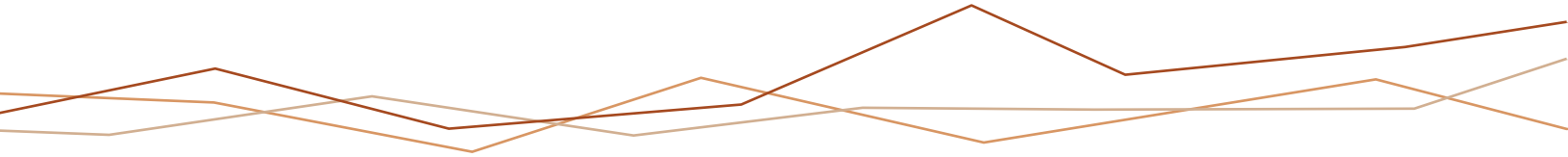
A "New Normal"?

THE PROSPECTS FOR LONG-TERM GROWTH IN THE UNITED STATES

By Aaron Steelman and John A. Weinberg

Following the recession of 2007–09, annual U.S. economic growth rates have been below long-term trends. While there are plausible arguments that this sluggishness may continue for some time, there is good reason to think more rapid growth rates will return.

The United States, since the end of World War II, has generally been seen around the world as an economic powerhouse. Indeed, that period has witnessed large gains in most Americans' quality of life, as life spans have grown sharply, access to education has expanded markedly, and people regularly enjoy consumer items that would have once been considered luxuries or were simply unimagined when the hostilities in Europe and Asia ended and Americans got back to peacetime life. From 1947 through 2007, the economy grew at roughly 3.4 percent annually. While growth is often expressed in terms of total economic output, a growing population will bring with it some amount of overall growth.



To measure improvement in average standards of living, growth of GDP per capita is the standard yardstick. The post-war average of 3.4 percent overall growth translated to an average growth rate per capita of about 2.1 percent. During that period, the United States experienced a few significant recessions and several milder downturns. Such fluctuations can be acutely felt by many people when they occur, but against the longer-run performance, they look relatively insignificant.

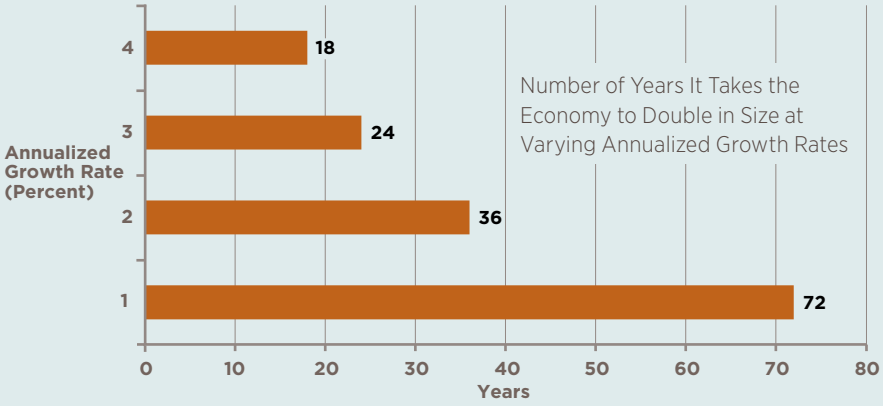
Since the financial crisis and Great Recession, though, many people's perception of the strength of the U.S. economy and its prospects for the future have dimmed. These skeptics point to the slowed pace of growth: Since 2010, the U.S. economy has grown at a rate of roughly 2.1 percent annually, which translates to an average growth rate per capita of about 1.3 percent, both well below the post-World War II rates prior to the Great Recession and, perhaps more notably, far below what has been seen in "catch-up" periods following previous significant downturns. For instance, following the 1981–82 recession, the U.S. economy rebounded sharply, growing 7.8 percent in 1983 and 5.7 percent in 1984. Some observers believe we have entered a period characterized by a "new normal" or even a "new mediocre"—and that it looks very different from what, on average, Americans enjoyed in the immediate decades after the soldiers returned home from World War II.[1] Proponents of the new normal hypothesis maintain that the United States is likely to grow at a substantially slower rate than it did prior to the Great Recession, with many predicting growth rates of roughly 1.5 percent to 2 percent.[2]

Some commentators who would generally place themselves in the skeptics camp argue that the new normal had already started, in a sense, prior to the Great Recession—that, the U.S. economy was already experiencing lower productivity and growth rates due to several important long-term trends. As Tyler Cowen, an economist at George Mason University, put it in his 2011 book *The Great Stagnation*, the United States has "built social and economic institutions on the expectation of a lot of low-hanging fruit, but that fruit is mostly gone" and has been since roughly the early 1970s.[3] In particular, he identifies three types of increasingly scarce "fruit": free land, technological breakthroughs, and smart but relatively uneducated kids.[4]

Regarding the first, until the beginning of the 20th century, free and fertile American land was plentiful and not only "did the United States reap a huge bounty from the free land (often stolen from Native Americans, one should not forget), but abundant resources helped the United States attract many of the brightest and most ambitious workers from Europe," Cowen writes. "Taking in these workers, and letting them cultivate the land, was like plucking low-hanging fruit." Second, Cowen also sees technological innovation, and especially breakthroughs, as slowing. "Life is better and we have more stuff, but the pace of change has slowed down compared to what people saw two or three generations ago." Third, in 1900, a very small percentage of Americans graduated from high school, while estimates of high school completion today range from roughly 75 percent to 90 percent. "In other words," Cowen writes,

Relatively Small Changes in Growth Rates Have Big Effects Over Time

There are many reasons why we might want to focus on long-run economic performance. But perhaps the most compelling one can be shown in the accompanying figure. In a sense, the faster the economy grows, the faster the future reaches us. Just like accounting for retirement, one can also account for where the economy will be in a given number of years using some basic actuarial principles. If an economy grows at 1 percent a year, it will take roughly 72 years for it to double in size in gross terms, a little less than the average lifespan of an American today. In contrast, if you change that assumption to an annualized growth rate of 3 percent, an economy will be twice as large in only 24 years, about the time when many Americans have finished college and are getting settled into their careers. So while we are justifiably concerned about today, it's useful to keep in mind that what might seem like relatively small changes in the longer-run growth path can have profound implications for our well-being and that of future generations.



"earlier in the twentieth century a lot of potential geniuses didn't get much education, but rather were literally 'kept down on the farm.' Taking a smart, motivated person out of an isolated environment and sending that person to high school will bring big productivity gains." Cowen makes a similar observation about college attendance. In 1900, he notes, just one in 400 Americans went to college, while about 40 percent of 18–24-year-olds were enrolled in college in 2009, a number that was roughly the same in 2015.

