



**THE RISE**  
and **FALL** of  
**NATIONS**

TEN RULES OF CHANGE IN  
THE POST-CRISIS WORLD

**RUCHIR**  
**SHARMA**

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## PEOPLE MATTER

*Is the talent pool growing?*

AT FIRST I DIDN'T THINK THERE WAS MUCH MYSTERY TO the lackluster global recovery. After 2008, when the United States fell into a deep recession and the world soon followed, economists argued that the recovery would be painfully slow because this was a "systemic crisis," not an ordinary recession, and I was persuaded. Their research showed that following a crisis that devastates the financial system, an economy typically experiences weak growth for four to five years even after the end of the recession. But as each year passed—five, six, seven—the global economy continued to perform more weakly than expected. By 2015, there was still not a single major region of the world where economic growth had returned to its pre-crisis average. I became convinced that the sluggish recovery was not normal. It was a mystery: Where was the missing growth?

Economists have put forth many reasons to explain why the world has been slogging through its weakest recovery in the postwar era. Most of the explanations focus on the way severe credit crises can depress the demand side of the economy, as consumers and companies struggle to work off their debts and slowly regain the confidence to spend money. Others blame weak demand on rising income inequality, the regulatory

crackdown on bank lending, or some other symptom of post-crisis stress disorder. While all these arguments may have some merit, the evidence is mixed as to what impact these factors had on economic growth. In the United States, there are clear signs that consumer demand fully recovered by 2015: Car sales have hit new highs and job growth is running at a brisk pace, yet the headline GDP growth number is still well below its pre-crisis pace. As often happens in a good mystery, perhaps the detectives have been looking in the wrong place.

My team and I turned our attention from the arguments that primarily focus on demand to those concerning supply, the side of the economy that supplies labor, capital, and land, the basic inputs to growth. We found an unexpected culprit. One critical cause of the missing growth was, of all things, a shrinking supply of people in the active workforce. This finding was so thoroughly at odds with popular fears about how human jobs are being replaced by the rise of robots and artificial intelligence, it seemed hard to accept at first. How could too few workers be a problem if technology has made them obsolete? But in this case at least, numbers don't lie.

A collapse in population growth was already under way before the 2008 crisis, and in fact it can explain a good chunk of the persistently disappointing recovery since. As we've seen, one simple way to measure an economy's potential to grow is by adding productivity growth and labor force growth, and while both have slumped worldwide, the productivity slowdown is widely disputed, since many experts think the official statistics are undercounting the impact of new digital technologies. In the United States, by the official numbers, productivity grew at an average pace of 2.2 percent between 1960 and 2005 before slowing to just 1.3 percent in the past ten years. The population slowdown was even more dramatic, and it is not in dispute. In the five decades before 2005, the U.S. labor force grew at an average annual pace of 1.7 percent, but slowed to just 0.5 percent over the past decade. In short, the clearest explanation of the missing economic growth in the United States is the roughly 1 percent decline in labor force growth, which is largely a

function of growth in the population of working-age people, between 15 and 64.

The world still echoes with recurring fear about the "population bomb" scenarios, which suggest that the number of people will outstrip supplies of food and other resources, with explosive results. Those scenarios rely on the United Nations' oft-cited forecast for the year 2050, which shows that population will rise by 2.4 billion people, from 7.3 billion to 9.7 billion. A number close to ten billion may sound frighteningly high, but the UN forecast in fact takes into account a dramatic slowdown in the population growth rate. Many fewer babies are being born, and fewer young people are entering the working-age cohort, while the overall population is growing mainly because people are living longer. This mix is toxic for economic growth.

For much of the post-World War II era, global population grew at an average of nearly 2 percent annually, which meant that the world economy could also expect to grow at a baseline rate of close to 2 percent—and a couple of percentage points more than that when output per worker was also growing. Then around 1990 global population growth just fell off a cliff. The growth rate has since halved to just 1 percent. The difference between 1 and 2 percent may not sound like much, but if the population growth rate had stayed at 2 percent since 1990, the global population today would be 8.7 billion, not 7.3 billion. The world would not be aging so rapidly, and we would not be talking about population's impact on economic growth.

The economic impact of the decline in the population growth rate has taken time to show up, because it takes a while for babies to reach the working age of 15. Of course, in many places people don't actually start working until they reach 20 or 25, depending on how long they stay in school. So it takes fifteen years or more for a baby bust to have a clear impact on the population contribution to economic growth, which has become increasingly clear in the last five years.

The fall in the global population growth rate was the delayed result of aggressive birth control policies implemented in the emerging world

in the 1970s, particularly the one-child policy China instituted in 1978. In emerging and developed countries, the population slowdown was also fueled by rising prosperity and education levels among women, many of whom decided to pursue a career and have fewer children or none at all.

The roots of this demographic shift lie in basic changes in mortality and fertility rates over the last half-century. Since 1960 advances in science and health care have allowed people to live longer. Worldwide, the length of the average human life has been extended from 50 years in 1960 to 69, and it is still rising. Already, most of global population growth is occurring among people over 50, and by far the fastest-growing segment of the population is people above 80. The overall population will continue to grow, albeit at a much-reduced rate, even as the segment that drives economic growth—working-age people—continues to shrink.

The period since 1960 has also seen a global baby bust, as the average number of births per woman has fallen from 4.9 to 2.5 worldwide. In emerging nations, the collapse has been more dramatic, encouraged by those aggressive birth control policies. Fertility rates in India and Mexico, two countries that were once a focus of fear about accelerating overpopulation, have plummeted from more than 6 to 2.5 or less since 1960. Both countries are now very close to the replacement fertility rate of 2.1—the rate below which the population eventually starts shrinking. As the world's fertility rate slips toward the critical level of 2.1, more and more countries are falling below the replacement level. Nearly one of every two people on earth already lives in one of the eighty-three countries where on average women have fewer than two children, from China, Russia, Iran and Brazil to Germany, Japan, and the United States.<sup>1</sup>

Working-age populations are already shrinking in some advanced countries, including Japan, Italy, and Germany, and while that shrinkage has been obvious for years, the same process is now unfolding or is poised to unfold even faster in many large emerging nations, including

China and India. Moreover, the global population growth rate is projected to keep falling over the next decade and beyond. This changes the planet's economic prospects in fundamental ways.

The slowdown in population growth is already sending economic shockwaves through society, affecting relations between generations, sexes, nationalities, and even the contest of man versus machine. When the United Nations recently rereleased its population forecast for nearly ten billion people by the year 2050, alarmists naturally repeated their warnings about overpopulation. Some are neo-Malthusians, who fear that population growth will outstrip growth in food supply, leaving a hungry planet. Some are neo-Luddites, who fear that the “rise of the robots” will make human workers obsolete, a threat all the more alarming if the human population is exploding. And some are anti-immigrant forces in Europe and the United States, who favor building border walls to keep out a “rising tide” of what one British cabinet minister calls “desperate migrants marauding around.”

