胀是一种危险，但只是众多危险之一。值得效仿的是沃尔克的人格力量，而不是他在过去那种特定经济环境中的所作所为。 ■



Tariffs and agribusiness

Zero-sum grain

The trade war gives agricultural merchants a surprise fillip—but not salvation

On December 10th Bunge, an American agribusiness giant, announced plans to replace both its chairman and its CEO. The move may seem ungrateful: the company's profits surpassed analysts' expectations in the most recent quarter, marking a turn after a string of bad years. But industry insiders were unsurprised. Despite cost-cutting and divestments, Bunge's share price is 28% below its February peak, even after a 3% jump when the reshuffle became public. Its travails are a sign of changing times for soft-commodity traders.

For decades ADM, Bunge, Cargill and Louis Dreyfus—the ABCDs of agribusiness—were unavoidable middlemen. From corn and cocoa to soya and sugar, they could best gauge supply and demand, thanks to superior intelligence on stocks and harvests. Their storage facilities placed them well to ride out price swings. State buyers and multinationals relied on their global footprint to source staples. Their networks of ports, ships and trucks meant they picked up profits all along the way.

But five years ago their grip started to loosen. In 2013 the quartet posted \$351bn in combined sales, equivalent to over a quarter of the world's annual food-import bill. By 2017 that had shrunk to \$260bn. At most companies profits also crashed, pummelling share prices. And though they together retain 235,000 staff, many traders have left.

Stable, low crop prices, induced by a persistent global glut, were squeezing margins. But the disintermediation owed more to structural forces. Phone apps could provide farmers with real-time data on prices in all markets.

Farms became bigger, and invested in storage. “Today you don’t need all these in-between halfway houses,” says Detlef Schoen, a former head of Cargill’s European grain business. The traders’ decline seemed unstoppable.

Until this summer. In June, after President Donald Trump slapped tariffs on \$50bn-worth of Chinese goods, Beijing retaliated by targeting soyabeans, America’s biggest farm export. That hammered American prices; Latin American substitutes soared. Brazilian soya, on par with American soya in May, opened up a wide lead before falling back as Brazil’s export season drew to a close and hopes for a truce in the trade war briefly rose (see chart).

American farmers were hit hard. But trading became profitable again. All four ABCDs have hinted at strong earnings for the period since June. In their high-volume, low-margin business, says Vincent Andrews of Morgan Stanley, a bank, agricultural traders shovel “pennies, nickels or dimes”. Until relatively recently, pennies were all they could pick up; now they are earning nickels. Volatility brings opportunities for arbitrage; depressed American prices mean bigger margins on processing soyabeans into animal feed.

Dimes may soon be on offer. “America must find new clients, China new suppliers. Traders have a new *raison d'être*,” says Jean-François Lambert, a consultant.

But the good times are unlikely to last. Trade shifts will outlast the war. And China will want to diversify away from America, says Heather Jones of Vertical Group, an investment firm. Disintermediation is likely to resume once the market settles. Digital market-places such as FarmLead, which covers 12% of North America’s grain market, mean farmers can shop around for the best price. “There’s no more loyalty in this business,” buyers tell Alain Goubau, the startup’s operations chief.

And the established players face another problem: new competition for supply. Glencore Agriculture, a trader backed by Glencore, a metals and mining firm, and by two Canadian pension funds, has been quicker to move into the Black Sea region, which now exports more wheat than America and Canada combined. Olam, a 30-year-old firm owned by Singapore's state fund, has carved out a lucrative niche in Asia and Africa, in spices and nuts.

Meanwhile China is advancing in Latin America. Since 2014 it has spent billions building up COFCO, a state-owned food processor, into an international trading platform. Though marred by integration problems, its acquisitions of parts of Noble Group and Nidera, two traders with South American presence, have made it a top-five exporter of Brazilian produce. It has invested in elevators, ports and processing plants, including a 60,000-tonne silo complex in Mato Grosso, Brazil's top soya-growing state. Valmor Schaffer, COFCO International's Brazil chief, says China buys 70% of the produce the company exports from Brazil, up from some 30% three years ago. Tariffs are a boon to Latin American farmers, he argues. China can test the quality of Brazil's late-year shipments, and likes what it gets. COFCO is not interested in sharing the spoils. Mr Schaffer says it would not like joint ventures with other traders unless it holds a majority stake.

The ABCDs remain the only truly global firms. But regional competition is adding to their main problem: too many companies are doing the same thing, says Sönke Lorenz of BCG, a consultancy. Tariffs or not, there are only two ways they can restore stable profits. They can diversify into food-manufacturing: Cargill, the most successful, derives two-thirds of earnings from its animal feed and protein business. Or they can consolidate, though their distinct cultures and ownership structures have till now made this hard.

Could the shake-up at Bunge create an opening? Saddled with bad investments in sugar production, it started a "strategy review" in October.

Yet there have been two failed takeover approaches in the past year, suggesting it remains too pricey for rivals to swallow whole.

Antitrust issues also loom large. “This company should already have been acquired five times. But no one is doing it,” says a former employee. Rivals may be waiting for Bunge to become a better bargain before slicing it up. ■



关税和农业综合企业

零和粮食

贸易战意外地给粮商注入了一剂强心针，但并不能完全拯救它们

12月10日，美国农业综合企业巨头邦吉（Bunge）宣布了更换董事长和首席执行官的计划。此举可能显得不厚道：公司最近一个季度的盈利超出了分析师的预期，标志着在连续多年不景气后终于迎来了拐点。但业内人士对这一人事变更并不感到意外。尽管这家公司削减了成本、剥离了部分资产，且在人事变更公布后公司股价上涨了3%，但还是比2月份的峰值低了28%。邦吉的困境凸显了软商品贸易商处境的改变。

几十年来，ADM、邦吉、嘉吉（Cargill）和路易达孚（Louis Dreyfus）这“ABCD四大粮商”曾是绕不过的中间人。从玉米、可可，到大豆和食糖，它们借助有关库存和收成的超强情报最准确地衡量供求，并且凭借存储设施安然度过价格波动。各个国家和跨国公司依靠它们在全球各地的布点来采购农产品。它们拥有的港口、船舶和卡车网络让它们在各个环节获利。

但五年前它们的掌控力开始松动。这四家公司2013年的总销售额达3510亿美元，相当于全球全年粮食进口额的四分之一还多。到2017年这一数字已缩水至2600亿美元。大多数公司的利润也大幅下降，股价因而大跌。尽管它们总共仍有23.5万名员工，但许多交易员已经离职。

持续的全球供过于求导致农作物价格稳定在低位，挤压了利润率。但脱媒更多是结构性力量所致。手机应用可以为农民提供所有市场的实时价格数据。农场变得更大，并开始投资仓储。“现在这些中间站你一个都不需要了。”嘉吉欧洲谷物业务前主管德特勒夫·舍恩（Detlef Schoen）表示。贸易商的衰落似乎已无可阻挡。