In a series of papers and his recently published book *The Rise and Fall of American Growth*, Northwestern University economist Robert J. Gordon also argues that the U.S. economy is likely to grow slowly—and also, like Cowen, traces this downward trajectory to roughly 1970. At the heart of Gordon's case are two ideas: first, that the pace of innovation has slowed, particularly compared to the middle of the 20th century, and there is little reason to believe that will change and, second, there are four large additional "headwinds" facing the U.S. economy.

The U.S. experienced several short recessions during the 1950s and 1960s, but overall economic growth was relatively strong.

Gordon describes the century following the Civil War as the period of great economic liberation, where a large portion of the United States was freed from "an unremitting daily grind of painful manual labor, household drudgery, darkness, isolation, and early death." He elaborates: "Manual outdoor jobs were replaced by work in air-conditioned environments, housework was increasingly performed by electric appliances, darkness was replaced by light, and isolation was replaced not just by travel, but also by color television images bringing the world into the living room. Most important, a newborn infant could expect to live not to age forty-five, but to age seventy-two."[5] What is more, these stark changes in Americans' way of life were broadly enjoyed, with virtually every American benefiting from the development of public waterworks, electricity, and antibiotics, and most seeing their workweeks become shorter and less physically onerous while their take-home pay increased. Leisure time and retirement, once abstract concepts, became the norm. As a result, Gordon dubs the period 1920–70 as the "Second Industrial Revolution" or "IR #2".

There has been innovation since 1970, Gordon concedes, but it can hardly be compared to IR #2. He argues that the effects of the digital revolution, or "IR #3," which

started with innovations that can be traced to the late 1970s and early 1980s but did not produce major changes in the way business was done until the mid-1990s, have been "felt in a limited sphere of human activity, in contrast to IR #2, which changed everything." Moreover, the productivity gains produced by IR #3 were most acutely felt for only about a decade, with advances coming much more slowly since 2004.[6]

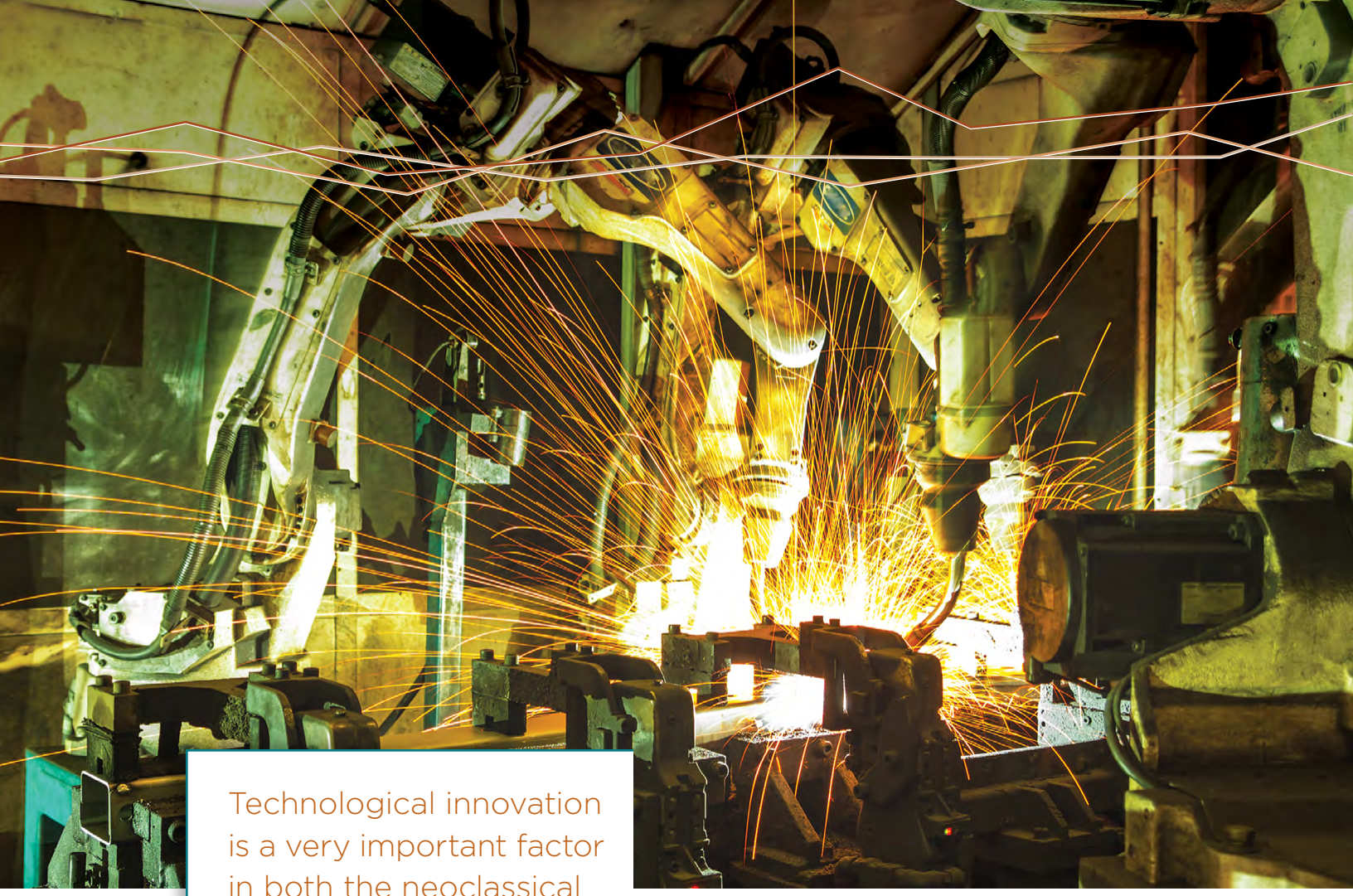
In addition to a slowing rate of innovation, Gordon, as noted before, argues that the U.S. economy faces four big headwinds. First, there's rising income inequality, which has reduced the share of economic gains going to the middle and working classes and with it their disposable income and purchasing power. Second, growth in educational attainment as measured by years of schooling completed has slowed and, among some parts of the population, decreased since 1970. In addition, the quality of primary and secondary education has become more stratified and the costs of higher education has increased. Such trends in education are themselves a contributor to the first headwind, growing income inequality. Third, the United States is experiencing significant demographic changes, most significantly many baby boomers are reaching traditional retirement age. That has reduced the number of hours worked per person. In addition, labor force participation among people who have not yet reached retirement age has dropped. Fourth, federal, state, and local governments face mounting debt, in large measure due to the aging of the population, as spending on "entitlement" programs such as Social Security and Medicare increases and pension obligations to public-sector employees grow. Gordon identifies two additional headwinds, which he thinks could be barriers to growth, though they are hard to quantify: "globalization," which could add to growing income inequality, and global warming and other environmental issues, which could require significant resources to address.[7]

All told, the slowing of innovation and the aforementioned headwinds suggest that the "outlook for future growth in the U.S. standard of living is not promising," Gordon writes. He doubts that "the standard of living of today's youths will double that of their parents, unlike the standard of living of each previous generation of Americans back to the late nineteenth century."[8]

In many ways, Cowen and Gordon have framed the issues surrounding the prospects for long-term economic growth in the United States quite well. In the next two sections, we discuss the ways economists have studied economic growth and its causes from the 1950s to the present. In sections four and five, we evaluate the arguments made for relatively slow long-run economic growth and discuss possible policy implications.

