

In an interview with CBS News, the president of the United States was asked if the nation's dire unemployment problem was likely to improve soon. "There's no magic solution," he replied. "To even stand still we have to move very fast." By this, he meant that the economy needs to create tens of thousands of new jobs every month just to keep pace with population growth and prevent the unemployment rate from rising even further. He pointed out that "we have a combination of older workers who have been thrown out of work because of technology and younger people coming in" with too little education. The president proposed a tax cut to stimulate the economy, but he kept returning to the subject of education—in particular, advocating support for programs focused on "vocational education" and "job retraining." The problem, he said, wasn't going to solve itself: "[T]oo many people are coming into the labor market and too many machines are throwing people out."<sup>1</sup>

The president's words capture the conventional—and nearly universal—assumption about the nature of the unemployment problem: more education or more vocational training is always the solution. With the proper training, workers will continuously climb the skills ladder, somehow staying just ahead of the machines. They will do more creative work, more "blue-sky" thinking. There is apparently no limit to what average people can be educated and trained to do—and likewise no limit to the number of high-level jobs the economy can create to absorb all these newly trained workers. Education and retraining, it seems, are a solution that is immutable across time.

For those who hold this view, it is perhaps of little import that the president quoted above was named Kennedy and the date was September 2, 1963. As President Kennedy noted, the unemployment rate at the time was about 5.5 percent, and machines were confined almost exclusively to "taking the place of manual labor." Seven months after the interview took place, the Triple Revolution report would land on a new president's desk. It would be another four years before Dr. King would make his own reference to technology and automation in Washington National Cathedral. In the nearly half-century since then, belief in the promise of education as the universal solution to unemployment and poverty has evolved hardly at all. The machines, however, have changed a great deal.

### Diminishing Returns to Education

If we were to draw a graph of the gains from ever-increasing investment in education, it seems very likely that we would end up with something that looks like the S-curves we discussed in Chapter 3. The low-hanging fruit of further education is long behind us. High school graduation rates have leveled off at roughly 75 to 80 percent. Most standardized test scores have shown little or no improvement in recent decades. We are on the flat part of the curve, where continued progress will be at best **incremental** (increasing).

An abundance of evidence suggests that many of the students now attending American colleges are academically unprepared for or, in some cases, simply ill-suited to college-level work. Of these, a large share will fail to graduate but very often will nonetheless walk away with daunting student loan burdens. Of those who do graduate, as many as half will fail to **land** (赢得难得的工作) a job that actually requires a college degree, whatever the job description might say. Overall, about 20 percent of US college graduates are considered overeducated for their current occupation, and average incomes for new college graduates have been in decline for more than a decade. In Europe, where many countries provide students with college educations that are free or nearly so, roughly 30 percent of graduates are overqualified for their jobs.<sup>2</sup> In Canada, the number is about 27 percent.<sup>3</sup> In China, a remarkable 43 percent of the workforce is overeducated.<sup>4</sup>

In the United States, the conventional wisdom tends to put most of the blame on students and educators. College students are said to spend too much time socializing and too little time studying. They are choosing fields with easy classes, rather than graduating with degrees in more rigorous technical fields. Yet, as many as a third of American students who do obtain a degree in engineering, science, or other technical fields fail to find a position that utilizes their educational background.<sup>5</sup>

Steven Brint, a sociologist at the University of California, Riverside, who has written extensively on higher education, argues that US colleges actually graduate students who are relatively well-matched to the available job opportunities. Brint notes that "a few jobs require specialized skills that can only be acquired in technical programs, but most jobs are relatively routine." "Following the directives of supervisors is essential" and "reliability and steady effort are highly valued." He concludes that "dedicated work is not required in college because it will not be required at work. In most jobs, showing up and doing the work is more important than achieving outstanding levels of performance"<sup>6</sup> If you were to purposely set out to describe the characteristics of a job vulnerable to automation, it would be hard to do much better than that.

The reality is that awarding more college degrees does not increase the fraction of the workforce engaged in the professional, technical, and managerial jobs that most graduates would like to land. Instead, the result very often is credential inflation; many occupations that once required only a high school diploma are now open only to those with a four-year college degree, the master's becomes the new bachelor's, and degrees from non-elite schools are devalued. We are running up against a fundamental limit both in terms of the capabilities of the people being herded into colleges and the number of high-skill jobs that will be available for them if they manage to graduate. The problem is that the skills ladder is not really a ladder at all: it is a pyramid, and there is only so much room at the top.

Historically, the job market has always looked like a pyramid in terms of worker skills and capabilities. At the top, a relatively small number of highly skilled professionals and entrepreneurs have been responsible for most creativity and innovation. The vast majority of the workforce has always been engaged in work that is, on some level, relatively routine and repetitive. As various sectors of the economy have mechanized or automated, workers have transitioned from routine jobs in one sector to routine jobs in another. The person who would have worked on a farm in 1900, or in a factory in 1950, is today scanning bar codes or stocking shelves at Walmart. In many cases, this transition has required additional training and upgraded skills, but the work has nonetheless remained essentially routine in nature. So, historically, there has been a reasonable match between the types of work required by the economy and the capabilities of the available workforce.

It's becoming increasingly clear, however, that robots, machine learning algorithms, and other forms of automation are gradually going to consume much of the base of the job skills pyramid. And because artificial intelligence applications are poised to increasingly **encroach** (invade) on more skilled occupations, even the safe area at the top of the pyramid is likely to **contract** (shrink) over time. The conventional wisdom is that, by investing in still more education and training, we are going to somehow cram everyone into that shrinking region at the very top.<sup>1</sup> I think that assuming this is possible is analogous to believing that, in the wake of the mechanization of agriculture, the majority of displaced farm workers would be able to find jobs driving tractors. The numbers simply don't work.

American primary and secondary education, of course, also has major problems. Inner-city high schools have staggering dropout rates, and children in the most poverty-stricken areas are at a significant disadvantage even before they enter the school system. Even if we could wave a magic wand and give every American child a top-notch education, that would only

---

<sup>1</sup> Keep in mind that many of these higher-skill jobs may also be threatened by **offshoring** (**outsourcing** 外包).

mean more high school graduates entering college and competing for the limited number of jobs at the top of the pyramid. That's not to say we shouldn't wave the wand, of course: we should—but we shouldn't expect it to solve all our problems. Needless to say, the magic wand doesn't exist, and although there is a universal consensus that we need to improve our schools, it exists at only the most superficial level. Start talking about more money for schools, charter schools, firing bad teachers, paying good teachers more, longer school days (or years), or vouchers for (finance) private schools, and the situation will rapidly degrade into political intractability (tough thing).

