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The Slowdown in Productivity Growth and Policies That Can Restore It

Emily Moss, Ryan Nunn, and Jay Shambaugh

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The Slowdown in Productivity Growth and Policies That Can Restore It

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Abstract

Labor productivity growth powers economic growth. Yet growth in productivity has generally slowed over the past half century, except for a brief burst during the mid-1990s and early 2000s. Since 2004 output per hour worked has grown at a pace of just 1.4 percent—which is half its pace in the three decades after World War II. This slowdown in productivity growth is not unique to the United States: all of the major advanced economies have experienced similar declines in productivity growth. In this paper we consider explanations for the slowdown in productivity growth as well as the public policies that can help restore it.

Introduction

At a time when the United States is in the grip of a public health crisis and an economic contraction that is more severe than any since the Great Depression, an academic discussion of productivity may seem esoteric. The present paramount concerns are saving lives, caring for the sick, and preventing more jobs and businesses from being swept away. The order of the day is stabilization, and the goals for the immediate future are recovery and a return to normalcy.

Yet we know from history that the economy is likely to bear the scars of lost jobs and incomes, lower living standards, and depressed output for years. The questions that put the problem of productivity growth front and center in the economic policy debate are crucial. Can we build the institutions and technologies that will allow us to surmount pandemics, climate change, and a host of other challenges? Can we recharge long-run economic growth in order to both lift living standards and help pay for vital pandemic economic response programs?

For living standards to rise over time, people need to be able to produce more with a given amount of work effort. Output growth does not guarantee an increase in wages or an equal distribution of gains, but it is necessary for sustained improvements in living standards. Increasing the number of hours that people work can certainly affect output, but there are limits to the amount of labor a society can or would want to mobilize. To achieve a sustained increase in output, the productivity of labor needs to increase. This increase can happen because workers become more skilled or more educated (increases in human capital), because workers have more physical capital to use in their efforts, or because of an overall increase in productivity from a combination of factors. This last element—often measured simply as the increase in output that cannot be explained by increases in labor or capital—is attributed to better technology, better management, and better institutions.

One hundred years ago, roughly 50 percent of the U.S. working-age population had a job (U.S. Census Bureau 1923).[1] Just prior to the 2020 recession, 61 percent of those over the age of 16 were employed (Bureau of Labor Statistics [BLS] 2020a). But those people tend to work about 40 hours per week, well below the 50 hours per week people typically labored a century ago (Whaples 2001). Consequently, the total number of hours worked per capita is roughly the same today as it was a century ago. Yet output per capita in the United States has grown more than six-fold during that time (Bolt et al. 2018). We are not working more—but we are working far more productively, which has generated massive increases in living standards over the past century.

This sustained growth in productivity over the past 100 years has meant that people have more food and resources, better health care and housing, and consumer products not dreamed of at a time when cars were just starting to dominate the roads and telephones were a luxury. Innovation and productivity drive living standards.

Innovation and the capacity to generate new technologies are as important today as they ever were. Challenges ranging from pandemics to climate change require novel ideas and technologies. New vaccines, clean energy, and a host of other innovations do more than incrementally raise living standards—they are essential to our way of life. Furthermore, we will need to generate faster output growth over time to help pay for the huge investments in people and health care necessary to survive the COVID-19 pandemic as well as make the substantial investments required to combat climate change.

Growth in productivity, though, has generally slowed over the past half century, except for a brief burst during the mid-1990s and early 2000s. In a world with new consumer technologies that seem to regularly reshape how we live, this may be surprising—but output per hour worked has grown at a pace of just 1.4 percent since 2004, or just half its pace in the three decades after World War II. Designing policies that will increase productivity growth is fundamental to improving American living standards over time. Sometimes wages have tracked productivity growth, while at other times productivity gains are only captured by a small set of people. Proper competition policy and labor market institutions are needed to ensure broadly shared growth.

In this paper we review the recent experience of labor productivity growth in the United States and explore some of the reasons for the slowdown in productivity growth over the past 15 years. We note that both physical capital investments and total factor productivity growth have slowed. We then discuss some of the broad reasons for the productivity growth slowdown and their policy implications. Although GDP and productivity are measured with error, we cannot attribute the slowdown to mismeasurement alone. Similarly, a shift in employment from higher-productivity (e.g., manufacturing) to lower-productivity (e.g., many services) sectors can explain some of the slowdown, but certainly not all. Nor does it appear we have simply reached physical limits to growth. The form and timing of the next wave of innovation is not obvious now, but it never was, either.