Accounting for Growth — The Neoclassical Model

In his speech accepting the Nobel Prize in December 1987, economist Robert Solow of the Massachusetts Institute of Technology noted that when he started thinking about economic growth, prevailing "theory, like much else in macroeconomics, was a product of the depression of the 1930s and of the war that finally ended it. So was I. Nevertheless it seemed to me that the story told by these



Technological innovation is a very important factor in both the neoclassical and endogenous growth models.

models felt wrong." In particular, Solow had in mind the work of the English economist Roy Harrod and the Russian-American economist Evsey Domar. The Harrod-Domar model maintained that steady economic growth at a constant rate required the national saving rate to be equal to the product of the capital-output ratio and the rate of growth of the labor force.[9] "Discomfort arose because they worked this out on the assumption that all three of the key ingredients… were given constants, facts of nature," Solow wrote.[10] But, in fact, all three are capable of changing at different rates at different times. This meant that an equilibrium growth path could be achieved only in rare circumstances. More often, the economy would be alternating between worsening periods of labor underutilization and long periods of growing labor shortage. Despite the severe effects of the Great Depression, American economic history did not fit this pattern. Solow looked to an alternative and in two papers in the 1950s[11] developed what came to be known as either the "Solow growth model"[12] or the "neoclassical growth model."

The Harrod-Domar model assumed that labor could not be substituted for capital in production. Solow removed this assumption and with it the "knife-edge notion of unstable balance" went with it. His model was quite elegant in its simplicity. Output was

determined by three factors: capital, labor, and technology. That measure of technology was later dubbed the "Solow residual" or "total factor productivity" (TFP) and includes a variety of things beyond technological progress, strictly speaking. And the evolution of labor and technology was taken as given.

The model has an important implication for long-run per capita growth: Since capital suffers from diminishing returns, capital accumulation can drive growth only in the short run, and, with no technological improvements, per capita output stagnates in the long run. So long-run growth (in output per worker) is due only to technological progress, or TFP, and that progress is exogenous, meaning it comes from forces outside the economic system. Early measurements done by Solow and others suggested that a very large share of growth was not driven by capital accumulation but by TFP. Indeed, Solow concluded that during the first part of the 20th century in the United States, about 80 percent of non-farm output growth was due to TFP.[13]

A line of the neoclassical growth literature in the late 1960s attempted to better understand and measure the factors of production. As New York Fed economist Kevin J. Stiroh has put it, economists working in this period "sought to develop better measures of investment, capital, labor, and other omitted inputs in order to reduce the magnitude of the unexplained residual."[14] That area of research enriched the neoclassical growth model and pioneering work was done by Dale Jorgenson and Zvi Griliches, then of the University of California, Berkeley and the University of Chicago, respectively.[15]

Growth theorists in the 1980s and 1990s built on the neoclassical model but changed an important assumption: In their models, technological growth was endogenous rather than exogenous. Endogenous technical change is change that is determined within the economic system, meaning that it is the consequence of the decisions and actions of people in the economy. Still, it is important to note that both neoclassical growth theorists and endogenous growth theorists focus on technology as one of the factors—if not the principal factor—driving long-run economic growth. Indeed, while one of the signal contributions of the neoclassical growth theorists was the development of tools that "enable us to measure the rate of technical change," Stiroh writes, the models of the endogenous "growth theorists provide an internal explanation for the sources of technical change."[16] Similarly, Harvard University economist Elhanan Helpman, himself a major contributor to the endogenous growth literature, notes that "there is convincing evidence that total factor productivity plays a major role" in accounting for cross-country variations in per capita income and patterns of economic growth. But while careful growth accounting can help us understand the relative "contribution of inputs and the contribution of total factor productivity, it does not unveil the causes of economic growth."[17]

Explaining Growth — The New Growth Theory

Among the implications of the neoclassical growth model is that economic convergence between countries would occur over time, with poorer countries catching up with richer

The Origins of Modern Economic Growth

In 1651, Englishman Thomas Hobbes famously described life as "solitary, poor, nasty, brutish, and short."[55] In many ways, he was right—certainly from today's perspective. But within about 100 years from the time of Hobbes' statement, the Industrial Revolution had started and then continued, in most economic historians' view, until about 1820 and 1840. The Industrial Revolution changed the world forever. From 1820 to present, GDP per person in Western Europe and the United States rose by more than a factor of 20, to about $26,000, estimates Stanford University economist Charles Jones.[56] But what gave rise to the Industrial Revolution and the massive increases in well-being it spawned? And is it true that economic growth, as has often been asserted, was virtually non-existent prior to it? The answer to the first question is: It's complicated. The answer to the second is: Probably not.

The Industrial Revolution, it seems pretty clear, was the result of innovation—in short, of ideas. As Northwestern University economic historian Joel Mokyr has argued, "The effective deployment of that knowledge, scientific or otherwise, in the service of production is the primary—if not the only—cause for the rapid growth of Western economies in the past centuries."[57] But that begs the question: Why? After all, people have been coming up with ideas forever.

Mokyr points to the Enlightenment of the late 17th centuries and 18th centuries. The ideas of this period, he argues, bridge the Scientific Revolution of Galileo, Descartes, and Newton with the Industrial Revolution of the mills and factories of Great Britain and continental Europe. In particular, the Enlightenment notions that economic growth and social progress can be achieved through knowledge—and that those things are desirable—were crucial to their actual attainment.[58] But it wasn't enough. Also necessary was what Mokyr calls the doctrine of "economic reasonableness," itself a product of the Enlightenment, and that was characterized by greater openness to trade, improved infrastructure, legal predictability and stability, and less distortionary taxation. Above all, it "redefined the role of the public sphere in the economic game, pointing to the delicate balance between those who lubricate the wheels of economic activity and those who manipulate them for their own profit. It recognized the possibility of what we might call today coordination failures and suggested policies to rectify them."[59]