这种趋势一直持续到今年夏天。6月，美国总统特朗普宣布对价值500亿美元的中国商品加征关税后，中国政府选择对美国最大的出口农产品大豆征收报复性关税。此举导致美国大豆价格暴跌，而拉美替代品的价格飙升。

巴西大豆的价格在5月时与美国大豆持平，之后大幅领先，直到巴西出口季接近尾声，加上贸易战休战的希望短暂增长，价格回落（见图表）。

美国农民遭受了重创。但交易又变得有利可图了。ABCD四家公司都暗示自6月以来收益强劲。摩根士丹利的文森特·安德鲁斯（Vincent Andrews）说，农产品贸易商在它们大体量、低利润的业务中，“一分一分、五分五分，或是一毛一毛”地挣钱。在不久之前，他们还只能一分一分地挣，现在他们能五分五分地赚了。价格波动带来了套利的机会：美国大豆价格低迷，意味着把大豆加工成动物饲料后利润会增加。

他们也许很快就能一毛一毛地挣了。咨询顾问让-弗朗索瓦·兰伯特（Jean-François Lambert）说：“美国必须找到新客户，中国必须找到新的供应商。这让贸易商有了新的‘存在价值’。”

但这样的好时光不太可能长久持续。贸易本身的变化会比贸易战更持久。而且，投资公司Vertical Group的希瑟·琼斯（Heather Jones）表示，中国也会想在美国之外的地方寻找卖家。一旦市场稳定下来，脱媒现象很可能恢复。像FarmLead这类数字市场占据了北美谷物市场12%的份额，它们让农民能够多方比较，找到最理想的价格。“这个行业再没有什么忠诚可言了。”买家们对这家创业公司的运营总监阿兰·古博（Alain Goubau）这样说道。

老牌企业还面临另一个问题：供应环节上的新竞争。由金属和矿业公司嘉能可（Glencore）以及加拿大两家养老基金支持的交易公司嘉能可农业（Glencore Agriculture）抢先一步进军黑海地区，目前该地区的小麦出口量超过美国和加拿大的总和。新加坡国家基金旗下有30年历史的奥兰公司（Olam）在亚洲和非洲开辟了一个利润丰厚的细分市场，经营香料和坚果业务。

与此同时，中国正在拉丁美洲攻城略地。自2014年以来，中国已斥资数十亿美元，力图将国有食品加工企业中粮集团打造成一个国际贸易平台。中粮收购了两家在南美有业务的贸易商来宝集团（Noble Group）和尼德拉

(Nidera) 的部分业务，虽然受到了一些业务整合问题的影响，但它仍因此成为了巴西五大农产品出口商之一。它已投资于电梯、港口和加工厂，包括位于巴西最大的大豆种植州马托格罗索 (Mato Grosso) 的一座6万吨的筒仓。中粮国际巴西分公司的负责人瓦尔莫·谢弗 (Valmor Schaffer) 说，中国购买了该公司从巴西出口产品的70%，三年前这一比例约为30%。他认为，美国的关税对拉美农民而言是一种利好。中国可以检验巴西亚年末出货的质量，对结果也满意。中粮集团无意与他人分蛋糕。谢弗表示，它不想和其他贸易商成立合资企业，除非持有多数股权。

真正意义上的全球性公司仍只有ABCD四家。但波士顿咨询公司的桑科·洛伦茨 (Sönke Lorenz) 说，区域竞争加剧了它们面对的一个主要问题：太多的公司都在做同样的事情。无论有无关税，只有两种方法可以让它们恢复稳定的利润。它们可以将触角伸向食品制造业以实现多元发展；四家公司中最成功的嘉吉有三分之二的利润来自动物饲料和蛋白质业务。它们也可以整合，尽管目前来看迥异的文化和所有权结构让这难以实现。

邦吉的人事变动能否创造一个良机？由于在制糖业投资上的失利带来的沉重负担，该公司在10月启动了“战略评估”。然而过去一年里两个针对邦吉的收购计划均告失败，这表明对竞争对手而言全盘收购仍过于昂贵。

反垄断也是个大问题。“这家公司早就该被收购五次了，但是没有公司这么做。”一位前雇员说。竞争对手可能正在等待邦吉有个更划算的价格，再群起瓜分它。 ■



Genetics and ethics

Next time, ask first

The affair of the gene-edited babies rumbles on

On November 26th He Jiankui, a DNA-sequencing expert at the Southern University of Science and Technology, in Shenzhen, claimed he had orchestrated the birth of the world's first gene-edited babies: twin girls who arrived in early October. That claim brought the fury of the world raining down upon his head and he has since disappeared from view—though he has not, apparently, been arrested as some news reports have suggested.

Exactly what Dr He achieved has also been called into question. He says he used a gene-editing technique called CRISPR-Cas9 to disable, in one of the twins, called Nana, both parental copies of a gene called CCR5. This gene encodes a protein used by HIV to enter cells. If Dr He's claim is true, he may have conferred on Nana immunity to infection by HIV, thus protecting her from AIDS, which HIV causes. Moreover, by editing the genes of a fertilised egg—from which all body tissues, including the ovaries, are derived—he has done this in a way that can be passed down the generations, a process known as germ-line editing.

Nana's sister Lulu, Dr He says, has also had her genome modified, but with only partial success in that only one parental copy of CCR5 was disabled and so she remains unprotected. However, an independent assessment of Dr He's data by several gene-editing experts, including Kiran Musunuru of the University of Pennsylvania, suggests the experiment achieved only partial success in both twins.

On the face of things, Dr He may have broken the rules in China (and would certainly have broken the law in some countries, had he conducted his

experiments elsewhere). An official investigation led by the university is under way into the details of the case, and will report in due course. But, regardless of the specifics, the whole affair prompts wider questions about the culture and ethics, in both China and the rest of the world, of the rapidly developing area of gene editing.

Such questions will be debated by the Global Observatory for Gene Editing, which will be launched next spring in Cambridge, Massachusetts. The project, masterminded by Sheila Jasanoff of Harvard University and Benjamin Hurlbut of Arizona State University, in Tempe, who are both social scientists rather than geneticists, will try to broaden discussion about the technology. The idea is to involve ethicists, legal experts and representatives of governments and civil society, as well as scientists, thus enabling people from all of these fields to see the others' points of view. By coincidence, Dr Hurlbut is particularly close to the He affair. He has met and corresponded with Dr He. Also, his father, William, is a bioethicist and physician at Stanford University, in California, where Dr He worked after he had completed his PhD. According to William Hurlbut, "Dr He sought me out because he had genuine concerns about the ethical implications of his work. He really wanted to understand."

To many researchers, it was unsurprising that the He affair happened in China. "Ethical governance has long been the Achilles' heel of China's scientific endeavour," says Lei Ruipeng, executive director of the Centre for Bioethics at Huazhong University of Science and Technology, in Wuhan. Regulatory loopholes, lack of accountability, lack of penalties for violating rules and a lack of awareness of the rules among health-care staff and the public alike have earned the country a reputation for being biotechnology's Wild West.