What all these alarms miss is that while ten billion sounds like a lot of people, the slowing rate of growth is what matters for the economy, including the food supply. Slower population growth means there will be less pressure on the entire chain of production, which doesn't have to supply as much clothing or housing or food. Farms won't have to increase production as fast as they have in the past to feed everyone, and they will have to expand mainly to meet the needs of elderly people, who consume up to a third fewer calories than young people. I don't want to minimize the real problems of hunger in many countries, but the economic driver of these problems is not population. For most countries, the primary economic threat is not too many people but rather too few young people, and the arrival of robots may simply help relieve the impending labor shortage. Farmbots may be the answer to retiring farmers.

In a world where more and more countries are going to face labor shortages, the current controversies over “marauding” migrants will give way to—or perhaps rage alongside of—aggressive campaigns

to attract or steal labor and talent from other countries. For countries confronting a rapidly aging and declining workforce, it doesn't matter whether immigrants arrive as "economic migrants" seeking opportunity or as "political refugees" fleeing war or persecution: Either group will boost the size of the labor pool. The pressure to attract or retain workers will be particularly acute in the emerging world, where fertility rates have fallen faster and life expectancy has increased much faster than they did in the past, when wealthy countries like Britain or the United States were in their early economic development stages.

For a nation's economic prospects, the key demographic question is: Is the talent pool growing? The first part of the rule for finding the answer is to look at the projected growth of the working-age population over the next five years, because workers (more than retirees or schoolchildren) are the drivers of growth. The second part of the rule is to look at what nations are doing to counteract slower population growth. One way is to try to inspire women to have more babies, an approach with a spotty record at best. The other is to attract adults—including retirees, women, and economic migrants—to enter or reenter the active labor force. The big winners will come from among those countries that are blessed with strong growth in the working-age population or are doing the best job of bringing fresh talent into the labor force.

### *The 2 Percent Population Pace Test*

To get a better handle on how demographics will limit national economies in coming years, I studied population trends in the countries on my list of postwar growth miracles—the fifty-six cases in which a country sustained an average economic growth of at least 6 percent for at least a decade. I found that during these booms the average growth rate of the working-age population was 2.7 percent. In other words, a significant part of the growth in these miracle economies could be explained by the fact that

more and more young people were reaching working age. This clear connection between a population explosion and an economic miracle has played out in dozens of cases, from Brazil in the 1960s and '70s to Malaysia from the 1960s through the 1990s.

As for how fast the working-age population needs to grow to raise the likelihood of an economic boom, it turns out 2 percent is a good benchmark. In three out of four of the miracle economies, the working-age population grew at an average pace of at least 2 percent a year during the full duration of a decade-long boom. A country is thus unlikely to experience a decade-long growth boom if its working-age population is growing at a rate less than 2 percent. And one striking change in the post-crisis world is that there are now very few countries with a population growing that fast. As recently as the 1980s, seventeen of the twenty largest emerging economies had a working-age population growth rate above 2 percent, but that number has fallen steadily from seventeen to only two in the 2010s, Nigeria and Saudi Arabia. And the number is still falling. By the next decade, between 2020 and 2030, there will be just one, Nigeria. A world with fewer large, fast-growing national populations will witness fewer economic miracles.

To be sure, economic booms don't always require population booms: in a quarter of the cases, above, the country did manage to generate a decade of rapid economic growth without the boost of 2 percent population growth. But most did so in unusual circumstances. Some were already relatively well off, such as Chile and Ireland in the 1990s, when some combination of reform and new investment increased productivity and compensated for weak population growth. Others were witnessing a return to economic calm during a period of reconstruction, as Japan, Portugal, and Spain were in the 1960s, and as Russia was a decade after the fall of the Soviet Union, with an added boost from high oil prices. Today no country can expect a similar boost, not when commodity prices are falling and political unrest is spreading.

This does not bode well for the emerging world, where more and more countries face the prospect of weak or even negative population

growth. Over the course of the 2010s, all the major emerging economies are projected to have working-age population growth rates below the 2 percent mark, including India, Brazil, Mexico, Indonesia, and Thailand. Already the working-age population is actively contracting in three large emerging countries: Poland, Russia, and most important, China. There the working-age population growth rate hovered under 2 percent as recently as 2003, then dropped steadily until it turned negative for the first time in 2015.

Population decline is now high on the list of reasons, alongside its heavy debts and excessive investments, to doubt that China can sustain rapid GDP growth. Since 2010 a credit binge has run up China's debts to around 300 percent of GDP, which has been widely discussed. The investment boom that was driving China's rapid growth has started to unravel and is now leaving development ghost towns all over the country. But the fallout from the depopulation bomb is at least as damaging to growth.

To produce strong economic growth in a country with a shrinking population is close to impossible, or as the European Commission warned in 2005, "Never in history has there been economic growth without population growth."<sup>2</sup> Based on the record for nearly 200 countries going back to 1960, there are 698 cases in which data for both population growth and GDP growth are available for a full decade. Among these cases, there were 38 in which a country's working-age population was shrinking over the course of the decade, and the average GDP growth rate for these countries was just 1.5 percent. And in only three of the 698 cases did a country with a shrinking population manage to sustain a GDP growth rate of 6 percent or more. All three were small countries bouncing back from a period of political turmoil, postwar chaos, or post-Soviet collapse: Portugal in the 1960s, and Georgia and Belarus between 2000 and 2010. This record suggests that an average growth rate of 6 percent or more is extremely unlikely in China, even though the official target is still above that threshold.

In a few other populous countries, the number of working-age people is growing at a rate near or above 2 percent, including the Philippines and some emerging countries with economies too small to make the top twenty, such as Kenya, Nigeria, Pakistan, and Bangladesh. These populations are also forecast to keep growing rapidly for the next decade, so they have a demographic edge on the competition. For them, the trick is to avoid falling for the fallacy of the "demographic dividend," the idea that population growth pays off automatically in rapid economic growth. It pays off only if political leaders create the economic conditions necessary to attract investment and generate jobs. In the 1960s and '70s, rapid population growth in Africa, China, and India led to famines, high unemployment, and civil strife. Rapid population growth is often a precondition for fast economic growth, but it never guarantees fast growth.

In most countries, before the 2000s, strong population growth was the norm but typically did not produce an economic miracle. In my study, more than 60 percent of the 698 cases had a working-age population growth rate of more than 2 percent, but only a quarter of those population booms led to an economic miracle or an average growth rate of 6 percent or more in the same decade. The countries where a population boom failed to produce an economic miracle include Turkey in every decade between 1960 and 2000, and the Philippines in every decade between 1960 and 2010. Today not even Kenya can assume that its world-leading population growth rate—projected at 3 percent between 2015 and 2020—will automatically make it a world-beating economy.

The Arab world provides a cautionary tale. There between 1985 and 2005 the working-age population grew by an average annual rate of more than 3 percent, or nearly twice as fast as the rest of the world. But no economic dividend resulted. In the early 2010s many Arab countries suffered from crippling high youth unemployment rates: more than 40 percent in Iraq and more than 30 percent in Saudi Arabia, Egypt, and Tunisia, where the violence and chaos of the Arab Spring began. In

India, where hopes for the demographic dividend have also been sky high, ten million young people will enter the workforce each year over the next decade, but lately the economy has been creating less than five million jobs annually.