Mokyr's story of why the Industrial Revolution occurred when it did is not the only plausible one offered by economic historians. But it has the virtue of also offering a plausible explanation of why economic growth was not, in fact, unheard of prior to the late 18th and early 19th centuries and also not confined to Great Britain. The latter idea was once controversial, as mentioned previously, but is less so today. Work by economists such as Roger Fouquet of the London School of Economics and Political Science and Stephen Broadberry of the University of Oxford, among others, seems to demonstrate that there was intermittent and localized growth in the Middle Ages, such as in the Netherlands in the 16th and 17th centuries and in Italy in the 14th century.[60] Indeed, that growth very likely made it possible for people to move to urban areas and into nonagricultural occupations. But none of the regions that experienced such progress previously ever switched from trade-based growth to technology-based growth. Trade-based growth remained vulnerable to setbacks and shocks, both natural, such as disease and disaster, and man-made, such as legal and institutional changes that hampered the expansion of commerce. In short, not only does the argument that ideas are a primary driver of economic growth seem compelling, so too does the argument that ideas helped make ideas-based growth possible.

countries. However, that is not observed in the data. While the cross-country variation in per capita wealth has been shrinking somewhat in recent decades, as some of the poorest countries in the world have made significant relative gains, there can be no doubt that the gap between what is generally considered the developed world and the developing world remains very large. This observation motivated economists Paul Romer, now of New York University, and Robert Lucas, of the University of Chicago, to, as Romer has put it, "drop the two central assumptions of the neoclassical model: that technological change is exogenous and that the same technological opportunities are available in all countries in the world."[18]

Lucas argued that if the same technology were available everywhere, resources, such as human capital, would not tend to move from where they are scarce to where they are plentiful and substantial differences in the level and growth of income would not persist. Yet both things are true. Lucas' theory is that there are "external effects" of human capital. Economists had long argued that improvements in a worker's human capital had "internal effects"—meaning benefits from building human capital accrued to the worker (and perhaps his or her family).[19] But Lucas, building on the work of sociologist and urban theorist Jane Jacobs,[20] posited that there were spillover effects associated with human capital. As Lucas succinctly noted: "Most of what we know we learn from other people."

Some of what we know comes through relatively formal channels, such as schooling. But some of it comes through less formal channels, meaning through observation, learning by doing, and the sharing of ideas among people working on similar problems. Lucas echoed Jacobs' argument that much of economic life is "creative" in a way that is similar to how we think of art or science being creative. "New York City's garment district, financial district, diamond district, advertising district and many more are as much intellectual centers as Columbia or New York University," Lucas wrote. "The specific ideas exchanged in these centers differ, of course, from those exchanged in academic circles but the process is much the same. To an outsider, it even *looks* the same: A collection of people doing pretty much the same thing, each emphasizing his own originality and uniqueness." Indeed, Lucas argued that the principal factor that can explain the dominant role of cities in economic life—why people and businesses cluster in relatively small geographic areas where land and housing is relatively expensive—are the benefits of external human capital.[21]

Lucas' work was complementary to work being done by Romer in a series of papers at roughly the same time.[22] Romer suggests that the evidence about growth that most economists have generally agreed to be true can be distilled to five facts. (1) There are many firms in a market economy. (2) Discoveries differ from other inputs in the sense that many people can use them at the same time. (3) It is possible to replicate physical activities. (4) Technological advance comes from things that people do. (5) Many individuals and firms have market power and earn monopoly rents on discoveries.[23]

According to Romer, the neoclassical model captured facts 1, 2, and 3 but left 4 and 5 largely unaddressed. Some

endogenous growth models, such as his own, "try to take the next step and accommodate fact 4." At the heart of Romer's work is the importance of ideas and their role in innovation and productivity improvements, which he argues is the prime driver of economic growth. Initially, it can be difficult to differentiate what Lucas refers to as the economy's "stock of knowledge" from Romer's focus on ideas. But there is an important difference in how they model the generation of new ideas or knowledge. In Lucas' formulation, technological progress is a byproduct of the economic decisions people make with regard to investment in physical and human capital. People make their decisions in a competitive environment, taking the current state of technology as given. But in the process of doing so, new things are learned about the production of goods and services, which advances the technological frontier.

By contrast, Romer focuses on the technological change that arises because of intentional actions of people responding to market incentives. That is, technology advances because people seek to profit from new ways of producing goods and services. To be sure, there are some people who come up with technological breakthroughs without any commercial applications in mind. But even in those cases, those innovations spur related innovations that do have market value. "Our initial understanding of electromagnetism arose from research conducted in academic institutions, but magnetic tape and home videocassette recorders resulted from private attempts by private firms to earn a profit," Romer notes.[24] In this regard, a country's institutions are crucial to providing the proper incentives for innovation and thus growth. Economist Daron Acemoglu of the Massachusetts Institute of Technology describes innovation-friendly regimes as "inclusive," meaning they have secure property rights, level playing fields, few barriers to entry for businesses and occupations, and basic public services and infrastructure. In addition, they have stable governments characterized by a broad distribution of political power so that authority can't be exercised in an arbitrary way.[25]

Particularly importantly, ideas are inherently nonrivalrous, meaning they can be used and built upon by multiple people simultaneously. Commenting on Romer's work, Stanford University economist Charles Jones provides a useful example: "If you add one computer, you make one worker more productive. If you add a new idea—think of the computer code for the first spreadsheet or word processor or even the internet itself—you can make any number of workers more productive."[26] Moreover, in a world of relatively fast transmission of ideas across space, ideas are no longer country or region specific. They can be "imported" from any part of the world fairly easily and cheaply.

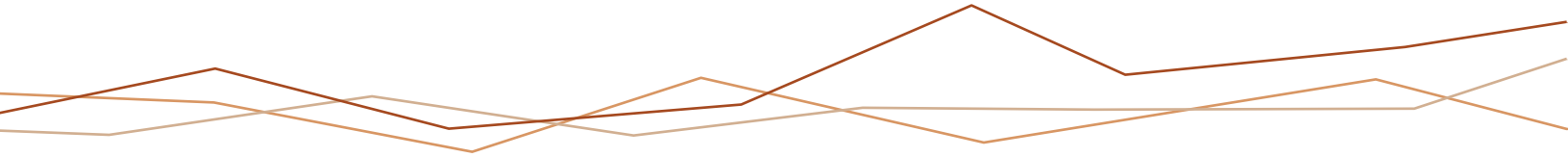
Romer then goes on to address fact 5, the existence of monopoly rents. Endogenous growth theorists working within the "Schumpeterian" framework, especially, have incorporated market power into their models.[27] These economists trace their work to Joseph Schumpeter, who noted the importance of technology in the 1930s and 1940s. He is best known for his book *Capitalism, Socialism, and Democracy,* and in particular his description of the "gale of creative destruction" as a "process of industrial mutation that incessantly revolutionizes the

As people work together on projects, sharing ideas, there are often spillover effects that enhance growth.

economic structure from within, incessantly destroying the old one, incessantly creating a new one."[28] They address the possibility that current innovators not only can exert positive knowledge spillovers on subsequent innovators, but can also drive out previous technologies (through what amounts to a process of creative destruction) and for short periods of time effectively earn monopoly rents.[29] Economists Philippe Aghion of Harvard University and Peter Howitt of Brown University argue that Schumpeterian models are generally "consistent with the empirical evidence on growth accounting, as in the neoclassical model." But like other theories of endogenous growth, "the causal explanation that it provides for economic growth is quite different from that of the neoclassical model." In short, neoclassical theory "can be seen as a special case of modern endogenous growth theory, the special limiting case in which the marginal productivity of efforts to innovate has fallen to zero."[30]

Thinking About the Future

Thus far, we have looked at the argument some economists have recently made that economic growth in the United States is likely to remain below historical trends for some time, provided a brief overview of the



neoclassical growth theory that was developed in the 1950s, and then looked at how the neoclassical model has been built upon by endogenous growth theorists in the 1980s and beyond. Given what we know from both theory and evidence, how should we evaluate the "new normal" hypothesis regarding sluggish future U.S. growth?