The rampant application of unproven stem-cell therapies, for example, made China a magnet for medical tourism until the government banned

such practices in 2012. In the same year a trial on children, without the consent of their parents, of the nutritional effects of genetically modified rice, sparked public outcry. More recently, somatic gene-editing therapies (those that modify the body cells of people already alive, rather than the cells of those yet to be born) have been mushrooming without always having had proper approval. Moreover, many Chinese scientists feel they are in a competition with the West that has nationalistic overtones, and have even more incentive to do high-visibility work as a consequence. In light of this the CRISPR-babies scandal was, says Dr Lei, a “time bomb waiting to explode.” A pressing question in her mind is, “are there other time bombs lurking around?”

Not everyone, though, is inclined to think this is the whole story. In Dr Musunuru’s view Dr He—and anybody who may have helped and encouraged him—are the products of a general scientific culture (not merely a Chinese one) that puts a premium on competition, sensational research and being the first. As he puts it, “If you do something that is very attention-raising, you are more likely to get funding. If you do something truly revolutionary, you might get a Nobel prize.”

Benjamin Hurlbut views the He affair as “a prism for seeing some of the profoundly troubling issues of international science.” William believes that despite Dr He’s mistake their conversations at Stanford revealed a man who was aware of the ethical issues. What struck both Hurlbuts was how little foundation Dr He had for clear ethical thinking. “This was clearly not part of the training he received,” in either China or America, says William Hurlbut. “I was trying to give him what he had never received—a sort of road map of the kind of issues and questions behind his work—but I couldn’t possibly do what his training didn’t do in a few conversations,” he says. “He still felt the pull of doing what he both believed was good and would earn him an international reputation in science.”

Benjamin Hurlbut observes that Dr He is just one of many scientists who want to understand the ethical implications of their work but do not have the training or resources to think them through. The gene-editing observatory, with its more wide-reaching approach to expertise, will seek to fix that. How to handle germ-line editing—indeed, whether it should ever be permitted—is a problem given urgency by Dr He's activities. As those activities demonstrate, it is not one that scientists can be trusted to deal with by themselves. ■



遗传学和伦理学

下一次，先提问

基因编辑婴儿事件引发的争议长久持续

南方科技大学的DNA测序专家贺建奎于11月26日宣称，在他的运作下，世界上首例基因编辑婴儿——一对双胞胎女婴——已于10月初诞生。这一声明激起全球公愤，令他成为众矢之的。此后贺建奎便从公众视野中消失了，尽管看样子他并没有像某些新闻报道所说的那样已被逮捕。

人们对贺建奎究竟取得了什么成果也产生了质疑。贺建奎说，他使用了一种名为CRISPR-Cas9的基因编辑技术，让双胞胎之一的娜娜的整对亲本的CCR5基因拷贝失效。由于CCR5基因编码的蛋白质是HIV入侵细胞的辅助受体，如果贺建奎所言属实，那么他可能赋予了娜娜对HIV感染的免疫力，这样她就不会患上由HIV引发的艾滋病。此外，贺建奎编辑的是受精卵的基因（包括卵巢在内的所有身体组织都源自受精卵），这让这种免疫力具有可遗传性，这一过程被称为生殖系基因编辑。

贺建奎说，露露（娜娜的姐姐）的基因组也经过了修改，但只取得了部分成功：仅单个亲本的CCR5基因拷贝失效，因此露露仍有可能感染艾滋病。然而，包括宾夕法尼亚大学的基兰·穆苏努鲁（Kiran Musunuru）在内的几位基因编辑专家对贺建奎的数据进行的独立评估表明，贺建奎的实验在两名双胞胎身上都只取得了部分成功。

从表面上看，贺建奎可能已违反了中国的法规（如果他是在其他地方进行的实验，则必定违反了某些国家的法律）。南科大已开始对事件细节展开正式调查，并将在适当的时候通报调查结果。但是，无论具体情况如何，整个事件令中国乃至全世界都对基因编辑这个快速发展领域的文化和伦理问题产生了更广泛的质疑。

明年春天，在马萨诸塞州的剑桥市（Cambridge）将启动“全球基因编辑观测站”（Global Observatory for Gene Editing）项目，对这些问题展开讨

论。该项目由哈佛大学的希拉·加萨诺夫 (Sheila Jasanoff) 和位于坦佩 (Tempe) 的亚利桑那州立大学的本杰明·赫尔伯特 (Benjamin Hurlbut) 策划。两人都是社会科学家而非遗传学家。该项目旨在扩大有关基因编辑技术的讨论范围，其发起者希望参与者不仅仅只有科学家，还有伦理学家、法律专家、政府和民间团体代表，从而使所有这些领域的人都能了解其他人的观点。巧合的是，赫尔伯特与贺建奎事件颇有渊源。他与贺建奎见过面，并有过通信往来。而且，他的父亲威廉·赫尔伯特 (William Hurlbut) 是斯坦福大学的生物伦理学家和医生，而贺建奎博士毕业后在那里工作过。他父亲说：“贺博士想办法找到了我，因为他真的很关心自己的研究可能引发怎样的伦理后果。他确实很想弄明白。”

对很多研究人员来说，这起事件发生在中国并不令人意外。华中科技大学生命伦理学研究中心执行主任雷瑞鹏表示：“伦理监管一直是中国科学探索的软肋。”监管漏洞、缺乏问责、缺乏对违规的惩罚，以及无论医护人员还是公众都缺乏法规意识，种种这些都让中国背上了生物技术“狂野西部”的坏名声。

例如，滥用未经验证的干细胞疗法一度使中国成为热门的医疗旅游目的地，直到2012年政府取缔了此类疗法。同年，一项未经父母允许便对儿童进行转基因大米营养效果的试验引来公众强烈抗议。最近几年，体细胞基因编辑疗法（修改活人的身体细胞，而不是胚胎细胞）如雨后春笋般涌现，而这些疗法并非全部得到了适当的批准。此外，许多中国科学家感到自己身处于一场与西方国家之间的带有民族主义色彩的竞争，因此更有动力从事关注度高的工作。雷瑞鹏说，有鉴于此，基因编辑婴儿丑闻是一颗“等待引爆的定时炸弹”。她脑海中常常出现的一个问题是，“周围是否还潜藏着其他定时炸弹？”

然而，并非每个人都倾向于认为这就是整个事情的来龙去脉。在穆苏努鲁看来，贺建奎——以及每一个可能帮助和鼓励过他的人——都是一种普遍的科学文化（并非中国独有）的产物。这种文化推崇竞争、有轰动效应的研究，以及冲在最前头。他说，“如果你做的事情非常引人注目，就更有可能获得经费。如果你做的事情真正具有突破性，可能就会获得诺贝尔

奖。”

本杰明·赫尔伯特认为贺建奎事件是“一面棱镜，透过它可看到国际科学界一些令人深感不安的问题”。其父威廉则认为，尽管贺建奎犯了错，但他与贺建奎在斯坦福大学的交谈表明贺建奎意识到存在伦理问题。令父子俩震惊的是，贺建奎非常缺乏开展清晰的伦理思考的基本素养。无论在中国还是在美国，“他显然都没有接受过这方面的训练”，威廉·赫尔伯特说。“我当时试图告诉他一些他从未学到过的东西——某种关于他研究背后的问题和疑问的路线图，但我不可能用几次谈话就解决他的训练未做到的事。”威廉接着说，“对于那些他认为既有益，又会为他在科学界赢得国际声誉的事情，他仍然心向往之。”