### The Anti-Automation View

Another often-proffered solution is simply to try to put a stop to this relentless progression toward ever more automation. At its most blunt, this might take the form of a union resisting the installation of new machinery in a factory, warehouse, or supermarket. There is also a more nuanced intellectual argument which says that too much automation is simply bad for us—and quite possibly dangerous.

Nicholas Carr is perhaps the best-known proponent of this view. In his 2010 book *The Shallows*, Carr argues that the Internet may be having a negative impact on our ability to think. In a 2013 article for *The Atlantic*, entitled "All Can Be Lost: The Risk of Putting Our Knowledge in the Hands of Machines," he makes a similar argument about the impact of automation. Carr complains about the "the rise of 'technology-centered automation' as the dominant design philosophy of computer engineers and programmers" and believes that this "philosophy gives precedence to the capabilities of technology over the interests of people." <sup>7</sup>

Carr's Atlantic article includes a number of anecdotes demonstrating how automation can erode human skills, in some cases with disastrous consequences. Some are a bit arcane (mysterious): for example, Inuit hunters in Northern Canada are losing a 4,000-year-old ability to navigate in a frigid environment as they search for game because they are now relying on GPS. Carr's best examples, however, are drawn from aviation. The paradox of increased cockpit automation is that, while the technology reduces the cognitive burden on pilots and almost certainly contributes to a better overall safety record, it also means that pilots spend less time actively flying the plane. In other words, they get less practice and, over time, the nearly instinctual reactions that professional pilots develop over countless hours of training can begin to degrade. Carr worries that a similar effect is likely to cascade across offices, factories, and other workplaces as automation continues its advance.

This idea that engineering "design philosophy" is the problem has also been embraced to some degree by economists. MIT's Erik Brynjolfsson, for example, has called for a "New Grand Challenge for Entrepreneurs, Engineers and Economists" to "invent complements (addition), not substitute[s] for labor" and "replace [the] labor saving and automation mindset with [a] maker and creator mindset." <sup>8</sup>

Suppose that a start-up company were to rise to Brynjolfsson's challenge and build a system specifically designed to keep people in the loop. A competitor designs a system that is fully automated, or at least requires minimal human intervention. In order for the more people-oriented system to be economically competitive, one of two things has to be true. Either it has to be significantly less expensive, to offset the increased labor costs, or it has to produce results so superior that they deliver substantially greater value to customers and ultimately generate enough additional revenue to make those extra costs appear to be a rational investment. There are good reasons to be skeptical that either case would be true in the vast majority of circumstances. In the case of white-collar automation, both systems would be composed primarily of

software, so there would be little reason for a major cost differential. It's possible that, in a few areas central to a business's primary focus, the people-oriented system might have a meaningful advantage (and ability to generate more revenue over the long run), but for the majority of more routine operational activities, where simply showing up is more important than doing an outstanding job, this again seems unlikely.

Furthermore, this simple cost comparison very likely understates the bias toward automation. Every new worker a business hires adds to a whole slew of peripheral costs. The more workers you have, the more managers and human resources staff you need. Workers likewise need offices, equipment, and parking spaces. Workers also introduce uncertainty: they get sick, perform poorly, take vacation, have car trouble, quit entirely, and generally run into a myriad of other potential issues.

Every new worker you hire also comes with a serving of potential liability. An employee might get hurt at work—or might somehow harm someone else. There's also the risk of reputational harm to the business. If you want to see some major corporate brands take a beating, try Googling the phrase "delivery driver throws package."

The bottom line is that, despite all the rhetoric about "job creators," rational business owners do not want to hire more workers: they hire people only because they have to. The progression toward ever more automation is not an artifact of "design philosophy" or the personal preferences of engineers: it is fundamentally driven by capitalism. The "rise of 'technology-centered automation'" that Carr worries about took place at least two hundred years ago, and the Luddites were unhappy about it. The only difference today is that exponential progress is now pushing us toward the endgame. For any rational business, the adoption of labor-saving technology will almost invariably prove to be irresistible. Changing that would require far more than an appeal to engineers and designers: it would require modifying the basic incentives built into the market economy.

Some of the concerns raised by Carr are real, but the good news is that in the most important areas we already have safeguards in place. The most dramatic examples of automation-related risks are those that threaten lives or lead to potential catastrophe. Aviation comes up again and again. Yet these areas are already subject to extensive regulation. The aviation industry has been aware of the interaction between cockpit automation and pilot skill levels for years and has presumably incorporated this knowledge into its training procedures. There is no question that the overall safety record of the modern aviation system is astonishing. Some technologists foresee aircraft automation taken to the extreme. Sebastian Thrun, for example, recently told the New York Times that "airline pilot" would be a "profession of the past" in the not-too-distant-future.<sup>9</sup> I really don't think we will see three hundred people filing onto an airplane with no pilots onboard anytime soon. The combination of regulation, potential liability, and simple acceptance on the part of society is certain to create powerful headwinds in occupations that are directly tied to public safety. It will be the tens of millions of other jobs—the fast food workers, the office drones, and all the rest—where the impact of automation on employment is likely to be most dramatic. In these areas, a potential technical failure or an erosion of skill has far less spectacular consequences, and there are relatively few barriers to a relentless progression toward full automation—driven, of course, by market incentives.

Throughout our economy and society, machines are gradually undergoing a fundamental transition: they are evolving beyond their historical role as tools and, in many cases, becoming autonomous workers. Carr views this as dangerous and would presumably like to somehow put a stop to it. The reality, however, is that the astonishing wealth and comfort we have achieved in modern civilization are a direct result of the forward march of technology—and the relentless drive toward ever more efficient ways to economize on human labor has arguably been the single most important factor powering that progress. It's easy to claim that you are against the idea of too much automation, while still not being anti-technology in the

general sense. In practice, however, the two trends are inextricably tied together, and anything short of a massive—and certainly ill-advised—intrusion of government into the private sector seems destined to fail at any attempt to halt the inevitable, market-driven rise of autonomous technology in the workplace.