Our research and analyses lead to clear policy implications. There is obviously no single policy that will restart American innovation and productivity growth on its own—but although the decline in growth has many causes, it is not a mystery. In order to generate faster innovation and productivity growth we need to:

- Aim macroeconomic policy at full employment to support productivity growth, particularly in the wake of recessions because firms do not invest or innovate as much during downturns;
- Reverse declining R&D spending and public capital (infrastructure) spending with stepped-up federal commitments to both;
- Fix problems in the intellectual property system that discourage rather than encourage innovation;
- Reform regulations that unnecessarily limit productivity without achieving other social goals;
- Remove impediments to business formation and worker mobility that lead to declines in economic dynamism;
- Ensure that educational opportunities allow Americans to achieve more education and training, in part to combat the recent slowdown in productivity growth as well as the aging of the workforce that can slow productivity.

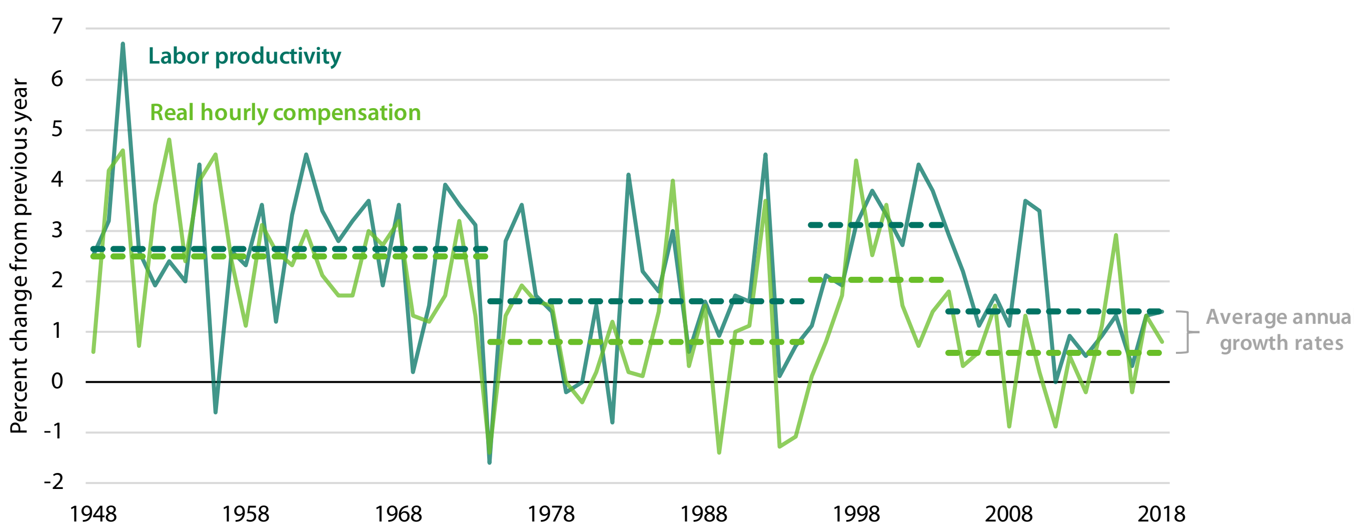
These policies are an important way to lift productivity growth over time. In doing so, living standards will be able to rise faster than in recent decades and put us on a more prosperous path than the one we were on before the pandemic began.

What Has Happened to Productivity Growth?

The total output of an economy is measured by its GDP: the value of all the goods and services produced during a given year. Although GDP omits many important contributors to well-being (e.g., good health, environmental quality, and

FIGURE 1.

U.S. Labor Productivity and Real Hourly Compensation, 1948–2018



Source: Bureau of Labor Statistics (BLS) 2020b; authors' calculations.

Note: Data reflect all employed persons in the private nonfarm business sector. Average annual growth rates for labor productivity and real hourly compensation (dashed lines) refer to the compounded rates of change calculated from the index level values of labor productivity and real hourly compensation in the start and end years for the periods 1948–74, 1974–95, 1995–2004, and 2004–18.

greater equality), it is a useful way to summarize the output of an economy that can be consumed, invested, or used by the government. GDP per person (i.e., total output per person) is therefore a rough measure of average living standards. The economy and its measurement can be complicated, but GDP per person is simply a combination of how many hours each person works and the output generated in one hour of their work.

Much of macroeconomics focuses on total economic output, which in turns depends on how many people have jobs, how many are unemployed, and how many are in the labor force. But over long periods it is the efficiency with which an economy generates total output—the amount of GDP per hour of work—that is more important. This efficiency measure is referred to as labor productivity; its growth is crucial for living standards to rise.

