长寿时代的理论与对策

Theories and Countermeasures for the Age of Longevity

泰康保险集团
Taikang Insurance Group

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目 录

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摘要：人类社会正在进入长寿时代，这将是关系人类未来发展的重大问题。长寿时代的特征是低死亡率、低生育率、寿命延长，在相当长的时间内，人们的预期寿命每 10 年会增长 2~3 岁，若干年后，相当多的人可能进入百岁人生。与此同时，人口年龄结构从金字塔结构转变为柱状结构，平台期老龄人口占比超越 1/4。本文完善了长寿时代的概念，认为长寿时代将是人口转变下的新均衡，并在此基础上对相关学术理论进行归纳研究，系统地阐述了长寿时代的特征和形成，进而提出长寿时代将带来健康时代和财富时代，对社会的经济模式、产业结构及各个方面造成影响。本文以动态的视角看待人类社会对老龄人口占比增多现象的应对现状，对长寿时代给社会经济可能带来的影响进行了剖析，指出长寿时代下会产生新形态的长寿经济，将在微观层面深刻改变个人的生活方式及健康财富规划，促使企业转变经营方式、保持组织活力、承担社会责任。基于此，本文从社会、政府、企业三个层面探讨了长寿时代的解决方案，尤其强调企业应创新商业模式、引入共享及生态理念，对引导长寿时代下的产业变革与企业转型具有理论与实践意义。

关键词：长寿时代 人口红利 长寿经济 产业结构

Theories and countermeasures for the age of longevity

Chen Dongsheng

Abstract: Human society is entering an age of longevity, which poses a significant challenge for the future development of humanity. This age of longevity is characterised by low mortality and birth rates and prolonged lifespans. For a quite long period of time, the life expectancy of human being has increased by 2-3 years every 10 years, and the number of centenarians in our midst is increasing. At the same time, the population age structure has changed, from pyramidal to pillar-shaped, and then plateaued with the elderly share of population higher than one quarter. This article further refines the definition of the age of longevity, considers it as a new steady state of the demographic transition, and, on this basis, performs an inductive research with relevant academic theories. The article will also provide a systematic explanation of the characteristics and causes of the age of longevity, and further propose that this age of longevity will usher in an era of health and an era of wealth, which will have an impact on society in terms of economic models, industrial structures and a range of other dimensions. In addition, this article provides a dynamic view of how our society is responding to the rapid ageing, evaluates the potential social and economic impacts of this age of longevity, and proposes that in this era, a new model of longevity economy will emerge, which will bring about profound changes to personal lifestyles, health management and wealth planning at the micro level, and encourage enterprises to change the ways in which they do business, to maintain organisational vitality, and to assume greater amounts of social responsibility. On this basis, this article discusses potential solutions to the challenges posed by this age of longevity from a community, government and corporate perspective, with a particular emphasis on the need for businesses to innovate in terms of their business models, and embrace the concept of sharing and the ecology. This article therefore has theoretical and practical implications for guiding industrial change and corporate transformation in this age of longevity.

Keywords: Age of longevity Demographic dividend Longevity economy Industrial structure

一、引言

随着世界老龄人口占比不断增加的趋势日益明显，学界普遍认为其速度加快会带来一系列社会问题，日本等部分国家已出现了经济衰退现象。但也有实证研究发现老龄人口不断增加与经济增长之间没有负面关系，经济学家将其归因于相关国家的科技发展及对老龄化的适应速度较快（Acemoglu and Restrepo，2017）。面对人类寿命日益延长，一些学者聚焦于寿命实质增长所带来的生活与就业的改变，提出了“长寿时代”（the Age of Longevity）的概念（琳达·格拉顿等，2018）[①]。我们认为“长寿时代”这一概念，虽然包含“老龄化”所描述的一些典型人口现象，但更多地指向老年人口占比升高后人类社会的一种相对稳定状态，有着更丰富的含义。**首先，“长寿时代”更具前瞻性，强调人口结构转变后的新均衡及其带来的影响，启迪个人和社会立足全生命周期，积极主动地应对这一变化。而老龄化多是关注老年人口变化的阶段性过程和发展困境，其视角往往着眼于老龄人口本身及其产生的问题，偏向被动应对。其次，“长寿时代”涵盖的领域更广，包括长寿与健康、财富等主题的内在关联，蕴涵了人口现象背后一系列的挑战和机遇。最后，在阐述“长寿时代”特征时，我们不仅仅停留在死亡率、出生率下降这两个导致“老龄化”的因素上，而是增加了对寿命增长和人口结构变迁长期趋势的预测，把“长寿时代”所指的长期的、相对稳定的人口和社会经济形态界定得更清晰。**本文旨在系统性地阐述“长寿时代”的内涵与外延，扩充完善其学术理论，并在社会、政府、企业层面探讨了对长寿时代的应对思路。

① 2014 年 International Health Economics Association（iHEA）曾以长寿时代的健康经济（Health Economics In the Age of Longevity）为主题举办世界健康经济大会。

A. Foreword

In the face of the accelerating trend of old-age dependency ratio, there is a widespread belief in the academic world that the increasing speed of population ageing will give rise to a range of social problems. Indeed, a number of countries, notably including Japan, have already begun to show signs of an economic recession. Empirical studies, however, have found no negative relationship between this ongoing acceleration in population ageing and economic growth, a fact that economists attribute to the technological developments of the countries involved, and their relatively rapid adaptation to ageing (Acemoglu and Restrepo, 2017). Faced with a constant increase in human life expectancy, a number of scholars have focused on the changes in lifestyles and employment brought about by the real increase in life expectancy, and have proposed the concept of "the Age of Longevity" (Lynda Gratton et al., 2018) [(1)]. In our view, although this concept includes a number of typical population traits encompassed by the term "ageing", it further highlights the relative stability of human society as the proportion of the elderly in the population increases, and therefore has a wider, deeper meaning. **First of all, this "age of longevity" is more forward-looking, emphasising the new steady state and the impact thereof following this demographic transition, inspiring individuals and society as a whole to grasp all stages of life cycle, and actively respond to this change. While ageing is mainly concerned with the gradual process of population ageing and the resulting development issues, its point of view often focuses on the ageing population itself and the problems that it creates, and tends to provide passive responses to these. Secondly, the "age of longevity" covers a wider range of areas, including the interconnection of longevity, health, wealth and other themes, implicitly suggesting a series of challenges and opportunities which lie beyond the population dynamics itself. Finally, when describing the characteristics of this "age of longevity", we have not merely confined ourselves to the twin factors of declining mortality and birth rate which lead to the "ageing", but have also expanded predictions of long-term trends in life expectancy growth and demographic changes, to provide a clearer definition of the long-term, relatively stable population and socio-economic patterns referred to in the "age of lon-**

(1) In 2014, the International Health Economics Association (iHEA) held a World Health Economics Conference on the topic of Health Economics In the Age of Longevity.

数据表明，世界正在快速地变老。联合国人口司《世界人口展望2019》显示，2019 年世界人口平均预期寿命已达到 72.6 岁，比 1990 年提升 8.4 岁，预计 2050 年全球平均预期寿命有望达到 77.1 岁。1990 年全球 65 岁及以上老人约占总人口的 6.2%，2019 年这一数字上升到 9.1%，预计到 2050 年将达到 15.9%。与此同时，80 岁以上高龄人口的增速会超过低龄老人，1990 年全球 80 岁以上人口只有 5400 万，2019 年已达 1.43 亿，预计到 2050 年将达到 4.26 亿。同时，联合国数据还显示 , 在过去的几十年里，全球几乎都在经历生育率的下降，总和生育率已从 1990 年的 3.2 降至 2019 年的 2.5，到 2050 年将可能降至 2.2 的水平。这也导致全球出生人口增速已经变得非常缓慢，预计到 2045 年后全球出生人口数量将开始逐年下降。根据联合国人口司中等假设水平预测，全球人口规模可能在 2100 年前后到达顶峰并开始回落，也有一部分人口学家认为 2050 年就有可能迎来人口拐点（达雷尔・布里克等，2019）。

联合国给出的人口中位数变化趋势显示，与许多欧美国家相比，东亚国家的老龄人口增长速度更快。其中，日本老龄人口占比自 2005 年开始超过北欧国家高居全球首位，其老年抚养比目前已达到 48%。2010 年至 2019 年之间，日本的死亡人数比出生人数多出 260 万人，预计到 21 世纪中叶日本人口将减少到 1 亿左右，21 世纪末将进一步缩水至 7500 万人。近年，日本的情况在亚太地区（韩国、新加坡、中国香港和台湾地区等）相继重演，其发展脉络具有借鉴意义。

与东亚发达国家和地区类似，中国的人均期望寿命在增加，老龄人口增长速度不断加快，人口年龄结构正在发生深刻变化。中国 2016

gevity". This article aims to provide a systematic explanation of the meaning and connotations of the "age of longevity", expand and enhance academic theory on the subject, and discuss responses to the age of longevity at the social, government and corporate levels.

The data indicates that the world is ageing rapidly. The United Nations Population Division's World Population Prospects 2019 shows that in 2019, the average life expectancy of the world's population was 72.6 years, an increase of 8.4 years compared to 1990. By 2050, global average life expectancy is expected to reach 77.1 years. In 1990, the elderly, i.e., those aged 65 years and above, made up 6.2% of the world's total population, whereas by 2019, this figure had risen to 9.1%; by 2050, it is expected to reach 15.9%. At the same time, the growth rate of the population over 80 years old will outstrip that of the younger segment of the elderly population. In 1990, the global population above 80 years of age comprised a mere 54 million people, whereas by 2019, this had risen to 143 million, and is expected to reach 426 million by 2050. United Nations data also shows that over the past few decades, the world has experienced a decline in fertility almost across the board. From 3.2 in 1990, the total fertility rate had dropped to 2.5 in 2019, and is likely to further decline to 2.2 by 2050. This has also brought about a significant slowdown in the growth rate of the global birth population, and global birth population numbers are expected to begin to decline year on year from 2045 onward. According to the United Nations Population Division's medium-variant projections, the size of the global population may peak around 2100 and then begin to fall, while some demographers believe that the population inflection point may come as early as in 2050 (Darrell Bricker et al., 2019).

According to the trend of population's median age reported by United Nations, the ageing population of the nations of East Asia is growing faster than that of many European and American countries. Of these nations, the proportion of Japan's elderly population has, since 2005, surpassed that of the Nordic countries, and now ranks first worldwide, with an old-age dependency ratio currently standing at 48%. Between 2010 and 2019, the number of deaths in Japan was 2.6 million higher than the number of births. It is estimated that, by the mid-21st century, Japan's population will reduce

年的人口预期寿命为 76.3 岁，在 195 个国家中排名 68 位，有学者认为若按此趋势保持下去，2040 年中国的排名将会上升至 39 位，人口预期寿命达到 81.9 岁（Foreman et al.，2018）。在老龄人口占比结构及增长速度方面，根据国家统计局公布的数据，中国 65 岁及以上人口占比已从 2000 年的 7.0% 上升到 2019 年的 12.6%。据联合国预计，到 2025 年中国 65 岁及以上人口占比就将上升到 14%，到 2045 年预计每 4 个中国人中就有 1 位老人。

与世界发达国家相比，中国将面临更多的挑战。中国人口基数大、生育率下降快，导致老龄人口增长进程愈发加速；国家医疗保障体制、福利保障体系难以匹配将要到来的社会人口年龄结构；人口预期寿命快速增长，但人均收入及储蓄均不及同时期发达国家，难以支撑个人退休期间的消费水平，或导致"未富先老"、"又老又穷"的社会现象发生。2019 年中国 65 岁及以上人口占比达 12.6%，人均 GDP 突破 1 万美元，而美、日、韩老龄人口比重达 12.6% 时人均 GDP 均在 2.4 万美元以上。有国外专家提出，中国未来的老龄人口增长速度很可能比日本更快，引起的问题也更严重。

人类进入 18 世纪中叶，尤其是工业革命以后，期望寿命开始前所未有地增长，长期以来相对恒定的人口年龄结构发生深刻改变，这引起了学者的极大兴趣和理论思考（安格斯·迪顿，2014）。近代人口学诞生以来经历了三个主要理论发展阶段：一是从 18 世纪末发展至今的马尔萨斯主义理论，二是 20 世纪后期兴起的人口衰竭理论，三是近 20 年间对"积极老龄化"（Active Ageing）的广泛探讨及相关研究。然而面对目前全球范围下的老龄人口增长浪潮，各种理论都难

to approximately 100 million and will shrink further to 75 million by the end of the century. In recent years, Japan's situation has been repeated across the Asia-Pacific region (South Korea, Singapore, and China's regions of Hong Kong and Taiwan, inter alia). Japan's pattern of population dynamics, therefore, has useful implications for China.

In a similar way to the developed nations and regions of East Asia, China's average life expectancy is also increasing, the growth rate of the elderly population is constantly accelerating, and the age structure of the population is undergoing profound changes. In 2016, China's life expectancy was 76.3 years, ranking 68th out of 195 countries. Some scholars believe that if this trend continues, China will climb the ranks to 39th by 2040, with a population life expectancy of 81.9 years (Foreman et al., 2018). In terms of the relative size of the elderly population, data released by China's National Bureau of Statistics shows that the proportion of the country's population aged 65 years and above has risen, from 7.0% in 2000 to 12.6% in 2019. According to United Nations estimates, by 2025, China's population aged 65 years and above will rise to 14%, and it is estimated that every one in four persons in China will be elderly by 2045.

Compared with the world's developed countries, China will face even greater challenges. China's large population base and rapidly declining fertility rate have accelerated the growth of its elderly population; the national health and welfare systems will find it difficult to keep up with the impending age structure of the population; and the life expectancy of the population is rising fast, but average per capita income and savings are lower than those of developed countries over the same stage of demographic transition. Difficulties are being encountered supporting the consumption levels of individuals during retirement, and instances of "Getting Old before Getting Rich" and old-age penury can be found across society. In 2019, China's population aged 65 years and above made up 12.6% of the total population, while per capita GDP had broken the USD 10, 000 barrier. By contrast, at the stage when their American, Japanese and Korean counterparts made up 12.6% of the population, these nations' per capita GDP already exceeded USD 24, 000. A number of foreign experts have proposed that the growth rate of China's future ageing population may very likely be higher than Japan's, and the problems that

以有效应对挑战。

第一类理论为马尔萨斯主义学派。近代人口问题研究的先驱马尔萨斯在其人口理论中阐述了农业社会中资源对人口增长的限制作用，后衍生出马尔萨斯学派，强调控制人口的必要性。20 世纪 70 年代，著名民间学术组织罗马俱乐部对工业时期的人口过度增长及其所致的经济增长极限作出建模预测（德内拉·梅多斯等 ,2019），认为马尔萨斯式的人口增长及资源利用将导致不可控的衰竭，应引起警惕重视。该类预测在近年被真实数据证明存在偏误，未充分考虑技术革命带来的资源解放以及城市化导致的生育意愿降低，过度放大了人口增长的潜在风险。

第二类理论密切关注老龄人口增长问题，并提出人口衰竭的预期。20 世纪末至今，全球相继迈入老龄人口快速增长阶段且各国缺乏有效应对方案，有关人口结构老龄化、人口规模衰减的分析研究开始大量兴起。1987 年，德克·范德卡（Dirk Van de Kaa）提出“第二次人口转变”（The Second Demographic Transition），对生育率低于人口替代率的现象作出解释（Van de Kaa，1987）。在分析老龄人口增长及人口规模下降的成因及影响方面，多国学者均指出人口老龄化及人口负增长会对消费、生产力、就业、创新、竞争力、财政储蓄与文明传承造成压力，此类研究强调老龄人口的负担性及人口负增长带来的挑战（Bloom et al.，2003；Maestas et al.，2016；大前研一，2017；梁建章、黄文政，2018；达雷尔·布里克等，2019）。

20 世纪 90 年代起“积极老龄化”引起了广泛探讨。联合国及世界卫生组织等国际组织开始倡导“健康老龄化”，后又提出“积极老

this will cause will be more severe.

As the human race entered the mid-18th century, and particularly following the Industrial Revolution, life expectancy began a period of unprecedented growth, and the population age structure, which had remained relatively constant for a long time, underwent profound changes, all of which has attracted great attention and theoretical discussion amongst scholars (Angus Deaton, 2014). Modern demography has undergone three major stages of theoretical development since its birth: the first is Malthusian theory, which has continued to evolve since the end of the 18th century to the present date. The second is the population decline theory, developed in the latter years of the 20th century, while the third is "active ageing", which has been widely discussed and extensively studied over the last 20 years. However, none of these theories appear able to effectively face up to the challenges of the current, global wave of population ageing.

The first of these theories is the Malthusian school. Malthus, a pioneer in research into modern population problems, expounded on the restrictive impact of resources on population growth in agricultural society in his population theory, and this later developed into the Malthusian school, which emphasised the necessity of population control. In the 1970s, the Club of Rome, a well-known non-governmental academic organisation, constructed models to predict the excessive population growth of the Industrial Era and the resulting limit of economic growth (Donella Meadows et al., 2019), and believed that population growth and resource utilisation would lead to uncontrollable failures as Malthus described, which required vigilance and close attention. In recent years, real-life data has shown that forecasts of this kind are biased, failing to fully consider the freeing-up of resources brought about by the technological revolution as well as the reduced desire to reproduce brought about by urbanisation, and hence excessively exaggerating the potential risks of population growth.

The second of these theories was intimately related to the growth of aged population, and raised the prospect of population decline. Since the end of the 20th century, the world as a whole has entered a phase of rapid population ageing, an issue to which no country has so far found an effective

龄化”概念，人们意识到应多角度地看待老龄人口增长现象，研究领域逐渐多样化、细分化。老龄人口增长开始被看作是科技、医疗、健康护理、公共卫生等多方面的进步，人们普遍认为该问题“机遇与挑战并存”。与此同时，2000 年以来中国关于养老问题的研究成果增多，上升趋势明显（曹献雨、睢党臣，2018）。

在各国老龄人口占比均不断升高的时代背景下，经典人口学理论显示出诸多缺陷，而针对老龄人口问题的研究，一方面以碎片化成果为主，缺乏成体系的理论指导，另一方面偏重数据分析和预测推演，缺少针对未来人口年龄结构的实践经验及系统性解决方案。站在过去看未来，将受制于当前社会阶段的发展逻辑，难以有效应对挑战。**本文通过解读全球人口发展脉络，指出长寿时代的不可逆性，立足未来人口和社会形态分析各要素间的相互作用，并由此推导出合理有效的对策**。文章将延伸丰富长寿时代的理论价值，建立一套发展的、符合未来寿命和人口年龄结构长期趋势的理论分析框架，深入剖析长寿时代的挑战和机遇，并指出企业及个人的应对思路。

文章首先阐述长寿时代的主要特征及形成原因，探讨低死亡率、低生育率，以及预期寿命保持增长、人口年龄结构趋向柱状、平台期老龄人口占比超越 1/4 等人口现象。第二，在微观角度指出长寿时代与健康时代、财富时代的关联性：长寿时代下预期寿命的延长、生存质量的提高和社会功能的变化将造就健康产业及健康经济，同时社会储蓄结构及财富积累形式将会发生变化，对养老金替代率充足的需求，会推动第二次人口红利（Mason and Lee，2004）。第三，从宏观角度说明长寿时代对生产、需求、就业、增长、社会公平等多方面的影响。

solution, and analytical research into the ageing of the population structure and shrinking population sizes has taken on new importance. In 1987, Dirk Van de Kaa proposed a "second demographic transition" to explain why fertility rates can be lower than the population replacement rate (Van de Kaa, 1987). In their analyses of the causes and effects of population ageing and population shrinking, scholars from around the world have all pointed out the pressure that population ageing and negative population growth will place on consumption, productivity, employment, innovation, competitiveness, fiscal savings and cultural heritage. Studies of this kind emphasise the burden of the ageing population and the challenges brought about by negative population growth (Bloom et al., 2003; Maestas et al., 2016; Kenichi Ohmae, 2017; Liang Jianzhang and Huang Wenzheng, 2018; Darrell Bricker et al., 2019).

Since the 1990s, "active ageing" has become a topic of widespread discussion. At this time, the United Nations, World Health Organisation and other international bodies began to advocate "healthy ageing", and later proposed a definition of "active ageing". People realised that the phenomenon of ageing population growth needed be viewed from multiple perspectives, and research in this field has gradually diversified and subdivided. The growth of the ageing population began to be seen in terms of advances in science and technology, medicine, healthcare, public health and other aspects, and people now generally consider the issue a "coexistence of opportunities and challenges". At the same time, China has since 2000 also more and more studies into the issue of elder care, and there has been an obvious upward trend in this research area (Cao Xianyu and Sui Dangchen, 2018).

This era of increasing ageing segments in the populations of various countries has shown up the various shortcomings of classic demographic theory, while research focusing on the issue of population ageing is on the one hand mainly based on fragmented results and lacking in systematic, theoretical guidance, while on the other, an emphasis on data analysis and forecasting is lacking in input from practical experience and systematic solutions for the age structure of the future population. Standing in the past as we look to the future makes us subject to the developmental logic of the current stage of society, making it hard to effectively overcome the challenges that we face. **This article provides an interpretation of the development context of**

最后，文章着重探讨了在长寿时代下，个人社会需要作出的调整，政府的作用，以及企业应如何创新商业模式、保持企业活力、承担企业社会责任，通过市场经济的方式解决社会问题，积极迎接机遇与挑战。

the global population in order to point out the irreversible nature of this age of longevity, analyses the interactions between the various elements based on future population and social patterns, and uses these to derive reasonable and effective countermeasures. The article will expand the theoretical value of the concept "age of longevity", establishes a developmental, theoretical analysis framework which is consistent with the long-term trends of future life expectancy and population age structure, provides an in-depth analysis of the challenges and opportunities posed by the age of longevity, and proposes suitable responses for enterprises and individuals.

We will first elaborate on the main characteristics and causes of the age of longevity, discussing the low mortality and fertility rates, as well as the sustained growth in life expectancy, the pillar-shaped tendency of the population age structure, and the phenomenon of the proportion of the ageing population making up more than a quarter of the population during the plateau period. Secondly, from a micro perspective, we will point out the interactions among the age of longevity, the era of health, and the era of wealth. On one hand, increased life expectancy, improved quality of life and changes in social functions will create growth opportunities for health-related industries and health economy. On the other, the changes which will occur in the social savings structure and forms of wealth accumulation, as well as the need for a sufficiently robust pension replacement rate will drive a second demographic dividend (Mason and Lee, 2004). Thirdly, we will use a macro perspective to illustrate the impact of the age of longevity on production, demand, employment, growth, social equity and other areas. Finally, this article will focus on discussing the adjustments which individuals and society will need to make in this age of longevity, the role of government, and the ways in which enterprises can develop innovative business models, maintain their corporate vitality, take on corporate social responsibility, use market economic means to resolve social issues, and actively meet the opportunities and challenges that arise.