Though discussions of rapid population growth tend to focus on big emerging countries, a rising number of workers is also critical to economic growth in developed countries. In recent decades, the United States has come to see itself as by far the most dynamic and flexible of the developed economies, far more innovative than Europe, far less hidebound than Japan. But much of its recent advantage could be traced to the fact that more young people were entering the workforce. Over the past thirty years, the working-age population has been growing much faster in the United States than in its major industrial rivals: twice as fast as in France and Britain, five times faster than in Germany, and ten times faster than in Japan. That demographic boost helps explain faster U.S. economic growth over the same period. In Germany and Britain, for example, factoring out their slow-growing populations, per capita income has been growing as fast as that of the United States. Over the last thirty years, the U.S. economy expanded at an average rate that was 0.9 percentage points faster than Germany's, and its working-age population also expanded exactly 0.9 percentage points faster. Otherwise this race was a draw.

Population forecasts for the developed world are quite discouraging for the 2015–20 period. Among the ten largest developed economies, the number of working-age people is expected to remain static in France, shrink a little in Spain, and contract at a rapid pace of 0.4 percent a year or more in Italy, Germany, and Japan. The U.S. forecast was less bleak, with a positive population growth rate of 0.2 percent, about the same as those of Britain and Canada. The best news for developed countries was confined unfortunately to smaller ones, led by Singapore and Australia. There the populations are still growing at a good pace, but for the global economy, these countries are too small to make up for weaker growth in all the bigger countries.

### *Baby Bonuses*

The race to fight the population slowdown is already on. Many countries over the past decade have recognized the economic threat and have taken steps to counteract it. In 2014 Denmark revised its high school sex education curriculum, which now warns teenagers about the dangers of waiting too long to have their own children. According to the United Nations, 70 percent of developed countries today have implemented policies to boost their fertility rate, rising from about 30 percent in 1996. At the same time, the number of emerging countries that have active policies to control population growth has leveled off since the 1990s at about 60 percent.

With the birthrate in many countries falling below the replacement level of 2.1, countries that subsidize motherhood are focused mainly on encouraging women to have more than two children, and in some nations the subsidies grow even more generous with the third, fourth, and fifth children. Many nations have tried offering women cash “baby bonuses” and other incentives to have more children, a form of state meddling in the reproductive process that is often ineffective and controversial.

In 1987 Singapore pioneered these efforts, launching a campaign under the slogan “Have three, or more if you can afford it.” The range of incentives it offered, including subsidized hospital stays, had little effect on the fertility rate. I was studying in Singapore at the time and can remember people joking about how the subsidies were adding to the lines of expectant Chinese moms looking to schedule C-sections on the highly auspicious date of 8-8-88. Canada introduced a baby bonus that same year, 1988, but withdrew it years later in part because—as other countries have also found—many of the women who responded to direct cash incentives were very poor, and their children added greatly to welfare expenses.<sup>3</sup>

When Australia's treasurer Peter Costello announced his country's first baby bonuses in 2005, he urged women to “lie back and think of the

aging population,” and more than a few of his compatriots cringed. Six years later Australia cut the bonuses, in part because these incentives did not appear to have much influence on the fertility rate, particularly when weighed against larger changes in society. In most wealthy countries, professional women have been putting off childbirth into their thirties in order to pursue a career—and are having fewer children as a result.

In France, the socialist government of Prime Minister Lionel Jospin tried to address this problem by making its baby bonuses so generous that they would appeal to professional women too. The plan, announced in 2005, was attacked from the right for breaking an already busted budget, and from the left for favoring the rich. Nonetheless the package was approved, including lavish incentives targeted solely at parents to have that golden third child: extra home help subsidies, tax cuts, a 10 percent pension increase, and a 75 percent discount on rail tickets. The parents would also get a monthly allowance of over \$400 for a third child, and perhaps most important, if one of them quit work to care for the third child, they would get a stipend of \$1,200 a month. That stipend seems likely to decrease the workforce today, in the name of increasing it tomorrow. In response to the critics, Peter Brinn, one of the chief architects of the French plan, defended subsidizing childbirth as “spending on the future.” By 2015, however, France too was cutting back significantly on its baby bonuses.

As the magnitude of population decline started to hit home in the emerging world, Chile recently became one of the first emerging countries to offer baby bonuses. Despite its reputation as a conservative Catholic culture with the attendant large families, Chile already has a fertility rate well below the replacement level. In 2013 the government responded to the growing fear of a depopulation bomb by announcing its baby bonus plans. Declaring himself more concerned about the falling birthrate than about natural disasters like the earthquake that hit Chile in February 2010, President Sebastián Piñera announced an escalating onetime payment of \$200 for a third child, \$300 for a fourth,

and \$400 for a fifth. “This sudden and precipitous drop in the birthrate represents a serious danger, a serious threat, that will affect what we really want to build as a country,” Piñera warned.

Around the same time China—the mother of all population planners—was rethinking its long-standing campaign to control fertility through one-child policies, which have contributed mightily to the country’s aging problem. The one-child policy encouraged many parents to abort female fetuses in order to ensure the birth of a male child, resulting in a society where the gender balance is badly skewed. Young men greatly outnumber young women, and many men will find it impossible to find wives. Draconian population controls have had a huge impact on the labor force, which is expected to lose a million workers a year in the coming decades. In late 2015 China finally announced it is ending the one-child policy.

It’s hard to predict what distortions aggressive policies encouraging women to have two, three, or more children might produce—something as complex as human fertility cannot be changed in a predictable way. A recent paper by the demographers Hans-Peter Kohler and Thomas Anderson explained why the extent of the baby bust in Europe varies so greatly from country to country. During the Industrial Revolution, women joined the labor force in large numbers, but social norms changed more slowly than the industrial economy. Men were still considered the chief breadwinners, and women were still expected to carry the burden of child rearing and housework. The underlying gender roles started to change in the 1960s, when the culture started to catch up to the economy—but faster in some countries than in others. In France, Britain, and the Scandinavian countries, mothers found it easier to return to work, owing in part to generous childcare services. In more traditional cultures like Germany and Italy, where old conceptions of gender roles ebbed more slowly, more women chose not to have children, and today birthrates are cripplingly low.

The impact of state intervention in the human reproductive process is thus likely to be both slow and unpredictable, due in part to the way



cultural lags and sexual biases vary from country to country. China did not intend for its one-child policy to favor males—indeed, it has tried to prevent doctors from revealing the sex of the fetus—but the traditions of a society still built around eldest sons twisted the impact. By 2014, the gender imbalance had reached a new height: 121 male babies were being born for every 100 female babies. On visits to Beijing and Shanghai in the early 2010s, I heard talk that China was reverting to the nineteenth century, when widespread female infanticide created a similar gender imbalance, which by some accounts helped trigger the “testosterone-fueled” carnage of the Taiping Rebellion (1850–64). This story was told half in jest, but the gender imbalance is a real concern. In other countries, the subsidies for more children are likely to have their own sets of unintended consequences. It is hard to see this kind of campaign as a positive sign for any economy.