The relationship between productivity and living standards can be seen in figure 1, which plots growth in labor productivity against growth in inflation-adjusted hourly compensation.[2] Wage growth correlates closely with productivity growth: there are higher wage increases during periods of fast productivity growth and smaller pay increases during periods of slow productivity growth.

Figure 1 breaks out productivity and wage growth into four commonly discussed postwar periods. The first is 1948–74, a period of strong productivity growth (average annual growth rate of 2.6 percent) and compensation growth (2.5 percent). The second is 1974–95, when both productivity and compensation growth slowed. Real compensation growth in fact slowed much more than productivity growth in this era, reflecting a variety of economic and policy headwinds that had limited gains for workers including a declining role for private sector unions, impacts from trade, and increased market power of firms in setting wages (Shambaugh and Nunn 2018; Shambaugh et al. 2017). The 1995–2004 period constituted a brief interregnum of faster growth, followed by 2004–18, when productivity and wage growth slowed to their lowest postwar levels. The continual gap between productivity and wage growth in the periods after 1973 underscores that boosting productivity growth alone is insufficient to lift wages and living standards for typical Americans. But the clear influence of productivity growth on wage growth suggests it is nevertheless an important factor in sustained growth in living standards.

According to standard growth accounting, labor productivity growth comes in three forms: (1) changes in labor composition, (2) capital deepening, and (3) total factor productivity (TFP) growth. Distinguishing these three contributors is important for understanding the roles of education, capital investment, and other improvements (e.g., technological progress), respectively. Increases in physical and human capital can be limited by our ability to save and invest as well as by diminishing returns to capital. But TFP growth is much less constrained, being principally limited only by our understanding and imagination. Figure 2 shows these components of labor productivity growth for the same periods highlighted in figure 1.

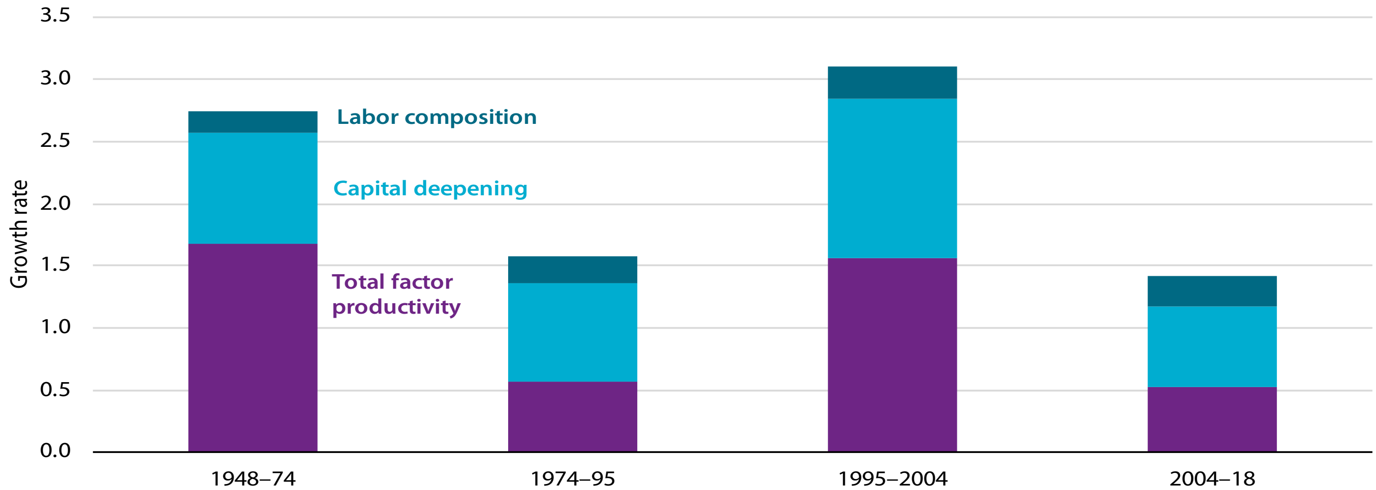
Both TFP and capital deepening made relatively large contributions to productivity growth during the 1948–74 period, followed by a sharp slump in TFP during the 1974–95 period. Changing labor composition, by contrast, made somewhat larger contributions—averaging from 0.2 to 0.3 percentage points per year—in subsequent periods. Productivity growth during the 1995–2004 period was driven by both rising TFP and capital deepening, with the latter making its largest contribution (1.3 percentage points per year) during this period. Overall productivity growth dropped off again in the past 15 years, though, with a pattern mirroring that of the 1974–95 period. TFP growth fell to its lowest level of all the postwar periods as shown in figure 2, accompanied by a sharp decline in capital deepening.[3]

Over the long run, neither changes in labor composition nor capital deepening can indefinitely drive robust labor productivity growth. In other words, simply adding more machines, more education, or more training cannot drive productivity growth forever on their own. TFP growth is an essential component of long-run productivity growth and the improvement of living standards.