二、长寿时代的特征及形成

（一）长寿时代的特征

18 世纪中期开始的工业革命打破了农业社会资源承载人口能力的限制，世界人口在那时开启了前所未有的大规模增长。基于对人口增长过程中出生率和死亡率变化的研究，1929 年美国人口学家沃恩·汤普森（Warren Thompson）提出按人口增长模式可以将各国划分为三类。在此基础上，1945 年弗兰克·诺特斯坦（Frank Notestein）进一步将人口增长模式归纳为潜在下降、转变增长、潜在高增长三个类别。此后对于人口增长模式的描述逐步发展形成了人口转变理论。**当前普遍将人口转变分为四个阶段，即第一阶段是高出生率、高死亡率，人口规模不变或增长极其缓慢；第二阶段是高出生率、死亡率下降，人口快速增长；第三阶段是出生率下降、低死亡率，人口增速放缓；第四阶段是低出生率、低死亡率，人口规模趋于稳定**。

当前世界正在由人口转变的第三阶段快速转向第四阶段，但第四阶段以及之后会进入什么状态？我们在此提出长寿时代的概念，认为它将是人口转变后的新均衡。这一时代伴随着五大特征：**低死亡率、低生育率、预期寿命持续提升、人口年龄结构趋向柱状、平台期老龄人口占比超越 1/4**。

1. 死亡率下降至低水平

19 世纪人类的死亡率开始显著下降。当时生活水平提高、营养改善是决定性的因素。工业革命带来社会生产力水平大幅提升，使人们逐步摆脱了饥饿的困扰，增强了抵御疾病的能力。英国和法国的预期寿命分别从 1750 年的 37 岁和 26 岁增至 1900 年的 48 岁和 46 岁。

B. Characteristics and causes of the age of longevity

(a) Characteristics of the age of longevity

The Industrial Revolution which broke out in the mid-18th century shattered the constraint of the capacity of agricultural social resources to support the population, and the world's population began to grow, on an unprecedented, massive scale. Based on research into changes in birth rates and mortality in the population growth process, US demographer Warren Thompson in 1929 first proposed dividing countries into three types based on population growth patterns. On this basis, Frank Notestein in 1945 further summarised the population growth pattern into three categories: incipient decline, transformational growth, and high growth potential. Since then, the description of population growth patterns has gradually developed into the theory of demographic transition. **Today, demographic transition is generally divided into four stages, namely a first stage characterised by its high birth rate and mortality, and a lack of change or extremely slow growth in population size; a second stage then introduces a high birth rate but a decline in mortality, and rapid population growth; a third stage then witnesses a decline in the birth rate, low mortality, and a slowing population growth rate; finally, a fourth stage has a low birth rate and mortality, and the population size tends to stabilise.**

The world is currently rapidly shifting from the third stage of the demographic transition to the fourth stage, but what state will we enter in this fourth stage and thereafter? Here, we would like to propose the concept of an age of longevity, and believe that this will form a new steady state following the demographic transition. This era will bring with it five major characteristics: **low mortality, low fertility, continuously increasing life expectancy, a population age structure tending toward a pillar shape, and an ageing population segment which exceeds 1/4 of the total during the plateau period.**

1. Decline in mortality to low levels

The 19th century saw the start of a marked decline in human mortality, which was mainly driven by improved living standards and nutrition. The Industrial Revolution brought about substantial increases in social

英国学者托马斯·麦基翁（Thomas McKeown）提出19世纪英国死亡率下降是由于经济和生活条件的改善，其中最重要的是饮食的改善（McKeown，1962）。美国学者罗伯特·福格尔（Robert Fogel）也提出人们对周围环境的控制和创造技术革新的能力相互促进推动了死亡率的不断降低（Fogel，2004）。

公共卫生条件的改善对死亡率的下降同样扮演着重要的作用，尤其是对传染性疾病的控制。以美国为例，由于通过水和空气传播的传染性疾病得到了有效控制，1900年至1940年美国整体死亡率下降了40%，预期寿命从47岁提升至63岁，原来在城市生活死亡率更高的问题也在这一时期消失了。研究发现净水过滤和氯化系统的广泛应用在其中发挥了巨大的作用，为美国带来了这一史无前例、最为快速的死亡率下降（Cutler，2005）。此外，20世纪40年代抗生素类药物的使用进一步降低了传染病的病死率。例如，根据美国疾控中心数据显示，在此期间肺结核的死亡率一下从1945年的39.9/10万降到了1955年的9.1/10万。

到20世纪下半叶，医疗和技术进步与死亡率下降的关系越来越密切。有研究指出美国20世纪50年代以来死亡率下降更多是得益于医疗进步带来的心脏病、中风等心血管疾病死亡率的降低。1950年至2016年美国预期寿命提升了11岁，其中一半以上的增长与65岁及以上人群生存率提升有关（Catillon et al.，2018）。此外，欧美发达国家在公共卫生方面的知识和现代医药技术向发展中国家的传播推动了全球死亡率的快速下降。1960~2000年期间公共卫生基础设施、免疫接种、疾病专项防治等成为带动发展中国家死亡率下降的重要因素，

productivity, gradually freeing people from hunger, and strengthening their resistance to disease. Between 1750 and 1900, life expectancy in the United Kingdom and France rose from 37 years and 26 years to 48 years and 46 years respectively. British scholar Thomas McKeown pointed out that the drop in mortality in the UK in the 19th century was attributable to improvements in economic and living conditions, the most important of which was the improvement in diet (McKeown, 1962). US scholar Robert Fogel also proposed that people's control over their environment and the ability to create technological innovation mutually promoted the continuous decline in mortality (Fogel, 2004).

The improvement in public health conditions played a similarly significant role in the decline in mortality, particularly with regard to the control of communicable diseases. If we take the US as an example, the effective control of air- and water-borne communicable diseases brought about a 40% reduction in overall US mortality between 1900 and 1940, an increase in life expectancy from 47 years to 63 years, and the phenomenon that mortality used to be higher in urban areas also disappeared at this time. Studies have shown that the widespread use of clean water filtering and chlorination systems played a huge role in this, bringing a historically unprecedented, rapid drop in mortality to the USA (Cutler, 2005). Furthermore, the introduction of antibiotic drugs in the 1940s further reduced mortality from infectious diseases. For example, US Centers for Disease Control and Prevention data shows that the death rate from tuberculosis during this period dropped from 399 per million in 1945 to 91 per million in 1955.

During the latter half of the 20th century, the relationship between medical and technological progress and declining mortality became ever closer. Studies have shown that since the 1950s, the drop in mortality in the United States has been predominantly due to a decline in mortality thanks to medical progress in the treatment of cardiovascular diseases such as heart disease and stroke, inter alia. Between 1950 and 2016, life expectancy in the United States increased by 11 years, and more than half of this increase was related to the increased rate of survival in people 65 years and above (Catillon et al., 2018). In addition, awareness of public health in the developed nations of Europe and the Americas and the spread of modern medical technology to

而收入和营养改善的影响已不像欧美发达国家早期所经历的那样显著（Soares，2007）。

新中国成立后，政府对卫生健康领域非常重视，并取得了巨大的成就，实现了死亡率的快速下降。20 世纪 50 年代初期发起的全民卫生运动极大地改善了中国公共卫生状况，显著提升了对传染病的防治能力。《中国妇幼健康事业发展报告（2019）》显示，与解放前相比，到 2018 年中国孕产妇死亡率从 1500/10 万下降到 18.3/10 万，婴儿死亡率从 200‰下降到 6.1‰，平均预期寿命从 35 岁提升至 77 岁（见图 1）。

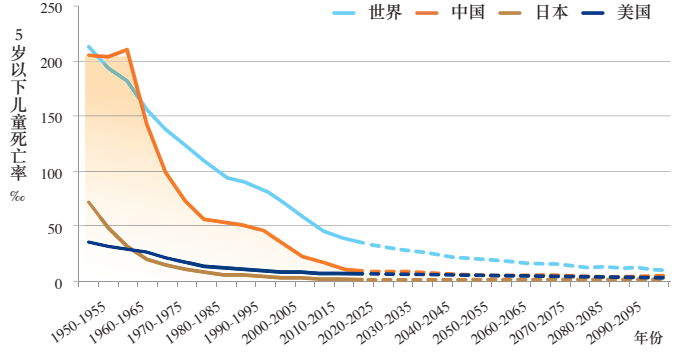

图 1：世界、中国、日本、美国 5 岁以下儿童死亡率变化趋势
数据来源（同图 2~ 图 5）：联合国 World Population Prospects 2019 数据库，https://population.un.org/wpp/Download/Standard/Population/。

2. 生育率下降至低水平

在农业社会，人是最重要的经济资源，孩子是生活保障和劳动力的来源，因此在高死亡率的生存环境下，高生育率是维持社会发展的需要。而工业革命的到来加速了城市化的进程，在这一过程中，女性的地位得到了根本性的提升，生育意愿也因此发生了改变。

首先，儿童死亡率的显著降低使人们对生育孩子数量的意愿产生

developing nations has driven a rapid decline in mortality worldwide. During the period from 1960-2000, public health infrastructure, immunisations, disease prevention and other measures have become major factors driving the drop in mortality in developing countries, although the impact of improvements in income and nutrition is no longer as significant as those previously experienced by the developed nations of Europe and the Americas (Soares, 2007).

Following the founding of the People's Republic of China, the government attached great importance to hygiene and health, and has achieved tremendous results, bringing about a rapid reduction in mortality. The National Health Campaign, launched in the early 1950s, brought about a great improvement in China's public health conditions, and significantly improved its ability to prevent and control infectious diseases. The China Maternal and Child Health Development Report (2019) shows that, when compared to the pre-1949 era, China's maternal mortality rate dropped from 15 per thousand to 0.183 per thousand in 2018, while infant mortality dropped from 200 per thousand to 6.1 per thousand, and average life expectancy rose from 35 years to 77 years (see Figure 1).

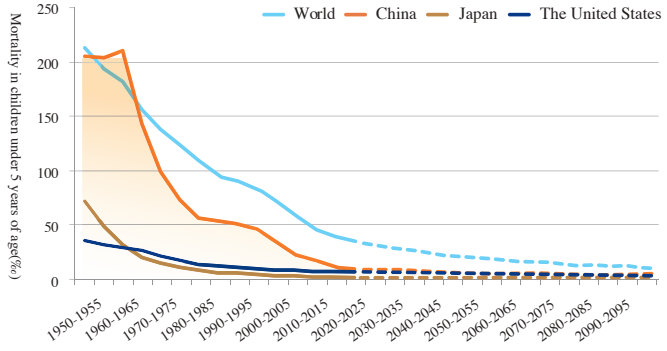

Figure 1: Mortality trends in children under 5 years of age around the world, and in China, Japan and the USA
Data source (Figures 2-5): United Nations World Population Prospects 2019 database, https://population.un.org/wpp/Download/Standard/Population/.

2. Decline in fertility to low levels

了变化。孩子的质量与父母在时间和金钱上的投入相关，夫妻在潜在生育孩子的供给量和需求量上需要寻求一个平衡（Becker，1960）。其次，女性受教育水平的不断提升，增强了女性社会和工作参与的能力，改变了女性对生育的态度，在一定程度上也相应推迟了结婚和生育年龄。此外，对有效避孕知识的掌握和避孕工具的普及使两性行为与生育实现了分离。随着 20 世纪 60 年代廉价、便捷的避孕药在美欧及此后在全球的快速普及，有效的避孕工具变得简单易得（保罗·莫兰，2019）。

20 世纪 70 年代开始，生育率走低成为全球性趋势。不仅是发达国家，随着低收入国家的发展，其生育率也随之降低。1950~2017 年所有国家和地区的总和生育率都出现了不同程度的下降，全球总和生育率下降了 49.4%，由 4.7 个活产婴儿降至 2.4 个（Murray et al.，2018）。另据联合国中等假设水平预测，全球生育率还将继续走低，到 2050 年每名妇女生育子女数将降至 2.2 个，到 2100 年降至 1.9 个。

中国自 20 世纪 70 年代起经历了生育率的快速下降，到 1980 年总和生育率已经从 6 左右降至 3 以下，到 20 世纪 90 年代已降至替代水平以下。这其中生育政策的影响只是一方面，实际上社会、人口、经济的发展变化越来越成为影响生育率的主导因素（都阳，2005）。近年中国二胎政策开放并没有带来生育率的回升，从国际经验来看，一些低生育率国家鼓励生育的政策也是需要漫长的时间积累才可能看出成效（杨昕，2016）（见图 2）。

In agricultural society, people are the most important economic resource, and children are a source of social security and labour. This means that, in an environment with a high mortality rate, a high fertility rate is necessary to ensure social development. However, the onset of the Industrial Revolution accelerated the process of urbanisation. Part of this process saw a fundamental improvement in the status of women, and this in turn brought about changes in their desire to reproduce.

First of all, the significant drop in child mortality brought about a change in people's willingness to have children. The quality of a child is partially determined by the amount of time and money invested by the parents, and partners must find a supply and demand balance in terms of the children that they may potentially have (Becker, 1960). Secondly, the continuous increase in the standard of women's education has also enhanced their ability to participate in society and work, and this has brought about changes in women's attitudes towards childbearing. To a certain degree, it has also delayed the age at which they marry and have children. In addition, a grasp of knowledge about contraceptives as well as the popularisation of contraceptive tools has also separated sexual activity from childbearing. With the rapid, widespread use of cheap and convenient contraceptive pill in the US, Europe and worldwide since the 1960s, effective contraception has become easy to obtain (Paul Morland, 2019).

Since the start of the 1970s, declining fertility has become a global trend. Developed nations have not been alone in this – as lower-income countries have developed, their fertility rates have also decreased. Between 1950 and 2017, there has been, to varying degrees, a decline in the total fertility rate in every single country and region. The global total fertility rate dropped by 49.4%, from 4.7 live births to 2.4 (Murray et al., 2018). In addition, according to United Nations medium variant assumption level forecasts, the global fertility rate will continue to decline: the number of children per woman will drop to 2.2 by 2050, and to 1.9 by 2100.

China has experienced a rapid drop in fertility since the 1970s. By 1980, total fertility rate had dropped from around 6 to below 3, and by the 1990s, had dropped further, to below the replacement level. However, the impact

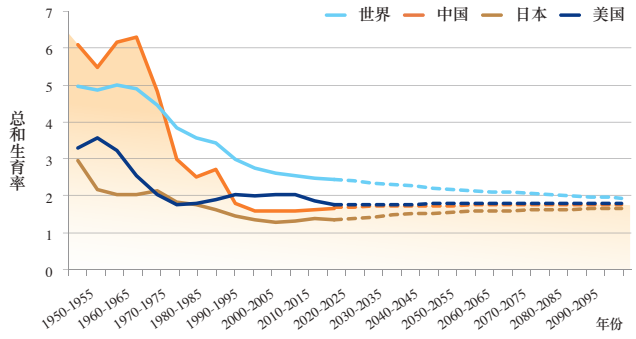

图 2：世界、中国、日本、美国总和生育率变化趋势

3. 预期寿命持续延长

新兴药物的不断创新、先进医疗技术的普及应用和进步使得心脑血管疾病、癌症、糖尿病、艾滋病等疾病逐渐从致死性的疾病杀手变成可控制的慢性疾病，人类的预期寿命得到持续延长，在过去半个多世纪里，主要发达国家都保持了每十年增长 2~3 岁的趋势。以癌症为例，研究数据显示，与 1991 年相比，2017 年美国癌症死亡率已经下降了 29%，其中 2008 年至 2017 年平均每年下降 1.5%，2016 年至 2017 年更是下降了 2.2%，创历年新高（Siegel et al.，2020）。

从全球来看，1950 年以来人口预期寿命显著提升。1950~2017 年全球男性预期寿命从 48.1 岁增至 70.5 岁，女性从 52.9 岁增至 75.6 岁（Dicker et al.，2018）。毫无疑问，人类的预期寿命还将保持稳步的增长，有预测研究指出到 2040 年全球男性和女性的预期寿命都将提升 4.4 年，届时日本、新加坡、西班牙、瑞士有望超过 85 岁，另有 59 个国家也将超过 80 岁（Foreman et al.，2018）。需要指出的是，近年来有研究发现美国和英国的人均预期寿命出现轻微下降，这背后是由青年人滥

of fertility policy is only one aspect of this. In fact, social, demographic and economic developments have increasingly become the dominant factors impacting the fertility rate (Du Yang, 2005).

In recent years, the launch of China's two-child policy has not brought about a resurgence in fertility. International experience has shown that policies to encourage childbirth in various low-fertility countries require plenty of time before the effects can be seen (Yang Xin, 2016) (see Figure 2).

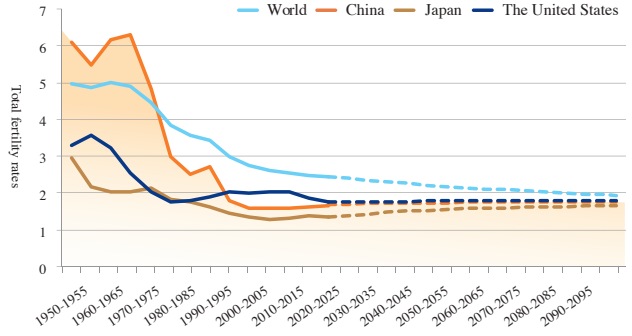

Figure 2: Trends in total fertility rates around the world, and in China, Japan and the USA

3. Life expectancy continues to increase

Continuous innovation in emerging pharmaceuticals, the widespread application of – and progress in – advanced medical technologies have gradually transformed cardio- and cerebrovascular diseases, cancer, diabetes, AIDS and other previously fatal diseases into controllable, chronic diseases, leading to ever greater human life expectancy. Over the past half-century, the major developed countries have all maintained a growth trend of 2-3 years every decade. To take cancer as an example, research data shows that when compared to 1991, the US cancer mortality rate in 2017 had dropped by 29%, including an average annual decrease of 1.5% between 2008 and 2017. In 2016 and 2017, this rate dropped even further, by 2.2%, a record high (Siegel et al., 2020).

The life expectancy of the global population has increased significantly since 1950. Between 1950 and 2017, global life expectancy increased from

用药物、酗酒和自杀等社会问题引起，并不是老年人去世早了，也不能代表长期趋势（Ho and Hendi，2018）。

在中国，伴随着死亡率的快速下降，预期寿命也得到了大幅提升。20 世纪 60 年代至 20 世纪 70 年代的 20 年间中国的预期寿命增长了 22 岁，之后以每 10 年增长约 3 岁的速度稳步提升，到 2018 年已达 77 岁。有研究预测到 2040 年中国预期寿命将达到 81.9 岁，也就是未来 20 年保持每十年增长约 2.5 岁的趋势（Foreman et al.，2018）。尽管联合国的预测相对保守，但是中国未来 30 年预期寿命仍将以平均每十年增长 1.6~1.7 岁的速度稳步提升（见图 3）。

对于人类寿命是否存在增长的极限，目前尚无定论。有研究回顾 1900 年以来多国数据后提出人类的寿命受各种自然因素的限制是存在天花板的（Dong et al.，2016）。但是也有研究发现当年龄超过 105 岁之后，死亡风险水平基本上不再变化，死亡率不再随着年龄增大而上升（Barbi et al.，2018）。**从经验角度看，经济、社会、医学的发展会不断推动人类寿命延长，人类的预期寿命可以持续地增长**（Oeppen and Vaupel，2002；Vaupel and Kistowski，2005）。

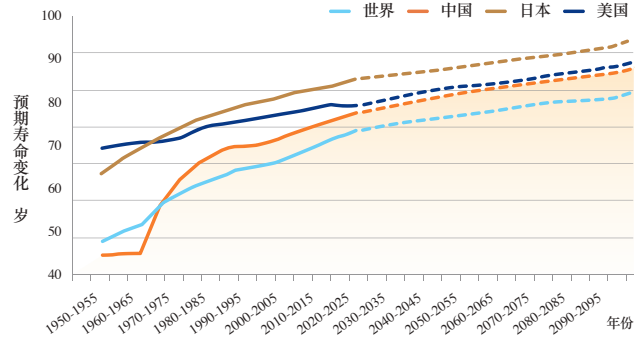

图 3：世界、中国、日本、美国预期寿命变化趋势

48.1 years to 70.5 years for males, and from 52.9 years to 75.6 years for females (Dicker et al., 2018). There is no doubt that human life expectancy will continue to see steady growth, and some predictive studies indicate that by 2040, global life expectancy for both males and females will increase by 4.4 years. By that time, the figure in Japan, Singapore, Spain, Switzerland is expected to exceed 85 years, while that for a further 59 countries will also exceed 80 years (Foreman et al., 2018). It should however be noted that in recent years, studies have found that average life expectancy in the US and UK has decreased slightly. This is due to social problems such as drug and alcohol abuse, suicide amongst young people, rather than premature deaths amongst the elderly. Equally, this does not represent a long-term trend (Ho and Hendi, 2018).

In China, hand in hand with a rapid decline in mortality, life expectancy has also improved significantly. In the two decades from the 1960s to the 1970s, life expectancy in China grew by 22 years, and has since then continued a rapid, stable growth rate of approximately 3 years every decade. By 2018, the figure stood at 77 years. Some studies predict that by 2040, life expectancy in China will reach 81.9 years, that is to say, the country will maintain a growth trend of 2.5 years every decade over the next 20 years (Foreman et al., 2018). The relatively conservative United Nations forecast is that life expectancy in China will still continue to increase steadily at an average rate of 1.6-1.7 years per decade over the next 30 years (see Figure 3).

Whether there is any limit to the human lifespan remains open to conjecture. Some studies which reviewed data from numerous countries from 1900 onward suggest that the human lifespan is limited by a number of natural factors, and that there is a ceiling (Dong et al., 2016). However, other studies have also found that at ages in excess of 105 years, the risk of death essentially does not change any further, and the mortality rate does not continue to increase with age (Barbi et al., 2018). **From an empirical point of view, economic, social and medical developments will continue to drive the extension of the human lifespan, and human life expectancy can continue to rise** (Oeppen and Vaupel, 2002; Vaupel and Kistowski, 2005).

4. 人口年龄结构趋向“柱状”，老龄人口占比高峰平台期超越 1/4

在死亡率和生育率下降的双重作用下，世界人口增速放缓，全球的人口年龄结构在由传统的金字塔形态向柱状转变，即各年龄段人口占比向均等化发展，老龄人口与青少年人口数量均等化（Haub，2013）。从更为长期的角度看，由于生育率的持续下降，人口年龄结构还可能出现倒梯形。

联合国数据显示，1960~2020 年，全球 0~14 岁少儿人口占比不断下降，由 37.2%降至 25.4%；65 岁及以上老龄人口占比持续上升，由 5.0%增至 9.3%，并且预计在 50 年后二者将趋于均等。同时，在过去的 60 年间各国人口年龄结构转变的速度有所不同，例如美国在移民持续涌入的影响下，人口年龄中位数由 29.7 岁增至 38.3 岁，只增长了 8.6 岁；而日本受生育率快速下降且长期低迷的影响，人口年龄中位数由 25.4 岁跃升至 48.4 岁，增长达 23.0 岁。相比世界平均水平，中国人口年龄结构也发生了较快的转变。1960~2020 年人口年龄中位数从 21.3 岁增至 38.4 岁，其中 1960 年至 1990 年只增加了 3.6 岁，而 1990~2020 年增长了 13.6 岁。

经济学上将由于劳动年龄人口数量和占比增长快于其他年龄组人口所带来的经济增长称为人口红利（demographic dividend）（Bloom et al.，2003）。它通常发生在人口转型的第三阶段末，因为此时生育率发生快速下降使得受抚养的青幼年人口明显减少（Bloom and Williamson，1998）。新中国成立后的前 20 年死亡率大幅下降，而生育率继续保持高水平直至 20 世纪 70 年代初才开始明显降低，这使得改革开放后劳动年龄人口出现了爆发性增长，抚养比下降、劳动力供给

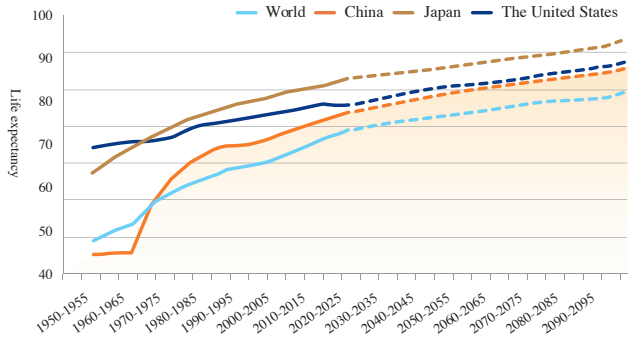

Figure 3: Trends in life expectancy around the world, and in China, Japan and the USA

4. The population age structure has become "pillar-shaped", with more than a quarter of the elderly population in a plateau period

Impacted by the dual effects of the decline in mortality and fertility, the world's population growth rate has slowed, and the age structure of the global population has shifted from a traditional pyramid shape to a pillar shape, that is, where the proportions of the population for all age segments develop at the same pace, and the numbers for the elderly and young populations are equal (Haub, 2013). From a longer-term perspective, a continued decline in fertility may even mean that the population age structure takes on an inverted trapezoid shape.