本杰明·赫尔伯特注意到，许多科学家都希望了解自身工作可能引发的伦理问题，却因为没有接受过相关训练或者缺乏相关资源而无法想清楚这些问题，贺建奎只是其中一员。以更广泛的视角来实现专业性的基因编辑观测站将设法解决这个问题。贺建奎事件凸显了一个问题的紧迫性：该如何对待生殖系基因编辑——确切来说，是否应该允许这种编辑。这类事件表明，这不是一个能放心地交由科学家自己解决的问题。■



Low-Earth-orbit satellites

Round and round they go

The launch of thousands of new satellites will boost the space economy

SPACE IS BECOMING more crowded. On December 3rd a Falcon 9 rocket made by SpaceX thundered into the sky. On board were 64 small satellites, more than any American company had launched before in one go. They have an array of uses, from space-based radar to the monitoring of radio-frequency emissions. One, designed by Trevor Paglen, an artist, will soon unfurl a 30-metre reflective structure that will shine down on Earth like an artificial star, visible to the naked eye.

These objects are part of the latest breed of low-Earth-orbit (LEO) satellites, which are designed to whizz around the planet only a few hundred kilometres above its surface. This month's launch is just a taste of what is planned. SpaceX and OneWeb, a communications firm, plan to launch satellites in their thousands, not hundreds (see Briefing). The pair are set to double the total number of satellites in orbit by 2027.

That promises to change things dramatically on Earth. LEO satellites can bring internet connectivity to places where it is still unavailable or unaffordable. This will also be an enduring source of new demand for the space economy. Morgan Stanley, a bank, projects that the space industry will grow from \$350bn in 2016 to more than \$1.1trn by 2040. New internet satellites will account for half this increase.

For that to happen, however, three worries must be overcome. Debris is the most familiar concern. As long ago as 1978, Donald Kessler, a scientist at NASA, proposed a scenario in which, when enough satellites were packed into low-Earth orbits, any collision could cause a chain reaction which

would eventually destroy all space craft in its orbital plane. The syndrome which bears Mr Kessler's name weighs heavily on the minds of executives at the new satellite firms. Debris could conceivably render entire tracts of space unusable for decades. (Collisions have already happened. In 2009 an American satellite and a Russian one crashed into each other above Siberia, sending over a tonne of metal fragments swirling around the planet at thousands of kilometres per hour.)

Solutions exist. One is to grab malfunctioning satellites and pull them down into Earth's atmosphere. Another is to monitor space more intensively for debris; a US Air Force programme called Space Fence is due to start in 2019. But technology is only part of the answer. Rules are needed to govern the safe disposal of old satellites from low-Earth orbit. The United States' Federal Communications Commission is revising its regulations with this in mind. Other countries should follow suit.

Cyber-security is a second, long-standing worry. Hackers could take control of a satellite and steal intellectual property, redirect data flows or cause a collision. The satellite industry has been slow to respond to such concerns. But as more of the world's population comes to rely on the infrastructure of space for access to the internet, the need for action intensifies.

The third issue follows from the first two. If a simple mistake or a cyber-attack can cause a chain reaction which wipes out hundreds of billions of dollars of investment, who is liable? Underwriters are studying the plans of firms that wish to operate large numbers of satellites. But there is a long way to go before the risks are well understood, let alone priced.

As space becomes more commercialised, mind-bending prospects open up: packages shuttled across the planet in minutes by rocket rather than by plane, mining equipment sent to asteroids, a stream of paying passengers launched to orbit and beyond. All that and more may come, one day. But

such activities would raise the same questions as LEO satellites do. They must be answered before the space economy can truly blossom. ■



近地轨道卫星

转圈圈

将有数千颗新卫星升空，推动太空经济发展

太空正变得越来越拥挤。12月3日，SpaceX制造的一枚猎鹰九号火箭轰隆升空。它上面装载了64颗小型卫星，超过之前任何一家美国公司单次发射卫星的数量。从天基雷达到无线电发射监测，这些卫星的用途多种多样。其中一颗由艺术家特雷弗·帕格林（Trevor Paglen）设计，内嵌的30米长反射器不久将会打开，变成一颗肉眼可见的人造星星，在地球的上空闪光。

这些都属于最新型的近地轨道卫星，在距地表仅几百公里的轨道上绕行。本月发射的只是计划中的一小部分。SpaceX和卫星通信公司OneWeb计划发射几千而不是几百颗卫星。两家公司的目标是让轨道卫星的总数到2027年增加一倍。

这会给地球带来巨大改变。近地轨道卫星可以为目前还未接入互联网或者联网成本过高的地区提供网络连接。而这也将是太空经济新需求的持久源泉。摩根士丹利预测，航天业的规模将从2016年的3500亿美元增长至2040年的超过1.1万亿美元。其中一半的增长将源自新型互联网卫星。

然而，要实现这一点必须解决三大忧患。其中最为人熟知的一个是空间碎片。早在1978年，美国国家航空航天局的科学家唐纳德·凯斯勒（Donald Kessler）就提出，当足够多的卫星进入近地轨道时，任何碰撞都可能引起连锁反应，最终破坏所在轨道平面内的所有航天器。这一被命名为“凯斯勒综合症”的理论是压在新型卫星公司高管心头的一块大石。碎片可能导致整个太空轨道在几十年内都无法使用。（碰撞事件已有发生。2009年，一颗美国卫星和一颗俄罗斯卫星在西伯利亚上空相撞，产生的一吨多金属碎片以每小时数千公里的速度在地球上空旋转。）

解决办法是有的。一个方案是“捉住”故障卫星，将其下拉至地球大气层中。另一个方案是更严密地监测太空中的碎片，美国空军一项名为“太空

“篱笆”（Space Fence）的相关计划将于2019年启动。但技术只是解决方案的一部分，还需要制定规则来管理近地轨道旧卫星的安全处置问题。为此美国联邦通信委员会（FCC）正在修订相关规定。其他国家也应效仿。

第二个担忧存在已久——网络安全。黑客可能劫持卫星，窃取知识产权，重新定向数据流，或者让卫星相撞。卫星行业对这类问题反应迟缓。但随着世界上越来越多人口依赖太空基础设施接入互联网，就此类风险采取行动变得愈加迫切。

第三个问题因前两者而生。如果一个简单错误或一次网络攻击就可能导致连锁反应，令数千亿美元的投资化为乌有，那么谁该为此负责？保险公司正在研究那些想要运营大量卫星的企业提出的计划。但要充分了解其中的风险尚需时日，更别说要为这些风险定价了。

随着太空空间变得更商业化，让人脑洞大开的前景渐现：通过火箭而不是飞机在几分钟之内横跨地球递送包裹；把采矿设备发射到小行星上；把付费乘客“发射”到地球轨道或更远的地方。某一天，这些乃至更多的想法也许都会一一实现。但这些活动会和近地轨道卫星引发同样的问题。必须先解答这些问题，太空经济才能真正开花结果。 ■



Free exchange

The lives of the parties

China's economy is more Soviet than you think

The notion that China's economy, though nominally communist, resembles that of the Soviet Union seems on its face absurd. The fall of the Iron Curtain revealed a rusted shell of a country, incapable of manufacturing goods the West might want. China is the world's biggest exporter; its cities are jammed with gleaming skyscrapers. Soviet citizens went without consumer luxuries or bought them dearly on the black market. China's growing middle class can choose from scores of designer brands at the local mall.