Unfortunately, TFP growth cannot be measured directly; rather, TFP growth is the component of labor productivity growth that remains after changes in labor composition and capital deepening are subtracted. It is important to remember that TFP growth is in fact a "measure of our ignorance" that can only be measured indirectly (Abramovitz 1956, 11). Economists often refer to TFP growth as technological improvement, but it encompasses much more, including changes in management practices, the efficiency with which capital and labor are used, and changes in institutional structures that can make production either more efficient or less efficient. Despite our inability to say precisely what TFP growth is, it amounts to a substantial portion of annual growth in economic output as shown in figure 3. Even during the low-growth 2004–18 period, annual TFP growth (0.5 percent) was 24 percent of real GDP growth (2.1 percent).

FIGURE 2.

Components of U.S. Labor Productivity Growth, 1948–2018



Source: BLS 2020c; authors' calculations.

Note: Data are for the private nonfarm business sector. The contribution of total factor productivity (TFP) is output per unit of combined labor and capital inputs. The contribution of capital deepening is capital services per hour multiplied by capital's share of current dollar costs. The contribution of labor composition is labor composition multiplied by labor's share of current dollar costs. Labor composition measures the effect of shifts in the age, education, and gender composition of the workforce. The figure shows the compounded rate of change calculated from the index level values in the start and end years of each period.

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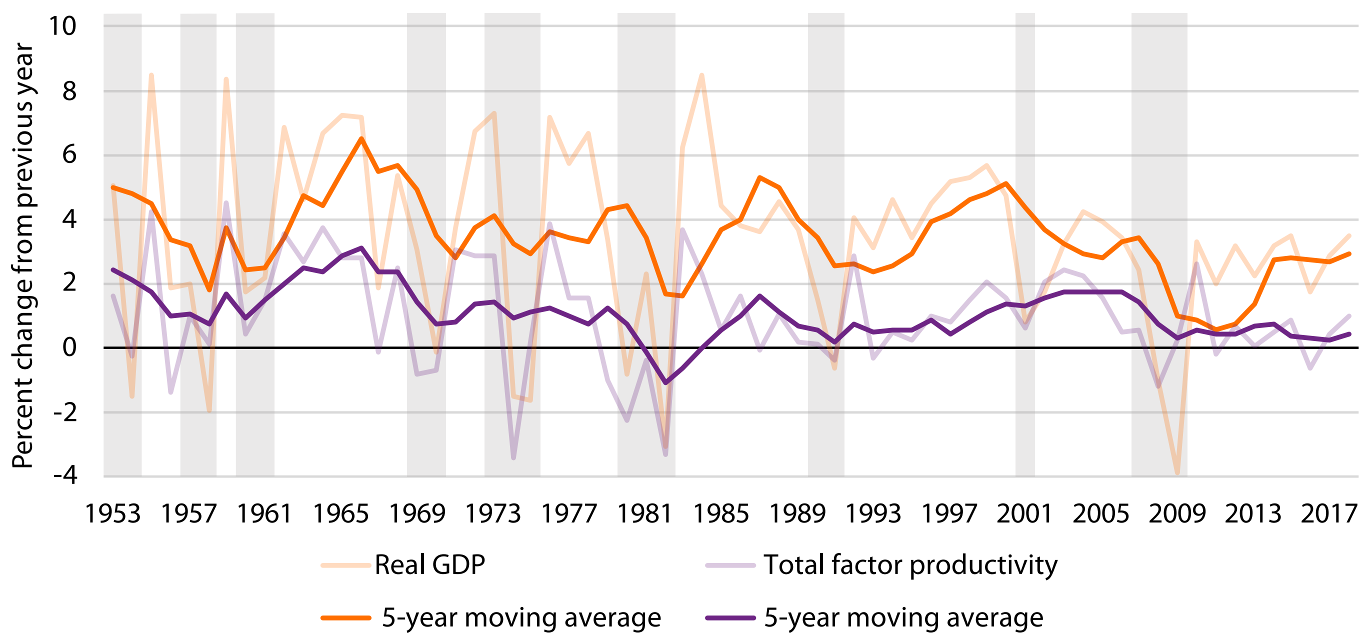
FIGURE 3.