United Nations data shows that from 1960-2020, the proportion of the world's child population aged 0-14 years declined continuously, from 37.2% to 25.4%. Conversely, the proportion of the population aged 65 years and above has continued to increase, from 5.0% to 9.3%, and it is estimated that 50 years later these two proportions will be close . At the same time, over the past 60 years, the rates of change in the population age structure for each country have varied widely. For example, in the US, under the impact of a continuous wave of immigration, the median age of the population increased from 29.7 years to 38.3 years, an increase of only 8.6 years. Meanwhile, in Japan, affected by a rapid decline in fertility and a long-term economic downturn, the median age of the population jumped from 25.4 years to 48.4 years, an increase of 23.0 years. Compared with the world average, the age

充分带来的人口红利推动了中国的高速发展。然而，随着人口年龄结构的进一步转变，中国的人口红利在快速消退。国家统计局数据显示，中国的总抚养比在 2010 年已降至低点，2013 年劳动年龄人口也已达到峰值。**伴随着死亡率、生育率降至低水平并趋于稳定，预期寿命稳步提升，老龄人口占比增加，中国的人口年龄结构开始日渐趋于柱状（见图 4）**。

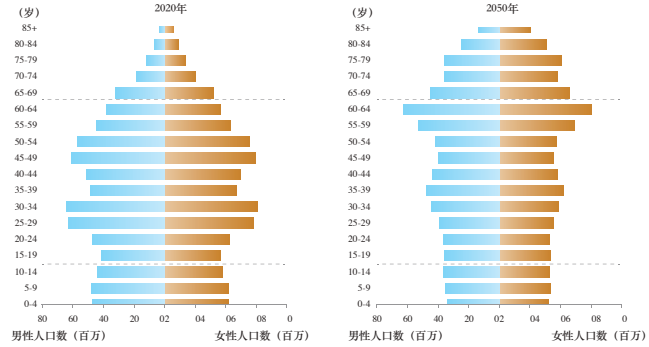

图 4：中国 2020 年、2050 年人口年龄结构预测

大多数经历人口转变第三阶段的国家都出现过或长或短的婴儿潮，之后生育率便急速下降。当婴儿潮老去，正好也是人口跨越第三阶段达到第四阶段的时候。低死亡率、寿命延长、生育率骤降造成了后期老龄人口的快速增长，经历过大幅婴儿潮的国家，老龄人口占比都会加速超越总人口的 1/4，并且在达到峰值后，由于稳定的低生育率和预期寿命的持续延长，其比例会保持相对稳定。

与这个规律相符合，中国老龄人口数量及其占比正在进入快速增长期。国家统计局数据显示，2019 年中国人口达到 14 亿，其中 65 岁及以上 1.76 亿，占比达到 12.6%。2017 年、2018 年、2019 年，65 岁

structure of China's population has also undergone rapid transformation. From 1960 to 2020, the median age of the population increased from 21.3 years to 38.4 years. From 1960 to 1990, the increase was a mere 3.6 years, whereas it grew by 13.6 years between 1990 and 2020.

In economic terms, the economic growth generated because the number and proportion of the working age population grew faster than any other age group is called the demographic dividend (Bloom et al., 2003). This normally occurs at the end of the third stage of the demographic transition, as the rapid decline in fertility at this time significantly reduces youth dependent population (Bloom and Williamson, 1998). In the 20 years following the foundation of the People's Republic of China, mortality dropped sharply, while fertility remained high until the early 1970s, after which it began to decline significantly. This led to the explosive growth of the working-age population following the start of the reform and opening up process, a drop in the dependency ratio, and the democratic dividend from China's full labour force drove the country's high-speed development. However, with the further transformation of the population age structure, China's demographic dividend is fading rapidly. National Bureau of Statistics data shows that China's total dependency ratio had fallen to a low point by 2010, while the working-age population also peaked in 2013. **With mortality and fertility at low levels and stabilising, and a steady increase in life expectancy, the proportion of the elderly population is increasing, and China's population age structure has started to take on an increasingly pillar-shaped appearance (see Figure 4).**

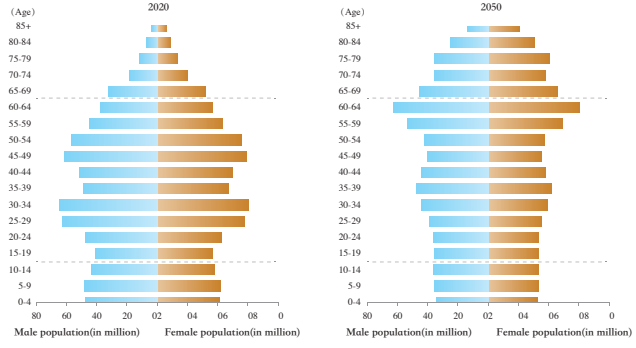

Figure 4: Forecasts for China's population age structure in 2020 and 2050

及以上人口分别新增 828 万、827 万、945 万。联合国预测，中国 65 岁及以上人口还将继续保持高位增长，直至 2040 年之后年均增幅才会降至 500 万人以下。到 2057 年 65 岁及以上人口与 80 岁及以上人口数量有望达到峰值，分别为 4.0 亿和 1.3 亿，占 29.6% 和 9.8%。同时，从全球视角来看，中国是世界老龄人口数量最多的国家，2030 年左右中国 65 岁及以上人口在全球老龄人口的占比将超过 25%（见图 5）。

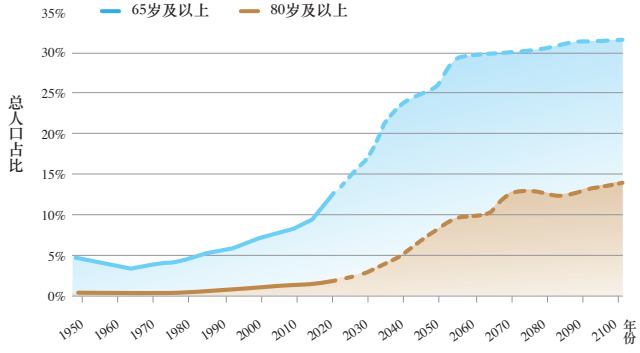

图 5：中国 65 岁及以上与 80 岁及以上人口占总人口比例变化趋势

（二）长寿时代与健康时代

在长寿时代，人类的预期寿命获得延长，同时也面临着与之前完全不同的健康挑战。健康成为更为迫切的需求，且这种需求将更加多样化和长期化，成为健康产业成长的强劲动力，健康时代随之来临。

1. 长寿时代疾病谱发生重大改变

人类疾病类型的流行病学转变（Epidemiological Transition）（Omran，1977）与长寿时代同步来临。2002 年召开的第二次世界老龄大会就已经指出，当时全球各区域都正处于流行病学转变的阶段，即从主要罹患传染性疾病和寄生虫病为主转向罹患慢性疾病和变性疾

Most countries which have undergone the three-stage demographic transition have experienced baby booms of varying lengths, after which the fertility rate has dropped sharply. The time that baby boomers get older is also precisely the time when the population crosses from the third stage into the fourth stage. Low mortality, extended lifespans and a sudden drop in the fertility rate lead to the rapid growth of the elderly population in the latter stage. In countries that have experienced large baby booms, the elderly proportion of the population accelerates to exceed one quarter of the total population, and after peaking, this proportion remains relatively stable because of stable, low fertility and continuous rising life expectancy.

In line with this law, both the number and proportion of China's elderly population are entering a period of rapid growth. National Bureau of Statistics data shows that China's population reached 1.4 billion in 2019, of which 176 million were aged 65 years and above, making up 12.6% of the total. In 2017, 2018 and 2019, the population aged 65 years and above increased by 8.28 million, 8.27 million and 9.45 million respectively. The United Nations predicts that China's population aged 65 years and above will continue to maintain a high rate of growth, and the annual rate of growth will not fall below 5 million before 2040. The population aged 65 years and above and the population 80 years and above are expected to peak by 2057, at 400 million and 130 million respectively, accounting for 29.6% and 9.8% of the total. At the same time, from a global perspective, China is the country with the largest number of elderly people in the world. By 2030 or so, China's population aged 65 years and above will make up in excess of 25% of the world's elderly population (see Figure 5).

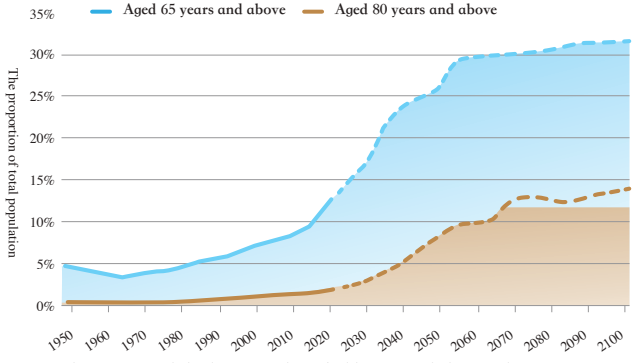

Figure 5: Trends in the proportion of China's population aged 65 years and 80 years and above to the total population

病为主（宋新明，2003）。

华盛顿大学健康指标与评估研究所（IHME）2017 年对 195 个国家和地区的研究表明：1990~2017 年，新生儿疾病、肠道感染、呼吸道感染、结核病等传染性疾病导致的过早死亡人数下降，而缺血性心脏病、中风、慢阻肺等慢性病、老年性疾病则大幅上升，特别是缺血性心脏病成为全球首要致死原因（Roth et al.，2017）。（见表 1）

表 1 1990~2017 年全球主要死亡原因变化

排名	1990	2017
1	新生儿疾病	缺血性心脏病
2	下呼吸道感染	新生儿疾病
3	肠道感染	中风
4	缺血性心脏病	下呼吸道感染
5	中风	肠道感染
6	先天性出生缺陷	道路伤害
7	结核病	慢性阻塞性肺疾病
8	道路伤害	艾滋病
9	麻疹	先天性出生缺陷
10	疟疾	疟疾

数据来源：华盛顿大学健康指标与评估研究所

中国也正在面临同样的转变，中国 1990~2017 年致死和生命损失疾病谱前五名已经从传染性疾病、新生儿疾病等急性疾病、儿童期疾病转变为心脑血管疾病、肿瘤、退行性疾病等慢性病、老年性疾病（Zhou et al.，2019）。（见表 2）

表 2 中国 1990~2017 年致死和生命损失疾病谱前五排名

排名	1990 年	2017 年
1	下呼吸道感染	中风
2	新生儿疾病	缺血性心脏病
3	中风	气管、支气管和肺癌
4	慢性阻塞性肺疾病	慢性阻塞性肺疾病
5	道路交通伤害	肝癌

数据来源：中国疾病预防控制中心、华盛顿大学健康指标与评估研究所

(b) The age of longevity and age of health

In the age of longevity, life expectancy will rise, but at the same time, we will also face health challenges which are entirely different than before. Health becomes a more pressing need, and this need will become ever more diversified and long-term. This will become a powerful engine driving health industry growth, ushering in an age of health.

1. Significant changes in the disease spectrum in the age of longevity

The epidemiological transition of human disease types (Omran, 1977) and the age of longevity arrive hand in hand. The Second World Assembly on Ageing held in 2002 highlighted the fact that at the time, all of the world's regions were in a stage of epidemiological transition, that is to say, they were shifting from infectious and parasitic diseases as the main sources of infection to a situation where chronic and degenerative diseases prevail (Song Xinming, 2003).

A 2017 study of 195 countries and regions by the Institute for Health Metrics and Evaluation (IHME) of the University of Washington shows that between 1990 and 2017, whereas the numbers of premature deaths from infectious diseases such as neonatal diseases, intestinal infections, respiratory tract infections and tuberculosis had dropped, chronic diseases such as ischemic heart disease, stroke and chronic obstructive pulmonary disease, as well as senile diseases increased significantly, and ischemic heart disease in particular had become the leading cause of death worldwide (Roth et al., 2017) (See Table 1).

Table 1: Changes in main causes of death worldwide, 1990-2017

Ranking	1990	2017
1	Neonatal diseases	Ischemic heart disease
2	Infection of the lower respiratory tract	Neonatal diseases
3	Intestinal infections	Stroke
4	Ischemic heart disease	Infection of the lower respiratory tract
5	Stroke	Intestinal infections
6	Congenital birth defects	Road injury
7	Tuberculosis	Chronic obstructive pulmonary disease
8	Road injury	AIDS
9	Measles	Congenital birth defects
10	Malaria	Malaria

Data source: Institute for Health Metrics and Evaluation, University of Washington

正是因为流行病学的转变，人类平均预期寿命延长的最大威胁已经从传染性疾病转移到衰老导致的退行性和人为疾病（如：道路伤害、意外死亡等），那些慢性退行性疾病未来随着人类生活方式变得更加健康、医疗技术创新加快、最终死亡年龄的延长，将在长寿时代与人类共存更长时间。

各类非传染性慢性病正成为人类长寿健康损失的主要原因。根据世界卫生组织（WHO）的定义，伤残调整生命年（DALY）用来估量由于各种致命及非致命疾病所导致的健康损失，它等于寿命损失年数（YLL）与残疾生命年数（YLD）之和（Murray，1994）[②]。使用华盛顿大学健康指标与评估研究所数据计算的结果表明：从 1970 年到 2016 年之间，传染病以及营养不良所导致的健康损失下降了 40.1%，与之对应的各种非传染性慢性病所导致的健康损失却整体增加了 36.6%，其中心血管疾病增长了 32.4%、神经系统疾病增长了 59.4%；同期全球范围内 80 岁以上人口贡献的健康损失增长了 98%（Wang et al.，2017）。同篇数据显示，老龄人口的增加给中国带来的健康损失情况比全球平均水平更为严峻。

2. 长寿时代使得带病生存时间延长

在长寿时代更多疾病将与高龄老人共存，带病生存成为长寿时代的普遍现象。如果将 60 岁以上老年人寿命分为健康状态和带病状态，就会发现人群预期寿命增加主要是带病生存时间的延长，特别是各种非遗传性慢性病导致的健康损失并不会短期内致人死亡，而是与人长期共存。华盛顿大学健康指标与评估研究所对 195 个国家和地区的研

② 命损失年数（YLL）是带病患者的死亡年龄与该年龄所对应的人口预期寿命之间的差值，残疾生命年数（YLD）等于一种疾病 / 受伤的普遍性指数乘以此疾病的严重程度。一个单位 DALY 代表健康损失了 1 年。针对每种疾病 / 受伤可以计算一个人群的 DALY 值，用来说明不同疾病所带来的对于健康的损失。

China is also facing the same transformation. Between 1990 and 2017, the top five causes of fatality in China changed from infectious, neonatal and other acute or childhood diseases to cardiovascular and cerebrovascular diseases, tumours, degenerative diseases and other chronic and senile diseases (Zhou et al., 2019) (See Table 2).

Table 2: Top five causes of fatality in China, 1990-2017

Ranking	1990	2017
1	Infection of the lower respiratory tract	Stroke
2	Neonatal diseases	Ischemic heart disease
3	Stroke	Tracheal, bronchial and lung cancer
4	Chronic obstructive pulmonary disease	Chronic obstructive pulmonary disease
5	Road traffic injury	Liver cancer

Data source: Chinese Centres for Disease Control and Prevention, Institute for Health Metrics and Evaluation, University of Washington

It is precisely because of this change in epidemiology that the greatest threat to the rise in average human life expectancy has shifted from infectious diseases to degenerative diseases caused by ageing and man-made diseases (e.g.: road injuries, accidental death, etc.). Chronic degenerative diseases of this kind will remain prevalent in humans for relatively longer periods of time in the age of longevity as human lifestyles become ever healthier, innovation in medical technology accelerates, and the final age of death is further extended.

Various types of non-communicable, chronic disease are becoming the main factor behind the loss of human longevity and health. Based on the World Health Organisation (WHO) definition, the disability-adjusted life year (DALY) is used to estimate the health loss caused by various fatal and non-fatal diseases. It is equal to the sum of the years of lost life (YLL) and years lived with disability (YLD) (Murray, 1994) [(2)]. Using the calculation results from the data from the University of Washington's Institute for Health Metrics and Evaluation, we find that from 1970 to 2016, the loss of health caused by infectious diseases and malnutrition dropped by 40.1%, while conversely, the loss of health caused by various non-communicable chronic diseases increased by 36.6% overall, of which cardiovascular disease grew by 32.4%, and neurological diseases grew by 59.4%. Over the same period, the loss of health contributed by the population aged 80 years and above grew by

(2) Years of lost life (YLL) is the difference between the age of death of a sick patient and the population life expectancy corresponding to that age. Years lived with disability (YLD) equals the universality index of a disease/injury multiplied by the degree of severity of the disease. One DALY unit represents one year of loss of health. The DALY value for a population can be calculated for each disease/injury to illustrate the loss of health caused by different diseases.

究表明：1990~2017 年间全球绝大部分国家的健康预期寿命[③]的增速要逊于预期寿命的增速，预期寿命增加 7.4 年，而健康预期寿命只增加了 6.3 年（Kyu et al.，2018）。英国学者基于欧洲 25 个国家的数据研究表明，2005~2011 年，65 岁老人的预期寿命增加了 1.3 年，而同期的健康预期寿命没有变化（Brown，2015）。在中国，1993 年的中国老年人供养体系调查显示 60 岁以上老年人在 60 岁以后的预期寿命中约 3/4 的时间处于各种慢性病的状态下（王梅，1993）。2018 年的第四次中国城乡老年人生活状况抽样调查成果显示中国 2018 年人均预期寿命是 77 岁，健康预期寿命仅为 68.7 岁，存在较大落差。

我们可以看到全球发展趋势表明：越是长寿，带病生存越将成为普遍现象。虽然我们寿命在不断增加，但生存质量则不一定随之变得更好。因此，获得的额外寿命是处于身体健康还是疾病状态这个问题变得越来越重要，如何面对长寿时代带病生存的疾病负担在未来将对卫生系统的规划、健康相关支出和健康产业的发展产生重大影响。

3. 长寿时代将促使健康产业发展

长寿时代的带病生存使得人们与健康相关的费用支出剧增。据国内外的有关资料，人均医疗费用和年龄密切相关，一般情况下，60 岁以上年龄组的医疗费用是 60 岁以下年龄组医疗费用的 3~5 倍（李剑阁，2002）。同时，老龄人口规模的增加必然带来社会医疗总费用的增加。日本研究显示，医疗技术进步、经济财富增加、人口老龄化和民众患病结构的不断变化共同导致医疗卫生支出不断攀升，技术进步因素占比 40%，为首要因素，其他因素分别占 26%、18% 和 16%（胡苏云，2013）。

③ 健康预期寿命（HALE）将伤残权重应用于健康状态，计算可以预期健康生存的年数，参见 https://www.who.int/gho/mortality_burden_disease/life_tables/hale_text/en/

98% (Wang et al., 2017). The same data shows that the loss of health to China caused by the elderly population is more severe than the global average.

2. The age of longevity prolongs the survival in disease

In the age of longevity, more diseases will coexist with the elderly, and survival in disease will become a common phenomenon. Dividing the lifespan of elderly persons aged 60 years and above into healthy and diseased states shows that the increase in life expectancy mainly comprises an extension of the survival in disease, particularly the loss of health caused by various non-hereditary chronic diseases. These do not cause death in the short term, and coexist with the individual involved over the longer term. The study of 195 countries and regions by the University of Washington's Institute for Health Metrics and Evaluation shows that between 1990 and 2017, healthy life expectancy [(3)] in most countries worldwide grew at a slower rate than life expectancy. Life expectancy increased by 7.4 years, while health life expectancy only increased by 6.3 years (Kyu et al., 2018). Using data from 25 European countries, a British study shows that between 2005 and 2011, the life expectancy of a 65 year-old increased by 1.3 years, whereas there was no change in healthy life expectancy over the same period (Brown, 2015). In China, a 1993 survey of the Chinese elderly support system shows that elderly people above the age of 60 spent three quarters of their life expectancy beyond the age of 60 living with some form of chronic disease (Wang Mei, 1993).The results of the 2018 Fourth Sample Survey of the Living Conditions of China's Urban and Rural Elderly shows that China's average life expectancy in 2018 was 77 years, whereas health life expectancy was only 68.7 years, indicating a relatively large gap.

We can see from global development trends that the longer we live, the more likely we are to survive in a disease. Although our life spans are continuously increasing, our quality of life is not necessarily increasing in equal measure. Therefore, the question of whether the extra life is spent in a state of good physical health or in a disease is becoming increasingly important. Finding ways to face the burdens of surviving in disease in the age of longevity will in future have a significant impact on the planning of health system, the expenditures of health-related activities and the development of the health industry.

(3) Health life expectancy (HALE) applies a disability weighting to a healthy state, and calculates the number of years over which one can expect to remain healthy. See: https://www.who.int/gho/mortality_burden_disease/life_tables/hale_text/en/

医疗技术创新是近年推动医疗费用增长的最重要原因之一。回溯医疗技术的发展路径，可以看到研究投入和医疗资源更多地向急性或者致死性疾病倾斜，在消除或延缓与年龄相关的慢性病和细胞变性类疾病方面却投入不够。这种不平衡的投入很大程度上是由于早期研究所处时代的人口结构不同造成的，那时人均期望寿命不超过 80 岁是常态，带病生存的人口比例较小，对社会的影响也有限。在当前阶段，人口结构已经开始发生重大变化，因此需要重新审视社会资源的分配方式。英国的一项研究显示了这种资源的错配情况，以呼吸道和神经精神类疾病为例，指出两种疾病的伤残调整生命年（DALY）占比分别为 8.3% 和 26.7%，而研究经费占比仅为 1.7% 和 15.3%，表明这两种疾病造成了较大的社会负担却未获得对等的资源投入；此外，癌症的伤残调整生命年（DALY）占比为 15.9%，明显低于神经精神类疾病，但研究经费占比却高达 19.6%[④]。目前主流的医疗技术还是以医院内使用的针对重大疾病的治疗手段为主，此类技术的成本和使用门槛高，导致费用昂贵。将患者从医院引流进入基础医疗机构，使用更多低成本的医疗技术，加强疾病预防和健康管理，将不仅对患者自身的健康有利，也将对遏制医疗费用的快速上涨起到积极的作用。

我们可以预见到，长寿时代将促使健康产业结构升级。在长寿时代，随着人体的衰老，不可避免地出现相关健康问题，带病生存成为常态，健康将成为个体关注的第一要素和最宝贵财富。第四次中国城乡老年人生活状况抽样调查显示老年人照护服务需求持续上升：2015 年，我国城乡老年人自报需要照护服务的比例为 15.3%，比 2000 年的 6.6% 上升近 9 个百分点；城乡老年人的居家养老服务需求项目排

④ 数据来源 UK health research analysis 2009/10 报告，
参见 http://www.ukcrc.org/research-coordination/health-research-analysis/uk-health-research-analysis/

3. The age of longevity will encourage the development of health industry

Survival in disease in the age of longevity has led to a sharp increase in health-related expenditure. Domestically and abroad, the relevant data shows that the amount of medical expenses per capita is closely related to age. Generally speaking, medical expenses in age groups above 60 years of age are 3-5 times those of age groups below that limit (Li Jian'ge, 2002). At the same time, the increasing size of the elderly population will inevitably lead to an increase in the total cost of social care. Japanese research shows that advances in medical technology, increasing economic wealth, an ageing population and ongoing change in the population's disease structure have all led to constantly rising medical and health care expenditures. Technological progress accounts for 40% of this, making it the primary factor, while the other factors account for 26%, 18% and 16% respectively (Hu Suyun, 2013).