The Union of Soviet Socialist Republics, formed five years after the Russian revolution of 1917, came apart at age 69. At 69, the People's Republic of China seems destined for world domination. Yet the Soviet economy seemed modern and dynamic once. China's GDP per person, at purchasing-power parity, remains below that in the Soviet Union on the eve of its collapse. And despite its capitalist trappings, the Communist Party is piloting China's economy in a direction similar to that of the Soviet Union in its twilight.

There can be advantages to economic backwardness, as Alexander Gerschenkron, a Ukrainian-American economist, once argued. Late developers can generate high returns on new capital and can copy technologies from richer places, without a laborious process of trial and error. In the first half of the 20th century the population of the Soviet Union remained largely rural, and industrialisation was far less advanced than in western Europe. By moving its people to cities and placing them in factories filled with Western technologies, the Soviets made up economic ground without relying on markets and private capital.

The results were striking—for a time. Official Soviet data exaggerated the economy's performance, but work by CIA analysts and other economists points to robust growth in the 1950s, with real output per person rising by nearly 6% annually. In the 1960s it grew by a slower but still solid 3%. In the 1961 edition of his seminal economics textbook, Paul Samuelson, a Nobel-prizewinning American economist, predicted that the Soviet economy would be larger than America's by the 1990s. When Nikita Khrushchev told the West "We will bury you", the threat seemed credible.

But flaws became increasingly apparent in the 1970s. Despite high investment, growth in output and productivity slowed sharply. By the 1980s productivity was declining (see chart). In an analysis published in 1994, William Easterly and Stanley Fischer blamed Soviet ills on falling returns to capital. The benefits of capital accumulation (saving to fund factories, equipment and so on) fall over time unless new productive uses for capital can be found.

From the 1970s tumbling returns to investment dragged the Soviet economy into a deepening rut. Other economies faced similar woes in that decade. But firms in market economies had more freedom and incentive to experiment with new technologies. Resources could flow more easily from stagnant firms to promising ones. Every aspect of the Soviet economy was directed by central planners, who could not replicate these dynamics.

China's development followed the Soviet path in some respects: industrialisation meant rapid urbanisation and the adoption of production techniques long established in richer economies. But China, unlike the Soviet Union, engaged with global markets. World trade helped discipline Chinese firms. Foreign subsidiaries and joint ventures facilitated the transfer of technologies and processes (to the chagrin of Western governments enraged by the theft of intellectual property). Middle-class

Chinese can spend their incomes on the same foods and fashions as people in the West.

Yet these capitalist trappings mask the continued influence of the state. Private Chinese firms account for just 52% of industrial output, a share that has risen from almost nothing in the early 1980s, but is no longer falling. In recent years their share of investment has begun to grow. Though there is nothing on the scale of Soviet central planning, the Communist Party exerts influence on other parts of the economy, as well—through preferential access to credit, for instance, and the dual obligation of party-linked executives to their firms and political masters.

The effects are malign. Growth in real output has fallen by more than half since 2007. More worrying, the contribution to growth from capital accumulation is higher now than it was in the 1980s or 1990s, and productivity makes less of a contribution. Indeed, productivity is actually declining, and at an increasing pace, according to recent work by Harry Wu and David Liang of Hitotsubashi University in Japan. Unpublished estimates by Mr Wu suggest that in 2016 total factor productivity, or the contribution to growth not accounted for by the addition of labour and capital, dropped back to levels last seen in the early 1990s. The problem is the same as that which plagued the Soviet Union: capital, directed by political interests, piling up in inefficient parts of the economy.

The work by Mr Wu and Mr Liang suggests that improving productivity in the information-technology sector has been China's saving grace. Productivity growth in IT-producing firms slowed only slightly in the years after the global financial crisis, they reckon, while in other parts of the economy falling productivity subtracted more than two percentage points from growth in GDP. But as the rest of the rich world has discovered, it becomes more difficult over time to wring efficiencies out of IT production.

China is not on the verge of collapse. In the 1980s the Soviets were burdened by sinking oil prices and soaring defence spending. China's market-oriented firms and more developed capital markets mean that the sorts of reforms it needs would be less disruptive than the painful transformation of the post-Soviet economy.

But it has plainly run out of room to boost productivity by mimicking advanced economies. Home-grown innovation could help, but is hamstrung by policies that shovel capital towards China's least productive firms. China may seem to have grown more comfortable with markets. But the Communist Party's interests still trump those of the private sector. There is no easy way to relax that constraint—or, perhaps, to avert a slide into stagnation. ■



自由交流

派对灵魂

中国经济比你想象的更苏联

中国经济虽然名义上是共产主义，但要说它像苏联经济似乎十分荒谬。铁幕的倒塌让一个国家生锈的外壳显露出来，它无法制造西方可能想要的商品。而中国是世界上最大的出口国；它的城市里挤满了闪闪发光的摩天大楼。苏联民众要么没有奢侈消费品可用，要么就得从黑市上出高价买来。而中国不断壮大的中产阶级在本地商场就有数十个设计师品牌可选。

苏维埃社会主义共和国联盟在1917年俄国革命爆发五年后成立，在它69岁时分崩离析。而中华人民共和国在它69岁时却似乎注定要统治世界。然而苏联经济也一度看起来十分现代且充满活力。按购买力平价计算，中国的人均国内生产总值依然低于崩溃前夕的苏联。尽管有诸多资本主义的特征，共产党正在试图将中国经济引向类似于苏联黄昏时的方向。

经济落后可能有其好处，乌克兰裔美国经济学家亚历山大·格申克龙（Alexander Gerschenkron）曾经这样说过。后发国家可以在新资本上获得高回报，并且可以从更富裕的地方复制技术，而无需经历耗时费力的试错过程。在20世纪上半叶，苏联人口的大部分仍在农村，工业化程度远不如西欧。通过将人民迁移到城市并将他们安置在充满西方技术的工厂中，苏联人不依赖市场和私人资本就建立了经济基础。

其成果引人注目——在一段时间里是这样。官方的苏联数据夸大了经济表现，但中情局分析师和其他经济学家的研究也指出了20世纪50年代增长强劲，期间人均实际产出每年增长近6%。到了60年代，增长放缓但仍然有扎实的3%。诺贝尔奖获得者、美国经济学家保罗·萨缪尔森在他开创性的经济学教科书的1961年版中预言，到90年代苏联的经济规模将超过美国。当尼基塔·赫鲁晓夫告诉西方“我们会埋葬你们”时，这种威胁似乎是可信的。