Gordon presents a plausible outlook. It is true that TFP growth associated with the digital revolution—or, again, as he puts it, IR #3—appears to have been relatively short lived relative to TFP growth associated with IR #1 and IR #2. During IR #2, 1920 to 1970, the annualized rate of TFP growth was 1.89. From 1970 to 1994, that number slipped to 0.57. It rebounded to 1.03 from 1994 to 2004, but then fell to 0.40 from 2004 to 2014. His interpretation for the rise from 1994 to 2004 and the drop thereafter is fairly straightforward: The introduction of the personal computer in the 1980s did not generate major productivity gains until the "invention of the Internet, web browsing, search engines, and e-commerce produced a pervasive change in every aspect of business practice."[31] However, those changes have largely been exploited and we are unlikely to see major additional changes from those technologies—and the prospect for new technological development that was as revolutionary as what we saw in the middle of the 20th century is unlikely. Yes, we will see more ingenuous apps for our mobile devices but, as he frequently quips in public lectures, "What would you rather have: your iPhone or indoor plumbing?"

Arguably the biggest problem with Gordon's analysis is that trying to predict the future is inevitably fraught with trouble. That is true in nearly every aspect of life. But it is perhaps particularly true when it comes to predicting innovation, which as we know comes in fits and starts and is hard to forecast.

Gordon's colleague at Northwestern, economic historian Joel Mokyr, argues that there are many areas of science in which significant discoveries seem promising, among them molecular microbiology, astronomy, nanochemistry, and genetic engineering. And while it is true that there is no automatic mechanism that turns better science into improved technology, "there is one reason to believe that in the near future it will do so better and more efficiently than ever before. The reason is access." Meaning, searching for vast amounts of information has become fast, easy, and nearly costless for researchers. Not only is the era of "Big Data" here but the ability to parse through the most arcane of data is no longer burdensome for people working on the frontiers of knowledge.

On the question of whether all the low-hanging fruit has been picked, Mokyr argues that the analogy is flawed. As he puts it, science "builds taller and taller ladders, so we can reach the upper branches, and then the branches above them." In other words, when a technological solution for a problem is found it often creates a new problem, which creates a new problem, and so on. "Each solution perturbs some other component in the system and sows the seed of more needs; the 'demand' for new technology is thus self-sustaining."[32]

Acemoglu is in general agreement with Mokyr on this point. The "macropicture is clear: there is little evidence we are running out of innovations," he writes. "This is not only because there are literally millions of

ideas that can be recombined into new ones to generate new processes and products, but also because every innovation poses new problems and opens the way for yet more innovations." In addition, he argues that in societies with good governance, market signals are sent to innovators to guide their work toward areas where societal benefits are large. As an example, he points to the U.S. pharmaceutical industry, where the production of drugs aimed to address problems faced by aging baby boomers has increased and the quality has improved.[33]

Insofar as there is a threat to technological advance, it is arguably not from a secular drying up of ideas but rather a shift from inclusive institutions that encourage and reward ingenuity and provide social stability toward extractive institutions that do just the opposite.[34] Still, while it is no doubt true that there are improvements to institutions that U.S. policymakers should consider (which we will address in the next section), there is little reason to think that the United States is heading from a system of broadly inclusive institutions to broadly extractive institutions. Also, while there are still far too many people in the world who live under regimes whose institutions, in the main, could be described as extractive, the broad trend is toward more liberalization across the globe, thus unleashing the potential of their citizens—people whose ideas will benefit not only them and their neighbors but people thousands of miles away.

What's more, even if we accept Gordon's hypothesis that technological growth is slowing and is likely to remain sluggish, as measured by TFP, that doesn't necessarily mean that we should discount the importance of recent innovations to human well-being. Princeton University economist Angus Deaton has made this point in an elegant essay that is worth quoting at length:

> I…challenge the proposition that the information revolution and its associated devices do little for human well-being. Many have documented the importance of spending time and socializing with friends and family, but this is exactly the feature of everyday life that the new communication methods work to enhance. All of us can remain in touch with our children and friends throughout every day, videoconferencing is essentially free, and we can cultivate close relationships with people who live thousands of miles away. When my parents said good-bye to relatives and friends who left Scotland to look for better lives in Canada and Australia, they never expected to see or talk to them again, except perhaps for a brief and astronomically expensive phone call when someone died. Today, we often do not even know where people are physically located when we work with them, talk to them, or play with them. We can also enjoy the great human achievements of the past and the present, cheaply accessing literature, music, and movies at any time and in any place. That these joys are not captured in growth statistics tells us about the growth statistics, not about the technology. If they are belittled by those who do not use them, it tells us only to pay no attention to those who purport to use their own preference to pass judgments on the pleasures of others.[35]

Relatedly, Deaton notes that broader societal trends are making life better for millions of people. Whether these can be tied to technological improvements is tenuous in some cases, less so in others. For instance, violence has fallen. From 2005 to 2014, the violent crime rate in the United States

fell 22.1 percent.[36] That is clearly important for those who otherwise would have been victims of violence, but it is also important for those who potentially could be subject to violence, as they are able to live with less fear and insecurity. Arguably, technological advances have improved policing of crime as well as the collection and processing of evidence that in the past would have been of little use to investigators, benefiting victims of crimes and those falsely accused. Reducing violent crime is an area where there remains room for further progress, with the potential for considerable improvement in people's lives.

On balance, there is reason to be sanguine about the prospects for future technological innovation. There is also reason to celebrate recent innovations that may not immediately appear as fundamentally transforming as, say, the development and widespread use of automobiles during the middle part of the 20th century, but that have still brought great gains to millions of Americans and billions of people worldwide, gains that arguably are not fully captured in many standard measures of well-being. It would be rash to attempt to predict with precision the pace at which future innovation will take place or how important those innovations will be, but it would also be premature to say that America's best days are behind us and that future generations will not live much better than we do today.[37] In the next section, we will raise several policy issues that might be addressed to help provide an environment in which innovation can continue to occur and economic growth can be robust. We acknowledge that some of these ideas may be difficult to achieve politically and that some could have adverse economic consequences for segments of the population. Insofar as the latter is true, policymakers may wish to consider ways to compensate those who are made worse off.