Medical technology innovation is one of the most significant drivers of the growth in medical expenses in recent years. Looking back over the development of medical technologies, we can see that research investment and medical resources have tended to focus on acute or fatal diseases, while there has been insufficient investment in the elimination or delay of age-related chronic disease and cell degenerative diseases. This uneven investment is largely due to the different population structure in the early years of research. At the time, average life expectancy did not normally exceed 80 years, only a small proportion of the population lived with an illness, and the social impact was also limited. At the current stage, however, the population structure has already begun to undergo significant change, and the way in which social resources are allocated therefore must therefore be re-examined. A British study illustrates this mismatch of resources, using respiratory and neuropsychiatric diseases as an example. The study finds that whereas the shares of these two diseases in disability-adjusted life year (DALY) were 8.3% and 26.7% respectively, the shares of research funding for them were 1.7% and 15.3% respectively. It indicates that although these two diseases pose a significant social burden, they have not been allocated equivalent investment resources. In addition, the disability-adjusted life year (DALY) share for cancer accounts for 15.9%, which is significantly lower than that for neuropsychiatric diseases, but the proportion of research funding is significantly higher,

在前三位的分别是上门看病、上门做家务和康复护理，其比例分别是38.1%、12.1%、11.3%。这些都是老年人群庞大的潜在需求，目前来看，只有部分社区提供这些服务，大部分社区都存在供给短缺（杨晓奇、王莉莉，2019）。

长寿时代，庞大的健康需求将促进大健康产业的极大发展。为人们提供健康生活解决方案，是大健康产业最大的商机，也将推动社会进入健康时代。在美国，卫生总支出占 GDP 的 17.9%，大健康是最大的产业。美国 65 岁及以上老人占总人口比例为 16%，卫生总支出占比达到 36%；如果从 55 岁算起，29% 的人口花费了 56% 的卫生支出[⑤]。目前，中国的经济结构中，房地产占比最高，其次是汽车，卫生总费用在 GDP 中占比仅有 6.4%。

健康时代里最核心的产业是医药工业、健康服务和健康保险。2019 年《财富》世界 500 强榜单中，美国有 15 家大健康企业，中国只有 2 家算是大健康企业。按照《“健康中国 2030”规划纲要》的目标，到 2020 年，中国健康服务业总规模超 8 万亿元，2030 年达 16 万亿元。可见，中国大健康产业具有巨大成长空间和产业结构转变机会，未来有望成为中国经济中的支柱产业之一。

（三）长寿时代与财富时代

长寿时代，人们的预期寿命延长，居民高度关注养老资金是否充沛。在公共养老资金有限的情况下，理性人将更有动机增加财富总量和延长财富积累期限来储备养老资金，形成旺盛的财富管理需求，因此，与长寿时代相伴而生的是财富时代。

1. 长寿时代，养老金替代率是关键

⑤ 数据来源 Kaiser Family Foundation analysis of Medical Expenditure Panel Survey，参见 https://www.healthsystemtracker.org/chart-collection/health-expenditures-vary-across-population/#item-start

at 19.6% [4]. At present, mainstream medical technology is still based on the treatment of major illnesses in a hospital setting, where the cost and use threshold for technologies of this kind are high, resulting in high expenditures. Transferring patients from hospitals to entry-level medical institutions, using more low-cost medical technologies, and enhancing disease prevention and health management initiatives will not only benefit the patient's own health, but will also play a positive role in curbing the rapid increase in medical costs.

We can foresee that the age of longevity will encourage the upgrading of the structure of the health industry. In the age of longevity, health problems associated with physical ageing will inevitably appear, survival with illness will become increasingly normal, and health will become an individual's primary focus of concern, as well as one of their most precious assets. The Fourth Sample Survey of the Living Conditions of China's Urban and Rural Elderly shows that demand for elderly care services continues to increase: in 2015, the proportion of elderly individuals in urban and rural areas of China who self-declared a need for care services stood at 15.3%, an increase of nine percentage points over the 6.6% figure for 2000; the three most common home and elderly care services requested by the elderly in urban and rural areas were home visits for medical care, home housework-support visits, and rehabilitation care, making up 38.1%, 12.1% and 11.3% of the total respectively. There is huge potential demand from the elderly population, and at present, only a limited number of communities provide such services. The vast majority of communities suffer from supply shortages in this area (Yang Xiaoqi and Wang Lili, 2019).

In the age of longevity, massive demand for health will encourage the outsized development of the health industry. Providing people with healthy living solutions will be the health industry's most significant commercial opportunity, and will also drive society into a new era of health. In the United States, total health expenditure makes up 17.9% of GDP, and health is the country's largest industry. The elderly, 65 years and above, make up 16% of the US's total population, and health expenditure in this segment accounts for 36% of the total. If calculated from the age of 55 onwards,

(4) Data source UK Health Research Analysis 2009/10, please see: http://www.ukcrc.org/research-coordination/health-research-analysis/uk-health-research-analysis/

根据生命周期理论，人的储蓄行为受所处年龄阶段影响（Ando and Modligliani，1963）。年轻时提供劳动力增加储蓄，老年时用于消费。**随着预期寿命的增加和预期抚养比的上升，个体会通过调整消费和储蓄行为、年轻时增加资本积累等方式应对延长的老年生活消费所需**（Lee and Mason，2006）**，以保证充足的替代率（平均养老金与社会平均工资之比）满足平滑消费，实现与生命等长的现金流**。

在老龄人口占比增多的背景下，公共养老金会持续承压，老年抚养比的上升和领取养老金年限的延长势必会导致狭义养老金替代率的下降。而广义养老储蓄资本（包括公共养老金和个人养老储备）在提前筹划尽早储备的前提下可以实现随老龄人口占比增多而提高。2019年墨尔本美世养老金指数报告样本国家数据显示，养老金充足率指数与老龄人口占比呈现正相关性，相关系数为 58%。养老金指数排名前三的荷兰、丹麦，其养老金结余资本与 GDP 之比分别是 173.3% 和 198.6%，且随着老龄人口占比的增加呈上升趋势。荷兰、丹麦等国家老龄人口占比更高，但因为鼓励养老储蓄政策的存在，养老资金储备保持了较高的充足率。

根据国家统计局数据显示，自 1997 年中国城镇居民基本养老体系改革以来，养老金社会平均工资替代率从 71.51% 降至 45.92%。在广义养老金总量上，与发达国家相比，中国的养老资金储备有待提高。中国养老金三支柱占 GDP 的比重仅为 8%，OECD 国家平均占比为 49.7%，而美国的占比也达到 146%（孙博，2018）。在养老金结构上，中国的养老储备严重依赖第一支柱，第二支柱和第三支柱占比过低。由于企业负担和经济结构的差异，中国发展第二支柱养老体系迟缓，

29% of the population spends 56% of total health expenditure [5]. Currently, real estate accounts for the largest share of China's economic structure, followed by automobiles, while total health expenditure only accounts for 6.4% of GDP.

The core sectors in this era of health are the pharmaceuticals, healthcare services and health insurance industries. The 2019 Fortune Global 500 included 15 health conglomerates in the USA, whereas in China, only two companies could be considered as health businesses. In line with the objectives set forth in the outline for Healthy China 2030, the total scale of Chinese healthcare services will exceed CNY 8 trillion by 2020, and CNY 16 trillion by 2030. It can be seen that China's health industry has huge potentials for growth and opportunities for industrial structural transformation, and it is expected to become a pillar industry in China's future economy.

(c) The age of longevity and the era of wealth

Human life expectancy rising extending in the age of longevity, and there is widespread popular concern over whether pension funds will provide sufficient coverage. Against a background of limited public pension funds, sensible people will be motivated to increase their total wealth, and extend the period over which they accumulate wealth in order to save for their pension funds, generating strong demand for wealth management services. This means that the age of longevity will be accompanied by an era of wealth.

1. In the age of longevity, the pension replacement rate is key

According to life cycle theory, people's saving behaviour is influenced by their stage of life (Ando and Modigliani, 1963). When they are young, they provide labour to increase their savings, which they subsequently spend in their old age. **As life expectancy and the expected dependency ratio rise, individuals will respond by adjusting their consumption and savings behaviour, and increasing their accumulation of capital while they are young, amongst other means, to meet the needs of their extended old age lifestyle** (Lee and Mason, 2006)**, to ensure a sufficient replacement rate (the ratio of the average pension to the average social wage), and thus ensure uninterrupted consumption and cash flows throughout the length of their lives.**

In the context of an increase in the proportion of the elderly population, pres-

(5) Data source: Kaiser Family Foundation analysis of Medical Expenditure Panel Survey. See: https://www.healthsystemtracker.org/chart-collection/health-expenditures-vary-across-population/#item-start

亟须提高第三支柱占比，让个人养老保险发挥更大作用。

2. 长寿时代带来财富的增长

在人口红利理论之后，人口经济学家提出第二次人口红利理论，即理性人会调整自己的消费和储蓄行为、人力资本投资行为、劳动力供给行为，以应对长寿时代的各项挑战（Disney，2000；Lee and Mason，2006；蔡昉，2009）。

人力资本在第二次人口红利形成中起到重要作用。经济学家卢卡斯将人力资本定义为“其质量取决于教育程度的有效劳动力”（Lucas，1988）。人力资本的重要成分包括健康和教育，在上一节我们已经对健康进行了讨论，这里我们将重点放在教育。个人层面，教育水平提高有利于受教育者竞争力的提升，促进职业生涯发展和工资收入提高。预期寿命的提高可以激励教育投入。个体理性预期的调整包括基于人力资本积累预期的教育年限和教育投资调整（杨英、林焕荣，2013）。预期寿命的提高使得教育投入的受益时间拉长，个体更有激励进行教育投资（Hansen and Lønstrup, 2012；Cervellati and Sunde, 2013）。宏观层面，老龄人口占比提升加速产业结构调整，劳动密集型产业让渡给资本、技术密集型产业，人力资本的价值更加重要。世界银行数据显示，预期寿命越长的国家受教育水平越高。预计中国劳动人口平均受教育年限将从 2018 年的 10.5 年上升至 2035 年的 12 年。总之，人力资本的质量提升将促进劳动生产率提升，居民收入水平亦将随之增加，进而促进社会财富总量的发展。

养老财富积累期限的延长，也将促进社会财富总量的发展。伴随着人口预期寿命延长与健康水平提升，健康低龄老人人数将大幅增加，

sure on public pensions will continue to rise, and the increase in the old-age dependency ratio as well as the extension of the pension period will inevitably lead to a drop in the pension replacement rate in its narrow sense. However, pension savings capital in the wider sense (including public pensions and private pension savings) can still be increased as the elderly proportion of the population grows, provided that planning for reserves is started as soon as possible. Sample country data from the 2019 Melbourne Mercer Global Pension Index shows that the pension adequacy ratio and the proportion of the elderly population have a positive correlation, with a correlation coefficient of 58%. The Netherlands and Denmark, which both rank in the Top 3 of the pension index, have ratios of pension surplus capital to GDP of 173.3% and 198.6% respectively, both of which are trending upwards as the elderly proportion of the population increases. Although the elderly proportion of the population is higher in countries such as the Netherlands and Denmark, pension fund reserves have maintained a relatively high adequacy ratio because of the existence of policies that encourage pension savings.

National Bureau of Statistics data shows that since the start of reforms to the basic pension system for urban residents in China in 1997, the social average wage replacement rate for pensions has dropped from 71.51% to 45.92%. In terms of the total pension amount in the wider sense, China's pension fund reserves need to be increased in comparison to developed countries. The three pillars of Chinese pensions only account for 8% of GDP, whereas the average for OECD countries is 49.7%; in the USA, the figure is 146% (Sun Bo, 2018). In terms of the pension structure, China's pension reserves are heavily reliant on the first pillar; the second and third pillars provide too low a proportion of this support. Due to differences in corporate burdens and the economic structure, China has been slow to develop the second pillar of its pension system, and further support from the third pillar is urgently required in order to enable personal pension insurance to play a greater role.

2. The growth in wealth brought about by the age of longevity

In line with demographic dividend theory, demographic economists proposed a second demographic dividend theory, namely that sensible people would adjust their own consumption and saving, human capital investment and labour supply behaviours to meet the challenges of the age of longevity (Disney, 2000; Lee and Mason, 2006; Cai Fang, 2009).

Human capital plays a major role in the formation of the second de-

叠加教育投入增加带来的人力资本质量提升，人力资本的折旧将放缓，该人群具备延长工作年限的基本条件。如果劳动人口的工作年限延长，其养老的财富储备期限将延长。事实上，多个老龄人口占比较高的国家采取了延迟法定退休年龄的方式来作为应对措施之一。此外，为应对长寿时代，理性人会在年轻时期更早地开始筹划养老的财富储备。以上两种方式都将延长养老财富储备的期限，提升社会财富总量。（见表 3）

表 3 部分国家退休年龄及其老龄人口占比

国家	原退休年龄（男）	原退休年龄（女）	对应年份	新退休年龄（男）	新退休年龄（女）	对应年份	延迟年数男 / 女	65 岁及以上人口占比 (2018 年)
英国	65	60	2012	65	62	2015	0/2	18.4%
德国	63	60	1985	65.5	65.5	2019	2.5/5.5	21.5%
日本	61	60	2010	65	64	2019	4/4	27.6%
美国	65	60	1983					15.8%
中国	60	55	2011					10.9%

数据来源：OECD Pension Policy Notes

3. 长寿时代居民的财富管理需求引领财富时代

长寿时代，居民将更加依赖投资回报和财富积累来养老，财富管理需求旺盛，长寿时代将带来财富时代。随着老龄人口总量和比例快速增长，公共养老金替代率呈下降趋势。同时，少子化使得依靠子女养老的可能性下降。因此，个人和家庭的投资回报对于居民养老的重要性提高。以中国、美国、日本、英国、德国等老龄人口占比较高的国家近 20 年的数据为例，随着老龄人口占比的不断提升，个人财富市场规模也持续增加。而且，一国个人财富市场规模与 GDP 的倍数关系基本趋于稳定，甚或上升。例如，根据瑞信 2019 年全球财富报告（Global Wealth Report 2019）显示，近 20 年来，中国的老龄人口

mographic dividend. Economist Robert Lucas defined human capital as effective labour whose quality is dependent on the level of education (Lucas, 1988). Major components of human capital include health and education. In the previous section, we discussed health, and here, we will focus on education. At the personal level, improving education standards is conducive to enhancing the competitiveness of the educated individual, promoting their career development and boosting their wage income. Increased life expectancy can stimulate investment in education. Adjusting the rational expectations of an individual can include adjustments to their years spent in education and to their investment in education based on human capital accumulation expectations (Yang Ying, Lin Huanrong, 2013). Increases in life expectancy extend the period of time over which the benefits of investment in education are reaped, making individuals more motivated to invest in education (Hansen and Lønstrup, 2012; Cervellati and Sunde, 2013). At the macro level, the increase in the elderly proportion of the population accelerates adjustments to the industrial structure: labour-intensive industries give way to capital- and technology-intensive industries, and the value of human capital plays an even more important role. World Bank data shows that countries with longer life expectancy have higher levels of education. It is forecast that the average years of education received by China's working population will increase from 10.5 years in 2018 to 12 years in 2035. In short, improving the quality of human capital will promote improvements in labour productivity, and income levels will increase accordingly, further promoting the overall development of social wealth.

Extending the period over which old-age wealth is accumulated will also promote the development of a society's total wealth. With the increase in the population's life expectancy and improved health, the number of healthy young elderly (i.e. people aged 55-75) will increase substantially. As the increase in investment in education will boost the quality of human capital and the depreciation of human capital will slow, this population segment now fulfils the basic criteria for extending their working lives. Extending the working lives of the working population means that the period over which they accumulate wealth for their pensions will also be prolonged. In fact, many countries in which relatively high proportions of the population are

占比从 7% 上升至 12%，个人财富市场规模从 4 万亿美元上升至 64 万亿美元，占 GDP 的比例从 3.1 倍上升至 4.7 倍，倍数呈持续上升态势；同期，美国的老龄人口占比从 12% 上升至 16%，个人财富市场规模从 42 万亿美元上升至 106 万亿美元，占 GDP 的比例从 4.1 倍上升至 5.2 倍，倍数呈上升趋势。

财富时代，中国居民财富结构将更加多元化。居民财富管理将直接影响居民消费，包括老年时期消费。根据西南财经大学与广发银行联合发布的《2018 中国城市家庭财富健康报告》，中国居民财富管理的结构不合理，主要表现为家庭住房资产占比过高（70%），远高于美国的 31%，严重挤压了金融资产配置。下一步，中国居民财富从房地产向金融资产转移预计将是大趋势，中国居民财富结构将更加多元化。另外经历资本市场洗礼，个人投资者开始变得更加理性，更加成熟，更倾向于向专业的财富管理机构寻求投资建议。瑞信 2019 年全球财富报告中也指出，中国人均财富在近 20 年间从 4293 美元提升至 5.85 万美元，增长了 13 倍；同期，与美国相比，中国人均财富水平从美国的 1/49 上升至 1/7.5，仍有较大提升空间。随着中国经济的持续发展，中国人均收入水平也将不断提升，个人财富市场规模将持续成长。

综上所述，长寿时代人口年龄结构将逐步形成新均衡，并以低死亡率、低生育率、预期寿命持续提升、人口年龄结构趋向柱状、平台期老龄人口占比超越 1/4 为主要特征。在长寿时代下，人类疾病谱转向慢性非传染性疾病，对健康寿命的关注将产生庞大的需求，促使健康产业结构升级，推动社会进入健康时代。同时，在长寿时代养老金替代率成为关键，人力资本质量提升、养老财富积累期限延长将促进社会财富总量的发展，个人消费、储蓄、财富积累的方式会为之改变，

elderly have chosen to delay the legal retirement age as a countermeasure. In addition, in response to the age of longevity, sensible people will start to plan their pension savings at an even earlier stage in their lives. Both of these methods will extend the duration of wealth accumulation for old age, and increase the total wealth of a society (See Table 3).

Table 3: Retirement age and elderly proportion of the population in selected countries

Country	Original retirement age (M)	Original retirement age (F)	Corresponding year	New retirement age (M)	New retirement age (F)	Corresponding year	Years delayed M/F	Proportion of the population aged 65 years and above (2018)
UK	65	60	2012	65	62	2015	0/2	18.4%
Germany	63	60	1985	65.5	65.5	2019	2.5/5.5	21.5%
Japan	61	60	2010	65	64	2019	4/4	27.6%
USA	65	60	1983					15.8%
China	60	55	2011					10.9%

Data source: OECD Pension Policy Notes

3. Wealth management needs in the age of longevity will open up an era of wealth

In the age of longevity, people will increasingly rely on returns on investment and the accumulation of wealth to provide for their old age. This will create strong demand for wealth management, and the age of longevity will usher in an era of wealth. As the elderly population grows rapidly, in terms of both total numbers and their proportion of the total population, public pension replacement rates will record a downward trend. At the same time, the reduction in the birth rate reduces the possibility of relying on one's children in one's old age. Because of this, personal and family returns on investment have become more important to people's pensions. If we look at data for the last 20 years in countries with relatively high proportions of the elderly in the population, such as China, the USA, Japan, the UK and Germany, the scale of the personal wealth market has continued to grow as the elderly proportion of the population has increased. Moreover, the relationship between the scale of a country's personal wealth market and its multiple of GDP has basically stabilised, or even increased. For example, according to

财富管理的旺盛需求将引领财富时代。随着人类迈入长寿时代，健康时代和财富时代必然随之到来，需要用大健康的视角系统性地分析三者的关系。

Credit Suisse's Global Wealth Report 2019, over the last 20 years, the elderly proportion of the Chinese population has increased from 7% to 12%, whereas the scale of its personal wealth market has increased from USD 4 trillion to USD 64 trillion. The ratio of the scale of personal wealth market to GDP also increased from 3.1 to 4.7, and this multiple is continuing to rise. Over the same period, the elderly proportion of the US population increased from 12% to 16%, the scale of the personal wealth market grew from USD 42 trillion to USD 106 trillion. The ratio of the market scale to GDP, which increased from 4.1 to 5.2, is continuing an upward trend.

In the era of wealth, the household wealth structure of Chinese people will become more diversified. Wealth management will have a direct impact on consumption, including consumption in old age. According to the 2018 Wealth and Health Report for Chinese Urban Families jointly published by Southwestern University of Finance and Economics and China Guangfa Bank, the wealth management structure of Chinese citizens is currently irrational, mainly due to the excessively high proportion of domestic housing assets (70%), far higher than the US figure of 31%, and this forms a severe constraint on the allocation of financial assets. Next, the transfer of Chinese individuals' wealth from real estate to financial assets is expected to become a major trend, and their household wealth structure will become more diversified. In addition, as they become more experienced in the capital markets, individual investors have begun to take a more rational and mature approach, and are more inclined to seek investment advice from professional wealth management institutions. The Credit Suisse Global Wealth Report 2019 also notes that over the past 20 years, China's per capita wealth has grown from USD 4293 to USD 58, 500, a 13-fold increase. Over the same period, compared to the US, China's per capita wealth has increased from 1/49 of the US level to 1/7.5, meaning that there is still plenty of room for improvement. As the Chinese economy has continued to develop, China's per capita income will also continue to increase, and the size of the personal wealth market will continue to grow.

In summary, the age structure of the population in the age of longevity will gradually establish a new equilibrium, characterised by low mortality and fertility, a continuing rise in life expectancy, a population age structure

三、长寿时代对社会经济的影响

长寿时代下，社会经济发展面临挑战和机遇。根据柯布－道格拉斯生产函数，经济增长主要受劳动力、资本和科技进步的影响。在长寿时代上述变量都会发生显著变化，进而对宏观经济产生深远影响。一些研究认为，老龄人口比例增加将导致经济增长放缓，或因为劳动力供给不足，或因为社会的储蓄率降低造成资本形成率低，或因为老龄化社会创新力不足等（陆旸、蔡昉，2014；马学礼、陈志恒，2014；周助平、刘海斌，2016）。长寿时代的社会还面临财富不平等加剧的挑战，低收入群体的境况在长寿时代可能进一步恶化，他们的生存需求和健康需求对社会保障提出更高要求，公共财政也面临更大压力。

但另一方面，当人们活得更长、更健康，并继续积极参与经济活动，长寿也将成为社会的财富来源。最新研究表明长寿时代未必会出现经济增速下行，主要原因是自动化技术的普及应用有效替代了下降的劳动力（Acemoglu and Restrepo，2017）。长寿正在定义未来，给经济和社会带来新的供给和需求，为各个年龄段的人提供创新、就业和经济增长的新机会。沃顿商学院人力资源中心主任彼得·卡普利（Peter Cappelli）主持的美国老年学协会的《长寿经济学》课题提出社会和经济应最大限度地利用长寿，消除年龄歧视，促进长寿经济的发展。

（一）长寿时代下社会经济面临的挑战

1. 长寿时代劳动力人口供给降低，冲击传统的工业化组织形态

劳动力是经济增长的核心因素之一。一方面，劳动力作为主要的生产要素，其数量增长可以推动生产增长；另一方面，劳动力人口也

tending to become pillar-shaped, and an elderly proportion of the population which exceeds one quarter of the total during the plateau period. In the age of longevity, the spectrum of human disease will switch to chronic non-communicable diseases. The focus on a healthy lifespan will generate massive demand, promote a structural upgrading of the health industry, and drive society into an era of health. At the same time, the pension replacement rate will become key in the age of longevity. Improvements in the quality of human capital and the extension of the period of time over which old-age wealth is accumulated will promote the development of a society's total wealth, and the ways in which individuals consume, save and accumulate wealth will change. Strong demand for wealth management will usher in an era of wealth. As mankind steps into the age of longevity, an era of health and an era of wealth will inevitably follow, and the relationship between the three of these must be systematically analysed from a broader perspective of healthcare.