但是到了70年代，弊端日益显现。尽管投资很高，产量和生产率的增长却大幅放缓。到80年代，生产率开始下降（见图表）。在1994年发表的一份分析报告中，威廉·伊斯特利（William Easterly）和斯坦利·费希尔（Stanley Fischer）将苏联的弊病归咎于资本回报率下降。除非能为资本找到高效的新用途，否则资本累积（即积蓄资金用于开办工厂和添置设备等）的效益会随着时间的推移而下降。

从70年代开始，投资回报的骤降把苏联经济拖入了越来越深的僵化。其他经济体在这十年中也面临着类似的困境，但市场经济体中的公司有更多的自由和动力来尝试新技术。资源可以更容易地从停滞的公司流向有前景的公司。苏联经济的方方面面都是由中央计划者指导，他们无法复制这些动力。

中国的发展在某些方面遵循了苏联的道路：工业化意味着快速的城市化以及采用富裕经济体中久经考验的生产技术。但与苏联不同的是中国与全球市场的接轨。世界贸易帮助训练了中国企业。外国子公司和合资企业促进了技术和工艺的转移（这让西方政府大为懊恼，它们因知识产权被盗而愤怒）。中国的中产阶级可以把收入花在西方人在消费的那些食品与时尚上。

然而，这些资本主义的特征掩盖了国家施加的持续影响。中国私营企业仅占工业产出的52%，这一比例与80年代初相比几乎没有增长，但不再下降。近年来，它们的投资份额开始增长。虽然规模远不能和苏联的中央计划相比，但共产党也会对经济的其他部分施加影响——例如通过优先信贷，以及党员高管对其公司和政治主人所负的双重义务等。

其效果很恶劣。自2007年以来，实际产出的增长降低了一半以上。更令人担忧的是，如今资本积累对经济增长的贡献高于80年代或90年代，而生产率的贡献减少了。事实上，日本一桥大学的伍晓鹰和戴维·梁（David Liang，音译）最近的研究表明，生产率实际上正在下降，并且下降的速度越来越快。伍晓鹰未公布的估计认为，2016年全要素生产率（即劳动力

和资本的增加未能解释的那部分增长贡献)已经回落到90年代初期的水平。这个问题一度也曾困扰苏联:资本受政治利益引导,堆积在经济效率低下的地方。

伍晓鹰和梁的研究认为,在信息技术领域提高生产率一直是中国仅有的优点。他们估计,在全球金融危机之后的几年中,IT生产企业的生产率增长仅略有放缓,而其他经济部门的生产率下降让GDP增长下跌了超过两个百分点。但正如其他富裕国家所发现的那样,随着时间的推移,从IT生产中挤出效率变得愈发困难。

中国并未处于崩溃的边缘。80年代,苏联人承受着油价下跌和国防开支飙升的沉重负担。中国以市场为导向的企业和更加发达的资本市场意味着,它所需要的改革不会具有后苏联经济的痛苦转型那样大的破坏性。

但通过模仿发达经济体来提高生产率的空间显然已经快要用尽了。本土创新可能会有所帮助,但却被那些把资金往中国生产率最低的公司堆积的政策所累。中国可能看起来对市场越来越适应了,但共产党的利益仍然凌驾于私营部门的利益之上。没有简单的方法来放松这种约束,或许也没有简单的方法来避免陷入停滞。 ■



Pollution in India

Dirty work

Even by the standards of poor countries, India is alarmingly—and unnecessarily—filthy. It needs to clean up

INDIA STINKS. If at this misty time of year its capital, Delhi, smells as if something is burning, that is because many things are: the carcinogenic diesel that supplies three-quarters of the city's motor fuel, the dirty coal that supplies most of its power, the rice stalks that nearby farmers want to clear after the harvest, the rubbish dumps that perpetually smoulder, the 400,000 trees that feed the city's crematoria each year and so on. All this combustion makes Delhi's air the most noxious of any big city (see article). It chokes on roughly twice as much PM 2.5, fine dust that penetrates deep into lungs, as Beijing.

Delhi's deadly air is part of a wider crisis. Seventy percent of surface water is tainted. In the World Health Organisation's rankings of air pollution, Indian cities claim 14 of the top 15 spots. In an index of countries' environmental health from Yale and Columbia universities, India ranks a dismal 177th out of 180.

This does not just make life unpleasant for a lot of Indians. It kills them. Recent estimates put the annual death toll from breathing PM 2.5 alone at 1.2m-2.2m a year. The lifespan of Delhi-dwellers is shortened by more than ten years, says the University of Chicago. Consumption of dirty water directly causes 200,000 deaths a year, a government think-tank reckons, without measuring its contribution to slower killers such as kidney disease. Some 600m Indians, nearly half the country, live in areas where water is in short supply. As pollutants taint groundwater, and global warming makes the vital monsoon rains more erratic, the country is poisoning its own

future.

Indian pollution is a danger to the rest of the world, too. Widespread dumping of antibiotics in rivers has made the country a hotspot for anti-microbial resistance. Emissions of carbon dioxide, the most common greenhouse gas, grew by 6% a year between 2000 and 2016, compared with 1.3% a year for the world as a whole (and 3.2% for China). India now belches out as much as the whole of Africa and South America combined.

In the past India has explained its failure to clean up its act by pleading poverty, noting that richer countries were once just as dirty and that its output of filth per person still lags far behind theirs. But India is notably grubby not just in absolute terms, but also relative to its level of development. And it is becoming grubbier. If electricity demand doubles by 2030, as expected, coal consumption stands to rise by 50%.

It is true that some ways of cutting pollution are expensive. But there are also cheap solutions, such as undoing mistakes that Indian bureaucrats have themselves made. By subsidising rice farmers, for instance, the government has in effect cheered on the guzzling of groundwater and the torching of stubble. Rules that encourage the use of coal have not made India more self-reliant, as intended, but instead have led to big imports of foreign coal while blackening India's skies. Much cleaner gas-fired power plants, meanwhile, sit idle.

Reliant on big business for funding and on the poor for votes, politicians have long ignored middle-class complaints about pollution, failing to give officials the backing to enforce rules, or to co-ordinate across jurisdictions. That is a pity, because when India does apply itself to ambitious goals, it often achieves them. Next year it will send its second rocket to the Moon.