### The Case for a Basic Income Guarantee

If we accept the idea that ever more investment in education and training is unlikely to solve our problems, while calls to somehow halt the rise of job automation are unrealistic, then we are ultimately forced to look beyond conventional policy prescriptions. In my view, the most effective solution is likely to be some form of basic income guarantee.

A basic, or guaranteed minimum, income is far from a new idea. In the context of the contemporary American political landscape, a guaranteed income is likely to be **disparaged**(scorn) as "socialism" and a massive expansion of the welfare state. The idea's historical origins, however, suggest something quite different. While a basic income has been embraced by economists and intellectuals on both sides of the **political spectrum**(政治谱系), the idea has been advocated especially forcefully by conservatives and libertarians. Friedrich Hayek, who has become an iconic figure among today's conservatives, was a strong proponent of the idea. In his three-volume work *Law, Legislation and Liberty*, published between 1973 and 1979, Hayek suggested that a guaranteed income would be a legitimate government policy designed to provide insurance against **adversity**(disaster), and that the need for this type of safety net is the direct result of the transition to a more open and mobile society where many individuals can no longer rely on traditional support systems:

*There is, however, yet another class of common risks with regard to which the need for government action has until recently not been generally admitted. . . . The problem here is chiefly the fate of those who for various reasons cannot make their living in the market . . . that is[,] all people suffering from adverse conditions which may affect anyone and against which most individuals cannot alone make adequate protection but in which a society that has reached a certain level of wealth can afford to provide for all.*

*The assurance of a certain minimum income for everyone, or a sort of floor below which nobody need fall even when he is unable to provide for himself, appears not only to be a wholly legitimate protection against a risk common to all, but a necessary part of the Great Society in which the individual no longer has specific claims on the members of the particular small group into which he was born.* <sup>10</sup>

Those words might well come as something of a surprise to those conservatives who buy into the currently fashionable extreme right-wing caricature of Hayek. To be sure, when Hayek uses the words "Great Society" he means something quite different from what Lyndon Johnson envisioned when he used the same phrase. Rather than an ever-expanding welfare state, Hayek saw a society based on individual freedom, market principles, the rule of law, and limited government. Still, his reference to "the Great Society" as well as his recognition that "a society that has reached a certain level of wealth can afford to provide for all" seems to stand in stark contrast to today's more extreme conservative views, which are more likely to embrace Margaret Thatcher's statement that "there is no such thing as society."

Indeed, a proposal for a guaranteed income would today almost certainly be attacked as a liberal mechanism for attempting to bring about "equal outcomes." Hayek himself explicitly rejected this, however, writing that "it is unfortunate that the endeavor to secure a uniform minimum for all who cannot provide for themselves has become connected with the

wholly different aims of securing a 'just' distribution of incomes "<sup>11</sup> For Hayek, a guaranteed income had nothing to do with equality or "just distribution"—it was about insurance against adversity as well as efficient social and economic function.

I think one of the primary takeaways from Hayek's view is that he was fundamentally a realist rather than an ideologue(空想家). He understood that the nature of society was changing; people had moved from farms, where they were largely self-sufficient, to cities, where they depended on jobs, and extended family structures were breaking down—leaving individuals to assume higher risks. He had no problem with a role for government in helping to insure against those risks. This idea that the role of government can evolve over time is, of course, highly applicable to the challenges we face today.<sup>2</sup>

The conservative argument for a basic income centers on the fact that it provides a safety net coupled with individual freedom of choice. Rather than having government intrude into personal economic decisions, or get into the business of directly providing products and services, the idea is to give everyone the means to go out and participate in the market. It is fundamentally a market-oriented approach to providing a minimal safety net, and its implementation would make other less efficient mechanisms—the minimum wage, food stamps, welfare, and housing assistance—unnecessary.

If we adopt Hayek's pragmatism and apply it to the situation likely to develop in the coming years and decades, it seems very likely that government will ultimately be called upon to take some type of action in the face of the increased risks to individual economic security brought about by advancing technology. If we reject Hayek's market-oriented solution, then we'll inevitably end up with an expansion of the traditional welfare state, along with all the problems that accompany it. It's easy to imagine the eventual rise of vast new bureaucracies geared toward feeding and housing masses of economically disenfranchised people—perhaps in dystopian quasi-institutional environments.

Indeed, this is very likely the path of least resistance—and the default if we simply do nothing. A basic income would be efficient and would have relatively low administrative costs. A bureaucratic expansion of the welfare state would be far more expensive on a per capita basis, and far more unequal in its impact. It would almost certainly help fewer people, but it would create a number of traditional jobs, some of which would be very lucrative. There would also be abundant opportunities for private-sector contractors to jump on the gravy train(a path to make a lot of money without much effort). These elite beneficiaries—the high-level administrators, the private-company executives—are sure to exert substantial political pressure for things to evolve along this path.

There are, of course, plenty of examples of this kind of thing already. Massive weapons programs that the Pentagon does not want are protected by Congress because they create a small number of jobs (relative to their enormous costs) and pad(填补) the profits of large corporations. The United States has a staggering 2.4 million people locked up in jails and prisons—a per capita incarceration(监禁) rate more than three times that of any other country and more than ten times that of advanced nations like Denmark, Finland, and Japan. As of 2008, about 60 percent of these people were nonviolent

---

<sup>2</sup> The idea that both government and society must evolve with the times is echoed by another conservative icon. Here's a quote from Thomas Jefferson, which is engraved into panel #4 of the Jefferson Memorial: "I am not an advocate for frequent changes in laws and constitutions, but laws and institutions must go hand in hand with the progress of the human mind. As that becomes more developed, more enlightened, as new discoveries are made, new truths discovered and manners and opinions change, with the change of circumstances, institutions must advance also to keep pace with the times. We might as well require a man to wear still the coat which fitted him when a boy as civilized society to remain ever under the regimen of their barbarous ancestors."

offenders, and the annual per capita cost of housing them was about \$26,000. <sup>12</sup> Powerful elites—including, for example, prison guards' unions and executives at the private corporations that operate many prisons—have strong incentives to ensure that the United States remains an extreme outlier in this area.

For progressives, a guaranteed income may be an easier sell in the current political environment. Despite Hayek's argument to the contrary, many liberals would likely embrace the idea as a method to achieve more social and economic justice. A basic income could effectively become a **brute-force**(蛮力的) algorithm designed to alleviate poverty and mitigate income inequality. At a stroke of the presidential pen, extreme poverty and homelessness in the United States might effectively be eradicated.