可以为社会提供广泛的终端需求，拉动相关产业的发展（施锦芳，2015）。**然而，进入长寿时代后，出生率明显下降，年轻人口占比乃至绝对数量减少，新增劳动力人口规模下滑，因此对经济发展将产生负面影响**。

劳动力的长周期下滑可能对人类传统的工业化组织形态造成冲击。工业化时代，生产组织形式从家庭逐渐演化到工厂和企业，生产的聚集性明显提升。劳动力人口大量聚集带动工业化和城镇化。同时，社会化大生产促进了社会分工，劳动效率持续提升，劳动力需求持续上涨，产出水平持续提高。当人类仍处于高生育率阶段，劳动力供给源源不断，可以满足生产需要。同时劳动力人口占比较高还会形成高储蓄和高投资的局面，称为第一次人口红利。历史上看，凡是成功实现工业化的国家，无论是英国、美国还是日本以及改革开放以来的中国，大都享受了第一次人口红利，经济也获得了高速发展。

长寿时代面临劳动力供给的挑战。由于出生率不断下降，年轻劳动力数量将在长周期出现萎缩，部分工厂和企业将面临无人可用的局面。这一趋势目前在日本已经有所体现。日本民间企业信誉调查机构——东京商工调查所数据显示，2019 年日本因“人手不足”而负债 1000 万日元以上并因此破产的企业数量达 426 家，比上一年增加 10%，是该因素被纳入统计以来数量最多的一年。可用劳动力的减少将会对人类的生产产生深远影响，一方面将迫使传统工业企业加速智能化、自动化转型，从而降低生产活动对劳动力的需求。另一方面，长期的劳动力短缺也可能会对工业化的组织形式产生冲击。由于技术进步将降低生产对人力资源的依赖，人类有可能演化出新的组织和生

C. The socio-economic impact of the age of longevity

The age of longevity will pose challenges and opportunities for socio-economic development. According to the Cobb-Douglas production function, economic growth is mainly determined by labour, capital and technological progress. In the age of longevity, these variables will change significantly, and this will have a profound impact on the macro-economy. Some studies claim that an increase in the proportion of the elderly population will lead to a slowdown in economic growth, either because of an insufficient labour supply, or because of a reduction in the overall savings rate, resulting in a low capital formation rate, or because of the lack of innovation in an ageing society, amongst others (Lu Yang and Cai Fang, 2014; Ma Xueli and Chen Zhiheng, 2014; Zhou Zhuping and Liu Haibin, 2016). Society in the age of longevity will also face the challenge of increasing wealth inequality. The situatios of low-income groups may further worsen in the age of longevity, and their survival and health needs will increase the demands placed on social security, while also placing public finances under increased pressure.

On the other hand, however, as people live longer, more healthily, and continue to actively participate in economic activity, longevity will also become a source of wealth for society. The latest research indicates that the age of longevity may not necessarily translate to a drop in the economic growth rate, mainly because the widespread application of automated technologies will have effectively replaced the declining labour force (Acemoglu and Restrepo, 2017). Longevity is currently defining our future, bringing new supply and demand to the economy and society, and providing new opportunities for innovation, employment and economic growth to people of all ages. The American Gerontological Association's Longevity Economics project, chaired by Peter Cappelli, director of the Centre for Human Resources at the Wharton School of the University of Pennsylvania, proposed that society and the economy should maximise the use of longevity, eliminate age discrimination, and promote the development of a longevity economy.

(a) The challenges facing society and the economy in the age of longevity

1. The labour supply will be reduced in the age of longevity, impacting traditional labour organisation patterns

The labour force is a core factor in economic growth. On the one hand, the labour force is a main input of production, and its numerical growth can drive

产形式，以应对新增劳动力资源下降带来的挑战，我们将在后面的部分予以讨论。

2. 长寿时代储蓄率降低，导致资本形成率下降

传统经济学理论认为，随着老龄人口的数量不断上升，消费率上升，储蓄率下降，对资本形成率产生负面影响。有研究指出，随着老龄人口占比增加和年轻人口占比减少，人口抚养比将会上升，导致抚养支出增加、储蓄率下降（陆旸、蔡昉，2014），而储蓄率下降则会导致资本形成率（资本形成占 GDP 的比重）降低。另有研究也表明了类似观点：人口老龄化最终会导致生产性人口相对乃至绝对减少，消费性人口相对乃至绝对增加（李军、刘生龙，2017）。因此，一个社会的老龄人口比重越高，意味着其分享产出成果的比例越高，可用于生产投资的产出比例相对较小，宏观上就会导致国民储蓄率下降、消费率上升，不利于资本积累。在全球角度看，美联储前主席格林斯潘甚至提出人口老龄化使全球投资资源萎缩[⑥]。

与之相应，第二次人口红利理论认为，人口结构变化过程中，人力资本回报水平变高，个体会调整消费和储蓄行为，通过个人资产配置和延长劳动力供给年限等方式应对未来的不确定性，促使社会财富积累增加。更进一步，老龄人口占比增加将导致社会劳动力下降，因此资本 / 劳动比率上升可以推动经济增长，该过程将对冲社会整体储蓄率下降的效果。然而第二次人口红利能否真正释放，仍然依赖许多外部性和制度性因素。一方面，老年人从生产者变成纯粹的消费者，不断消耗其资本积累。减缓老年人的资本消耗则要求社会建立起更全面、更包容的养老制度和服务体系。另一方面，人均资本的提升要转

⑥ 《财经》2019 年 11 月 12 日报道，格林斯潘（Alan Greenspan）表示，因为人口老龄化，美国、英国等社会福利支出出现显著增长，福利的支出挤占了国内储蓄总额的空间，进而挤出了国内投资总额，后者正是生产力增长的主要决定性因素。

production growth, while on the other, the working age population can also provide a wide range of end-user needs for society, and stimulate the development of associated industries (Shi Jingfang, 2015). However, entering the age of longevity has led to a significant drop in the birth rate, concomitantly bringing about a reduction in the young population, both in terms of proportion and even absolute numbers, while the size of the new labour population has also declined, which will have a negative impact on economic development.

The long-term decline of the labour force may have an impact on the traditional industrial organisation patterns in human society. In the industrialised era, production organisation forms gradually evolved from the family into factories and companies, significantly improving the concentration of production. This massive concentration of the labour force was the driving force behind industrialisation and urbanisation. At the same time, large-scale social production encouraged the social division of labour, and labour efficiency has continued to rise, demand for labour has continued to expand, and output levels have continued to climb. When mankind was still at the high-fertility stage, there was a continuous supply of labour to satisfy production needs. At the same time, the relatively high working-age proportion of the population also resulted in high levels of savings and investment, creating the so-called first demographic dividend. Historically speaking, every country which has successfully achieved industrialisation, be it the United Kingdom, United States, Japan or China following opening up and liberalisation, has enjoyed this first demographic dividend, and their economies have developed at a rapid pace.

The labour supply challenges to be faced in the age of longevity. The declining birth rate means that the young labour force will shrink over the longer term, and certain factories and companies will face skills shortages. This trend is already apparent in Japan. According to data from Tokyo Shoko Research, a Japanese credit research agency for private companies, a total of 426 companies in the country recorded losses of more than JPY10 million and were bankrupted because of "labour shortages", a year-on-year increase of 10%, the highest since this figure was first included in the statistics. The reduction in available labour will have a profound impact on human production. On the one hand, this will force traditional industrial companies to accelerate their shift to smart operations and transformation, thereby reducing the need for labour in production activities. On the other hand, long-

化为经济增长需要依赖外部的制度性建设，尤其是资本市场的建设。

3. 长寿时代劳动力老化，影响社会创新效率

长寿时代面临整个社会创新效率的挑战。人类的创新活动并非平均分布在整个生命周期中。研究表明，个人创新能力随着年龄的增长而呈倒“U”型曲线，老年人的学习能力、创新能力、开拓进取能力不如年轻人，劳动力老化将对劳动生产率提高和科技创新动力提升带来不利影响（马学礼、陈志恒，2014）。此外，长寿时代将延长人类的工作年限，年长者处于组织内重要位置的时长也会相应增加，年轻人升迁难度加大，有可能限制创新才能和创新意愿的发展。综上，长寿时代可能会对社会整体创新效率有负面影响。

4. 长寿时代社会不平等程度加深

长寿时代的到来本身也可能加剧财富的不平等。为了研究其作用机制，可将社会人口分为年轻人口和老龄人口两组。**从组内角度看，长寿时代可能导致收入和消费的差异随时间延长不断扩大**。同龄人之间消费和收入的差异将随着年龄的增长而扩大，因为个体的收入和消费受自身教育、职业、健康状况、家庭背景等因素的影响，而这些差异会随着时间的推移不断放大（Deaton and Paxon，1997；Chen et al.，2017）。例如，脑体劳动者收入的剪刀差长期存在。近年来由于劳动成本的上升，上述情况有所缓解。但脑力劳动者可以通过经验积累、不断学习等方式降低人力资本下降速度，而体力劳动者的劳动能力直接受其身体健康状况影响，随着年龄增大，丧失劳动能力的风险不断升高，因此长期看二者的收入差距有可能拉大。中国 1996~2009 年的收入和消费数据显示，人口老龄化确实会加剧组内收入不平等（董志强等，2012）。

term labour shortages may also have an impact on the forms of industrialised organisation. Because technological progress will reduce the reliance of production on human resources, mankind may evolve new forms of organisation and production in order to cope with the challenges posed by the reduction in new labour resources, and we will discuss this in the following sections.

2. Decreased savings rates in the age of longevity, leading to a drop in the capital formation rate

Traditional economic theory believes that as the elderly continue to increase in number, the consumption rate rises, the savings rate drops, and this has a negative impact on the capital formation rate. Certain studies note that as the elderly proportion of the population increases and the younger proportion get smaller, the population dependency ratio will increase, leading to an increase in dependency expenditure and a drop in the savings rate (Lu Yan and Cai Fang, 2014), while a decline in the savings rate will in turn lead to a drop in the capital formation rate (the ratio of capital formation to GDP). Other studies also highlight a similar view: an ageing population will eventually lead to a relative or even absolute decline in the working-age population, and a relative or even absolute increase in the consumer population (Li Jun and Liu Shenglong, 2017). Therefore, the higher the elderly proportion of the population in a society, the higher the proportion of its consumed output. The proportion of output which can be used for investing in production is therefore relatively smaller, which will lead to a decline in the national savings rate and an increase in the consumption rate at the macro level, which is not conducive to capital accumulation. From a global perspective, former US Federal Reserve Chairman Alan Greenspan has even proposed that the elderly population will shrink global investment resources[(6)].

Correspondingly, the second demographic dividend theory believes that as part of the process of demographic change, the return on human capital will increase, while individuals will adjust their consumption and savings behaviour, and respond to future uncertainty through the accumulation of personal assets and their extended presence in the labour force, inter alia, promoting the increased accumulation of social wealth. Furthermore, the increase in the elderly proportion of the population will lead to a decline in the labour force. It is therefore possible for an increase in the capital/labour ratio to drive economic growth, a process which will hedge against a decline in the overall social savings rate. However, the actual trig-

(6) A Caijing report on 12 November 2019 quoted Alan Greenspan as saying that the significant rise in welfare expenditure driven by the ageing population in countries such as the US and UK meant that welfare expenditure was squeezing total domestic savings, and then total domestic investment, which is the decisive factor for the growth of productivity.

从组间角度看，长寿时代可能拉大年轻人口和老龄人口的收入差距。在现行的工作模式和退休制度下，长寿时代将会产生更多不直接参与生产的老龄人口，这部分人口不参加第一次分配，而主要参与第二次分配。然而，由于社会建构的因素影响，老年人在第二次分配中也不占据主导地位，因此老龄人口的经济状况主要取决于年轻时的财富积累。随着老龄人口的不断增长，参与社会生产的年轻人和不参与社会生产的老年人之间的财富差距将不断拉大，进而导致社会不平等程度加深。

与收入不平等伴生的是健康不平等问题。低收入群体由于缺乏营养、无法有效获取医疗资源等多重因素导致健康状况相对更差。研究指出，中国老龄人口的健康不平等也日益凸显（杜本峰、王旋，2013）。综上所述，长寿时代一部分老龄弱势群体可能会面临贫病交加的境况，他们需要社会更多关注和支持，同时也对现行的福利制度和公共财政提出更高要求。

（二）长寿时代下社会经济发展的机遇

1. 长寿时代技术进步对劳动力的替代率提升

在前文的分析中，我们从理论层面列举了老龄人口占比增加对经济增长可能产生的一些负面影响。但是，针对 OECD 国家 1960 年至 2011 年的实证研究显示，人均 GDP 的变化和老龄人口占比的关系并不显著（Gehringer and Prettner，2017）。

理论层面与实证分析的偏离可能源于人们低估了长寿时代技术进步对劳动力的替代效应，而当前老龄化进程较快的国家却往往是自动化技术发展较快的国家。Acemoglu 和 Restrepo（2017）的理论文章从

gering of the second demographic dividend is still reliant on a large number of external and institutional factors. On the one hand, as the elderly change from producers into pure consumers, they are constantly consuming their accumulated capital. Reducing capital consumption by the elderly requires that society establish a more comprehensive and inclusive pension and services system. On the other hand, the transformation of the increased per capita capital into economic growth is dependent on the construction of external institutions, and that of capital markets in particular.

3. The ageing of the labour force in the age of longevity will impact the efficiency of innovation

The age of longevity faces the challenge of innovation and efficiency across society as a whole. Man's innovation activity is unevenly distributed across their entire life cycle. Studies have shown that personal capacity for innovation forms an inverted "U" curve with age. Older people do not have the same ability to learn, to innovate and to strike out on their own as their younger counterparts. The ageing of the labour force will have an adverse impact on the increase in labour productivity and the drive towards scientific and technological innovation (Ma Xueli, Chen Zhiheng, 2014). In addition, the age of longevity will extend the working lives of human beings, and the length of time that the elderly hold important positions in an organisation will also increase correspondingly. It will become increasingly difficult for the young to achieve promotion, which may limit the development of innovative talent and the willingness to innovate. In summary, the age of longevity may have a negative impact on overall social innovation efficiency.

4. The rising inequality in the age of longevity

The onset of the age of longevity itself may also exacerbate wealth inequality. In order to understand how this works, let's divide the population into two groups: the younger and older populations. **When viewed from a group perspective, the age of longevity may cause differences in income and consumption to expand continuously over time.** Differences in consumption and income among people of the same age will widen with age, because individual income and consumption are all affected by an individual's education, profession, state of health, family background and other factors, and these differences will continue to change and magnify over time (Deaton and Paxon, 1997; Chen et al., 2017). For example, the scissor gap in the incomes of white-collar workers is by no means a new phenomenon, although rising

两方面讨论了劳动力减少对经济的影响。一方面劳动力下降导致总产出下降，另一方面由于劳动力的下降会内生性地激发产业自动化和机器人产业的发展，最终的总产出并不一定下降。后者会发生主要是当资本和劳动力的缺口足够大时，资本变得比劳动力更便宜，通过资本转化的机器代替劳动力变得有利可图。另有研究指出长寿对技术进步和生产力增长产生积极影响，其对 OECD 国家的实证分析证实了这一理论（Gehringer and Prettner，2017）。

2.“长寿经济”创造新的供给与需求

随着老龄人口增多，老年人的消费成为经济的重要组成部分，但目前这种消费观念是工业时代建立的，认为老年人退出劳动力市场，保持老年人健康的唯一方法就是休息。根据欧盟委员会的一项研究显示，主导老年人消费的是保健品和照料服务，在这个观念下，有学者将此称为银发经济。虽然这是社会整体消费的重要部分，但不可否认的是，这部分消费对社会整体的投资和消费挤出效应更大，并且在劳动力市场上争夺年轻劳动力，引发人力资源的危机。消耗性的老年人消费加速社会总体资源的危机，反过来，社会总体资源的危机又加剧老龄人口生活拮据的困难，所以银发经济对经济的正面影响极其有限（Caplan，2014）。

与银发经济强调老年人的消耗性消费不同，真正适应长寿时代社会经济结构的是更有活力的长寿经济。在长寿经济的概念下，老年人除作为消费者外，同时还担任着生产者和创新者的角色，在消费端和供给端同时推动经济增长和社会进步。我们正处于一个科技驱动的转型期，对体力劳动的需求在持续减少或者可以被机器人所代替，互联

labour costs have led to a certain easing of this situation in recent years. However, white-collar workers are able to reduce their rate of decline in human capital through their accumulated experience, and ongoing learning, etc. By contrast, the ability to work of blue-collar workers is influenced by their own state of health. As they get older, the risk that they will lose their ability to work continues to increase, such that over the longer term, the income gap between the two may widen. China's income and consumption data for the 1996-2009 period shows that the elderly population will indeed exacerbate inequalities in income within the group (Dong Zhiqiang et al., 2012).

From an inter-group perspective, the age of longevity may widen the income gap between the younger and older populations. Under the current working model and retirement system, the age of longevity will produce more elderly people who no longer participate directly in production. This segment of the population does not participate in primary distribution, but instead mainly participates in secondary distribution. However, because of the influence of social-constructed factors, the elderly similarly fail to occupy any dominant position in secondary distribution, meaning that the economic status of the elderly population is mainly determined by their accumulation of wealth when they are young. As the elderly population continues to grow, the wealth gap between the young, who participate in social production, and the elderly, who do not, will continue to widen, leading to further social inequality.

Hand in hand with income inequality comes the issue of health inequality. The relatively poor state of health of low-income groups is attributable to factors including a lack of nutrition, and an inability to effectively access medical resources, inter alia. Studies have shown that health inequalities in China's elderly population are increasingly significant (Du Benfeng and Wang Xuan, 2013). In summary, certain elderly and vulnerable groups may be faced with poverty and disease in the age of longevity. They must receive greater attention and support from society at large, while a higher standard must at the same time also be established for the current welfare system and public finances.

(b) Opportunities for socio-economic development in the age of longevity

1. Technological progress in the age of longevity is increasing the labour force replacement rate

网正在重新组合生产要素，使得空间上的移动需求大大减少，人工智能正在与人类智力结合。老年人的价值将被重新认识、定位和发掘，而不是停留在社会资源的消耗者这个刻板的定位上。运用新思路让老年人通过更灵活的方式参与劳动力市场，传授知识技能、传递经验或者进行社会服务工作，让老年人“持续”生产和创新，创造属于他们自己的“第三次人口红利”。正如美国麻省理工学院老龄实验室（AgeLab）的约瑟夫·库格林（Joseph Coughlin）教授在《长寿经济》一书中指出，长寿世界的未来取决于老年人在其中的行动（Coughlin，2017）。

长寿经济是老龄人口推动的所有经济活动及其连锁反应的总和。一方面，世界上几乎每个国家老龄人口的比例都将增加，市场需求非常庞大且可以预见增长。老年人通过不断变化的需求推动大量新产品和服务并为其提供资金，特别是那些采用技术创新的产品和服务，以直接、间接或者引导的方式形成和改变市场，缔造全新的长寿经济。波士顿咨询集团（Boston Consulting Group）预计，到 2030 年，美国 55 岁以上的人口将占美国自 2008 年以来消费支出增长的 50%，日本和德国的这一数字分别升至 67% 和 86%。美国退休人员协会（AARP）预测，老年人对于经济和社会的贡献举足轻重，且 2050 年之前随着老龄人口的增加都将持续上升。例如，2018 年，美国 50 岁及以上人口直接消费支出 7.6 万亿美元，占全部人口的 56%，至 2050 年将达 27.5 万亿美元，占比将提升至 61%。这些趋势将为未来 30 多年的经济增长奠定基础。另一方面，人们在过了退休年龄之后继续参与劳动力市场，继续工作或创业，继续赚取和支出工资，其经济活动的贡献

In the previous analysis, we listed some of the negative effects of the elderly proportion of the population in economic growth at the theoretical level. However, empirical research focusing on OECD countries between 1960 and 2011 shows that the relationship between changes in per capita GDP and the elderly proportion of the population is statistically insignificant (Gehringer and Prettner, 2017).

The divergence between the theoretical level and empirical analysis may stem from an underestimation of the substitution effect of technological progress on the labour force in the age of longevity, whereas countries with a relatively fast ageing process are often countries in which automation technologies have developed relatively rapidly. A theoretical article by Acemoglu and Restrepo (2017) discusses the impact of a shrinkage of the labour force on the economy from two aspects. The decline in the labour force on the one hand leads to a drop in total output, while on the other, it provides an endogenous stimulus to the development of industrial automation and robotic industries, such that final total output may not necessarily decline. The latter occurs mainly when capital is relatively abundant and labour is relatively scarce. In this case, capital becomes cheaper than labour, and it becomes profitable to replace the labour force with machinery through the transformation of capital. Another study points out that longevity has a positive impact on technological progress and productivity growth, and its empirical analysis of OECD countries confirms this theory (Gehringer and Prettner, 2017).

2. New supply and demand created by the "Longevity Economy"

As the elderly population grows, consumption by the elderly will become an important part of the economy, but this concept of consumption has so far been established in the industrial era: it assumes that the elderly have withdrawn from the labour market, and that the only way to preserve the health of the elderly is to allow them to rest. According to a study by the European Commission, health products and care services dominate the consumption of the elderly, a proposal which some scholars call the silver-haired economy. Although this comprises a significant part of overall social consumption, it cannot be denied that this consumption segment has a greater crowding-out effect on overall social investment and consumption, and competes for young labour in the employment market, triggering a human resources crisis. Expendable consumption by the elderly accelerates the overall crisis in social

持续增加，持续推动经济增长。在许多情况下，老年人的生产力和创造力甚至可能随着年龄的增长而提高。一个常被提及的现象是，年长的劳动力大多受雇于知识密集型行业，具备更多的知识技能和经验，并因此更有价值。事实上，这些知识技能和经验的积累也有助于创业。据美国退休人员协会（AARP）统计，在美国，50 岁及以上人士的创业率最高，约为 20 多岁人士的 2 倍，他们建立了美国近 1/3 的创业企业。尊重老年人，让他们有机会持续为雇主发挥自己的知识技能和经验，或者创业，这将使他们成为振兴经济的更强大的力量。

长寿经济蕴含巨大的商业机会，其经济收益不可估量，将吸引越来越多的企业、机构和投资者参与其中。这些商业机会超越我们现有的规范界限，因为新时代的老年人在平均意义上比上一代更为富裕，且更多受过高等教育，其财富水平和支出方式持续演进，习惯于创新驱动的市场。企业、机构和投资者在突破传统思维方式、持续创新面向老年人的产品和服务的过程中，需要真正去理解老年人的多元化需求，应在满足基本生理或安全需求之外，更好地满足老年人更高层次的需求，例如适老化的科技产品、提升生活质量的消费医疗产品以及满足继续发展需求的教育文化产品等。

企业、机构和投资者还需为老年人参与经济活动、创造价值、建设和影响周围的世界全面赋能，例如鼓励老年人参与创新、为老年人提供工作岗位和适老化环境、为老年人提升竞争力创造条件等等，从而增加老年人的收入。以汽车制造商为例，宝马为了留住技术熟练、经验丰富的老龄工人，改造生产线、创造合适的工作环境以便让其继续工作。2011 年新生产线应用于其在德国丁戈林（Dingolfing）的一

resources. Conversely, the crisis in overall social resources exacerbates the everyday hardships of the elderly population, meaning that the positive impact of the silver-haired economy on the economy is extremely limited (Caplan, 2014).