A more promising approach focuses on trying to bring more people into the active workforce. That means opening doors to people who are physically and mentally capable but are not formally employed. While population shifts gradually, measures to reshape the workforce can have a rapid impact, because you don't have to wait fifteen to twenty years for a woman, a retiree, or an economic migrant to grow up. Providing childcare services can bring women with children back to work. Opening the nation's doors to economic migrants can expand the working aging population virtually overnight. And reversing the twentieth-century campaign that pushed the retirement age down into the fifties in many industrial countries could bring a forgotten generation back to work very quickly. To drill down into likely changes in the size and talent of the labor pool, watch mainly for shifts in the number of senior citizens, women, migrants, and even robots entering the workforce.

### *Free the Forced Retirees*

In recent decades the widening impact of population decline has been magnified by a worldwide decline in the labor force participation rate—

or the share of working-age adults who are in a job or looking for one. There are some major exceptions to this drop-off in workers, including Germany, France, Japan, and the United Kingdom, but the United States is seeing one of the more dramatic declines. In the last fifteen years, the labor force participation rate in the United States has fallen from 67 to 62 percent, much of it coming after the global financial crisis. Without that decline in participation, the U.S. labor force would have had twelve million more workers in 2015. Though some of this shift may be a passing phenomenon, reflecting the millions of unemployed workers who gave up on looking for a job in the frustrating depths of the great recession, the decline in participation would have happened anyway because of aging. In the United States, the labor force participation rate drops from a little over 80 percent for 45-year-olds to less than 30 percent for 65-year-olds, and it is expected to continue falling in most countries as the world ages.

Smarter countries are rethinking the whole idea of a “retirement age,” a concept that was unknown before the 1870s. In earlier periods, people worked until their bodies or minds gave out, and they prepared for their dotage by having a lot of children, in the hope that at least one would care for them. Then a railroad company in western Canada asked a seemingly narrow but, as it turned out, portentous question: How old is too old to drive a train safely?<sup>4</sup> The answer back then was 65, which became the official retirement age in many countries. Even as older people remained active into their seventies and eighties, the age limit stuck.

The first government retirement benefits, offered to ease the financial uncertainties of old age, also appeared in the late nineteenth century, in Bismarck's Germany. Back then fertility rates in Europe were well above the replacement level, and life expectancy was much lower, so the working-age population was growing rapidly, in absolute numbers and as compared to the elderly population. With a growing supply of workers to fund a limited number of pensioners, Bismarck's retirement plan—which taxed the young to pay pensions to the old—worked fine.

Circumstances have reversed. Working-age populations are stagnating, but the Bismarckian “pay as you go” retirement plans remain the standard, even though various critics say they have become unsustainable Ponzi schemes. It’s not possible to recruit enough young contributors to pay for the pensions of retirees, who have become a bit too comfortable with these plans. While I was visiting Vienna in October 2013, a vibrant Austrian hotel manager told me in a casual chat that, still fit at 58, she was looking forward to her retirement in two years, when she said she would be entitled to public pension benefits nearly equal her last salary. She planned to replace her work with tango dancing, cross-country cycling trips, and backcountry skiing adventures.

Even the richest countries have figured out that they can no longer afford golden years that come so early. To figure out which nations are most vulnerable to aging and its costs, simply compare the number of working-age people between 15 and 64 to the number of dependent people who are older than 64 or younger than 15—also known as the dependency ratio. Changes in the dependency ratio say a lot about an economy’s growth potential, by revealing what percent of the population is entering its productive years, saving money, and contributing to the pool of capital available to invest rather than drawing down pension funds. During its postwar economic boom, South Korea’s GDP growth rates rose or fell year by year very closely in line with changes in the dependency ratio. China’s GDP growth also peaked in 2010, the same year the dependency ratio bottomed out at one dependent for every three workers and started to climb.

This number today holds a lot of drama, particularly in aging regions like Europe, where the size of the working-age population relative to the elderly population has fallen by half since the 1950s and is expected to halve again over the next thirty years. The aging process, which has already hit most advanced countries, is expected to unfold even faster in emerging ones, again because of a sharper fall in fertility rates and a faster rise in life expectancy. Worldwide, the average person today lives nineteen years longer than he or she did in 1960, but in China the

average person lives thirty years longer and dies at 75. This progress is remarkable, but it has a cost. Today the share of the Chinese population that is over 65 is on track to double from 7 to 14 percent between 2000 and 2027. By way of contrast, that doubling process took 115 years in France and 69 years in the United States.

Population trends impact an economy mainly by increasing or decreasing the number of available workers, but they have a secondary impact on productivity. In recent years countries with faster-growing populations have also tended to exhibit faster productivity growth. As the dependency ratio declines, with more people entering the workforce and earning an independent living, a country’s income increases, and that creates a greater pool of capital, which can be used to invest in ways that further raise productivity. According to the demographer Andrew Mason, this secondary demographic dividend was an important boost to the economic growth rates of East and Southeast Asia, where saving rates are relatively higher and the workforce has been relatively large.<sup>5</sup>

Furthermore, a more experienced labor force also tends to be more productive. The best-positioned countries are those taking steps to keep older people in the workforce and out of the “dependent” population. In 2007, Germany increased the retirement age from 65 to 67 for men and women, a measure that will be phased in gradually. Most other European nations have followed suit, including Poland. Over the next five years, Poland’s working-age population is expected to shrink by more than 3 percentage points to 66 percent, the sharpest drop in any large country, while the elderly population continues to boom. Battles over raising the retirement age and other issues unique to a gray society now shape political debate, while Polish entrepreneurs have tried to make an opportunity out of aging. Rest homes that Poles call Houses of Peaceful Elderliness are multiplying all over the country. European countries including Italy and Portugal have already pegged changes in the retirement age to increases in life expectancy, and others are already debating a retirement age of 70 or more. There are

holdouts—notably France—but pushing back the retirement age is a big step forward for aging economies, and every additional year that it is pushed back saves billions in pension costs and delays the impact of the depopulation bomb.

It would be a mistake, however, to assume that the state can press all aging workers to stay on the job with the stroke of a pen. In Mexico, the official retirement age is 65, but the typical Mexican man retires at 72. In France, the official retirement age is also 65, but the typical Frenchman actually retires before 60. Changing the official retirement age and the level of pension benefits can encourage people to stay on the job, but it can't produce overnight changes in the work culture. In most countries, the duration of the retirement "golden years" continues to lengthen, weighing on the economy. In the thirty-four industrial countries that belong to the Organization for Economic Cooperation and Development (OECD), from China and South Korea to the United States and Britain, the gap between the age at which the average person retires and the age at which he or she dies is now fifteen years, having increased steadily from two years in 1970.

The costs of paying pensions are mounting to crippling levels, perhaps nowhere more than in Brazil, where the average man retires at 54 and the average woman at 52—earlier than in any OECD member country. Meanwhile the average pension covers 90 percent of the retiree's final salary, compared to an OECD average of 60 percent. Brazil is one of the countries where the growing imbalance between workers and retirees most threatens the shaky edifice of Bismarckian retirement systems. On this front too governments are struggling to keep up with the effects of the depopulation bomb.