Narendra Modi, the prime minister, promised with admirable frankness

when he took over to rid the country of open defecation. Four and a half years and some \$9bn later, his Clean India campaign claims to have sponsored the building of an astonishing 90m toilets. This is impressive, but India is still not clean. Its skies, its streets, its rivers and coasts will remain dangerously dirty until they receive similar attention. ■



印度的污染

脏活

即便以穷国的标准衡量，印度的污染程度也很惊人，且并非必要。它亟需治理环境

印度臭气熏天。每年这个时候这里都是雾蒙蒙的。在首都德里，空气中总有一股烧东西的味道，那是因为的确有很多东西在燃烧：致癌的柴油为市内四分之三的汽车提供燃料，肮脏的煤炭是该市大部分电力的来源，附近农民收割后要清理稻秆，垃圾堆永远在闷烧，市内的火葬场每年要烧掉40万棵树，如此等等。这些燃烧令德里成为全球大城市中空气最糟糕的地方。其PM 2.5（可吸入肺部的细颗粒物）浓度约为北京的两倍。

德里可怕的空气质量是一场更大范围危机的一部分。印度70%的地表水受到污染。在世卫组织的空气污染排名中，前15名有14个是印度城市。在耶鲁大学和哥伦比亚大学的国家环境健康指数中，印度排名糟糕，在总共180个国家和地区中位列第177位。

这不仅造成许多印度人生活条件恶劣，还会夺去他们的生命。最新的估计显示，单单因吸入PM 2.5而死亡的人数每年在120万至220万之间。芝加哥大学表示，德里居民的寿命因此缩短了十年以上。一家政府智库估计，饮用脏水每年直接导致20万人死亡，这还没算上由此导致的肾病等慢性致命疾病的影响。约有六亿印度人生活在供水短缺的地区，几乎占全国人口一半。污染物污染了地下水，全球变暖也令该国极度依赖的季风降雨变得更不稳定，印度正在毒害自己的未来。

印度的污染也在危及世界其他地区。在河流中大肆倾倒抗生素已令印度成为耐药性的高发地区。2000年至2016年间，印度的二氧化碳（最常见的温室气体）排放量每年增加6%，而全球数字仅为1.3%（中国为3.2%）。印度目前的排放量相当于非洲和南美洲的排放总和。

过去，印度以贫穷为由为治理环境污染不力开脱，还指出富裕国家曾经同样污染严重，而且论人均污染量，印度仍远不及它们。但印度的污染不仅

绝对数量大，相对其发展水平也很高，而且污染还在变得更加严重。如果到2030年其电力需求如预期般翻番，用煤量将增加50%。

诚然，某些减少污染的方法成本高昂。但也有廉价的解决方案，比如纠正印度官员自己犯下的错误。举个例子，政府为稻农提供补贴，实际上等于鼓励了他们大量使用地下水及焚烧稻杆。而鼓励使用煤炭的政策并未像设想的那般让印度变得更自给自足，反而导致其大量进口外国煤炭，熏黑了印度的天空。与此同时，清洁得多的燃气发电厂却闲置一旁。

政客依赖大企业的资助和穷人的选票，长期以来一直忽视中产阶级对污染的不满，既未能支持官员执行反污染法规，也没有协调各个司法管辖区。这令人遗憾，因为印度只要致力于雄心勃勃的目标，就往往能够实现。明年印度将向月球发射第二枚火箭。

印度总理莫迪接任时坦率承诺要让印度彻底摆脱随地如厕的陋习，令人钦佩。在四年半的时间里，他的“清洁印度”运动耗资约90亿美元，声称资助建造了9000万座厕所，数量惊人。这是了不起的成绩，但印度依然没有干净起来。印度的天空、街道、河流和海岸仍将污秽不堪，充满危险，除非它们也能得到类似的关注。 ■



Marketing sport

A league of their own

Luck and shrewd management made the Premier League a global hit

David Dein, the former vice-chairman of Arsenal Football Club, was obsessed with toilets. In the 1980s the loos at English football grounds were vile and few, so supporters often resorted to using sinks or walls instead. The squalor embodied all that was wrong with the game. At American sports events, Mr Dein saw fans treated like paying customers rather than cattle. The atmosphere was congenial to families. The toilets were superior.

A belief that English football could become a far more appealing and hygienic product—and a more lucrative one—animated Mr Dein's plans for radical change. As Joshua Robinson and Jonathan Clegg of the *Wall Street Journal* relate in "The Club", Mr Dein and his associates thought they needed to mimic the promotion of American sports. Arsenal and other leading clubs duly launched the Premier League, which broke away from the existing competitions in 1992. They studied the NFL exhaustively and pillaged its best ideas. "Monday Night Football" was lifted word-for-word. Even if some innovations flopped—cheerleaders were quietly scrapped—the new league heralded an age of transformation in English football.

The late 1980s had been marked by ugliness and neglect—tragically in the cases of a fire in Bradford in 1985 and the deadly crush at Hillsborough Stadium in Sheffield in 1989. The game had become a national embarrassment, but it was transformed into one of Britain's most successful exports. Its broadcasting rights are now worth £2.8bn (\$3.5bn) a year, making it comfortably the richest football league in the world. The combined revenue of its clubs has increased by over 2,500%.

Through interviews and astute analysis, the authors make it clear that the Premier League got lucky. Its arrival coincided with 15 years of strong economic growth, plus a boom in pay TV. The English language made it more accessible to global audiences than Italy's Serie A, previously considered the top contest. But it also benefited from shrewd management. Richard Scudamore, the league's longtime boss, emails personal thank-yous to all 80 broadcasters after each season. In a classic example of unintended consequences, a clause in the founding document was instrumental too. All money from overseas broadcasting (negligible in the early years) was divided equally between teams. That ensured a greater degree of competition than elsewhere, enabling Leicester City to win a fairytale title in 2016.

Eschewing the day-to-day dramas of managerial sackings and player transfers, the authors unpick how the league became a "global sports business, and entertainment behemoth". There are some intriguing nuggets in this forensic and impeccably sourced account. Roman Abramovich would rather have bought Arsenal than Chelsea—but was wrongly told the club was not for sale. For all its razzmatazz, the Premier League still has only one-tenth as many staff as the NBA or NFL, a statistic that reflects the enduring power of the clubs.

Today the Premier League is not so much England's football league as the world's: its foreign broadcasting rights are now worth almost as much as the domestic ones. Such popularity surpasses anything Mr Dein could have dreamed of. The only danger, the authors warn, is that the wealthiest teams are endlessly pushing for even more cash and power; in 2018 they successfully ended equal distribution from overseas rights. The latest wrangling between the elite and those below them looks a lot like the manoeuvring that prefigured the Premier League's formation. ■



体育营销

他们自己的联赛

好运气加上精明的管理让英超红遍全球

阿森纳足球俱乐部前副主席大卫·戴恩（David Dein）对厕所十分在意。上世纪80年代，英国足球场的厕所卫生条件差，数量还少，球迷往往会上用洗手盆或贴着墙边如厕。这种脏乱差也体现出足球这项运动的种种弊病。戴恩在观摩美国的体育赛事时发现，观众们都被当成花了钱的金主而非牲口对待。赛场上的气氛适合家庭欢聚，厕所也是无与伦比。