Unlike the silver-haired economy, which emphasises expendable consumption by the elderly, the longevity economy is more dynamic, and truly adapted to the socio-economic structure of the age of longevity. Under the concept of the longevity economy, the elderly act not only as consumers, but also at the same time as producers and innovators, promoting economic growth and social progress on both the demand and supply sides simultaneously. We are currently in a technology-driven period of transformation, in which demand for manual labour is continuously decreasing or being replaced by robots. The Internet is combining the factors of production in completely new ways, greatly reducing the need for spatial mobility, and artificial intelligence is now being combined with human intelligence. The value of the elderly will once again be recognised, positioned and explored, instead of remaining static in a fixed role as a consumer of social resources. New lines of thinking will be used to enable the elderly to participate more flexibly in the labour market, share their knowledge and skills, impart their experience or engage in social service, so that the elderly can "sustain" production and innovation, and create their own "third demographic dividend". As Professor Joseph Coughlin of MIT's AgeLab notes in his book, The Longevity Economy, the future of the longevity world will be dependent on the activities of the elderly in it (Coughlin, 2017).

The longevity economy is the sum of all the economic activities driven by the elderly population and their chain reactions. On the one hand, the proportion of the elderly population will increase in almost every country worldwide, forming very high market demand with predictable growth. The elderly are driving and providing funding for a large number of new products and services through their continuously changing needs, particularly those products and services which make use of innovative technologies to shape and alter the market, either directly, indirectly or in a guided manner, creating a brand-new longevity economy. The Boston Consulting Group estimates that by 2030, the US population aged 55 years and above will account for 50% of the increase in consumer spending since 2008; for Japan and Germany, this figure is 67% and 86% respectively. The American Association of Retired Persons (AARP) forecasts that the contribution of the elderly to the economy

个大型新工厂，该工厂完全由 50 岁及以上的工人运营。此外，宝马、奥迪、大众等汽车制造商均在创新实验可穿戴机器人——外骨骼，通过减轻关节负担并增强力量来提升老龄工人的生产力和竞争力。长寿经济在某些特定领域表现尤为显著，主要包括金融服务和保险（Migliaccio，2019）、医疗健康和科技，这些特定行业正被推向创新和拓展的新方向，例如无龄感的智能家居技术、无人驾驶等。

发展长寿经济有利于缓解社会不平等。市场将围绕老年人的多元化需求形成丰富的业态，为老年群体的健康生活和顺利工作提供更细致的服务和支撑。同时，更多的老年人将参与到生产创造中。老年人在岗时间的延长和收入增长能一定程度上缓解养老金替代率不足的问题，也有利于减轻对于劳动人口比例下降导致财富差距扩大的担忧。

在互联网、人工智能、机器人等技术不断进步的基础上，长寿经济作为一种新的经济模式，在全球老龄人口占比上升的大趋势中，将成为全球经济的驱动力，并造福于各年龄层和各代人。随着人口预期寿命的延长，个体在较长的生命周期内学习、生产、生活的方式发生巨大转变，经济和社会价值也随之整体转变，长寿经济变得更为普遍，充分激发"第三次人口红利"，进而成为经济和社会的核心之一。

（三）长寿时代下日本的社会经济变化分析

日本目前是全球人口老龄化最严重的国家之一，世界银行数据显示，2014 年其 65 岁以上人口比重达到 25%，可以说率先跨入长寿时代。长寿时代下的日本社会经济发生了深刻变化。我们根据前文提供的理论视角，分析日本的变化，将会给未来的中国更加深入的启示。

人口红利衰退，储蓄率降低，经济增长缓慢。第二次世界大战后

and society will be significant, and will continue to increase together with the elderly population until 2050. For example, in 2018, direct consumption expenditure by the American population aged 50 years and above totalled USD 7.6 trillion, accounting for 56% of the total population. By 2050, this will have reached USD 27.5 trillion, accounting for 61%. These trends will provide the foundations for economic growth over the next 30 years. On the other hand, as people continue to participate in the labour market after they reach retirement age, continue working either as employees or as entrepreneurs, and continue to learn and spend their wages, their contribution to economic activity will continue to increase, and continue to drive economic growth. In many cases, the productivity and creativity of the elderly may even increase with age. A frequently mentioned phenomenon is that the older workforce is mostly employed in knowledge-intensive industries, with greater knowledge skills and experience, and is therefore more valuable. In fact, these accumulated knowledge skills and experience are also useful in entrepreneurship. American Association of Retired Persons statistics show that in the US, people aged 50 years and above have the highest rates of entrepreneurship (about twice that of people in their 20s), and they make up almost one-third of start-ups in the US. Respecting the elderly and giving them the opportunity to continue to apply their knowledge, skills and experience on behalf of their employers, or as entrepreneurs, will make them an even more powerful force for revitalising the economy.

The longevity economy encompasses huge business opportunities, its economic potentials are immeasurable, and it will attract participation from ever greater numbers of businesses, institutions and investors. These business opportunities go far beyond our existing normative boundaries, because in this new era, the elderly are on average wealthier and more educated than the generation that came before them, and their wealth levels and spending patterns are continuing to evolve, accustomed as they are to innovation-driven markets. In the process of breaking through traditional ways of thinking and continuously innovating products and services for the elderly, businesses, institutions and investors must gain a real understanding of the diverse needs of the elderly, and in addition to being able to meet their basic physiological or safety needs, must be better able to meet the higher-level needs of the elderly, such as elder-friendly technology products, consumer medical products that improve their quality of life, and education and cultural products which meet their need for continued development, inter alia.

至 20 世纪 70 年代日本经济进入高速增长时期。世界银行数据显示，1970 年日本 65 岁及以上老龄人口占总人口的比重达到 7%，社会开始正式步入老龄化。人口的拐点也标志着劳动密集型经济高速发展模式的结束。1994 年日本老龄人口比重已达到 14%，步入重度老龄化。与之对应的，20 世纪 90 年代以来，日本经济总体走下坡路，长期处于低迷状态。这一期间，日本储蓄率与 15~64 岁人口占比在 1991 年左右同时到达高点，之后开始步入漫长的下降通道。储蓄的萎缩也带来日本投资的萎缩。日本投资增速在从 90 年代初也开始震荡下行，随后一直在 0% 附近徘徊。日本的利率也随之持续下行，甚至进入负利率时代，背后主要原因是资金的需求（投资）下降速度快于资金供给（储蓄）的下降速度。

日本劳动生产率的增长放缓，技术替代加快。劳动生产率代表每单位有效劳动的平均产出，是决定一国经济是否具有未来增长性的标志性指标。日本劳动生产率增速在 1970 年后下行的趋势明显。劳动生产率来自三个方面，资本深化、劳动力素质、全要素生产率。资本深化即资本劳动比的提高。亚洲生产力组织（Asian Productivity Organization）的数据显示（见图 6），近 40 年影响日本劳动生产率的三个要素都出现不同程度下降。资本替代方面，劳动力成本上升、数量短缺促使资本加大对劳动力的替代。但随着资本对劳动的边际替代率递减和投资的萎缩，资本深化近几年对劳动生产率甚至出现拖累。全要素生产率方面，老龄人口占比的增加刺激了技术替代，日本机器人和自动化等尖端技术高速发展。20 世纪 70~80 年代日本全要素生产率强力支撑劳动生产率，但是泡沫破灭后这种支撑有所减弱。全要素

Businesses, institutions and investors must also fully empower the elderly to participate in economic activity, create value, build and influence the world around them, for example by encouraging the elderly to participate in innovation, by providing jobs and elder-friendly environments for the elderly, and creating the right conditions for the elderly to improve their competitiveness, inter alia, thereby increasing their income. Let's take the car manufacturer BMW as an example: in order to retain their older workers with their technological skills and wealth of experience, the company transformed the design of their production line, creating a suitable working environment so that they could continue working. In 2011, the new production line was introduced at a large new plant in Dingolfing, in Germany, entirely operated by employees aged 50 years and above. In addition, BMW, Audi, Volkswagen and other vehicle manufacturers are all innovating and experimenting with wearable robots – exoskeletons to increase the productivity and competitiveness of elderly workers by increasing physical strength and reducing the burden on joints. The longevity economy has made particularly notable inroads in a number of areas, mainly including financial services and insurance (Migliaccio, 2019), healthcare and technology. These specific industries are being pushed to innovate and expand in new directions, such as ageless smart home technologies, autonomous vehicles, and much more.

Developing the longevity economy will help alleviate social inequality. The market will form a rich business environment based on the diverse needs of the elderly, and provide more finely tuned services and support to ensure the healthy lives and occupational comfort of elderly groups. At the same time, more elderly people will participate in production and creation. The extension of the employment of elderly people and income growth will to a certain degree be able to alleviate the issue of the insufficient pension replacement rate, and will also help to alleviate the concern that a decline in the proportion of the working population will lead to a widening of the wealth gap.

Based on the continued progress of the Internet, artificial intelligence, robotics and other technologies, the longevity economy will act as a new economic model, and become the force driving the global economy and benefiting people of all ages amidst a trend in which the elderly proportion of the population is generally increasing. As the population's life expectancy rises, the ways in which individuals study, produce and live throughout their extended life cycles will undergo massive changes. Economic and social values will also undergo wholesale change, and the longevity

生产率的逐步低迷也与长寿时代下日本社会阶层固化和家长式企业管理结构抑制创新有关。劳动力素质方面，世界领先的高等教育普及率使得日本人口素质整体较高，高素质劳动力成为对冲劳动生产率下行的重要因素。

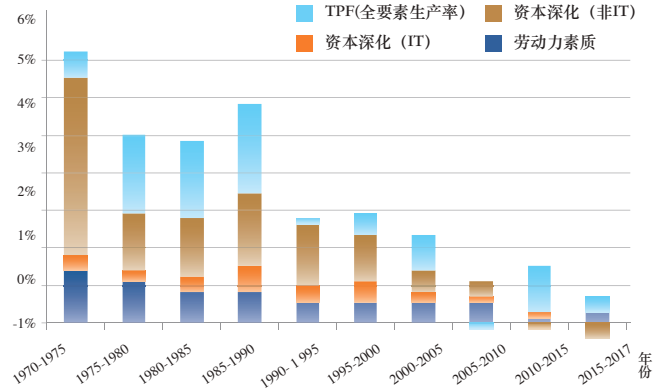

图 6：日本 1970~2017 年劳动生产率增速分解
资料来源：Asian Productivity Organization 报告 APO productivity Databook 2019，
https://www.apo-tokyo.org/publications/ebooks/apo-productivity-databook-2019/

日本银发经济相关消费需求提升，但并未完全迎来长寿经济。长寿时代下消费是日本经济增长最重要的驱动力，日本内阁府数据显示，消费贡献了近 60% 的 GDP。虽然日本人口总量近年出现缩减，但日本的消费总量整体呈稳定低速增长态势。日本社会与老年人相关的医疗保健、护理类消费支出在总消费中的占比逐渐提升。日本的老年人更多扮演消费者的角色，通过消耗性的消费推动经济进步。虽然日本也在适应老龄化的挑战，部分老年人退休后仍参与劳动力市场，但我们认为，其参与程度生产力规模和创造力还不足以使日本老年人成为生产者和创新者的角色，长寿经济还并未在日本完全实现。

economy will become more widespread, providing wide-ranging stimulus for the "third demographic dividend", furthering its importance as a core focus point for the economy and society.

(c) Analysis of socio-economic changes in Japan in the age of longevity

Japan is currently one of the countries with the oldest population worldwide. World Bank data shows that in 2014, the elderly aged 65 years and above made up 25% of the population, making the country one of the first to enter the age of longevity. Japan's society and economy have undergone profound changes in the age of longevity. On the basis of the theoretical perspective that we detailed above, we will now analyse the changes that Japan has undergone in order to provide a more in-depth insight into China's future.

The demographic dividend is fading, the savings rate is decreasing, and economic growth is sluggish. From the end of the Second World War until the 1970s, Japan underwent a period of rapid economic growth. World Bank data shows that in 1970, Japan's elderly population aged 65 years and above accounted for 7% of the total population, after which its society formally began to age. This population inflection point also marked the end of the country's labour-intensive development model, which once delivered rapid economic growth. By 1994, Japan's elderly population accounted for 14% of the total, and the country entered a period of severe ageing. Correspondingly, the Japanese economy has generally declined since the 1990s, and has been in the doldrums for a long time now. During this period, Japan's savings rate and the proportion of the population aged between 15-64 years both reached high points in around 1991, after which they began a slow downward trajectory. Shrinking savings also brought about a decline in Japan's investment. Japan's investment growth rate also began to fluctuate downward from the early 1990s onwards, and has since consistently hovered around 0%. Japan's interest rates also continued to decline, even entering negative interest rate ranges. The main reason behind this is that demand for funds (investment) fell faster than the supply of funds (savings).

Japan's labour productivity growth has slowed, and technology substitution has accelerated. Labour productivity represents the average output per unit of effective labour, and is a landmark determinant of the future growth prospects of a country's economy. The downward trend of Japan's labour productivity after 1970 is all too obvious. Labour productivity comprises three aspects: capital deepening, the quality of the labour force,

老年贫困也加大了日本社会收入差距。随着"老龄少子化"现象加剧和医疗成本提升，日本的老年贫困问题日益突出（丁英顺，2017）。同时，劳动人口下降导致养老金缺口逐年扩大，对公共财政造成沉重压力。由于收入相对较低的老龄人口的比例不断提高，日本社会总体的收入差距呈扩大趋势。从反映收入分配差异程度的基尼系数来看（见图 7），1985~2015 年 30 年间，日本社会的基尼系数大幅上升。其他发达国家的数据也表明随着老龄化进程加深，社会的不平等程度将会加深。

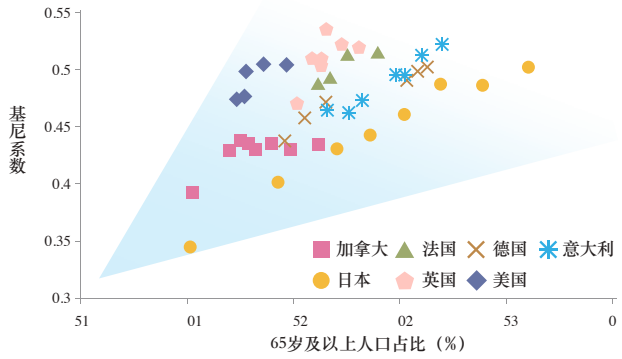

图 7：各国 1985~2015 年老龄化与基尼系数变化趋势
资料来源：OECD 数据库，https://stats.oecd.org/

（四）对中国的启示

1. 通过教育提高人力资本，以抵消劳动力和生产率下降的影响

与日本 20 世纪 70 年代相似，中国正处在经济结构转型的过程中，消费逐渐成为经济的驱动力，与之对应的，第三产业占 GDP 比上升，第二产业占比经历顶峰后下降。**产业结构转型直接影响劳动力需求结构**，以服务业为代表的第三产业的劳动力需求也相应增加。

and total factor productivity. Capital deepening refers to increases in the capital-labour ratio. Asian Productivity Organization data (see Figure 6) indicates that over the last 40 years, these three factors influencing Japanese labour productivity have all decreased to varying degrees. In terms of capital substitution, rising labour costs and shortages have prompted capital to increase labour substitution. However, with a diminishing marginal replacement rate of capital for labour and shrinking investment, the deepening of capital has even dragged down labour productivity in recent years. In terms of total factor productivity, the increasing ageing of the population has stimulated technology substitution, and cutting edge technologies such as robotics and automation have developed rapidly in Japan. From the 1970s to the 1980s, Japan's total factor productivity provided powerful support for labour productivity, but this support fell away following the bursting of the economic bubble. The gradual downturn in total factor productivity is also related to the social ossification of Japanese society in the age of longevity and the suppression of innovation by paternalistic corporate management structures. In terms of labour quality, the country's world-leading higher education penetration rate ensured the high overall quality of Japan's population, and this high-quality workforce has become a significant factor dampening the decline in labour productivity.

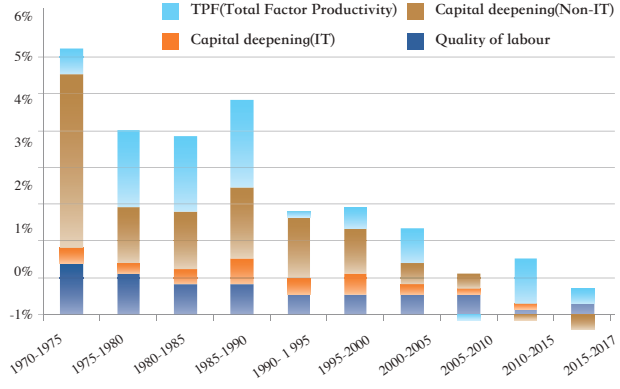

Figure 6: Breakdown of Japanese labour productivity growth rates, 1970-2017
Data source: Asian Productivity Organization (APO) Productivity Databook 2019, https://www.apo-tokyo.org/publications/ebooks/apo-productivity-databook-2019/

Japan's silver-haired economy related consumption demand has risen,

服务社会下，教育带来人力资本上升，可以抵消部分劳动力供给和劳动生产率下降的影响。不论是从个人收入还是从宏观经济角度，教育的投资回报率都极高（Psacharopoulos，1994）。教育是造成各国生产力差距的重要原因。劳动力受教育程度越高，生产力越发达（Mankiw et al，1992）。正如日本高素质劳动力是对冲劳动生产率下行的重要因素，教育红利对劳动力需求有较强的替代作用。长寿时代下的老龄人口占比提升对经济的负面影响主要集中在工业社会中，而通过投资教育提高人力资本，在服务社会下可以有效地抵消劳动力萎缩给经济带来的负面影响。

2. 加快技术替代，通过技术创新引导经济增长

自动化和机器人的应用将成为解决劳动力下降的重要手段。日本的例子中，自动化和机器人产业顺应着长寿时代蓬勃发展，许多行业加快了机器和技术替代人力。随着技术的不断发展，经济学家预言的机器人代替人工劳动的时代在不断逼近。世界银行的数据则显示，OECD 国家中将有 57% 的工人的工作能被机器取代。从 1993 年到 2007 年，欧美已经投入经济生产的机器人增长了 4 倍，数量大概在 150 万 ~175 万之间。波士顿咨询估计，这一数量在 2025 年将会增长至 400 万 ~600 万。各行业使用机器人情况分别为：汽车行业使用了 39% 的机器人，居各行业之首；电子、金属、塑料化工行业分别为 19%、9% 和 9%（Acemoglu and Restrepo，2017）。机器人替代传统人力，将提高生产效率，加速自动化及相关行业的发展，进而进一步引导创新促进经济增长。

3. 通过建设有效的资本市场提升第二次人口红利的效率

but has yet to fully usher in a longevity economy. In the age of longevity, consumption is the most important force driving Japanese economic growth. Japanese Cabinet Office data shows that consumption contributes almost 60% of GDP. Although the country's total population has shrunk in recent years, Japan's overall consumption has shown stable, slow growth. Japanese society's consumption of ageing-related healthcare and nursing has gradually increased its proportion of total consumption. In Japan, the elderly predominantly play a role as consumers, and promote economic progress through expendable consumption. Although Japan is also adapting to the challenges of ageing, and numbers of elderly people continue to participate in the labour market after retirement, we believe that the degree of participation and the scale of productivity and creativity remain too low to allow Japan's elderly to become producers and innovators. The longevity economy has yet to come to full fruition in Japan.

Old-age poverty has also increased the income inequality in Japan. Exacerbated by the lower numbers of children to support elderly parents and the increase in medical costs, the issue of old-age poverty in Japan has become increasingly apparent (Ding Yingshun, 2017). At the same time, the decline in the labour force has led to a pension deficit which is widening year by year, and which has put heavy pressure on public finances. As the proportion of the elderly population with relatively low incomes continues to increase, the overall income inequality in Japanese society continues to expand. Judging from the Gini coefficient, which reflects the degree of deviation in income distribution (see Figure 7), the Gini coefficient of Japanese society has risen sharply in the 30 years between 1985 and 2015. Data for other developed nations also indicates that as the ageing process continues, the degree of social inequality will also worsen.

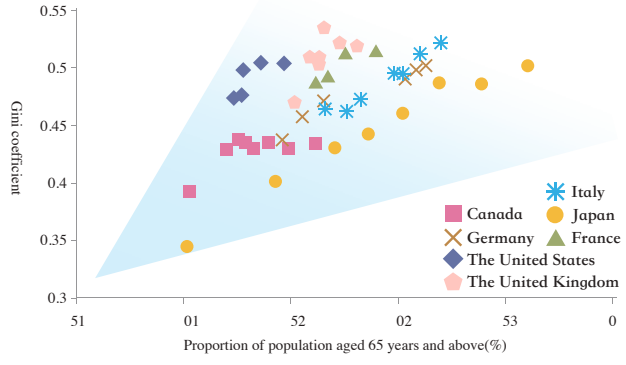

Figure 7: Ageing and Gini coefficient trends by country, 1985-2015
Data source: OECD database, https://stats.oecd.org/

有效资本市场是释放第二次人口红利的最佳渠道。改革开放促进中国第一次人口红利释放。随着劳动力素质提高、社会公共环境改善，第二次人口红利机会窗口已经开启。第二次人口红利的条件要求更高，人均资本的提升要转化为经济增长，需要依赖外部的制度性建设，尤其是资本市场的建设。如果资本市场的市场化程度低，融资渠道单一，会造成融资成本高，资源难以有效分配。日本的例子显示，社会进入长寿时代也会直接影响利率及投资收益率。未来如果全球新兴市场都进入长寿时代，全球的资本市场和投资收益也必将进入新的均衡态。另一方面养老金资产规模持续增长使得获得高收益的难度增加。上述几重作用将挑战中国养老财富的长期投资收益率是否能持续显著超越通货膨胀，实现保值增值。因此中国的养老金投资机构需要重视权益资产配置，提升对资本市场直接融资水平。

4. 引入长寿经济，创造第三次人口红利

引入长寿经济理念，让老年人“持续”生产和创新，创造属于他们自己的“第三次人口红利”，需要改变原有的受教育、工作、退休三段式的工业时代用工方式，需要运用新思路创造属于老年人的消费和生产方式。

传统理论认为老龄化对经济的负面作用主要来自于劳动力短缺，对资源的消耗和阶级固化对创新的阻碍。长寿经济下，情况可能变化。首先劳动力短缺可以通过机器人和人工智能替代，同时受过良好教育的老龄人口有能力和意愿参与生产，某种程度上可以缓解传统劳动力下降的压力。另一方面老年人阅历、经验、学识丰富，可以增加智力要素的供给。其次资源的消耗可以通过发展新兴健康产业减少资源挤

(d) Implications for China

1. Improving human capital through education to offset the impact of declines in the labour force and productivity

In the same way as Japan in the 1970s, China is in the process of transforming its economic structure, and consumption is gradually becoming the driving force of the economy. Correspondingly, the ratio of tertiary industry to GDP has risen, while that of secondary industry is falling after peaking. **The transformation of the industrial structure has had a direct impact on the labour demand structure,** and labour demand from the tertiary industry, represented by the service industry, is also increasing correspondingly.