U.S. Real GDP and Total Factor Productivity, 1953–2018



Sources: Bureau of Economic Analysis (BEA) 2020b; BLS 2020d; authors' calculations.

Note: Data are for the private nonfarm business sector. Five-year moving averages for 1953 are calculated using data from 1949–53. Shaded bars denote recessions.

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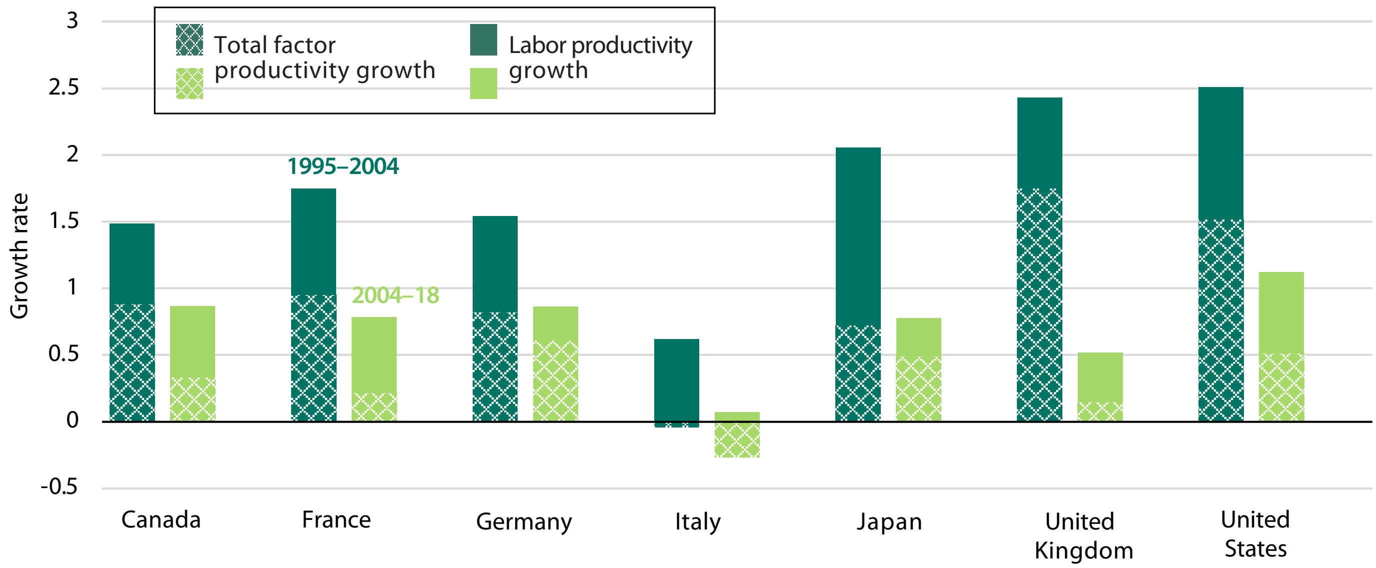
FIGURE 4.

Labor Productivity Growth and Total Factor Productivity Growth in G-7 Countries, 1995–2018



Source: Organisation for Economic Co-operation and Development (OECD) 2020; authors' calculations.

Note: Data are for the total economy. Labor productivity growth is GDP per hour worked. Average annual growth rates are calculated from indexed measures of GDP in constant U.S. dollars using 2015 purchasing power parities. The crosshatched segment of each bar represents the contribution of TFP growth to that country's overall labor productivity growth during a given period.

The recent declines in both labor productivity growth—and TFP growth in particular—have been global phenomena, suggesting that United States-specific factors are less likely to be responsible for the productivity slowdown. As shown in figure 4, labor productivity growth and TFP growth both have declined since 1995 in every G-7 economy. Despite its sizable decline in annual labor productivity growth between the two periods shown (1.4 percentage points), the United States remains the fastest-growing of the G-7 economies at 1.1 percent per year during the 2004–18 period (figure 4). Canada is next at 0.9 percent and Italy is last at 0.1 percent over the same 2004–18 period. In all the economies shown, falling TFP growth has been a major contributor to falling labor productivity growth. This decline stretches outside the advanced economies. Although productivity growth in China stayed strong until the 2008 financial crisis, it has made a much smaller contribution to output growth since then (Raiser and Soh 2019).

Why Has Productivity Growth Declined and How Can Public Policy Help?