戴恩相信英国足球可以大幅提高它的吸引力和卫生状况，也更能赚钱。这驱动他规划根本性的变革。《华尔街日报》的约书亚·罗宾逊（Joshua Robinson）和乔纳森·克雷格（Jonathan Clegg）在《俱乐部》（The Club）一书中讲述道，戴恩和他的工作伙伴们认为他们需要模仿美国体育赛事的推广方式。阿森纳联合其他一些顶尖俱乐部适时推出了英格兰足球超级联赛，于1992年脱离旧有赛事。他们详尽地研究了美国职业橄榄球大联盟（NFL），搜刮其最好的点子为己所用。《周一足球之夜》（Monday Night Football）这个名字更是直接照搬而来。虽然有些创新举措玩砸了（啦啦队就被悄无声息地取消了），但新联赛预示着英国足球即将进入变革的时代。

上世纪80年代中后期的英国足球场以丑恶和疏忽闻名，悲剧事故频发，比如1985年布拉德福德（Bradford）球场大火，以及1989年谢菲尔德的希尔斯堡球场（Hillsborough Stadium）发生踩踏事故造成多人伤亡。这项运动成为举国之耻，但后来却被改造成为英国最成功的出口产品之一。如今英超一年的转播权价值28亿英镑（35亿美元），让它轻松成为世界上最富有的足球联赛。英超各家俱乐部的收入总和已增长超过2500%。

通过访谈和缜密的分析，两位作者明确指出英超是交了好运。其推出适逢经济持续15年强劲增长，而付费电视也处于繁荣期。英超走红前，意甲被

视为顶级赛事，但英语让英超比意甲更便于全球观众收看。但英超同样也受益于精明的管理。英超在位许久的老板理查德·斯库达摩尔（Richard Scudamore）在每个赛季结束后都会向80个转播商发电子邮件表示感谢。英超成立文件中的一个条款也起到了重要作用，实为“无心插柳”的经典案例。海外转播收入（早些年数额还微不足道）全部由各球队平分。这保证了英超比别处的联赛有更大程度的竞争，正是这一点使得莱斯特城在2016年梦幻般地赢得了联赛冠军。

两位作者有意避开教练下课和球员转会这类日常戏码，深入剖析英超是如何成为一个“全球性的体育生意和娱乐巨头”的。二人的记述分析透彻，资料来源无懈可击，其中还包含一些非常有趣的信息。罗曼·阿布拉莫维奇（Roman Abramovich）原本更想买阿森纳而不是切尔西，但却被错误地告知前者并不出售。尽管英超一派繁忙喧嚣的气氛，但其员工数量仍然只有NBA或NFL的十分之一，从这个数据可以看出联赛各俱乐部经久不衰的影响力。

今天，与其说英超是英国的足球联赛，不如说是整个世界的联赛：如今其海外转播收入几乎已与国内转播收入相当。戴恩当初怎么也不会想到英超竟会有如此热度。作者警告道，唯一的危险就是那些最富有的球队仍在无休无止地争取更多的金钱和影响力：2018年，它们成功令平分海外转播收入的模式终结。豪门和小队之间近来的纷争非常像当年存在于英国足坛、促使英超创立的不光彩的操作模式。 ■



Economic forecasting

The worst except for all the others

GDP predictions are fairly reliable—but only in the short term

Some investors worry that America will face a recession in the next few years, after one of the longest expansions on record. Stock indices have fallen by 10% since early October. Yields on short-term government bonds exceed those of some longer-dated ones, often a harbinger of a downturn. Despite this, economic forecasters project GDP growth of about 2% in 2020.

How much confidence should one have in these predictions? For the past 20 years *The Economist* has kept a database of projections by banks and consultancies for annual GDP growth. It now contains 100,000 forecasts across 15 rich countries. In general, they fared well over brief time periods, but got worse the further analysts peered into the future—a trend unsurprising in direction but humbling in magnitude. If a recession lurks beyond 2019, economists are unlikely to foresee it this far in advance.

Economies are fiendishly complex, but forecasters usually predict short-term trajectories with reasonable accuracy. Projections made in early September for the year ending four months later missed the actual figure by an average of just 0.4 percentage points. Errors rose to 0.8 points when predicting one year out. But over longer horizons forecasts performed far worse. With 22 months of lead time, they misfired by 1.3 points on average—no better than repeating the previous year’s growth rate.

The biggest errors occurred ahead of GDP contractions. The average projection 22 months before the end of a downturn year missed by 3.7 points, four times more than in other years. In part, this is because growth figures are “skewed”: economies usually expand slowly and steadily, but

sometimes contract sharply. As a result, forecasters seeking to predict the most likely outcome expect growth. However, they adjust too slowly even once bad news arrives, says Prakash Loungani of the IMF. That suggests they are prone to “anchoring”—over-weighting previous expectations—or to “herding” (keeping their predictions near the consensus).

If forecasters displayed such biases consistently, an aggregator could beat the crowd by granting more weight to those with good records. But top performers rarely repeat their feats. When it comes to GDP, the best guide is the adage that prediction is difficult—especially about the future. ■



经济预测

靠不住，但再无更好选择

GDP预测还算靠谱，但只是在短期内

美国目前的扩张期是史上最长之一，一些投资者担心接下来几年美国会面临经济衰退。自10月初以来，美股下跌了10%。短期政府债券的收益率高于部分长期政府债券的收益率，这通常是经济衰退的预兆。尽管如此，经济预测者仍然预计2020年美国的GDP增速将在2%左右。

对于这些预测，人们该寄予多大信心？过去20年里，《经济学人》一直经营着一个数据库，收录了投行和咨询公司对历年GDP增速的预测。现在该数据库已包含15个富裕国家的十万条预测。总体而言，短期预测的准确性不俗，但分析师的预测期越长，准确度就越差。这一趋势在方向上并不令人意外，但偏差的程度就令人惭愧了。如果是过了2019年以后存在经济衰退的风险，那么经济学家现在是不太可能会预见到的。

经济体的情况错综复杂，但预测者通常能以还算不错的准确度预测短期的经济发展轨迹。在9月初做出的对于四个月后截止的一年的预测与实际数字平均仅相差0.4个百分点。在预测未来一年的走势时，误差上升至0.8个百分点。但如果是更长期的预测，准确度就要糟糕得多。对于22个月以后前景的预测，平均误差为1.3个百分点，并不比直接使用上一年的增长率数字强。

最大的偏差发生在GDP收缩前。在一个衰退年度结束前22个月做出的预测的平均误差为3.7个百分点，是距其他年份22个月时所作预测误差的四倍。这在某种程度上是因为增长数据有“偏向性”：经济通常是缓慢而稳定地扩张，但有时会急剧收缩。因此，为使预测最有可能应验，预测者会预计出现增长。然而，国际货币基金组织的普拉卡什·洛嘉尼（Prakash Loungani）表示，即使坏消息出现了，他们调整也不够及时。这表明他们倾向于“锚定”（过于依赖之前的预期）或“羊群”行为（让自己的预测接近

共识）。

如果预测者一直都表现出这种偏向性，一个聚合器或许可以通过给予成绩优秀的预测者更大的权重，而得到超出众人的结果。问题是有过良好预测的人很少能再次成功。说到GDP，最好的指针还是那句老话：预测不容易，尤其是对未来的事。 ■