### *What Happened to Women in the Workforce?*

The worldwide movement of women into the workforce that energized much of the postwar era has stagnated in the past twenty years, with the average female labor force participation rate stuck at around 50 percent.

Typically women participate in the labor force at a very high rate in poor rural countries, where feeding the family requires all hands to work in the fields. The participation rate then falls as countries industrialize and move into the middle-income class, as some women shift to housework, falling out of the formal labor force. Finally, if the country grows richer still, more families have the resources to send women to college—and from there they often enter the labor force in large numbers.

To get a sense of which economies have the most—or the least—opportunity to generate growth by building up the female labor force, one can compare countries in the same income class. Among rich countries, according to a 2015 study by Citi Research, female labor force participation ranges from nearly 80 percent in Switzerland to 70 percent in Germany and less than 60 percent in the United States and Japan. To its own benefit, Japan is waking up to this fact. Since coming to power in 2012, Prime Minister Shinzo Abe has explicitly recognized the role that women could play to fix Japan's severe aging problem, and he has incorporated "Womenomics" as a central element in his plan to revive the economy. Womenomics includes improving childcare services and parental leave, cutting the "marriage penalty" that taxes a family's second earner at a higher rate, and encouraging Japanese corporations to put more women in executive positions. During the first three years of Abe's term, some eight hundred thousand women entered the workforce, and he claimed his campaign was also pushing more women into corner office jobs.

In Canada, an effort to open doors to women produced quick results. Only 68 percent of Canadian women participated in the workforce in 1990; two decades later that figure had increased to 74 percent, largely on the back of reforms including tax cuts for second earners and new childcare services. An even more dramatic boom in the number of working women came in the Netherlands, where the female labor participation rate has doubled since 1980 to 74 percent today, as a result of expanded parental leave policies and the spread of flexible, part-time working arrangements. In relatively short order, the Netherlands caught

up to and raced past the United States, in terms of utilizing the talents of its women.

No matter how aggressive these campaigns get, all countries have a higher male than female participation rate, though this gender gap varies widely by country. The countries with the smallest gender gap, less than 10 percent, include Norway, Sweden, Canada, and Vietnam. Vietnam may seem like an unlikely entry on that list, but these gender gaps are related to political culture, and many socialist or Communist countries, including China, have taken concerted steps to bring women into the workforce. That is true even in Russia, which has a relatively high female labor force participation rate despite Soviet-era laws that close over 450 occupations as “too strenuous for women.” Vladimir Putin signed off on these restrictions when he took power in 2000, and Russian courts upheld them as recently as 2009. In a 2014 survey of 143 emerging countries, the World Bank found that 90 percent have at least one law that limits the economic opportunities available to women. These laws include bans or limitations on women owning property, opening a bank account, signing a contract, entering a courtroom, traveling alone, driving, or controlling family finances.<sup>6</sup>

Such restrictions are particularly prevalent in the Middle East and South Asia, the regions with the world’s lowest rates of female labor force participation, 26 and 35 percent respectively. The gender gap exceeds 50 points in Pakistan, Iran, Saudi Arabia, and Egypt, and the hurdles to working women often involve a combination of written laws and cultural norms. In a *New Yorker* magazine piece, Peter Hessler profiled a Chinese entrepreneur who opened a cell phone factory in Egypt but had to shut it down within a year partly because his female employees—despite a strong work ethic—were compelled by Egyptian cultural norms to refuse night shifts and to quit once they got married.<sup>7</sup> In larger countries such as India, where fewer than 30 percent of women participate in the labor force, the overall figures also conceal shocking pockets of backwardness. In the Indian state of Bihar, out of a

population of 100 million, only 2 percent of women work in formal jobs that are counted as part of the labor force.

The cultural barriers are real but not insurmountable. Latin America, which has a reputation for harboring some of the world’s most macho cultures, is also making rapid gains in bringing women into the workforce. Between 1990 and 2013 only five countries increased their female labor force participation rate by more than 10 percentage points, and all were Latin countries. In first place was Colombia, where the share of adult women active in the workforce rose by 26 percentage points, followed by Peru, Chile, Brazil, and Mexico.

The reasons for this boom are complex, but one is that Latin educational systems have opened up to women; in Colombia, Profamilia, a private group founded in the 1970s by wealthy women, has played a major role. Profamilia took on the powerful Catholic Church and lobbied for wider access to contraception, so that women could choose to delay childbirth in favor of a career. The fertility rate has dropped sharply, while the female labor force participation rate has skyrocketed. In many countries, all the leaders need to do to reap the economic boost from working women is to lift existing restrictions, which is a lot easier than providing costly new childcare services or generous parental leave.

Cultures don’t change overnight, but laws can. The IMF says that when countries grant women the right to open a bank account, female labor force participation rises substantially over the next seven years.<sup>8</sup> Yet the pool of untapped female talent is still huge. Many countries are starting to recognize how much they stand to gain by opening work-site doors to women. The biggest gains are possible in the countries with the worst aging problems and the lowest female participation rates, including Japan and South Korea. In the United States, women joined the workforce in record numbers for much of the postwar era, but that trend peaked around 2003 and has been ebbing. A possible reason is that the United States combines a particularly high marriage tax penalty with unusually low spending on childcare services. It is also the

only industrial country with no national policy guaranteeing some paid leave for new parents.

The OECD recently estimated that eliminating the gender gap—bringing as large a share of adult women into the workforce as men—would lead to an overall increase in GDP of 12 percent in its member nations between 2015 and 2030. The GDP gains would peak close to 20 percent in both Japan and South Korea and more than 20 percent in Italy, where less than 40 percent of women are in the formal labor force. A similar analysis in 2010 by Booz and Company showed that closing the gender gap in emerging countries could yield even larger gains in GDP by 2020, ranging from a 34 percent gain in Egypt to 27 percent in India and 9 percent in Brazil.

### *The Battle to Attract Migrants*

One basic driver of population growth has remained steady in recent decades. Since 1960 the global fertility rate has plummeted, and life expectancy has extended from 50 years to 69 and is still rising, but the rate of migration has stayed pretty much the same. Half a century ago migrants accounted for about 3 percent of the global population, and in 2012 they still accounted for about 3 percent. And for all the fear generated in 2015 by the surge of more than one million refugees into Europe from war-torn Syria, Iraq, and Afghanistan, these surges are likely to last only as long as the localized violence. The more powerful underlying trend is the collapse of working-age population growth in the emerging world, which is already decreasing flows of economic migrants from these countries to the developed world. Between 2005 and 2010 net migration from developing to developed countries totaled 16.4 million people, but from 2010 to 2015 that total fell by nearly five million.

In fact, at least before anti-immigrant movements took off in Europe and the United States in 2015, the competition to attract foreign workers had been heating up. According to the United Nations, the number

of countries that had publicly stated plans to try to increase the size of their populations “via immigration” more than doubled to twenty-two in 2013, from ten just three years earlier. To get a sense of which countries are doing well in attracting migrants, watch for which nations have been gaining or losing the most in population, as a result of net migration. Between 2011 and 2015 among the biggest gainers in the developed world were Australia, Canada, the United States, and Germany.