The decline in productivity growth is overdetermined: there are too many explanations for the shift, some of which are overlapping. Some explanations suggest that productivity growth remains high and that the decline is simply mismeasured, while others point to shifts in industry or labor composition. Some explanations suggest that we have simply exhausted the pool of easily attained innovations and will face much slower productivity growth rates over time, while others blame the aftereffects of the Great Recession for parts of the most recent productivity slowdown. Rules and regulations can also affect innovation, while incentives for public and private investment can affect both capital deepening and the pace with which new innovations are discovered and used.

In this section we consider several of the core explanations for the slowdown in productivity growth before turning to potential policy solutions. Given that productivity has slowed down before—notably after 1973—many of these topics have been explored before as economists sought to explain the prior slowdown.[4] A single, clear rationale for the current slowdown is impossible to determine, but the slowdown's multiple causes are in some sense a case for optimism since they provide many channels through which policy could boost productivity growth and living standards.

MISMEASUREMENT OF PRODUCTIVITY GROWTH

Economic measurement is imperfect, and the calculation of productivity is no exception. Consequently, some have wondered if the decline in measured productivity growth is an artifact of that mismeasurement rather than a genuine economic change (Brynjolfsson and McAfee 2011; Feldstein 2015). Given that TFP growth is measured as the remainder of GDP growth left over after changes in labor and capital inputs are accounted for, the mismeasurement of any of those data would affect the overall measurement of labor productivity growth—and TFP measurement in particular.

One especially fraught aspect of both productivity and real GDP measurement concerns the proper assessment of inflation. It is notoriously difficult to adjust for improvements of goods and services, either as their quality improves over time or as new goods and services are introduced (Moulton 2018). If the quality or value of new products are not properly captured in prices, GDP itself will be mismeasured. If these measurement problems worsen substantially over time, productivity growth could appear (falsely) to decline.

Reflection on recent technological and product innovations lends credence to the mismeasurement hypothesis. Many services on the internet (e.g., email and online navigation) are available to consumers at no cost, despite those services contributing substantially to consumer welfare. And even the best efforts of statistical agencies may be insufficient to capture improvements in information-age goods like smartphones. More problematic is the difficulty in measuring quality improvements in service sectors (like education or health care), and those sectors have grown as a share of the economy (Moulton 2018). If the industries for which output and quality are difficult to measure have become a larger share of the economy, the extent of the overall mismeasurement problem could be increasing.

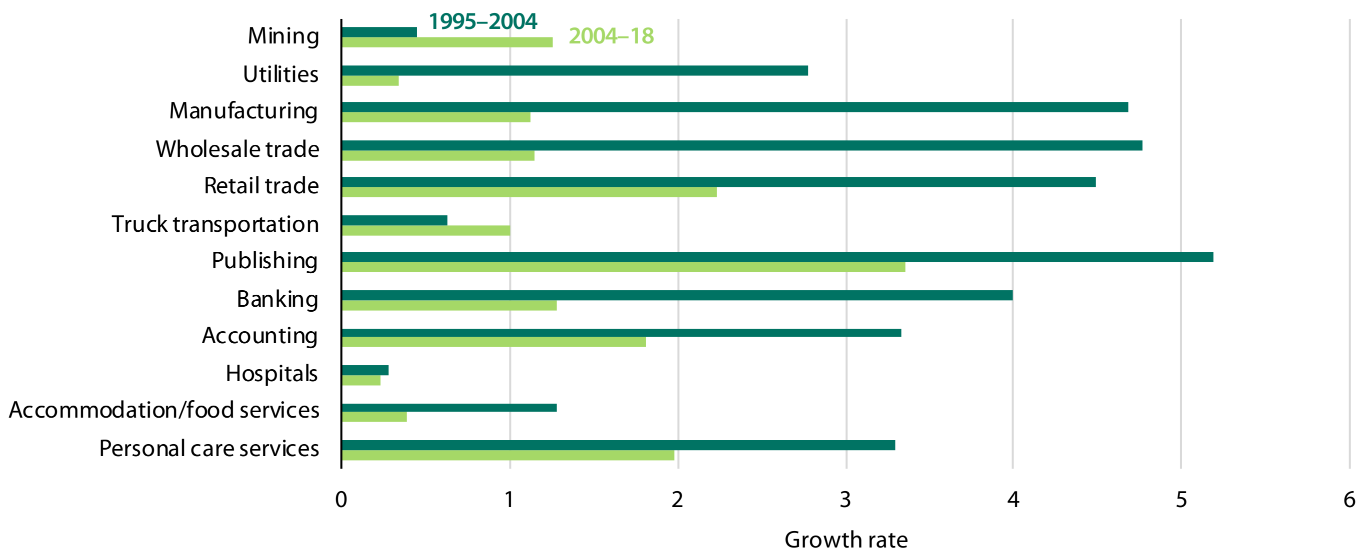
However, the best available evidence suggests that mismeasurement alone does not explain the decline in productivity growth. For one, many new products (smartphones) or services (internet search engines) became available prior to the post-2004 slowdown in productivity. It is unclear that the rate at which new, high-quality products and services are introduced is increasing. Research suggests information technology hardware, for which productivity growth is difficult to measure, was a bigger contributor to mismeasurement prior to the post-2004 slowdown. Adjusting for mismeasurement in these goods actually worsens the labor productivity growth decline that must be explained (Byrne, Fernald, and Reinsdorf 2016). Moreover, the sheer size of the productivity growth decline would be very difficult for mismeasurement to account for on its own: true labor productivity in mismeasured industries would need to have risen by an implausible 363 percent over 11 years (Syverson 2017).