### Incentives Matter

The most important factor in designing a workable guaranteed income scheme is getting the incentives right. The objective should be to provide a universal safety net as well as a supplement to low incomes—but without creating a disincentive to work and to be as productive as possible. The income provided should be relatively minimal: enough to get by, but not enough to be especially comfortable. There is also a strong argument for initially setting the income level even lower than this and then gradually increasing it over time after studying the impact of the program on the workforce.

There are two general approaches to implementing a guaranteed income. An unconditional basic income is paid to every adult citizen regardless of other income sources. Guaranteed minimum incomes (and other variations, such as a negative income tax) are paid only to people at the bottom of the income distribution and are phased out as other income sources rise. While the second alternative is obviously less expensive, it carries with it the danger of disastrous perverse incentives. If the guaranteed income is **means-tested**(经过调查的) at relatively low income levels, recipients will see an effective tax rate on any further earnings that can reach **confiscatory**(没收的) levels. In other words, they can fall into a "poverty trap" where there is little or no benefit to working harder. Perhaps the worst possible example of this occurs with the Social Security disability program, which many people likely attempt to utilize as a kind of guaranteed income when their other options are exhausted. Once a person is approved for disability payments, any attempt to work beyond that point carries the danger of losing both the income and the accompanying health care benefits. As a result, virtually no one who gets into the program ever works again.

Clearly, if a guaranteed income is means-tested, then this should happen at a relatively high level, preferably well into middle-class territory. A person who decides to **forego**(放弃) other earning opportunities then faces a long fall. Another good idea would be to discriminate between active and passive income. A guaranteed income might be means-tested aggressively against passive income such as a pension, investment income, or Social Security. Active income like wages from a job, self-employment income, or earnings from a small business either would not be means-tested at all or would occur at a much higher level. This should ensure a consistent incentive for everyone to work as hard as possible, given the opportunities available.

A guaranteed income scheme would also be likely to create a number of more subtle incentives for both individuals and families. Conservative social scientist Charles Murray's 2006 book *In Our Hands: A Plan to Replace the Welfare State* argues that a guaranteed income would be likely to make non-college-educated men more attractive marriage partners. This group has been the hardest hit by the impact of both technology and factory offshoring on the job market. A guaranteed income might help increase marriage rates among lower-income groups, while helping to reverse the trend toward more

children being raised in single-parent households. It would also, of course, make it more feasible for one parent to choose to stay at home with young children. These are all things that might appeal to people across the political spectrum. .

Beyond this, I think there are compelling reasons to go further . and build some explicit incentives into a basic income program. The most important of these would be geared toward education, especially at the high school level. Recent data shows that there continues to be a strong economic incentive to pursue a college degree. However, the unfortunate reality is that this is the case not so much because opportunities for college graduates are expanding dramatically but because prospects for those with only a high school diploma are collapsing. I think this creates a real danger that, for a significant number of people who are not destined to graduate from college, the incentive to complete high school may be diminished. If a struggling high school student knows that he will receive a guaranteed income regardless of whether or not he graduates, that obviously creates a very powerful perverse incentive. Therefore, we ought to pay a somewhat higher income to those who earn their high school diploma (or the equivalent through testing).

The general idea is that we should value education as a public good. We all benefit when the people around us are more educated; this generally results in a more civil society as well as a more productive economy. If we are destined to transition into an era where traditional work becomes less available, then an educated population will be in a better position to find constructive uses for leisure time. Technology is creating many opportunities to spend time in productive ways. Wikipedia has been built through countless hours of labor by unpaid contributors. The open source software movement offers another example. Many people start small online businesses to supplement their income. Yet, in order to successfully participate in such activities you need to reach a minimal educational threshold.

Other incentives might also be implemented. For example, a higher income might be paid to those who volunteer for community service activities or participate in environmental projects. When I suggested building explicit incentives of this type into a guaranteed income in my previous book, *The Lights in the Tunnel*, I received a fair amount of pushback from more libertarian readers who strongly objected to the idea of an intrusive "nanny state." Nonetheless, I think there are some basic incentives—most critically education— that nearly everyone ought to be able to agree on. The essential idea is to replicate (albeit artificially) some of the incentives associated with traditional jobs. In an age when more education may not always lead to an improved career path, it's important to ensure that everyone has a compelling reason to at least complete high school. To me, the resulting advantages to society seem obvious. Even Ayn Rand, if she were rational, would presumably perceive a personal benefit in being surrounded by people with a higher level of education and more options for constructive use of their free time.

### The Market as a Renewable Resource

Aside from the need to provide a basic safety net, I think there is a powerful economic argument for a guaranteed income. As we saw in Chapter 8, increasing technology-driven inequality is likely to threaten broad-based consumption. As the job market continues to erode and wages stagnate or fall, the mechanism that gets purchasing power into the hands of consumers begins to break down, and demand for products and services suffers.

To visualize the problem, I find it useful to think of markets as renewable resources. Imagine a consumer market as a lake full of fish. When a business sells products or services into the market, it catches fish. When it pays wages to its employees, it tosses fish back into the lake. As automation progresses and jobs disappear, fewer fish get returned to the lake. Again, keep in mind that nearly all major industries are dependent on catching large numbers of moderately sized fish. Increasing inequality will result in a small number of very large fish, but from the point of view of most mass-market



industries these aren't worth a whole lot more than normal-sized fish. (The billionaire is not going to buy a thousand smart phones, cars, or restaurant meals.)

This is what's known as a classic "tragedy of the commons" problem. The vast majority of economists would likely agree that a situation like this calls for some kind of government intervention. In the absence of this, there is no individual incentive to do anything except catch as many fish as possible. Real-world fishermen may understand fully that their lake or ocean is being over-fished and that their livelihoods will soon be threatened, but they will nonetheless go out every day and maximize their catch because they know their competitors will do the same. The only viable solution is to have some regulatory authority step in and impose limits.

In the case of our consumer market, we don't want to limit the number of virtual fish that businesses can catch. Instead, we want to make sure the fish get replenished. A guaranteed income is one very effective way to do this. The income gets purchasing power directly into the hands of lower- and middle-income consumers.