Perhaps the big surprise is Germany, which in 2015 received global attention for a growing backlash against the influx of war refugees that included arson attacks on local refugee centers and neo-Nazis chanting “Heil Hitler.” Chancellor Angela Merkel suffered a decline in her popularity ratings that was partly attributable to her policy of opening doors wide to immigrants. However, were it not for a positive boost from net migration, Germany’s population would have shrunk after 2011. Between 2011 and 2015, net migration boosted the German population by 1.6 percent—a number that exactly matched the increase in the United States, which is seen as the land of immigrants.

While the inflow of migrants was a big plus for the German economy, it was still relatively small compared to the pace of population decline. Between 2014 and 2015 the number of new arrivals spiked more than eightfold to about one million, but Germany would have to accept even more—about 1.5 million—every year between 2015 and 2030 in order to maintain its current balance of working-age people to retirees. That is not to suggest that Germany can or should simply accept more than a million refugees a year, because the challenges of integrating that many people into the economy quickly are real. It is only to dramatize the scale of Germany’s aging problem, in which the imbalance between old and young is unfolding even faster than the refugees were arriving in 2015. This situation is typical for many industrial countries: Even a huge increase in the number of migrants they accept will only partially offset the depopulation bomb.

Outside of the refugee crisis, Canada and Australia have seen even bigger migration-driven boosts to their population than Germany, with

total increases of 3.3 and 4.3 percent respectively since 2011. In recent years Australia's population has grown faster than that of any large developed country mainly because it has been open to orderly immigration. Two-thirds of the country's population growth is accounted for by migrants, most of them arriving from India and China. Australia's population is aging and its economic growth slowing, but if it keeps its doors open—which is far from certain in 2015, as an anti-immigrant movement gains momentum—the economic deceleration will be far slower than in most other rich countries.

Japan has been the anti-Australia, closing its doors about as tightly as a modern nation could. Less than 2 percent of its population is foreign born, compared to 30 percent of Australia's. Until recently this insularity was considered a competitive advantage; in the 1980s analysts inside and outside Japan saw the "harmony" of a monotone culture and the absence of ethnic conflict as one reason for its economic rise. Prime Minister Yasuhiro Nakasone and other political leaders publicly embraced the "homogeneous" society as essential to Japan's identity and strength. As recently as 2005, internal affairs minister Taro Aso—who later became deputy prime minister—celebrated the idea of Japan as "one race, one civilization, one language and one culture."

Some high government officials still take that line, but their views have collided with a widening realization in the Abe administration that Japan is going to be one lonely, shrinking civilization if it does not welcome economic migrants. Prime Minister Abe has increased the number of visas available to these new arrivals, and the numbers are picking up. But right now Japan has a net annual gain from migration of about fifty thousand people a year, and it would have to increase that number roughly tenfold to make up for its projected population decline through the year 2030. In other words, Japan would have to become a lot more like Australia.

South Korea is another ethnically uniform culture that once embraced its homogeneity as a source of cohesion in politics and discipline in the workforce. But it has been changing much faster than Japan

in the face of a similarly stark decline in its working-age population. The shock of the Asian financial crisis of 1997–98 forced South Korea to rethink its cloistered ways. While there were about a quarter-million immigrants in South Korea before the crisis, since the year 2000 the immigrant population has increased 400 percent to 1.3 million, compared to an increase of just 50 percent in Japan. South Korea's government now promotes multiculturalism as official policy. Immigration services officials boast of their far-reaching efforts to lure talent, and the United Nations has lauded South Korea's system of providing foreigners with work permits in industries facing labor shortages. Though the working-age population is already shrinking, it would have been shrinking four times more rapidly without the influx of migrants. Further, since taking office in 2013, President Park Geun-hye has promised new moves to address the aging problem by attracting young foreigners to work in South Korea.

These campaigns to recruit economic migrants contrast with the disorganized efforts of nearby Thailand, now known as the "Old Man of Southeast Asia" because it is the only country in that region in which the working-age population is expected to shrink over the next five years. Led by a proselytizing bureaucrat who came to be known as Mr. Condom, Thailand in the 1970s pushed a birth control program that was, some now argue, too successful. Cops handed out condoms in traffic, and monks blessed condoms in temples. Mr. Condom—his real name was Mechai Viravaidya—offered free vasectomies at his restaurant chain Cabbages and Condoms and developed an international reputation by bringing fistfuls of condoms to World Bank talks. The fertility rate fell sharply, from 6 children for the average woman in 1970 to below the replacement level in the early 1990s.

Women aren't the answer for Thailand, because its female labor force participation rate is already more than 70 percent—by far the highest among countries at Thailand's income level, owing to the liberal Thai culture. Compared to others in Southeast Asia, this laid-back Buddhist society is also unusually open to foreigners, with nearly four

million immigrants comprising more than 5 percent of its population, versus less than 1 percent in the Philippines and Indonesia. It is common in Thailand to meet foreign executives running major companies—something that rarely happens in more nationalist neighbors such as Indonesia or Malaysia. Migrant laborers—mainly fellow Buddhists from Myanmar, Laos, and Cambodia—also move easily in and out of Thailand, but they come as they choose, neither recruited nor discouraged. “It’s a classic Thai tale. No conscious policy,” a Bangkok-based economist told me during a visit to the city in October 2013. “Technically many of the immigrants are here illegally, but who really cares about the law?” To counter its aging problem, Thailand would need to offer a more deliberate welcome to immigrants.

Among the large emerging nations, the big recent gainers from migration have been Turkey, Malaysia, and South Africa, all of which have become regional magnets for refugees and job seekers. Between 2011 and 2015 inbound migration increased the population of South Africa by 1.1 percent, of Malaysia by 1.5 percent, and of Turkey by a striking 2.5 percent. In 2014, even as right-wing parties across western Europe were screaming for the expulsion of immigrants and refugees, Turkey quietly extended legal status to more than one million refugees, many of them from Syria. At least some Turkish leaders recognized the opportunity to import labor muscle and talent, including the many doctors and other well-educated professionals in the refugee ranks. In 2014, according to World Bank president Jim Yong Kim, a quarter of the new businesses in Turkey were started by Syrians, and the fastest-growing regions of Turkey were those where refugees had settled.<sup>9</sup>

### *Brain Gain, Brain Drain*

As the competition to attract labor heats up, the competition for skilled labor is going to be especially fierce. As of 2014, two-thirds of the OECD member nations had recently implemented, or were in the process of implementing, policies designed to increase high-skilled immigration.

These programs have driven a 70 percent increase in the number of university-educated immigrants living in OECD nations to a total of 35 million over the 2000s. Despite the anti-immigrant upwelling of 2015, that underlying competition to attract foreign talent has continued.

For decades, the United States has benefited from brain gain, which has helped to fuel the entrepreneurial energy of American society. Today immigrants make up 13 percent of the total U.S. population, but they account for 25 percent of the new business owners and 30 percent of the people working in Silicon Valley. Of the top twenty-five U.S. tech companies in 2013, 60 percent were founded by first- or second-generation immigrants. Steve Jobs at Apple: second generation from Syria. Sergey Brin at Google: first generation from Russia. Larry Ellison at Oracle: second generation from Russia. Jeff Bezos at Amazon: second generation from Cuba. While many of these founders with immigrant roots hail from countries mired in war or economic dysfunction, quite a few come from families that left the heavily regulated economies of Europe, including old East Germany (Konstantin Guericke of Symantec), France (Pierre Omidyar of eBay), and Italy (Roger Marino of EMC).