Implications for Policy

Perhaps the first thing that policymakers ought to acknowledge when confronting policy issues aimed at boosting innovation and economic growth is that there are factors related to long-term economic growth that are largely beyond their control. One of them is the domestic birth rate. A fact that seems to hold true across nearly all countries is that as they get richer, the fertility rate declines. In 2013, University of Chicago economist Gary Becker estimated that more than 80 countries have fewer births annually than are required to replace the number of individuals who die each year, including every country in Western Europe, China, Japan, Russia, and Canada.[38] In the United States, the fertility rate was only slightly above the replacement rate. The United Nations predicts that many of these countries will have smaller populations in 2050 than they do today.[39]

Such trends have significant economic implications. As noted in the introduction to this essay, Gordon argues that demographic trends are one of the four major "headwinds" that the U.S. economy faces. In particular, the declining fertility rate (accompanied by lower overall labor force participation) will make it more difficult to fund entitlement programs such as Social Security and Medicare, which depend on payroll taxes to distribute benefits.

In the neoclassical model, declining population has a very clear and direct effect

on output. As the amount of labor falls, so does output. In endogenous growth models, population has the same direct effect on labor input, but many also feature an indirect effect. Growth in such models is largely a function of ideas, and the more people in a country, the more ideas they will create. As Charles Jones argues:

> First, just as the total output of any good depends on the total number of workers producing the good, more researchers produce more ideas. A larger population means more Mozarts and Newtons, and more Wright brothers, Sam Waltons, and William Shockleys. Second, the nonrivalry of knowledge means that per capita output depends on the total stock of ideas, not on ideas per person. Each person in the economy benefits from the new ideas created by the Isaac Newtons and William Shockleys of the world, and this benefit is not degraded by the presence of a larger population.[40]

So how might policymakers address the issue of declining fertility rates in the United States? As noted above, this seems to be an issue that is largely out of their control, at least directly. One could imagine schemes that would subsidize births but, as Becker, who viewed population growth as a net positive, argued, those programs can be expensive and hard to administer.[41] An obvious alternative to domestic population growth is to look abroad and effectively import ideas through more liberalized immigration policies. Consistent with Lucas' theory of economic growth, people can be more productive when placed in close proximity to others, jointly working on projects, than in isolation, though arguably the importance of proximity has declined somewhat as long-distance communication has improved and become cheaper. Policies that would increase the level of skills by making it easier for workers to come to the United States would benefit the immigrants themselves and native-born Americans, on average.[42]

Closely tied to the issue of immigration is that of trade. Since at least the publication of *The Wealth of Nations* by Adam Smith in 1776,[43] economists have generally been supportive of liberal trade policies. Such policies permit countries to specialize in the production of goods where they have a comparative advantage, as classical economist David Ricardo noted,[44] leading to an increase in output per worker. But Romer points out that the benefits of trade extend beyond increasing the efficiency of the production of goods that already exist. Trade also introduces new or improved types of goods and services from abroad.[45]

Similarly, economist Gene Grossman of Princeton University and Elhanan Helpman posit a theory of integration and growth, where trade may help the process of technological dissemination if foreign exporters suggest ways that their goods can be used more productively or foreign importers indicate how local products can be made more attractive to consumers in their country. In addition, exposure to international competition may mitigate redundancy in industrial research. "Whereas a firm that develops a product for a protected domestic market need only make use of technologies that are new to the local economy," they write, "one that hopes to compete in the international marketplace will be forced to generate ideas that are truly innovative on a global scale."[46] The United States ought to act on the

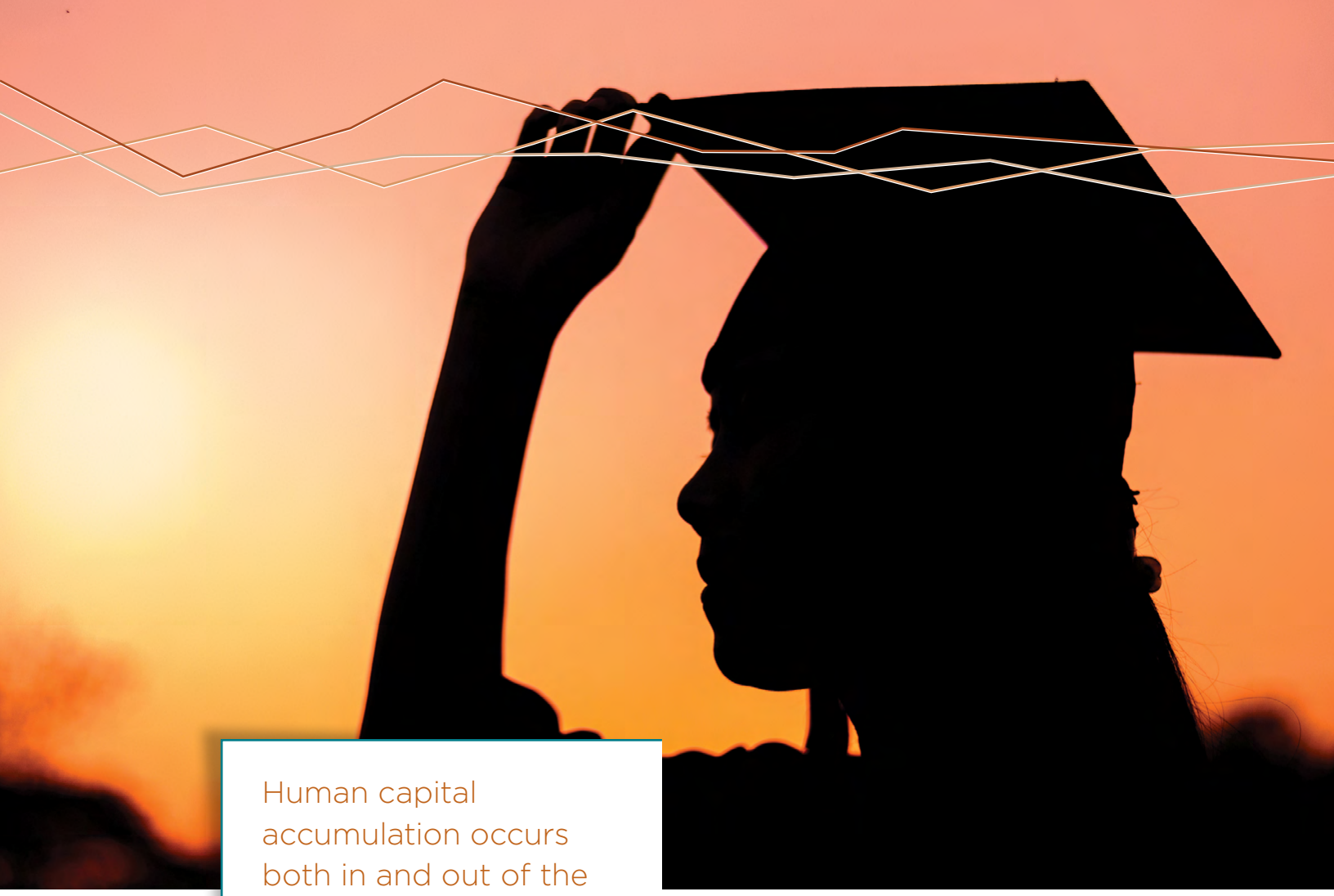
presumption that just as competition within a country improves efficiency and its citizens' welfare, so too does trade between countries. Thus, policymakers ought to be wary of imposing barriers that would impede such transactions and make most people worse off than they otherwise would be.[47]