If we look further into the future and assume that machines will eventually replace human labor to a substantial degree, then I think some form of direct redistribution of purchasing power becomes essential if economic growth is to continue. In a May 2014 paper on the future of American economic growth, economists John G. Fernald and Charles I. Jones speculated that robots could "increasingly replace labor in the production function for goods." They then go on to suggest that "in the limit, if capital can replace labor entirely, growth rates could explode, with incomes becoming infinite in finite time"<sup>13</sup> This strikes me as a **nonsensical** (meaningless) result; it's the kind of thing you get by plugging numbers into an equation without really thinking through the implications. If machines substitute for workers entirely, then no one has a job or an income from any type of labor. The vast majority of consumers have no purchasing power. So how can the economy keep growing? Perhaps the tiny percentage of people with significant capital ownership could do all the consuming, but they would need to continuously purchase goods and services of staggering value in order to keep the global economy growing.<sup>3</sup> And this, of course, is the "techno-feudalism" scenario we looked at in Chapter 8—not an especially hopeful outcome.

There is, however, a more optimistic view. Perhaps the mathematical model Fernald and Jones are using might be said to assume a mechanism—other than income from labor—for distributing purchasing power. If something like a guaranteed income were implemented, and if the income were increased over time to support continued economic growth, then the idea that growth could explode and incomes could soar might make sense. This will not happen automatically; the market is not going to sort things out on its own. A fundamental restructuring of our economic rules will be required.

I think that viewing markets—or the entire economy—as a resource also works well from another perspective. Recall that in Chapter 3, I argued that the technologies poised to transform the job market result from a cumulative effort that has spanned generations and has involved countless individuals, and has often been funded by taxpayers. To some extent, you can make a reasonable argument that all these accumulated advances—as well as the economic and political institutions that enable a vibrant market economy—are really a resource that belongs to all citizens. A term often used in place of

---

<sup>3</sup> What we call "the economy" is really the total value of all the goods and services produced and sold to someone. The economy can either produce enormous numbers of low and moderately priced goods and services, or a much smaller number of very high-value goods and services. The first scenario requires broad distribution of purchasing power; this is currently made possible by jobs. In the second scenario it is unclear what products and services the economy could produce that would be valued so highly by the wealthy elite. Whatever these high-priced goods were, they would need to be consumed voraciously by the lucky few—otherwise the economy would not grow at all: it would contract.

"guaranteed income" is "citizen's dividend," which I think effectively captures the argument that everyone should have at least a minimal claim on a nation's overall economic prosperity.

### The Peltzman Effect and Economic Risk Taking

In 1975, the University of Chicago economist Sam Peltzman published a study showing that regulations designed to improve automobile safety had failed to result in a significant reduction in highway fatalities. The reason, he argued, was that drivers simply compensated for the perceived increase in safety by taking more risks <sup>14</sup>

This "Peltzman effect" has since been demonstrated in a wide range of areas. Children's playgrounds, for example, have become much safer. Steep slides and high climbing structures have been removed and cushioned surfaces have been installed. Yet, studies have shown that there has been no meaningful reduction in playground-related emergency room visits or broken bones. <sup>15</sup> Other observers have noted the same phenomenon with respect to skydiving: the equipment has gotten dramatically better and safer, but the fatality rate remains roughly the same as skydivers compensate with riskier behavior.

The Peltzman effect is typically invoked by conservative economists in support of an argument against increased government regulation. However, I think there is every reason to believe that this risk compensation behavior extends into the economic arena. People who have a safety net will be willing to take on more economic risk. If you have a good idea for a new business, it seems very likely that you would be more willing to quit a secure job and make the leap into entrepreneurship if you knew you had access to a guaranteed income. Likewise, you might decide to leave a safe job that offered you few opportunities for personal growth in order to take a more rewarding but less secure position at a small start-up company. A guaranteed income would offer an economic cushion for all types of entrepreneurial activity, from the person starting an online business, to the "mom and pop" retailer or **restaurateur**(艺术品修复), to the small farmer or rancher facing a drought. In many cases, it might be enough to get small businesses through difficult periods that would otherwise bring about their failure. The bottom line is that, rather than resulting in a nation of slackers, a well-designed guaranteed income has the potential to make the economy more dynamic and entrepreneurial.

### Challenges, Downsides, and Uncertainties .

A guaranteed income is not without downsides and risks. The most important near-term concern is whether or not a strong disincentive to work would be created. While machines clearly seem destined to take on more and more work over time, there is no question that the economy will remain heavily dependent on human labor for the foreseeable future.

There are, to date, no examples of such a policy having been implemented on a national level. The state of Alaska has paid a modest annual dividend funded by oil revenue since 1976; in recent years, the payments have typically been between \$1,000 and \$2,000 per person. Both adults and children are eligible, so the amount can be significant for families. In October 2013, proponents of a guaranteed income in Switzerland gathered enough signatures to put a proposal for a remarkably generous unconditional monthly stipend of 2,500 Swiss francs (or about \$2,800) on the national ballot, although no date has yet been set for the vote. Small-scale experiments in the United States and Canada have shown a reduction of roughly 5 percent in the number of hours that recipients chose to work; however, these were temporary programs and therefore less likely to influence behavior than a permanent program. <sup>16</sup>

One of the greatest political and psychological barriers to the implementation of a guaranteed income would be simple acceptance of the fact that some fraction of recipients will inevitably take the money and drop out of the workforce. Some

people will choose to play video games all day—or, worse, spend the money on alcohol or drugs. Some recipients might pool their incomes, crowding into housing or perhaps even forming "slacker communes." As long as the income is fairly minimal and the incentives are designed correctly, the percentage of people making such choices would likely be very low. In absolute numbers, however, they could be quite significant—and quite visible. All of this, of course, would be very hard to reconcile with the general narrative of the **Protestant work ethic (core belief: self-reliant)**. Those opposed to the idea of a guaranteed income would likely have little trouble finding disturbing anecdotes that would serve to undermine public support for the policy.