It is sometimes suggested that the introduction of free services can account for the productivity growth decline. But services that appear to be free often are in fact monetized via advertising or harvesting data and can wind up indirectly counted in GDP calculations. More generally, goods and services have always generated consumer surplus that is not captured in GDP statistics because individuals gain a value of welfare from products greater than the price that firms charge. It is unclear that the internet age has given rise to more uncaptured surplus than was generated during the creation of the television or telephone.

Thus, while GDP and productivity are surely mismeasured to some extent, the research consensus is that this mismeasurement cannot fully explain the decline in

FIGURE 5.

Labor Productivity Growth by Selected Industries, 1995–2018



Source: BLS 2020b; authors' calculations.

Note: Due to data availability, data for accounting are for 1997–2018 and data for hospitals are for 1995–2016. The industries presented in this figure are not comprehensive of the private, nonfarm business sector; they represent 51.4 percent of total employment and 50.6 percent of hours worked in the nonfarm business sector as of the first quarter of 2016. The industries shown represent the largest (by 2016 employment) detailed industries for each of the 11 major sectors (excluding arts, entertainment, and recreation due to low employment). For example, accounting was the largest detailed industry within the professional services sector.

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productivity growth after 2004. It is therefore worth exploring what other factors have pushed down productivity growth over time.

SHIFTING INDUSTRY MIX

A related possibility is that the U.S. labor market may have shifted workers toward sectors with lower productivity levels or growth. This could happen naturally and would not necessarily be a cause for alarm. If one sector experiences rapid growth in output per hour, but does not grow as a share of consumption, then as time passes there will be fewer and fewer people working in that sector. In the United States, manufacturing—which has high output per hour and high productivity growth—has shrunk as a share of employment due to shifts in trade and consumption patterns (BLS 2020b; authors' calculations). Workers flowing into lower-productivity sectors may have contributed to lower aggregate productivity growth.

Triplett and Bosworth (2004) describe the widely held view that a rising service sector share of the economy would tend to reduce productivity growth. But they show that the service sector was a major consumer of innovations in information technology, helping to propel the 1995–2004 resurgence in productivity growth and making the pure-reallocation explanation look less likely.

Furthermore, if reallocation was the entire cause of the slowdown, productivity growth would hold steady for each industry while the reallocation to lower productivity sectors would reduce the average. However, a preliminary look at productivity growth by industry shows that there was a widespread decrease in productivity growth between the 1995–2004 and post-2004 periods. In other words, it is not just that employment shifted across industries in a way that depressed aggregate productivity growth. Rather, labor productivity growth in most industries was simply higher during the 1995–2004 period than it was during the 2004–18 period.

Figure 5 shows annualized labor productivity growth rates for selected large industries over the 1995–2004 and 2004–18 periods.[5] During the 1995–2004 period most industries saw strong labor productivity growth: for example, retail trade grew at 4.5 percent annually and manufacturing grew at 4.7 percent. Over the subsequent 2004–18 period both of those industries grew much more slowly at 2.2 percent and 1.1 percent, respectively. Of the industries shown in figure 5, only mining (which benefited from the U.S. fracking boom) and truck transportation grew more quickly in the latter period.