In recent years Silicon Valley tycoons have become increasingly concerned that the United States was closing its doors to highly skilled foreigners, putting the country at a disadvantage in the talent wars. Since 2000 the United States has let in more and more foreigners to study but not to work. The number of student visas rose to nearly half a million over that period, but the number of employment or H1B visas held steady at around 150,000. The United States was sending 350,000 graduates home each year, mostly to India and China, and competitors were circling California, picking off fresh talent.

In 2013 the tech analyst Mary Meeker circulated photos of a billboard that the Canadian government placed on Highway 101, the main artery through Silicon Valley, taking a cheeky jab at President Barack Obama’s promise of a foreign policy “Pivot to Asia.” The billboard read, “H1B problems? Pivot to Canada.” Before a visit to the Bay Area in the summer of 2013, Canada’s minister of citizenship, immigration, and

multiculturalism, Jason Kenney, said he was going to spread the word that Canada is “open for newcomers” and was “not going to apologize” for poaching talent. “If you guys cannot figure out your immigration system, we’re going to invite the best and the brightest to come north of the border,” he said.

It would be hard to find a crisper declaration of the global talent war. One way to identify winners is to look for countries where immigrants account for a large and growing share of university grads, which suggests that the nation has been gaining in educated talent. This gain is most dramatic in Britain, Canada, and particularly Australia, where immigrants represent 30 percent of the total population but 40 percent of university grads. That 10 percent gap represents significant brain gain. In the United States and Japan, immigrants represent equal shares of the university-educated population and the general population, so their impact is less powerful. In Germany, the Netherlands, and some other European countries, the immigrant population is less likely to hold degrees than the local population.

These differences are not small. The Chinese and Indian families moving to Australia and Canada tend to bring their high educational standards with them, and their children do as well on standardized high school tests as the locals. In fact, in Australia they do better—the only major industrial country where this is the case. In the United States and Britain, they do somewhat worse. But in many continental European countries, particularly in the north, they do dramatically worse. In Sweden, for example, 20 percent of native students score “below the level required to participate fully in modern society,” but 60 percent of first-generation immigrants fall below the benchmark. Similarly glaring disparities are found in Germany, France, Switzerland, and other northern countries, where concerns are growing that migration is feeding the rise of an underclass, further taxing overburdened welfare and pension systems.

There is no question that cultural barriers complicate the process of integrating migrants into an advanced economy, but the same is true

of integrating women and the elderly. Moreover, the fear of unskilled migrants is probably overblown. A growing body of research shows that immigration—skilled or not—tends to boost productivity and economic growth. World Bank economist Caglar Ozden recently looked into the often-heard charge that immigrants steal jobs from locals and found little truth to the claim.<sup>10</sup>

In general Ozden found that migrants often take jobs that locals don’t want or can’t fill. On a visit to Greece in June 2015, when its debt crisis was still raging and concern was high over double-digit youth unemployment, I was struck by how many local business owners nonetheless complained about the work ethic of young Greeks, saying they prefer to live at home on the generous pensions of their mothers, who shield them from grunt jobs. Almost to a man, the business owners said they liked to hire immigrants who were eager to work, a claim that has some support in data showing that in Greece the labor force participation rate is 10 percentage points higher for migrants than for locals.<sup>11</sup> That is the highest gap in Europe, so Greece is perhaps an extreme case, but migrants do often fill unwanted positions.

Ozden also found that unskilled migrants tend either to have no impact on local wages and employment or to increase wages and employment. He draws a parallel with the case of Malaysia, where the large recent influx of foreigners allowed many high-school-educated locals to become junior managers of immigrant laborers rather than be laborers themselves. This resulted in a big boost to economic growth, and the boost from skilled migrants tends to be even larger.

The main human drivers of productivity growth in the United States are scientists, tech professionals, engineers, and mathematicians—fields in which immigrants are already overrepresented. In this way migrants tend to fill jobs locals don’t want at both the low end and the high end, whether as maids or math professors. Skilled migrants also spur technological progress by carrying across borders the sort of information that is hard to write down, because they are learned and disseminated through hands-on experience, like the details of making semiconduc-



tors. According to Harvard University's *Atlas of Economic Complexity*, the key to driving economic growth is not so much individual experts as the combination of expertise required to make complex products: for example, the mix of experience in batteries, liquid crystals, semiconductors, software, metallurgy, and lean manufacturing required to make a smartphone. The fastest way to secure this array of talent is to import it. The same idea applies to more and more fields in an age when even cooking has become culinary science. On a trip to Peru in January 2014, I was surprised to discover that by some rankings, Lima is home to three of the world's top twenty restaurants, a result of the mixing of Latin and Asian styles that has its roots in the migration of labor from China and Japan back in the nineteenth century.

For many emerging nations, the battle is as much about retaining as attracting talent. In the 2000s, by one estimate, some ninety thousand inventors moved out of China and India, many of them to the United States. That represented potentially dramatic gains for the United States and substantial losses for the emerging giants, but there is no systematic way to track these trends. I simply keep my ear to the ground for current evidence of brain drain and its reverse.

Sometimes the headline numbers can be misleading. Between 2011 and 2015 Russia witnessed strong positive net migration due to an influx of hundreds of thousands of job seekers from former Soviet Satellite states, led by Ukraine. But the increasing numbers of talented Russians leaving the country outstripped this influx. More than 180,000 Russians left in 2013, five times more than those who departed in 2009 and close to peaks reached during the banking crisis in 1998. Those leaving were entrepreneurs, writers, scientists, and the sons and daughters of families that could afford to send their children abroad to study, in the hope that they could eventually settle outside Russia. Dinner table conversation among the Russian elite dwelled on how to secure a visa to a desirable foreign country and how to get one's money out with the family.

The Chinese economy was much farther from a crisis situation than Russia's, but my colleagues there reported similar chatter. More than

ninety thousand millionaires left China between 2000 and 2014—by far the largest outflow in raw numbers for any country. A Barclays Bank survey in 2014 of two thousand wealthy Asians found that the Chinese were by far the most likely to be considering emigration, with 47 percent of them saying they aimed to leave their home country within five years. Among the Chinese aiming to emigrate, roughly three out of four cited economic security, a better climate, and better job and school opportunities for their children overseas. Chinese dinner table conversations were all about the best place to go: the United States or Australia or Canada. Recent news reports said that tens of thousands of Chinese were looking to invest in Australia and Canada in order to secure special visas that allow large investors to move to those countries legally. When smart people are seeking to move out of a country it is a bad sign, and when they are looking to move out along with their money, it is an even worse sign.