In a service society, education has brought about an increase in human capital to offset some of the impact of the decline in labour supply and labour productivity. Whether from a personal income or macro-economic perspective, the return on investment in education is extremely high (Psacharopoulos, 1994). Education is a major cause of productivity gaps between countries. The higher the level of education of the labour force, the higher the development of productivity (Mankiw et al., 1992). Just as Japan's high-quality labour force is a significant factor dampening the decline in labour productivity, the education dividend plays a powerful substitution role for labour demand. In the age of longevity, the negative economic impact of an increase in the elderly proportion of the population is mostly concentrated in industrial society, whereas improvements in human capital through investment in education in a service society can effectively offset the negative impact of the contraction of the labour force on the economy.

2. Accelerating technology substitution, and guiding economic growth through technological innovation

The application of automation and robotics will become an important means for resolving the decline in the labour force. In the case of Japan, the automation and robotic industries are booming in the age of longevity, and many industries have accelerated the replacement of manpower with machinery and technology. As technology continues to develop, economists predict that an era in which robots replace human labour is approaching. World Bank data shows that in OECD countries, the tasks performed by 57% of employees can be done by machines. Between 1993 and 2007, the number of robots put into economic production in Europe and the US grew four-fold,

占。过往老龄化对投资的挤出作用主要来自医疗、护理等环节消耗资源。而这些部门是从急症诊疗角度提供产品，造成资源的浪费，甚至阻碍经济的增长。在认识到老人带病生存问题后，新的健康产业将以基础医疗和慢病管理为中心，这就减少了资源的挤占。最后创新的阻碍可能会在长寿经济新的组织形态下得到缓解。当全球步入长寿时代，在传统经济之外将产生围绕老龄人口的长寿经济，其范畴和结构、组织形态和生产方式都是新的，可视为社会经济的增量。在增量经济的影响下，不同年龄层人口的社会矛盾和冲突可能缓解。

在中国老龄人口占比持续提升的背景下，在需求侧，适应老年人需求的创新将在更大程度上拉动经济，比如无人驾驶、智能家居可能成为重要的产业；医养结合社区更好地满足老年人的生活需要，与之相关的养老产业链也将蓬勃发展。在供给侧，如何让老年人也能够“持续”生产，创造属于他们的“第三次人口红利”也值得探索。在长寿时代的主题下，长寿经济与科技将可能产生前所未有的生产方式。自动化与人工智能技术进一步对初级劳动力进行替代，信息化和互联网化强化智力要素供给，全新的经济形态、生产方式会出现，劳动生产率或将大幅提升。全新的生产需要的劳动力素质将不同于传统，对教育部门提出终身教育的需求，并促进劳动力市场在年龄结构上达到一个新的平衡。

5. 重塑政府职能，促进长寿时代下的社会公平

在长寿时代，社会面临的最大挑战是财富不平等加剧，以及与之伴生的健康不平等问题。如何确保低收入者也能保持健康长寿是政策制定者需要考虑的关键议题。日本相对完善的老龄人口社会保障体系

totalling between 1.5 and 1.75 million units. Boston Consulting estimates that this number will grow to between 4 to 6 million by 2025. Robot use differs by industry: 39% of robots are used in the automotive industry, the highest of any industry; the figures for the electronics, metallurgical, and plastics and chemicals industries are 19%, 9% and 9% respectively (Acemoglu and Restrepo, 2017). The substitution of traditional manpower with robots will increase production efficiency, accelerate the development of automation and other associated industries, and show the way for further innovation to promote economic growth.

3. Improving the efficiency of the second demographic dividend by building effective capital markets

Effective capital markets are the best channels for unleashing the benefits of the second demographic dividend. Reform and opening up promoted the release of China's first demographic dividend. Improvements in labour force quality as well as in the social and public environments opened the window of opportunity for the second demographic dividend. The requirement for obtaining the second demographic dividend are even higher, because the transformation of the increase in per capita capital into economic growth is dependent on external institutional construction, and that of capital markets in particular. Excessively low marketisation of capital markets and unitary financing channels will result in high financing costs, and make the effective allocation of resources more difficult. The example of Japan shows that the entry of society into the age of longevity will also have a direct impact on interest rates and return on investment. In the future, if global emerging markets enter the age of longevity, global capital markets and returns on investment will certainly arrive a new equilibrium. On the other hand, the continued increase in the size of pension assets will make it harder to achieve high returns. The various roles mentioned above will challenge whether the long-term returns on investment on China's old-age wealth will be able to continue to significantly surpass inflation, and whether pension wealth can achieve the preservation and appreciation of value. Therefore, China's pension investment institutions must pay attention to the allocation of equity assets, and improve the level of direct financing in the capital market.

4. Introducing the longevity economy and creating the third demographic dividend

Introducing the concept of the longevity economy, enabling the elderly to "sustainably" produce and innovate, and creating their own "third demographic dividend" will require changes to the original, three-phase

固然可以借鉴，同时也要看到由于日本经济增长迟缓、快速老龄化使公共养老金支出不断上升，给政府造成沉重的财政压力，带来了政府债务风险（张士斌等，2012）。我们认为，政府更重要的职能是激发长寿时代的经济活力，促进个人在不同生命阶段的财富积累，如提高教育水平、倡导终身学习和职业教育、鼓励企业面向老龄人口创新、允许更灵活的就业形式和用工形式；同时提升基本医疗卫生服务水平，提升卫生服务的效益，满足多层次的医疗健康需求；在全面提高国民在人力资本和财富积累的基础上进行合理的再分配，缩小收入差距，提高弱势群体的生活质量和健康水平。

industrial-era approach of education, work and retirement, and will require new lines of thinking to create means of consumption and production which belong to the elderly.

Traditional theory believes that the negative effect of ageing on the economy is mainly attributable to labour shortages, crowding-out effect on investments, and class solidification which hinders innovation. In the longevity economy, this situation may change. First of all, labour shortages will be alleviated through its substitution with robots and artificial intelligence, while at the same time, the well-educated elderly population will be able and willing to participate in production, which will to a certain degree alleviate the pressure from the decline in the traditional labour force. On the other hand, the wealth of knowledge, experience and expertise of the elderly may also increase the supply of the intellectual factor. Secondly, through developing emerging health industries, elder consumption may take less resource. In the past, the crowding-out effect of ageing on investment was mainly due to the consumption of resources in medical treatment, nursing, and other areas. These provided products from an emergency diagnosis and treatment perspective, causing a waste of resources, and even hindering economic growth. As they become aware of the issue of the survival of the elderly with illness, these emerging health industries will focus on basic medical care and the management of chronic diseases, reducing resource consumption. Finally, obstacles to innovation may be eased under the new patterns of organisation in the longevity economy. As the world enters the age of longevity, in addition to the traditional economy, a longevity economy will emerge around the elderly population. Its scope and structure, organisation patterns and means of production will all be new, and should be seen as an increment to the social economy. Under the influence of this incremental economy, social contradictions and conflicts between different age segments of the population may ease.

In the context of a continuous increase in the elderly proportion of China's population, on the demand side, innovations which meet the needs of the elderly will drive the economy to a much greater extent, and some, such as autonomous vehicle and smart homes, may become major industries. The medical and nursing communities will be better able to meet the daily living needs of the elderly, and the associated eldercare industrial chain will also flourish. On the supply side, it is worth exploring ways of enabling the elderly to "sustain" production, as well as to create their own "third demographic

四、长寿时代的对策

长寿时代是关系人类未来发展的重大问题，如何应对长寿时代带来的挑战，如何让长寿时代不伴随贫困和疾病，是整个人类面临的全球性的大问题，甚至是关系人类未来发展方向和生死存亡的问题。长寿时代和随之而来的健康时代和财富时代，影响的不仅仅是老龄阶段的个体，而是涉及全生命周期的人生规划。重新规划长寿时代个体全生命周期的安排，使个体可以更好地应对长寿时代的挑战，是社会、政府和企业都需要考虑的问题。

1. 在社会层面，需通过产业结构的变迁满足长寿时代的个人需求

个人是社会的基本单元，长寿时代，个人需求将呈现新特征。工业化时代人们通常将人生划分为三个阶段，教育期、就业期和退休期。随着长寿时代的到来，人生将由多个阶段组成，而不是工业化时代单一的线性维度（琳达·格拉顿等，2018）。随着人生的延长和人生阶段的变化，个人需要重新审视长寿的生命过程，对人力资本和财富的积累与消费重新进行规划。在此背景下，个人需求将表现出三个特征：**一是健康需求，**让生命质量得以有效延长，有充分的活力面对人生阶段的变化，而不是在虚弱和病痛中虚耗漫长的人生；**二是财务和养老金需求，**为预期增加的寿命储备更多的资金，维持财务稳定，满足养老和健康的需求，从而获得有质量的长寿人生；**三是获取新知识、新技能的需求，**长寿时代个人维持生计所需的知识和技能将不断变化，需要终身学习，随时代变化掌握新的技能，以更好地积累财富应对长寿人生。这些个人需求的变化都对现行的社会经济、政治、文化、教育、就业等所有结构提出挑战。

dividend". Within the framework of the age of longevity, the longevity economy and technologies may likely bring about unprecedented means of production. Automation and artificial intelligence technologies will continue to replace the primary labour force, while informatisation and Internetisation will enhance the supply of intellectual-focused factors. All-new economic patterns and means of production will emerge, and labour productivity will improve sharply. The labour force quality required by this all-new production will differ from its traditional counterpart, and will require the education sector to offer lifelong learning, and encourage the labour market to achieve a new equilibrium within the age structure.

5. Reshaping government functions, and promoting social equity in the age of longevity

In the age of longevity, the most significant challenge facing society will be the exacerbation of wealth inequality, and the associated issue of inequality in health. Ensuring that low-income people are also able to maintain a healthy, lengthy life is a key issue that decision-makers must come to grips with. Japan's relatively well-established social security system for its elderly population can certainly be used as a reference, but it must at the same time also be borne in mind that Japan's slow pace of economic growth and its rapidly ageing population have caused public pension expenditures to rise on an ongoing basis, placing heavy financial pressure on the government, and bringing with it the risk of government debt (Zhang Shibin et al., 2012). We believe that the most important function of a government is to stimulate the economic vitality of the age of longevity, and encourage the accumulation of personal wealth over the different stages of their life, for example by improving education levels, advocating lifelong learning and professional education, encouraging companies to innovate for the elderly, and allowing more flexible employment and ways of working. At the same time, the levels of basic medical and healthcare services must be improved, and the effectiveness of healthcare services must be enhanced in order to meet medical and healthcare needs at multiple levels. A comprehensive improvement in the accumulation of human capital and wealth should form the basis for a rational redistribution thereof, so as to narrow the income gap, and improve the quality of life and levels of health of vulnerable groups.

个人需求的变化将带动社会产业结构从工业化向后工业化迈进。在这方面，中国可以借鉴很多发达国家转型的经验。从美国劳工统计局的数据来看，进入 21 世纪，服务相关的第三产业在经济中的占比得以提升。农业在 1869 年占美国 GDP 的近 40%，到 2013 年只有 1%。与农业相比，服务业在经济中的份额从 1929 年的 40% 上升到 2013 年的 65% 左右。与这个趋势类似，长寿时代个人最核心的三个需求恰恰都对应当前服务业中的高端产业。未来，与长寿相关的健康、养老、教育产业和与之对应的科技、研发产业的增长速度将明显高于均值。

2. 在政府层面，需健全社保体系，推动医养供给侧改革，引导长寿经济转型和个体行为转变

面对长寿时代的到来，社保体系的筹资与支付将面临更大的挑战，从维护社保体系稳定的角度看，政府可采取适当推迟职工退休年龄、增加社保缴费年限、提高社保筹资基数等措施。同时，政府应使社会保障体系适应长寿时代的变化，比如优化养老金三支柱比例，发展个人养老第三支柱，推动长期性广义养老金开展市场化投资；同时合理支出医保资金，提升慢病管理的效益，建立广覆盖的长期照护机制等。除了维护基础社会保障体系的稳定和高效，政府应该着力降低长寿时代的供给侧的成本，通过各类政策引导和激励扩大医养服务供给，充分发挥市场作用，弥补养老和健康服务缺口。政府可以通过土地与税费政策以及水、电、气等基础能耗的价格优惠政策，降低医养服务供给方的建设和运营成本；进一步放宽社会资本投资设立健康服务、养老机构的准入，为医养行业拓展投融资渠道；加强对医养运营服务的市场化监管与标准体系建设，推动社会办与公立医养服务供给方享受同等的发展与扶持政策。同时，政府应该持续引导保险与金融领域完

D. Countermeasures in the age of longevity

The age of longevity comprises a major issue in the future development of mankind, and finding ways to deal with the challenges that this era will bring and to free it from poverty and disease is a global issue facing humanity as a whole, even affecting the direction of our future development, and survival. The age of longevity and the eras of health and wealth which will come with it will affect individuals not only in their old age, but also their life planning across their entire life cycle. Replanning an individual's arrangements across their entire life cycle in the age of longevity will allow them to more effectively meet the challenges of the age of longevity, and this is an issue which society at large, government and companies must take into consideration.

1. At the social level, individual needs will need to be met in the age of longevity through changes in the industrial structure.

The individual is the basic unit of society, and in the age of longevity, individual needs will take on new characteristics. In the industrial era, people often divided their lives into three stages: an education phase, an employment phase, and a retirement phase. With the onset of the age of longevity, life will still consist of multiple stages rather than a single linear dimension of the industrial era (Lynda Gratton et al., 2018). With the extension of their life spans and the changes in their life stages, individuals will need to re-examine their life paths in a context of longevity, and re-plan their accumulation and consumption of human capital and wealth. In this context, individual needs will take on three characteristics. **The first is a need for health,** so as to effectively prolong their quality of life, and to ensure sufficient vitality to face the life stage changes rather than squander this longer life in a state of weakness and illness. **The second is a need for finance and pensions,** in order to reserve more funds for the expected increase in lifespan, maintain financial stability, and meet old age and health needs, so as to enjoy a high-quality life in the context of longevity. **The third is a need to acquire new knowledge and skills.** The knowledge and skills required to sustain one's livelihood in the age of longevity will continue to change, and lifelong learning and the mastery of new skills over time will be required in order to accumulate wealth for a longer lifespan. These changes in personal needs pose challenges to all of our existing socio-economic, political, cultural, educational and employment structures.

善支付与产品体系，有效促进健康、养老相关服务消费，使得供给方在满足长寿时代服务需求的同时也能获得不断创新发展的动力。此外，政府应该鼓励教育和互联网产业提供更加适应长寿时代下民众的多层次职业教育、兴趣学习和社会交流需求的平台。

在经济政策层面，正如前文分析，为了减轻老龄人口对经济的冲击，政府除了持续推动技术升级，还需要大力推动长寿经济发展，创新就业岗位、提高就业的灵活性，为老年人继续参与经济活动、创造社会价值提供条件，在此基础上全面激发老龄人口的多元化需求，提升产业结构转型的质量和对长寿时代的适应性。

最后，政府应积极引导个人转变认识和行为，使个人更积极主动地规划长寿人生。长寿时代的到来是个不可逆的命题，政府可加大教育、宣导的力度，帮助民众更清晰明确地认识到新时代的到来及个体将面对的挑战，鼓励个人持续积累人力资本，更早地开启财富规划。如前所述，长寿时代下，个人的人生将不再是单一的线性维度，在教育、职业选择等方面个体将具有更多的灵活性。对此，政府有必要考虑更灵活的社会治理模式与政策制度，帮助个体实现非线性人生所需的过渡，提高适应性。

3. 在企业层面，需加速商业模式和组织转型以应对长寿时代的挑战

作为国民经济的细胞、市场经济活动的主要参与者，企业在长寿时代能够发挥的作用对社会、政府和个人来说都具有重要意义，同时企业未来的发展也必将受到长寿时代的影响，长寿时代正是企业解决突出矛盾、满足人民群众对美好生活的向往、创造核心价值的时代。长寿时代的社会需求以老龄人口的需求为基础，老人的需求将不仅仅

Changes in personal needs will drive the social and industrial structure from an industrial to a post-industrial era. In this regard, China can learn from the experiences of many developed countries which are undergoing this transition. According to data from the US Bureau of Labor Statistics, as we enter the 21st century, the proportion of services-related tertiary industries in the economy has increased. In 1869, agriculture accounted for close to 40% of US GDP; by 2013, this was a mere 1%. In contrast to agriculture, the share of the service sector in the economy has risen, from 40% in 1929 to approximately 65% in 2013. Similarly to this trend, the three core personal needs of the age of longevity all correspond with high-end industries in today's service sector. In future, the growth rates of longevity-related health, pensions and education industries and their associated technology and R&D industries will be significantly higher than the average.

2. At the government level, it is necessary to improve the social security system, promote healthcare supply-side reforms, and guide the transformation of the longevity economy and changes in individual behaviour

Faced with the onset of the age of longevity, the financing and payment of the social security system will face even greater challenges. The government could take appropriate measures to ensure the sustainablity of the social security system, such as postponing the retirement age of workers, increasing the number of years required for social security contributions, or raising the social security funding quota. At the same time, the government should adapt the social security system to the changes brought about by the age of longevity, for example by optimising the proportion of the three pension pillars, developing the third pillar, personal pensions, or encouraging long-term general pensions to conduct market-oriented investments. At the same time, medical insurance funds should be spent properly, in order to improve the effectiveness of chronic disease management, and establish a broad-coverage, long-term care mechanism. In addition to maintaining the sustainability and efficiency of the basic social security system, the government should work to reduce supply-side costs in the age of longevity, employing a variety of policies to guide and encourage the expansion of the supply of medical and nursing services, to fully utilise the role of the market, and to plug any gaps in pension and healthcare services. The government could also reduce the supply-side construction and operating costs of medical and nursing services through land and taxation policies, and price concessions for the consumption of basic necessities such as water, electricity and gas. It could further

是维持生存，而是实现自己的愿景，企业必须深刻了解这一需求变化，在商业上进行创新。哈佛大学的管理学者克莱顿·克里斯坦森（Clayton Christensen）于 1997 年提出了颠覆性创新理论，指出颠覆性创新就是用更简单、更便宜、比现有技术更可信赖和更方便的技术去争取胜利（克莱顿·克里斯坦森，2014）。为了满足长寿时代老人的需求，企业需要不断降低成本，使得面向老人的产品和服务更方便和实惠。举例来说，美国养老社区的发展，就遵从了这样一个创新原则，如“太阳城”，通过出售老年人可以贷款购买的大型养老社区住宅，把高尔夫俱乐部变成老人的日常的生活，开启了美国对积极退休生活的消费（Trolander，2011）。目前，新一代的养老社区正在把消费型的社区变成一个小型的长寿经济体，既通过规模化、集约化的方式满足老年人的基础性和发展性消费，又鼓励老人发挥银发智力继续创作与生产，这大大降低了高品质长寿生活的成本。

与需求改变和供给侧的创新相对应，我们认为共享和生态将成为企业的新组织形式。为了应对长寿时代的挑战，长寿时代的企业需要建立共享机制，以激发组织活力、提升组织效率。工业化时代的企业习惯于标准化的、流程化的、易于执行和管理的工作机制。而伴随长寿时代的到来，多阶段人生使得人们的工作和生活变得更灵活，这种灵活性将使传统企业对流程化、标准化和可预测性的诉求难以得到满足。为了适应这种变化，企业自身的内部型态也需要足够的灵活性来适应未来更多样化的个人职业发展需求。企业传统的雇佣模式将转变为合伙模式，建立利益共享机制，让成员找到归属感、价值感，体现企业家精神，从而最大程度地展现出积极性和创造力。同时，由于长寿时代人口年龄结构柱状特征，各年龄段人口分布均匀，年龄组内和

relax access to establish healthcare services and pension institutions for social capital, and expand investment and financing channels for the medical and nursing industries. The government could also enhance the market-based supervision and establish a system of standards for medical and nursing operations services, and call for equal development and support policies for social and public providers of medical and nursing services. Simultaneously, the government should continue to guide insurance and financial sector to further its payment and product systems, and effectively promote the consumption of health and eldercare services, so that providers can achieve the momentum for continuous, innovative development while at the same time meeting the service needs of the age of longevity. In addition, the government should encourage the education and Internet industries to provide platforms which are more suited to people's multi-level vocational education, interest-oriented learning and social exchange needs in the age of longevity.

At the economic policy level, as we have seen above, in order to mitigate the impact of population ageing on the economy, the government should not only continue to support and encourage technological upgrading. It should also forcefully drive the development of the longevity economy, create new jobs, increase employment flexibility, and provide the necessary conditions for the elderly to continue to participate in economic activity and create social value. This would provide the basis for a comprehensive stimulus of the diverse needs of the elderly population, and improve the quality of the transformation of the industrial structure as well as its adaptability to the age of longevity.

Finally, the government should actively guide individuals to modify their knowledge and behaviour, so that individuals can plan their longevity lifestyles more proactively. The onset of the age of longevity is irreversible. The government can expand educational and publicity efforts, help the population to gain a clearer understanding of the onset of this new era and the challenges that individuals will have to face, and encourage individuals to continue to accumulate human capital, as well as embark on their wealth planning at an earlier stage. As we mentioned earlier, in the age of longevity, an individual's life will no longer be a single linear dimension – individuals will have much greater flexibility, in educational, professional and other areas. In this regard, the government will need to consider more flexible models of social governance and policy making, to help individuals to complete the transition necessary for a non-linear life, and to improve their adaptability.

3. At the corporate level, the transformation of business model and or-

组间的需求趋于多元化，这会带来市场集中度的下降和市场需求的多样化。而面对市场变化，只有建立生态产业体系的企业才能够满足长寿时代客户多样化的需求。在长寿时代，随着信息技术带来的便利，传统的大型企业将有可能被更多的小而精的细分领域的更专业的企业所包围，大型企业将与越来越多的小企业组成生态系统，共同迎接未来的挑战。

我们注意到，相较其他企业，商业保险公司在参与构建长寿时代下的产业体系方面具有独特优势。保险是金融服务业，更是民生产业，与养老、健康产业有天然的交集。一方面商业保险公司可以通过不同类型的保险金的累积，解决不同层级客户未来长期的养老和健康资金需求；另一方面，在长寿时代商业保险公司不仅可以是个人和家庭医养支付资金的重要承担者，是企业和政府采购养老和健康保障计划的产品提供者，更可以成为医疗、养老、健康服务产业创新发展的有力促进者。借用保险资金特有的长期性和稳定性，商业保险公司长期投资支持养老地产、医疗健康产业的发展，不仅能解决上述产业发展的融资问题，也能实现保险资金投资的多元化，更是保险产业链的延伸，建立产业生态取得协同效用。

中国正在迎来长寿时代，中国领先的保险公司都在不同程度上探索企业解决方案。泰康保险集团在 23 年的商业实践中把一家传统的人寿保险公司逐步改造、转变、转型为大健康生态体系，探索出一套应对长寿时代需求与挑战的企业解决方案，具有一定典型性，行业纷纷效仿，已经成为哈佛商学院的教学案例[⑦]，这里我们作为案例加以研究。泰康保险集团股份有限公司成立于 1996 年，至今已发展成为

⑦ 哈佛商学院案例
参见 Kirby, William C., Shu Lin, John P. McHugh, and Yuanzhuo Wang. "From Cradle to Heaven: Taikang Insurance Group." Harvard Business School Case 320−088, February 2020. (Revised March 2020.)

ganisation must be accelerated in order to meet the challenges of the age of longevity

As the living cells of a nation's economy and the main participants in market economic activities, companies can play an extremely significant role with regard to society, government and the individual in the age of longevity. At the same time, the future development of a business will also necessarily be impacted by the age of longevity, and this era will be the one in which businesses resolve their outstanding contradictions, satisfy the population's desire for a better life, and create core values. Social needs in the age of longevity will be based on the needs of the elderly population, and the elderly will need not only to survive, but also make their own vision a reality. Companies will need to gain a profound understanding of this change in needs, and ensure that they innovate in their business. Clayton Christensen, a management scholar at Harvard University, first proposed the theory of disruptive innovation in 1997, pointing out that disruptive innovation is achieving your objective using simpler, easier technologies which are more reliable and more convenient than those presently available (Clayton Christensen, 2014). In order to meet the needs of the elderly in the age of longevity, enterprises will need to continue to reduce their costs, and make products and services for the elderly more convenient and affordable. To give just one example, the development of elder care communities in the US has adopted innovative principles of its kind. In one example, Sun City have made the golf club an everyday destination for pensioners by selling homes in large-scale elder care communities which the elderly can purchase with a mortgage, introducing the consumer concept of active retirement to the USA (Trolander, 2011). Today, this new generation of retirement communities is turning consumer-oriented communities into small-scale, long-lived economic entities, which not only meet the basic and developmental consumption of the elderly through scalability and intensive methods, but also encourage the elderly to make use of their silver-haired wisdom to continue to create and produce, greatly reducing the cost of high-quality, longevity living.