In general, I think the fact that some people would elect to work less—or perhaps even not at all—should not be viewed in universally negative terms. It's important to keep in mind that the individuals who choose to drop out will be self-selecting. In other words, they will generally be among the least ambitious and industrious members of the population.<sup>4</sup> In a world where everyone is forced to compete for a dwindling number of jobs, there is no reason to believe that the most productive people will always be the ones to land those jobs. If some people work less or drop out entirely, then wages for those who are willing to work hard may rise somewhat. That fact that incomes have been stagnant for decades is, after all, one of the primary problems we are trying to address. I don't see anything especially dystopian in offering some relatively unproductive people a minimal income as an incentive to leave the workforce, as long as the result is more opportunity and higher incomes for those who do want to work hard and advance their situation.

While our value system is geared toward celebrating production, it's important to keep in mind that consumption is also an essential economic function. The person who takes the income and drops out will become a paying customer for the hardworking entrepreneur who sets up a small business in the same neighborhood. And that businessperson will, of course, receive the same basic income.

A final point is that most policy errors in implementing a guaranteed income ought to eventually be self-correcting. If the income were initially too generous and thereby resulted in a strong disincentive to work, then one of two things would happen. Either automation technology would be sufficiently advanced to pick up the slack in production (in which case there would be no problem), or there would be a labor shortage and a burst of inflation. A general increase in prices would devalue the basic income and re-create the incentive to supplement it with work. Unless policy makers did something truly misguided—like, for example, building an automatic cost-of-living increase into the income scheme—any inflation would probably be short-lived, and then the economy would find a new equilibrium.

Beyond the political challenges and risks associated with a general disincentive to work, there is also the question of the impact a basic income might have on housing costs in high-rent areas. Imagine giving every resident of a city like New York, San Francisco, or London an extra thousand dollars per month. There are probably good reasons to expect that a very large fraction of that increase—perhaps nearly all of it—would eventually end up in the pockets of landlords as residents compete for scarce housing. There are no easy solutions to this problem. Rent control is one possibility, but it comes with lots of documented downsides. Many economists have called for relaxing zoning restrictions so that denser housing can be built, but this is sure to be opposed by existing residents.

---

<sup>4</sup> Obviously, I'm leaving aside those people who might choose to drop out of the workforce (at least temporarily) for reasons we would likely consider more legitimate, such as caring for children or other family members. For some families, for example, a basic income might turn out to be a partial solution to the looming elder-care problem.

There is a counteracting force, however. A guaranteed income, unlike a job, would be mobile. Some people would be very likely to take their income and move away from expensive areas in search of a lower cost of living. There might be an influx of new residents into declining cities like **Detroit(similar to 东北老工业城市)**. Others would choose to leave cities altogether. A basic income program might help revitalize many of the small towns and rural areas that are losing population because jobs have evaporated. Indeed, I think the potentially positive economic impact on rural areas might be one factor that could help make a guaranteed income policy attractive to conservatives in the United States.

Immigration policy is another area that would obviously need to be adjusted in the wake of the implementation of a guaranteed income. It seems likely that immigration as well as any subsequent path to citizenship and eligibility for the income would have to be restricted, or perhaps a significant waiting period would need to be imposed for new citizens. All of this would, of course, add even more complexity and uncertainty to a political issue that is already intensely polarizing.

### Paying for a Basic Income

If the United States were to give every adult between the ages of twenty-one and sixty-five, as well as those over sixty-five who are not receiving Social Security or a pension, an unconditional annual income of \$10,000, the total cost would be somewhere in the vicinity of \$2 trillion <sup>17</sup> This amount would be reduced somewhat by limiting eligibility for the basic income to citizens and perhaps by means-testing it against earned income beyond a certain point. (As I suggested earlier, it would be very important to phase the guaranteed income out only at a fairly high level in order to avoid a poverty trap scenario.) The total cost would then be offset by reducing or eliminating numerous federal and state anti-poverty programs, including food stamps, welfare, housing assistance, and the Earned Income Tax Credit. (The EI TC is discussed in further detail below.) These programs add up to as much as \$1 trillion per year.

It goes without saying that raising sufficient revenue would be an enormous challenge in today's political environment, given that nearly all American politicians are terrified to even utter the word "tax" unless it is followed immediately by the word "cut." The most feasible approach might be to use a variety of different taxes to raise the necessary revenue. One obvious candidate would be a carbon tax, which could raise as much as \$100 billion per year while helping to reduce greenhouse gas emissions. There have already been proposals for a revenue-neutral carbon tax with a **rebate(退还)** for every household, and this might serve as a starting point for a basic income. Another option is a value-added tax. The United States is the only advanced nation that does not currently rely on such a tax—essentially a type of consumption tax that gets tacked on at every step in the production process. A VAT is passed on to consumers as part of the final price charged for products and services and is generally considered to be a very efficient way to raise tax revenue. There are numerous other possibilities, including higher corporate taxes (or the elimination of tax avoidance schemes), some type of national land tax, higher capital gains taxes, and a financial transaction tax.

It seems inevitable that personal income taxes would also have to increase, and one of the best ways to do this is to make the system more progressive. One of the implications of increasing inequality is that ever more taxable income is rising to the very top. Our taxation scheme should be restructured to mirror the income distribution. Rather than simply raising taxes across the board or on the highest existing **tax bracket(纳税等级)**, a better strategy would be to introduce several new higher tax brackets designed to capture more revenue from those taxpayers with very high incomes—perhaps a million or more dollars per year.

## Everyone a Capitalist

While I believe that some form of guaranteed income is probably the best overall solution to the rise of automation technology, there are certainly other viable ideas. One of the most common proposals is to focus on wealth, rather than income. In a future world where nearly all the income is captured by capital, and human labor is worth very little, why not simply make sure that everyone owns enough capital to be economically secure?

Most of these proposals involve strategies like somehow increasing employee stock ownership in businesses or simply giving everyone a substantial balance in a mutual fund. In an article for The Atlantic, economist Noah Smith suggests that the government could give everyone "an endowment of capital" by purchasing a "diversified portfolio of equity(多元化股权投资组合)" for every citizen when he or she turns eighteen. A rash decision to "cash out, and party" would be "prevented with some fairly light paternalism(家长干预), like temporary 'lock-up' provisions.<sup>18</sup> The problem with this is that "light paternalism" might not be enough. Imagine a future in which your ability to survive economically is determined almost exclusively by what you own; your labor is worth little or nothing. In that world, there would be no more stories about the person who lost it all and then worked his or her way back to the top. If you make a bad investment or get ripped off by a Bernie Madoff type, then the error might well be unrecoverable. If individuals are ultimately given control over their capital, then it's inevitable that this scenario would play out for some unlucky people. What would we do for individuals and families who found themselves in this kind of situation? Would they be "too big to fail"? If so, there would be a clear moral hazard problem: people might see little downside in taking excessive risks. If not, we'd have people in genuinely dire situations with little or no hope of escape.