Education is also clearly important to the future of economic growth in the United States. The building of human capital, as we have seen, brings with it gains to the person who has acquired skills as well as the economy as a whole. In addition, universities tend to be incubators for ideas, some that have no obvious immediate commercial application and others that do. How to "fix" America's educational system, particularly at the elementary and secondary levels, is a perennial topic of debate and, while there is merit in focusing on specific proposals that deal with, say, how to construct curricula, we would like to discuss a few broader principles.

First, it appears that there are significant returns to early childhood education. Skills that are acquired early in life tend to build on each other over time.[48] Second, we ought to take a broad view of what we mean when we use the term "skills." Some of these may not be easily measurable through standardized tests but seem to have important long-run effects. For instance, noncognitive skills such as following instructions, patience, and work ethic can lay the foundation for mastering more complex cognitive skills later in life.[49] Third, we ought not take a one-size-fits-all approach to education. It is true that, on average, a college degree brings with it significant monetary returns over the course of a person's life. But that does not mean that all students should be guided toward college. For those who are unsure whether college is right for them, the choice to go can be costly in terms of foregone earnings and also bring with it substantial debt, while at the same time yielding little in improved earnings if they do not complete their degree. People who have some college but have not attained a degree earn only about 15 percent more than their peers with only a high school degree. This is particularly important when we consider that the college dropout rate is roughly 40 percent.

It should also be noted that the high school dropout rate nationwide is roughly 20 percent, but in many of our major cities that number rises above 50 percent. What's more, many of those students often go to school in fear for their safety and, if they do graduate, do not have the same skills, on average, as their peers in suburban or private schools. This feeds inequality and raises a host of troubling questions about social equity. Improving access to good educational opportunities for students in urban areas in principle should be an example of "low-hanging fruit." How we harvest that fruit, however, has proven to be a difficult issue to address. The pursuit of better solutions will, and should, continue, not only because it may improve aggregate economic performance but also because it is important to bettering the lives of some of our country's most disadvantaged citizens.[50]

The cumulative effects of economic regulation appear to be exerting a drag on the U.S. economy. While some regulations—for instance, those that require firms to effectively internalize the costs they impose on others—arguably promote both efficiency and equity, many regulations serve little



Human capital accumulation occurs both in and out of the classroom and benefits individuals and the economy overall.

aggregate economic purpose but instead deliver concentrated benefits for certain groups, often by helping to protect them from competition.[51] Robert Gordon dubs these barriers to entry as "regressive regulation" and identifies excessive monopoly privileges granted under intellectual property law, protection of incumbent service providers through occupational licensing, and artificial scarcity through land-use regulation as areas ripe for reform.[52]

The policy considerations discussed here lie mostly beyond the responsibility of the central bank, and monetary policy in particular. It is true that monetary policymakers need to be attentive to the forces shaping long-run growth. Different underlying rates of growth imply differences in the general level of interest rates—rates will tend to be lower in a more slowly growing economy. Accordingly, expectations about average growth rates going forward will be one of the factors that influence policymakers' assessments of the appropriate setting of their short-term interest rate instrument. But in terms of the influence of monetary policy on growth, the most important contribution is to provide an environment of macroeconomic stability that is friendly to innovation and growth. Similarly, the Federal Reserve's role in the regulation of financial intermediation—in particular, permitting firms to

borrow, lend, and innovate, while guarding against excessive risk-taking—is important to the maintenance of a sound financial sector, without which economic growth is difficult.[53]

In sum, there can be little doubt that the U.S. economy does face some significant challenges. However, the "new normal" is far from a given. The prospects for continued innovations that improve measured as well as unmeasured standards of living remain stronger than the skeptics maintain. And there are policy areas that, if addressed thoughtfully, likely could yield improvement in economic performance and human welfare.[54] It might be hard for many people to imagine the U.S. economy growing like it did in, say, the 1950s, but how many Americans in 1930 would have thought that the rest of the 20th century would have produced such massive gains for such a huge swath of the population? ■

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ENDNOTES

1 See El-Erian (2010) and Lagarde (2014).

2 See Jorgenson, Ho, and Samuels (2014).

3 Cowen (2011, 7).

4 It should be noted that in his 2013 book *Average Is Over*, Cowen considers himself more optimistic about U.S. economic growth over the long run, though he worries that the distribution of its benefits will be highly uneven depending on the relative skill levels of workers.

5 Gordon (2016, 1).

6 Gordon (2016, 566–579).

7 Gordon (2016, 605–639).

8 Gordon (2016, 21–22).

9 While called the Harrod-Domar model, the model is the product of independent work by each of the authors, in particular Harrod (1939) and Domar (1946).

10 Solow (1988, 307–308).

11 Solow (1956) and Solow (1957).

12 The Solow growth model is sometimes referred to as the "Solow-Swan growth model," as Australian economist Trevor Swan developed similar ideas roughly contemporaneously (Swan 1956).

13 Solow (1957, 314–316).

14 Stiroh (2001, 41).

15 Jorgenson and Griliches (1967).

16 Stiroh (2001, 2).

17 Helpman (2004, 26–33).

18 Romer (1994a, 4).

19 As Lucas, Romer, and others were developing endogenous growth models, in which human capital played an important role, economists Gregory Mankiw, David Romer, and David Weil of Harvard University, the University of California, Berkeley, and Brown University, respectively, sought to augment the neoclassical model by including accumulation of human capital as well as physical capital and argued that this change produced results that were consistent with many of the implications of the neoclassical model. See Mankiw, Romer, and Weil (1992).

20 Jacobs (1969) and Jacobs (1984).

21 Lucas (1988, 35–38).

22 See Romer (1986), Romer (1987), and Romer (1990).

23 Romer (1994a, 11–17).

24 Romer (1990, S72).

25 Acemoglu (2013, 15–16).

26 Jones (2015a, 1).

27 Two foundational papers in Schumpeterian growth theory are Grossman and Helpman (1991b) and Aghion and Howitt (1992). For a useful overview of Schumpeterian growth models, see Aghion, Akcigit, and Howitt (2014). Solow is less enthusiastic about Schumpeter's contributions. He writes that Schumpeter is viewed as a patron saint among some endogenous growth theorists and that he should be treated as such: "paraded around one day each year and more or less ignored the rest of the time (Solow 1994, 52)."