Even as governments battle to attract immigrant talent, popular backlashes against mixing migrants into society are still common if self-defeating. Outside insular Japan, the general rule of thumb for most industrial democracies is that immigrants account for 10 to 15 percent of the population. Recent polls by Ipsos MORI, the British market research group, show that the populace in Germany and the United Kingdom believes the immigrant community is twice that size. The perception gap is even wider in France and the United States, with polls indicating that people think the immigrant population is three times bigger than it really is: American respondents estimated that immigrants account for 32 percent of the population, when the actual figure is 13 percent.

This misperception reflects fear of outsiders and skews political debate toward limiting immigration rather than welcoming a healthy mix. In 2015, a front-running candidate for U.S. president, Donald Trump, promised to force Mexico to pay for an impregnable wall on the border. But with the working-age population in Mexico poised to fall as well, Mexicans will have less reason to seek work in the United States. Trump and his supporters didn't realize it, but in the four years before 2015, net migration from Mexico had fallen to zero, in part

because construction jobs in the United States had been harder to find. This dynamic, with falling population growth in the emerging world reducing migration to the developed world, is likely to grow stronger in coming years.

### *Welcome, Robot*

Fear of the robotic future is now as strong as fear of migrants and refugees, and it is built on a lack of imagination. In the early nineteenth century, when nine in ten Americans worked in farm jobs, it would have been hard to imagine that this figure would fall to about one in one hundred today and even harder to imagine where all the new jobs would come from. No one could have foreseen the full scale of the employment boom in the manufacturing and services industries. Paradoxically, pessimists today argue that robots will replace manufacturing jobs, and leave humans with no jobs at all, because it is again hard to imagine what comes next.

The pessimists say that the latest tech revolution is different because earlier generations of machines were made as tools for humans to use, but the newest technology is made to think like humans. This transformation is not about robotic arms providing muscle on the assembly line, they say—it's about automatons with artificial intelligence capable of "machine learning" and of, one day, designing the assembly line, all powered by the awesome computing capacity of the cloud and big data. In one of the most widely cited forecasts, the Oxford University researchers Carl Benedikt Frey and Michael Osborne predicted in late 2013 that about 47 percent of U.S. jobs are at risk from automation in the next decade or two.<sup>12</sup> The most common job for American men is driving, and one forecast has driverless smart cars and trucks replacing them all by 2020.

This line of logic parallels many arguments we have heard before. Berkeley's Machine Intelligence Research Institute has tallied up forecasts for when artificial intelligence (AI) will arrive, and the standard

prediction today is that it will be upon us in twenty years. But that was also the standard prediction in 1955. The joke in the AI field is that if you say AI is coming in twenty years, you can get investors to fund your work; if you say five years they will remember and expect you to deliver, and if you say one hundred years they won't be interested.

While the robotics revolution could come faster than most previous technology revolutions, it is likely to be gradual enough to complement rather than destroy the human workforce. A huge gap still exists between the size of the world's industrial robot population—about 1.6 million—and the global industrial labor force of about 320 million humans. Most of these industrial robots are currently unintelligent machines, committed to a single task like turning a bolt or painting a car door, and indeed nearly half of them work in the car industry, which is still the single largest employer (of humans) in the United States.

Workplaces evolve to incorporate machines, but people find a way to fit in. Though U.S. banks have replaced a lot of humans with automated tellers, the savings have allowed them to open up a lot more branches, so that in total the number of human tellers actually increased from 500,000 in 1980 to 550,000 in 2010. Addressing the predictions of a jobless future, the Harvard economist Lawrence Katz has remarked, "We never run out of jobs. There is no long-term trend of eliminating work for people."<sup>13</sup>

If automation was displacing humans as fast as implied in recent books like Martin Ford's *The Rise of the Robots*, then we should be seeing the negative impact on jobs already. We're seeing the opposite. Another mystery of the postcrisis era is that while economic growth has been unusually weak, job growth in the major industrial countries (which use by far the most robots) has been relatively strong. In the G-7, the group of seven top industrial countries led by the United States, unemployment has fallen faster than expected in the face of weak economic growth, and faster than during any comparable period since at least the 1970s. Not only that, but the unemployment rate has been falling despite the fact that in Germany, Japan, Britain, and every G-7

country except the United States, the share of working-age people who participate in the labor force has been rising. The job picture has been particularly strong in Germany, Japan, and South Korea—which are also the industrial countries that employ the most robots.

Admittedly, the automaton invasion is in its early stages and picking up speed, but both historical and current evidence suggests humans will come to some agreeable arrangement with these invaders of their own creation. One of the new trends is cobots, industrial robots with swing arms safe enough to work alongside and in cooperation with people, rather than inside cages. The techno-optimists believe robots will be our servants, not our replacements, and will free us for lives of pampered leisure in retirement. Be that as it may, a strong practical argument can be made that the answer to fewer young people is more robots. An alarmed interviewer recently asked the Nobel economist and author Daniel Kahneman about the threat posed by the “rise of the robots” to a heavily industrialized country like China. “You just don’t get it,” Kahneman responded. “In China, the robots are going to come just in time” to rescue the country from population decline.<sup>14</sup>

In the future, economists may count growth in the working robot population as a positive sign for economic growth, the same way that today they analyze growth in the working-age human population. Whether by design or happy accident, many of the countries with the most rapidly aging populations also have the largest robot populations. According to the International Federation of Robots, the highest density of robots in the world can be found in South Korea, which in 2013 had 437 industrial robots per 10,000 employees, followed by Japan with 323, and Germany with 282. China was way behind with only 14, but on the bright side—arguably—it also had the world’s fastest-growing robot population, up by 36,000 in 2013.

I am optimistic on automation in the workplace because I believe that the laws that govern the economic world are similar to those that govern the physical world, in which nothing is ever lost, nothing is gained, and everything is transformed. Over the past twenty-five years,

as McKinsey consulting has pointed out, about a third of the new jobs created in the United States were types that did not exist, or barely existed, twenty-five years ago. In the next transformation of the workplace, humans are likely to replace the jobs lost to robots and artificial intelligence with new jobs we can’t yet imagine.

### *All Hands on Deck*

As the economic impact of population decline unfolds, some analysts will argue that the smart response to slower population growth is no response. That was the contention of many people in Japan, where the rapid aging of the population was visible as early as the 1960s, when the birthrate first fell below the replacement rate. The do-nothing argument is that the economic impact of population decline doesn’t matter, if it doesn’t lower per capita incomes. But it is hard for any country to hold that above-it-all pose. The reality of global competition will always intrude. In 2010 China became the world’s second-largest economy, passing Japan, which has since mobilized much more aggressively to try to restart economic growth and respond to the challenge that China poses to its political and military position in Asia. A growing population matters for global status and the power that comes with economic might, apart from the greater dynamism and higher productivity that results from new people entering the workforce.

To assess which nations are best or worst positioned to grow, look first at projections for growth or shrinkage in the working-age population, to gauge the potential baseline gain for future economic growth. Just as important, track which countries are doing the most or the least to leverage whatever population gains they will enjoy. Are they opening the workforce to the elderly, to women, to foreigners? Are they taking steps to increase the talent level of the workforce, particularly by attracting highly skilled migrants? In a world facing a future of growing labor shortages, it’s all hands—human or automated—on deck.