The vast majority of people would, of course, act responsibly in the face of this kind of risk. But that might result in its own problems. If loss of your capital meant destitution for you and your children, would you be willing to invest a chunk of it in a new business venture? Experience with 401k retirement plans has shown that many people elect to invest too little in the stock market and too much in lower-return investments they perceive as safe. In a world where capital is everything, that preference might well be amplified. There could be huge demand for safe assets, and as a result the returns on those assets would be very low. In other words, a solution based on giving people wealth might result in something quite different from the Peltzman effect I suggested we might see with a guaranteed income. Excessive risk aversion could lead to less entrepreneurship, lower incomes, and less vibrant market demand.\*<sup>5</sup>

Yet another problem, of course, is paying for these equity endowments. My guess is that redistribution of vast amounts of capital would prove even more politically toxic than would be the case for income. One possible mechanism for prying wealth away from its current owners was proposed by Thomas Piketty in his book *Capital in the Twenty-First Century*: a global tax on wealth. Such a tax would require cooperation between nations in order to avoid massive capital flight into lower-tax jurisdictions. Nearly everyone (including Piketty) agrees that this would be impractical for the foreseeable future.

Piketty's book, which was deluged with(given) attention in 2014, argues that future decades are likely to be marked by an inevitable progression toward increased inequality of both income and wealth. Piketty approaches the issue of inequality purely from the perspective of a historical analysis of economic data. His central thesis is that the return on capital is usually

---

<sup>5</sup> Some economists, most notably former US Treasury secretary Larry Summers, have suggested that the economy is currently trapped in "secular stagnation"—a situation where interest rates are near zero, the economy is operating below its potential, and there is too little investment in more productive opportunities. I think a future where everyone is dependent almost entirely on his or her mutual fund balance for economic survival might well result in a similar outcome.

greater than the overall rate of economic growth, so that capital ownership inevitably becomes a larger slice of the economic pie over time. He shows surprisingly little interest in the trends we've focused on here; indeed, the word "robot" appears on only one of his book's nearly seven hundred pages. If Piketty's theory is correct—and it has been subject to a great deal of debate—then I think advancing technology is likely to greatly amplify his conclusions, quite possibly producing even higher levels of future inequality than his model predicts.

It's possible that as the issue of inequality, and especially its impact on the political process in the United States, gains ever more visibility with the public, the kind of wealth tax that Piketty advocates might someday become viable. If so, I would argue that rather than portioning out redistributed capital to individuals, it would be better to set up a centrally managed sovereign wealth fund (similar to the Alaska fund) and then use the resulting returns to help fund a basic income.

### Near-Term Policies

While the establishment of a guaranteed income will probably remain politically unfeasible for the foreseeable future, there are a number of other things that might prove helpful in the nearer term. Many of these ideas are really generic economic policies geared toward enabling a more robust recovery from the Great Recession. In other words, they are things we ought to be doing in any case, independently of any concern about the impact of robots or automation on jobs.

Foremost among these policies is the critical need for the United States to **invest in public infrastructure** (拜登在做). There is an enormous **pent-up(repressed)** requirement to repair and refurbish things like roads, bridges, schools, and airports. This maintenance will have to be performed eventually; there is no getting around it, and the longer we wait the more it will ultimately cost. The federal government can currently borrow money at interest rates remarkably close to zero, while unemployment among construction workers remains at double-digit rates. Our failure to take advantage of this opportunity and make the necessary investments while the cost is low is likely to someday be judged to be economic malpractice of the highest order.

While I'm skeptical that policies geared toward more education and vocational training will offer a long-term, systemic solution to the problem of technological unemployment, there are certainly many things we can and should be doing to improve the more immediate prospects for students and workers. We probably can't change the reality that there will be only a limited number of jobs available at the top of the skills pyramid. However, we certainly can address the issue of workers who don't have the necessary skills for the opportunities that do exist. In particular, there is an obvious need for more investment in community colleges. Some professions with low unemployment rates, especially health care—related fields like nursing, are currently subject to significant educational bottlenecks; there is overwhelming demand for training, but students are unable to get into classes that are filled beyond capacity. In general, community colleges represent one of our most important resources for enabling workers to navigate an increasingly dynamic job market. Given that jobs—and entire occupations—may be poised to evaporate at an accelerating pace, we should do everything possible to make opportunities for retraining available. Expanding access to relatively inexpensive community colleges, while doing more to rein in predatory **for-profit(以盈利为目的)** schools that have been set up primarily to harvest financial aid dollars, would result in improved prospects for a great many people. As we saw in Chapter 5, MOOCs and other innovations in online education may also eventually have a meaningful impact on vocational training opportunities.

Another important proposal centers on expansion of the Earned Income Tax Credit, a subsidy paid to low-income workers in the United States. The EITC is currently subject to two primary limitations. First, the unemployed are not eligible;



in order to ensure an incentive to work, the benefit is paid only to people who have earned income. Second, the program is primarily configured as a form of child support. A single parent with three or more children could get a maximum of about \$6,000 per year in 2013, while a childless worker could receive only \$487—or about \$40 per month. The Obama administration has already proposed to expand eligibility for workers without children, although the maximum benefit would still only be about \$1,000 per year. Transforming the EITC into a viable longer-term solution would require extending eligibility to those who are unable to find jobs—and that, of course, would amount to converting the program into a guaranteed income. The near-term prospects for expanding the EITC in any way seem **bleak(hopeless)**, as Republicans in Congress have expressed a desire to actually cut the program.

If you accept the argument that our economy is likely to become ever less labor-intensive over time, then it follows logically that we ought to shift our taxation scheme away from labor and toward capital. Currently, major programs that support the elderly, for example, are funded largely by payroll taxes that fall on both workers and employers. Taxing work in this way allows those businesses that are highly capital- or technology-intensive to, in a sense, free-ride—reaping the benefits of our markets and institutions while escaping their obligation to contribute to the support of programs that are critical to society as a whole. As the taxation burden falls disproportionately on more labor-intensive industries and businesses, it will further increase the incentive to shift away from human labor and toward automation whenever possible. Eventually, the entire system could well become unsustainable. Instead, we ought to transition to a form of taxation that asks more from those businesses that rely heavily on technology and employ relatively few workers. We eventually will have to move away from the idea that workers support retirees and pay for social programs, and instead adopt the premise that our overall economy supports these things. Economic growth, after all, has significantly outpaced the rate at which new jobs have been created and wages have been rising.