28 Schumpeter (1942, 83).

29 In Schumpeterian growth models, the legal protection of intellectual property rights (IPR), which too can be seen as a form of temporary monopoly power, is generally considered crucial to induce innovation because it permits innovators to reap financial benefits from their work. Daron Acemoglu of the Massachusetts Institute of Technology and Ufuk Akcigit, now of the University of Chicago, for instance, have developed a dynamic framework to study the interactions between IPR and competition. They argue "that protection given to companies with significant technological leads over their rivals also dynamically incentivizes companies with more limited technological leads—as further innovation will not only increase their productivity but also grant them additional IPR protection. This new effect implies that optimal IPR policy should be state dependent and provide greater protection to companies with significant technological leads and only limited IPR protection for those without (Acemoglu and Akcigit 2012, 38–39)." As we shall see later in this essay, though, some economists and policy analysts believe that IPR protection is excessively restrictive and liberalization would be good for growth. Notably, Michele Boldrin of Washington University and David Levine of the University of California, Los Angeles believe that IPR, on net, are harmful to economic growth and should be eliminated. See Boldrin and Levine (2002) and Boldrin and Levine (2009).

30 Aghion and Howitt (2007, 80).

31 Gordon (2016, 575–576).

32 Mokyr (2013).

33 Acemoglu (2013, 25–26).

34 For a cross-country examination of institutional characteristics—such as the rule of law, predictable and relatively modest regulation, and efficient provision of public services—and their importance for economic development and growth, see La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999).

35 Deaton (2013, 41).

36 Federal Bureau of Investigation (2015).

37 It is worth noting that it is possible that some technological advances—what might be thought of as new and often general purpose technologies, as opposed to incremental innovations—might actually slow economic growth for a period as firms learn how to make use of those technologies, but then contribute to faster economic growth over time as they are incorporated into production practices. See Hornstein and Krusell (1996).

38 Becker (2013).

39 United Nations (2015).

40 Jones (2005, 1073). This line of argument has a long pedigree. In 1968, a time when many social scientists were worried about overpopulation causing enormous societal problems, Columbia University economist Edmund Phelps argued: "One can hardly imagine, I think, how poor we would be today were it not for the rapid population growth of the past to which we owe the enormous number of technological advances enjoyed today. ...If I could re-do the history of the world, halving population size each year from the beginning of time on some random basis, I would not do it for fear of losing Mozart in the process (Phelps 1968, 511–512)." Similarly, University of Maryland economist Julian Simon argued that people were the "ultimate resource" in numerous popular writings and, most comprehensively, in *The Ultimate Resource 2* (Simon 1998). Michael Kremer, a development economist at Harvard University, has looked empirically at the relationship of population growth and technological progress from the prehistoric period to 1900. He concludes that technological growth has been higher when population has been larger, including in places that were isolated physically from other parts of the world, such as during the period between the melting of the polar ice caps, which eliminated land bridges, and Europeans' reestablishment of contact with North America. He also develops a model in which technological change is not necessarily dependent on the presence of genius producing sharp one-time gains but instead on continuous acceleration. See Kremer (1993).

41 Becker (2013).

42 There is also a strong case for liberalizing immigration policies for lower-skilled workers, both on ethical and efficiency grounds, but that argument is beyond the scope of this essay.

43 Smith (1776).

44 Ricardo (1817).

45 Romer (1994b, 25).

46 Grossman and Helpman (1994, 40). It should be noted that Grossman and Helpman have also constructed examples where closing off trade might also increase a country's long-run growth rate. For example, a country that has a relative abundance of natural resources and unskilled labor may be induced by trade to specialize in activities that make use of those activities and forego human-capital-intensive activities that would result in the development of new technologies, thus reducing the pace of non-agricultural output. See Grossman and Helpman (1991a, 237–257). But they add: "These arguments should not be taken to imply that illiberal trade policies would generally be beneficial to a country that sees slower growth as a result of openness to trade. A country that lacks the size and technological experience to support a world class R&D effort, or one that has the endowments appropriate to activities like agriculture or mining, typically will gain from specializing in the production of goods that do not require the latest technologies (Grossman and Helpman 1994, 41)."

47 It is true that liberal trade policies do produce some net losers. For instance, those people formerly employed in industries that are now partly or largely located in other countries may be worse off due to international trade. But rather than trying to restrict the free flow of ideas and goods—and thereby blunt the substantial economic benefits that result—a more desirable alternative, insofar as any action is taken, would be to provide financial compensation for those who have been economically harmed. Economist Earl Grinols, now of Baylor University, provides an overview of the merits of different policies that would achieve that end in Grinols (1996).

48 Heckman (2008).

49 Bowles, Gintis, and Groves (2008).

50 Students in urban areas also are disproportionately likely to be raised in single-parent homes or homes with significant dysfunction. There is compelling evidence that this, too, contributes to lower lifetime earnings as well as, for example, higher incarceration rates. See Schwartz (2005) and Lerman and Wilcox (2014). Policymakers ought to focus on what can be done to address such problems—including, perhaps most of all, the elimination of policies that inadvertently foster them. Gordon (2016, 644–646) offers some thought-provoking suggestions in this regard.

51 Mancur Olson explains this dynamic in *The Logic of Collective Action: Public Goods and the Theory of Groups* (Olson 1965).

52 Gordon (2016, 649). Brink Lindsey of the Cato Institute makes a similar argument but includes restrictions on high-skilled immigration under the "regressive regulation" rubric as well: "[A]ll these entry barriers undermine economic growth by restricting vital inputs to innovation. Copyright and patent protections restrict the recombination of ideas that is the essence of innovation by making some ideas artificially inaccessible. Immigration laws restrict the inflow of highly skilled individuals who are disproportionately entrepreneurial and innovative. Occupational licensing restricts the formation of new businesses, which frequently are the vessels of new products or new production methods. And zoning restricts urban density, a vital catalyst for the innovative recombination of ideas (Lindsey 2015a, 28)."

53 Using data from 80 countries during 1960–89, economists Robert G. King and Ross Levine, then of the University of Virginia and the World Bank, respectively, provided evidence that the level of financial development is strongly associated with real per capita GDP growth, the rate of physical capital accumulation, and efficiency improvements in the use of physical capital. See King and Levine (1993).

54 For a thoughtful discussion of many other policy areas where reform might be helpful to long-term growth, see Lindsey (2015b).

55 Hobbes (1651).

56 Jones (2015b, 4).

57 Mokyr (2005, 287).

58 Mokyr (2005, 288–290).

59 Mokyr (2005, 336–337).

60 See Fouquet and Broadberry (2015) and Goldstone (2002).