We believe that sharing and the ecology will become a new form of organisation for businesses in response to changing needs and supply-side innovation. In order to meet the challenges of the age of longevity, businesses in the age of longevity will need to establish sharing mechanisms to stimulate organisational vitality and improve organisational efficiency. Businesses in the industrial era have become accustomed to standardised, process-orient-

一家涵盖保险、资管、医养三大核心业务的大型保险金融服务集团。作为保险业首个在全国范围投资养老社区试点企业，该公司已完成北京、上海、广州等 19 个全国重点城市养老社区布局，成为全国最大的高品质连锁养老集团之一。秉承医养融合理念，养老社区内配建以康复、老年医学为特色的康复医院。围绕长寿时代的主题，该公司通过打造长寿、健康、富足三个闭环，构建大健康产业生态体系。其中，长寿闭环指寿险与养老服务构成的闭环，客户购买寿险和年金保障，在养老社区里安享晚年；健康闭环指健康险与医疗服务构成的闭环，客户购买健康保险保障，在医疗体系享受诊疗等健康服务；富足闭环指养老金与资管构成的闭环，客户购买各类财富管理产品实现财富的保值增值，保障自己的医疗和养老需求。我们认为，通过支付加服务，再结合中间的投资积累时间价值，泰康的商业模式构建出不同于传统保险竞争的全新维度，产生比较优势。

从商业模式的角度来看，创新的本质是便捷和实惠。面对长寿时代的挑战，泰康将保险与实体医养相结合，通过专属的年金保险产品“幸福有约”附加养老社区保证入住函的方式，既为客户未来的长寿生活提供足够的资金积累，又提前锁定优质养老社区资源，实现了保险客户与养老服务的链接。在此基础上泰康进一步提出“活力养老、高端医疗、卓越理财、终极关怀”四位一体的全生命周期商业模式，在实体服务方面实现了对老年生命链的整合，目标是使长者们以最优的成本、最高的效率获得最优质的医养康宁全方位服务和体验。同时为了能够配合该商业模式的销售和服务，该公司打造了“健康财富规划师”这一全新职业，幸福有约系列产品、泰康之家养老社区和健康财富规划师三位一体全方位满足长寿时代人们对美好生活的向往。我

ed working mechanisms which are easy to implement and manage. With the advent of the age of longevity, however, a multi-stage life will allow people to work and live more flexibly, and this flexibility will be difficult to meet for traditional businesses with process-oriented, standardised and predictable requirements. In order to adapt to this change, the internal forms of businesses themselves will also need to be flexible enough to adapt to the more diverse personal vocational development needs of the future. Enterprises' traditional employment models will transform into partnership models, and benefit-sharing mechanisms will be established to allow members to find a sense of belonging and value, and reflect an entrepreneurial spirit, thus maximising enthusiasm and creativity. At the same time, because of the pillar-shaped population age structure of the age of longevity, the population will be evenly distributed throughout each age group, and needs within and between different age groups will tend to diversify, which will lead to a reduction in market concentration and a diversification of market demand. In the face of market changes, only businesses which establish an industrial ecology system will be able to satisfy the diverse needs of customers in the age of longevity. In the age of longevity, the convenience provided by information technology will mean that traditional large-scale businesses will very likely be surrounded by greater numbers of specialised businesses in small or sophisticated subsectors. These large-scale enterprises will create an ecological system incorporating ever-increasing numbers of small enterprises in order to meet future challenges.

We note that in comparison with other enterprises, commercial insurance companies have a unique advantage when participating in the construction of an industrial system in the age of longevity. Insurance is a financial services industry, yet it is also a livelihood industry, having natural connections with eldercare and health industries. On the one hand, commercial insurance companies can solve the long-term pension and health funding needs of different levels of customer through the accumulation of different types of insurance funds. On the other, commercial insurance companies in the age of longevity are able to act not only as the disburser of personal and family medical care payments, but also as product providers to corporate- and government-sponsored and pension and health insurance plans. Furthermore, they could become powerful promoters of innovative development in the medical, pensions and healthcare services industries. By leveraging the long-term, stable nature of insurance funds, long-term investment by commercial insurance companies to support the development of eldercare real estate and

们认为，泰康这种模式带来的效率提高和成本降低体现在以下几个方面：首先，养老社区在设计上体现适老化（如采用小户型设计），在建设运营上体现集约化，在连锁经营上从品牌推广到供应链都具有规模经济，这都体现了商业创新的本质；第二，养老社区的连锁运营有利于养老科技的创新和应用，替代部分昂贵人力，这有助于效率的进一步提升，使得居民享受更高质量和便捷的服务；最后，社区居民通过泰康的保险产品提前储蓄，享受复利效应，在入住后可以大大降低财务压力。泰康这种商业模式将使得更多的中产阶级能够负担得起高品质的养老生活，提高支付能力，降低消费成本，更好地追求长寿时代下的愿景，将推动一场养老革命。

作为一个企业面向长寿时代的探索，我们也发现它会对政府政策和社会发展造成深远的影响。近年来国家颁布一系列文件鼓励和支持保险企业为社会服务领域提供长期股本融资、参与养老服务机构的建设运营、引领医养领域的改革发展，比如 2020 年银保监会联合十三部委颁布的《关于促进社会服务领域商业保险发展的意见》就指出，允许商业保险机构有序投资设立中西医等医疗机构和康复、照护、医养结合等健康服务机构；鼓励保险资金与其他社会资本合作设立具备医养结合服务功能的养老机构，增加多样化养老服务供给等等。泰康方案的实践与国家政策的制定颁布相互促进和印证。在社会层面，泰康养老社区正在通过提供长寿服务向社会赋能，尝试成为长寿经济的试验田。在需求端，养老社区致力于提供健康咨询、健康管理等医疗服务，提供高质量的文化活动及交流场所，通过科技应用打造更多适老化设施，实现健康养老、文化养老、智慧养老；在供给端，养老社区为长者们发挥余力反哺社会搭建新的平台，通过提供远程教学、搭

healthcare industry could not only resolve the aforementioned issues regarding the financing of industrial development, but could also bring about the diversification of insurance fund investment. Furthermore, this extension of the insurance industry chain establishes an industrial ecology and achieves synergies.

China is currently ushering in the age of longevity, and the country's leading insurance companies are all to various degrees seeking their own business solutions. The Taikang Insurance Group has, over 23 years of operational practice, gradually changed, transformed and remodelled itself from a traditional life insurance company into an ecological system of Big Health, seeking out a range of corporate solutions which meet the needs and challenges of the age of longevity. This case is representative to a certain degree, and the industry has gradually followed suit, such that it is now a study case at the Harvard Business School [(7)], and we will take a closer look at it here. The Taikang Insurance Group was established in 1996, and has since developed into a major insurance and financial services group covering three core businesses: insurance, asset management and healthcare. The company was the first pilot enterprise in the insurance industry to invest in elderly care communities on a nationwide scale, establishing a network of elderly care communities distributed across 19 key cities in China, including Beijing, Shanghai and Guangzhou, making it one of China's largest high-quality eldercare chain businesses. In line with their integrated concept of healthcare, these elderly care communities incorporate rehabilitation facilities providing rehabilitation and geriatric care. Focusing on the theme of the age of longevity, the company has constructed a ecological system of Big Health by creating three closed loops: longevity, health and wealth. Here, longevity refers to a closed loop of life insurance and eldercare services, in which customers purchase life insurance and annuity insurance, so that they can enjoy their old age in eldercare communities; health refers to a closed loop of health insurance and healthcare services, in which customers purchase health insurance coverage, and receive diagnostic and other medical services within the healthcare system; and wealth refers to a closed loop comprising pension and asset management, in which customers purchase a range of wealth management products in order to ensure that their wealth is preserved and appreciates, thus protecting their own healthcare and eldercare needs. We believe that through payment plus services, combined with intermediate investments to accumulate time value, Taikang's business model constructs an all-new dimension unlike its

(7) For the Harvard Business School School case, see: Kirby, William C., Shu Lin, John P. McHugh, and Yuanzhuo Wang. "From Cradle to Heaven: Taikang Insurance Group." Harvard Business School Case 320-088, February 2020. (Revised March 2020.)

建专家平台等方式让长者们积累的知识经验持续指导社会生产，持续创造价值。

综上所述，泰康方案的本质是用商业方式推动一场养老革命，用市场经济的方法和商业创新来不断提升效率、降低成本，为人类社会进入长寿时代提供应对思路。这不仅是长寿时代的企业解决方案，而且是一种以企业的力量推动社会和政府解决长寿时代挑战的方案。在长寿时代的浪潮之下，中国需要更多企业投入到社会民生工程的建设当中，成长为大健康和大民生工程的核心骨干企业。

traditional insurance competitors, providing it with a competitive advantage.

From a business model perspective, the essence of this innovation is its convenience and affordability. Faced with the challenges of the age of longevity, Taikang has combined insurance with physical healthcare, and uses an exclusive annuity insurance product, "Happiness Guide", together with guaranteed admittance to an eldercare community, thus providing customers with sufficient funds to cover their future longevity. In addition, high-quality eldercare community resources are also locked in in advance, establishing a link between the insurance customer and the eldercare service. On this basis, Taikang further proposes a four-in-one full-lifecycle business model, comprising "vibrant elderly care, high-end medical care, outstanding financial management, and end-of-life care". In terms of physical services, this achieves the integration of the old-age life chain, the aim being to enable the elderly to obtain the highest-quality Kangning healthcare range of services and experience at the lowest cost and with the highest efficiency. At the same time, in order to coordinate the sales and services provided under this business model, the company has created a new career position, of "Health & Wealth Planner (HWP)". This trinity, of the Happiness Guide range of products, the Taikang Community eldercare communities and the Health & Wealth Planner (HWP), effectively satisfy people's yearning for a better life in this age of longevity. We believe that the improvements in efficiency and the reductions in costs brought about by this Taikang model are reflected in the following ways: first of all, the eldercare communities are elder-friendly in terms of their design (for example, in their use of small apartment designs), while also intensifying construction and operations processes, and the operations chain incorporates economies of scale ranging from brand promotion through to supply chains. All of these factors reflect the essence of business innovation. Secondly, the chain operation of the elderly care communities is conducive to the innovation and application of technologies for the elderly, partly replacing expensive manpower, which helps to further improve efficiency, and provides residents with access to higher quality, more convenient services. Finally, community residents save in advance through the use of Taikang's insurance products, benefiting from the compound-interest effect, which greatly reduces their financial pressure after they move in. Taikang's business model will enable greater numbers of middle-class people to afford high-quality old-age living, improve their ability to pay, reduce consumption costs, and more effectively pursue the vision of an age of longevity, which will drive an eldercare revolution.

五、结论

各类数据都在表明世界正在快速变老，人类社会正在进入长寿时代，人口年龄结构将逐步形成新均衡，低死亡率、低生育率、预期寿命稳步提升、人口年龄结构趋向柱状、平台期老龄人口占比超越 1/4 构成了这一时代的五大特征。伴随着长寿时代的到来，带病生存将成为普遍现象，为了使得漫长的长寿生涯可以更加有质量，个体投入在健康上的费用将剧增，庞大的健康需求将促进健康产业的发展和健康产业结构的变化；同时，长寿时代社会储蓄结构及个人财富积累形式将会发生变化，个人将更加依赖投资回报和财富积累来满足养老和健康的需求，长寿时代必将带来健康时代和财富时代。从宏观角度看，当前对于长寿时代对宏观经济的影响有不同的观点：有的认为老龄人口比例增加将导致经济增速放缓，也有最新的研究表明长寿时代未必会导致经济增速下行。长寿时代下社会经济的发展既面临挑战，如社会创新效率受限以及财富不平等程度加深等，又存在机遇，尤其是适应长寿时代社会经济结构的是更有活力的长寿经济，老年人的价值将被重新认识、定位和发掘。日本目前是全球人口老龄化最严重的国家之一，长寿时代下的日本劳动力、社会经济发生了深刻变化，对中国应对长寿时代的冲击具有经验启示。从日本经验可以推知通过提高人力资本、加快技术引导、促进社会公平、建设有效的资本市场、引入长寿经济创造第三次人口红利等可以有效促进经济发展。长寿时代已经来临，相比其他国家，中国人口基数大、老龄人口增长进程愈发加速，但人均收入及储蓄均不及同时期发达国家，难以支撑个人退休后的健康和养老消费水平，长寿时代的到来对中国社会和经济的影响程度更

As a company facing the age of longevity, we have also found that this will have a profound impact on government policy and social development. In recent years, the state has promulgated a series of documents encouraging and supporting insurance enterprises to provide long-term equity financing in the social services sector, to participate in the construction and operation of eldercare institutions, and to lead the reform and development of the medical and nursing fields. For example, in 2020, Opinions on Promoting the Development of Commercial Insurance in the Field of Social Services, promulgated by the China Banking and Insurance Regulatory Commission in conjunction with 13 ministries, noted that commercial insurance institutions should be allowed to invest in the establishment of medical institutions providing Traditional Chinese and Western medical services, as well as institutions which provide a combination of rehabilitation, care, medical, nursing and other healthcare services. Insurance funds should be encouraged to cooperate with forms of other social capital to establish eldercare institutions which provide integrated medical and eldercare services, and increase the supply of diversified eldercare services, inter alia. Practice in the Taikang programme and the formulation and promulgation of state policy provide mutual promotion and confirmation. At the social level, Taikang eldercare communities empower society through the provision of longevity services, as they attempt to become a test sector for the longevity economy. On the demand side, the eldercare communities are committed to providing medical services such as health consultancy and management, and also provide high-quality cultural activities and venues for residents to meet in. Science and technology is being applied to create more elder-friendly facilities, and achieve health-focused, culture-oriented, smart elder care. On the supply side, the eldercare communities provide a new platform on which the elderly can apply their abilities and give back to society. Through the provision of distance teaching and the establishment of expertise platforms, inter alia, the accumulated knowledge and experience of these elders continue to guide social production, and to create value.

In summary, the essence of the Taikang programme is to promote an eldercare revolution using commercial methods, and continuously increase efficiency and reduce costs using market economy and business innovation in order to provide an appropriate line of thinking for human society as it enters the age of longevity. This is not only an enterprise solution for the age of longevity, but also a solution which leverages the power of business to promote

大，重新规划长寿时代个体全生命周期的安排，是社会、政府、企业都需要考虑的问题。中国的企业已经在积极探索长寿时代的解决方案，为中国乃至全球面对长寿时代的挑战和机遇提供了一种以企业实践推动社会变革的可持续稳定发展方案。

本文系统性地阐述了长寿时代的特征与形成，扩充并丰富了其内涵与外延，对相关的学术理论进行了详实的研究，并从动态视角探讨了长寿时代的挑战和机遇，提出了对中国应对策略的建议，初步提出了解决方案的设想和具体商业实践。在长寿时代的理论框架下，下一步需进一步扩充完善长寿时代相关的人口学、健康经济学、长寿经济等学术理论的研究，深入解析长寿经济的需求结构和生产方式，延伸丰富长寿时代解决方案的实践探索，重点探讨在中国社会经济发展的背景下如何前瞻性地根据长寿时代的理论推动社会产业结构的变化，引领商业企业的发展变革，解决长寿时代可能带来的各种社会问题。

social and governmental solutions to the challenges of the age of longevity. In the face of the age of longevity wave, China needs more companies to invest in the construction of social livelihood projects, and grow into core backbone Big Health and Big Livelihood businesses.

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E. Conclusion

Extensive data indicates that the world is ageing rapidly, and that human society it is now entering an age of longevity. The population age structure will gradually arrive at a new steady state with five major characteristics: low mortality, low fertility, steadily increasing life expectancy, a population age structure tending to become pillar-shaped, and an elderly proportion of the population which exceeds one quarter of the total during the plateau period. With the onset of the age of longevity, survival with illness will become a common phenomenon. In order to ensure a higher level of quality for their longer lives, the personal expenditures in healthcare will rise sharply, and massive demand for healthcare will promote the development of the health industry as well as changes in the health industry's structure. At the same time, the social savings structure and the forms by which individual wealth is accumulated in the age of longevity will change, and individuals will rely more on investment returns and the accumulation of wealth to meet their eldercare and healthcare needs. The age of longevity will inevitably also bring an era of health and an era of wealth. From a macro perspective, there are currently a range of views on the impact of the age of longevity on the macro-economy: some believe that the increase in the proportion of the elderly population will lead to a slowdown in economic growth, while some recent studies indicate that the age of longevity may not necessarily lead to a decline in the economic growth rate. In the age of longevity, socio-economic development will face challenges, such as the limited efficiency of social innovation and deepening wealth inequality, inter alia. Nonetheless, there are also opportunities, particularly for more vibrant longevity economies, which are better adapted to the socio-economic structure of the age of longevity. The value of the elderly will be re-recognised, positioned and discovered. Japan is currently one of the countries with the oldest population worldwide. In the age of longevity, Japan's labour force, society and economy have undergone profound changes, a fact which has empirical implications for China as it deals with the impact of the age of longevity. It can be inferred from the Japanese experience that economic development can be effectively promoted by increasing human capital, accelerating technological guidance, promoting social equity, building effective capital markets, and ushering in a longevity economy to create a third demographic dividend, amongst others. The age

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of longevity has already arrived. Compared with other countries, China has a large population base, and population ageing is accelerating. However, its per capita income and savings are not as high as those of developed countries when they were at a similar stage of demographic transition, and it will face difficulties supporting the healthcare and eldercare consumption of individuals once they retire. The arrival of the age of longevity will have a greater impact on China's society and economy, and re-planning the arrangements for the entire lifespan of an individual in the age of longevity is an issue which society, government and companies need to consider. Chinese companies are already actively exploring solutions to the age of longevity by leveraging corporate practice to drive social change in order to provide sustainable, stable development for China and the rest of the world in the face of the challenges and opportunities of the age of longevity.

This article has provided a systematic explanation of the characteristics and causes of the age of longevity, expanding and elaborating its meaning and connotations. It also provides detailed research into the associated academic theories, and discusses the challenges and opportunities posed by the age of longevity from a dynamic view. It provides suggestions for China's strategic response, and puts forward preliminary ideas for solutions and specific business practice. Within the theoretical framework of the age of longevity, the next step will be to further expand and enhance research into academic theories on the age of longevity, including demography, health economics and the longevity economy, inter alia, in-depth research of the demand structure and means of production of the longevity economy, as well as extend the practical exploration of solutions for the age of longevity, focusing on a discussion of ways to proactively drive change in social and industrial structures, direct the development and change of commercial enterprises, and solve the various social issues that the age of longevity may bring based on age of longevity theory within the context of China's socio-economic development.

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长寿时代关键词汇
中英文对照

active ageing	积极老龄化
age of longevity	长寿时代
age of negative interest rate	负利率时代
ageing	老龄化
all stages of life cycle	全生命周期
artificial intelligence	人工智能
benefit-sharing mechanism	利益共享机制
capital deepening	资本深化
capital formation rate	资本形成率
capital-labour ratio	资本劳动比
chronic diseases	慢性疾病
chronic non-communicable diseases	慢性非传染性疾病
class solidification	阶级固化
closed loop of wealth	富足闭环
closed loop of health	健康闭环
closed loop of longevity	长寿闭环
compound-interest effect	复利效应
core backbone business	核心骨干企业
corporate transformation	企业转型
culture-oriented elderly care	文化养老
demographic dividend	人口红利
demographic transition	人口转变
dependency ratio	抚养比
disability adjusted life year (DALY)	伤残调整生命年
ecological system of Big Health	大健康生态体系
economic model	经济模式
eldercare revolution	养老革命
elderly-friendly	适老化
employment model	雇佣模式
end-of-life care	终极关怀
entrepreneurial spirit	企业家精神
epidemiological transition	流行病学转变
era of wealth	财富时代
financial services industry	金融服务业
first demographic dividend	第一次人口红利
four-in-one	四位一体
full-lifecycle business model	全生命周期商业模式

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Gini coefficient	基尼系数
guaranteed admittance	保证入住函
Happiness Guide	幸福有约
Health & Wealth Planner (HWP)	健康财富规划师
health economy	健康经济
health-focused elderly care	健康养老
healthy life expectancy	健康期望寿命
high-end medical care	高端医疗
household wealth structure	居民财富结构
industrial change	产业变革
Industrial Era	工业化时代
industrial structure	产业结构
infectious diseases	传染性疾病
inflation	通货膨胀
integrated medical and eldercare services	医养融合
labour productivity	劳动生产率
labour shortage	劳动力短缺
labour-intensive	劳动密集型
life expectancy	预期寿命
life planning	人生规划
livelihood project	大民生工程
longevity economy	长寿经济
long-lived economic entity	长寿经济体
long-term equity financing	长期股本融资
long-term returns on investment	长期投资收益率
low birth rate	低生育率
low mortality	低死亡率
Malthusian theory	马尔萨斯主义理论
median age of population	人口中位数
middle class	中产阶级
MIT's AgeLab	麻省理工学院老龄实验室
new steady state	新均衡
old-age dependency ratio	老年抚养比
old-age life chain	老年生命产业链
old-age wealth accumulation	养老财富积累
outstanding financial management	卓越理财
partnership model	合伙模式
pension adequacy ratio	养老金充足率
pension and services system	养老制度和服务体系
pension replacement rate	养老金替代率
pillar-shaped population age structure	人口年龄柱状结构
population age structure	人口年龄结构

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population decline theory	人口衰竭理论
population replacement rate	人口替代率
post-industrial era	后工业化时代
pyramidal population age structure	人口年龄结构金字塔
quality of the labour force	劳动力素质
rate of survival	生存率
rehabilitation facility	康复医院
replacement rate	替代率
return on investment	投资回报率
second demographic dividend	第二次人口红利
sense of belonging	归属感
sense of value	价值感
shrinkage of the labour force	劳动力减少
silver-haired economy	银发经济
silver-haired wisdom	银发智力
smart elderly care	智慧养老
social governance model	社会治理模式
social inequality	社会不平等
social innovation	社会创新效率
social security system	社会保障体系
spectrum of human disease	疾病谱
Taikang Community	泰康之家
Taikang Insurance Group Inc.	泰康保险集团股份有限公司
technology-intensive	技术密集型
The American Association of Retired Persons (AARP)	美国退休人员协会（AARP）
the disability-adjusted life year	伤残调整生命年
third demographic dividend	第三次人口红利
three pillars of pension	养老金三支柱
total factor productivity	全要素生产率
total fertility rate	总和生育率
transformation of the industrial structure	产业结构转型
vibrant elderly care	活力养老
wealth accumulation	财富储备
wealth management	财富管理
years lived with disability (YLD)	残疾生命年数
years of life lost (YLL)	寿命损失年数