If these proposals strike you as overly ambitious, then there remains at least one policy prescription that ought to be straightforward. Given the trends we've reviewed in these pages, it seems evident that we should not now be setting out to dismantle the social safety net we currently have in place. If there is, in fact, any good time to slash the programs that the most vulnerable segments of our population rely on—without also putting in place a viable alternate solution—then, surely, this is not that time.

THE POLITICAL ENVIRONMENT in the United States has become so toxic and divisive that agreement on even the most conventional economic policies seems virtually impossible. Given this, it's easy to dismiss any talk of more radical interventions like a guaranteed income as completely pointless. There is an understandable temptation to focus exclusively on smaller, possibly more feasible, policies that might **nibble at(啃噬)** the margins of our problems, while leaving any discussion of the larger challenges for some indeterminate point in the future.

This is dangerous because we are now so far along on the arc of information technology's progress. We are getting onto the steep part of the exponential curve. Things will move faster, and the future may arrive long before we are ready.

The decades-long struggle to adopt universal health coverage in the United States probably offers a pretty good preview of the staggering challenge we will face in attempting to bring about any kind of whole-scale economic reform. Nearly eighty years passed from the time Franklin Roosevelt first proposed a national health care system until the passage of the Affordable Care Act. In the case of health care, of course, America had as working examples the long-established systems of every other advanced nation in the world. But there are no examples of a working guaranteed income— or, for that matter, any other policy designed to adapt to the implications of future technology. We will have to make it up as we go along. Given this, it is surely not too soon to begin a meaningful discussion.

That discussion will have to **delve into(explore)** our fundamental assumptions about the role of labor in our economy and the way people respond to incentives. Everyone agrees that incentives are important, but there are good reasons to believe that our economic incentives could safely be moderated somewhat. This is true at both ends of the income spectrum. The premise that even modestly higher marginal tax rates on top incomes will somehow destroy the impetus for entrepreneurship and investment is simply unsupportable. The fact that both Apple and Microsoft were founded in the mid-1970s—a period when the top tax bracket stood at 70 percent—offers pretty good evidence that entrepreneurs don't spend a lot of time worrying about top tax rates. Likewise, at the bottom, the motivation to work certainly matters, but in a country as wealthy as the United States, perhaps that incentive does not need to be so extreme as to elicit the specters of homelessness and destitution. Our fear that we will end up with too many people riding in the economic wagon, and too few pulling it, ought to be reassessed as machines prove increasingly capable of doing the pulling.

In May 2014, payroll employment in the United States finally returned to its pre-recession peak, bringing to an end an epic jobless recovery that spanned more than six years. Even as total employment recovered, however, there was general agreement that the quality of those jobs was significantly diminished. The crisis had wiped out millions of middle-class jobs, while the positions created over the course of the recovery were disproportionately in low-wage service industries. A great many were in fast food and retail occupations—areas that, as we have seen, seem very likely to eventually be impacted by advances in robotics and self-service automation. Both long-term unemployment and the number of people unable to find full-time work remain at elevated levels.

Lurking behind the headline employment figure was another number that carried with it an ominous warning for the future. In the years since the onset of the financial crisis, the population of working-age adults in the United States had increased by about 15 million people.<sup>19</sup> For all those millions of **entrants(new member)** into the workforce, the economy had created no new opportunities at all. As John Kennedy said, "To even stand still we have to move very fast." That was possible in 1963. In our time, it may ultimately prove unachievable.

For your reference: 出版信息参看下页原著截图



# **RISE OF THE ROBOTS**

**TECHNOLOGY AND THE  
THREAT OF A JOBLESS FUTURE**

**MARTIN FORD**

**BASIC  
BOOKS**

A Member of the Perseus Books Group  
*New York*

Copyright © 2015 by Martin Ford

Published by Basic Books,  
A Member of the Perseus Books Group

All rights reserved. Printed in the United States of America. No part of this book may be reproduced in any manner whatsoever without written permission except in the case of brief quotations embodied in critical articles and reviews. For information, address Basic Books, 250 West 57th Street, New York, NY 10107.

Books published by Basic Books are available at special discounts for bulk purchases in the United States by corporations, institutions, and other organizations. For more information, please contact the Special Markets Department at the Perseus Books Group, 2300 Chestnut Street, Suite 200, Philadelphia, PA 19103, or call (800) 810-4145, ext. 5000, or email [special.markets@perseusbooks.com](mailto:special.markets@perseusbooks.com).

Designed by Pauline Brown

Library of Congress Cataloging-in-Publication Data

Ford, Martin (Martin R.)

Rise of the robots : technology and the threat of a jobless future / Martin Ford.

pages cm

Includes bibliographical references and index.

ISBN 978-0-465-05999-7 (hardback) — ISBN 978-0-465-04067-4

(e-book) 1. Labor supply—Effect of automation on. 2. Labor supply—Effect of technological innovations on. 3. Employment forecasting.

4. Technological innovations—Economic aspects. I. Title.

HD6331.F58 2015

331.13'7042—dc23

2014041327

10 9 8 7 6

## CONTENTS

<i>Introduction</i>	<i>ix</i>
<i>Chapter 1</i> The Automation Wave	1
<i>Chapter 2</i> Is This Time Different?	29
<i>Chapter 3</i> Information Technology: An Unprecedented Force for Disruption	63
<i>Chapter 4</i> White-Collar Jobs at Risk	83
<i>Chapter 5</i> Transforming Higher Education	129
<i>Chapter 6</i> The Health Care Challenge	145
<i>Chapter 7</i> Technologies and Industries of the Future	175
<i>Chapter 8</i> Consumers, Limits to Growth . . . and Crisis?	193
<i>Chapter 9</i> Super-Intelligence and the Singularity	229
<i>Chapter 10</i> Toward a New Economic Paradigm	249
<i>Conclusion</i>	281
<i>Acknowledgments</i>	285
<i>Notes</i>	287
<i>Index</i>	317