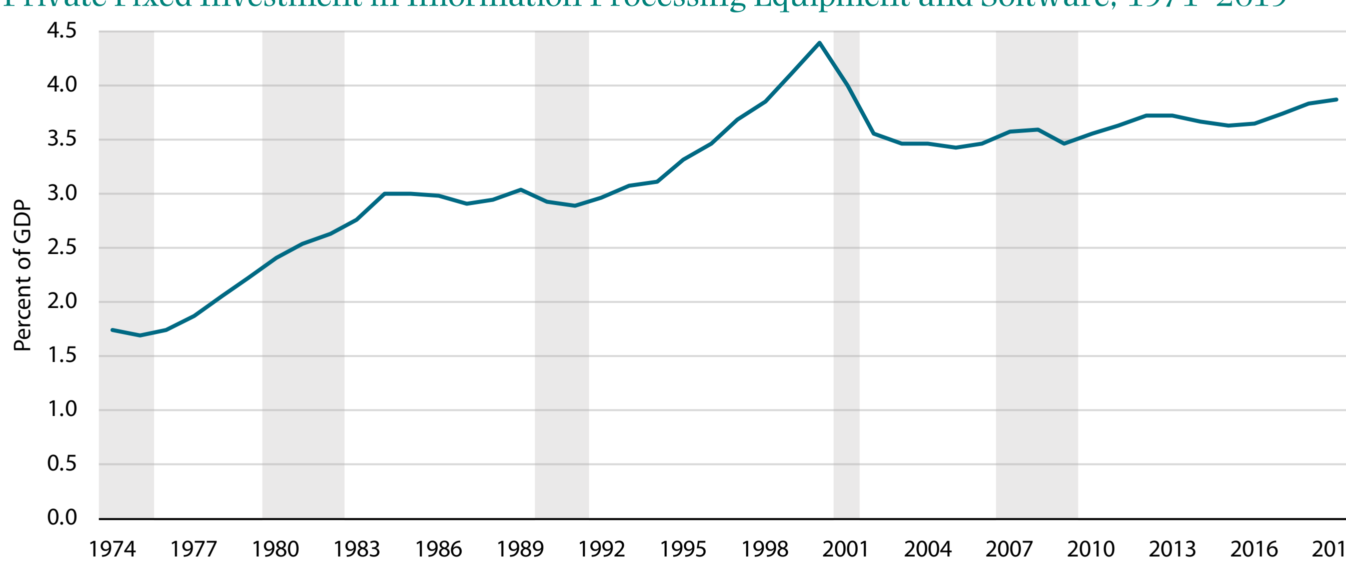
Researchers have calculated labor productivity growth rates over these periods under the (counterfactual) assumption that industry composition did not shift, finding counterfactual growth rates that are very close to the growth rates actually observed (Byrne, Fernald, and Reinsdorf 2016). The movement of workers across industries does not appear to be driving what is in fact a broad-based decline in productivity growth.

LIMITS TO INNOVATION AND PRODUCTIVITY GROWTH

Growth in TFP is not exclusively determined by changes in technology. Better management practices and institutions, for example, can drive TFP growth even if no new technologies are devised (Bloom, Sadun, and Van Reenen 2017). But TFP

FIGURE 6.

Private Fixed Investment in Information Processing Equipment and Software, 1974–2019



Source: BEA 2020a; authors' calculations.
Note: Shaded bars denote recessions.

remains profoundly influenced by scientific and technological progress. For example, TFP growth in the 1920s through 1940s—roughly 2–3 percent annually—was driven by the deployment of technologies like electricity, chemicals, and telecommunications (Shackleton 2013). The 1995–2004 interlude of high productivity growth was largely driven by new information technologies and the widespread introduction of the internet.

The importance of these technological developments has led some to see in them an explanation for the post-2004 and, indeed, the 1974–95 declines in productivity growth. Most notably, economist Robert Gordon (2016) argues that productivity growth has slowed because recent technological progress has been much less impressive than in earlier periods. The innovations of the late-19th and early-20th centuries—from sanitation to the internal combustion engine—completely reshaped American life. As these innovations were fully exploited through the middle of the 20th century, they generated tremendous productivity growth. The argument maintains that, considered as a whole, technological progress since then has been relatively paltry.

However, this assessment does not mean that technological progress must remain weak in the coming years. Some researchers see promise in technologies like artificial intelligence and machine learning that are now being developed and deployed but whose benefits have yet to diffuse widely (Brynjolfsson, Rock, and Syverson 2017). The economist Robert Solow, awarded the Nobel Prize for his contributions to understanding economic growth, is well known for saying in 1987 that he saw "the computer age everywhere but in the productivity statistics" (Solow 1987). In the following decade of the 1990s productivity began to surge, partly because of innovations in computing technology (Shackleton 2013). Innovations and the productivity growth that they generate are not always coincident.

One possibility is that advanced economies like the United States are in a temporary technological lull. During the 1995–2004 period the benefits of investments in information processing technologies became widely available and productivity growth was accordingly brisk. Figure 6 shows the sharp rise in investment (as a fraction of GDP) in information processing equipment and software, which began in the early 1990s at around 3 percent and peaked in 2000 at 4.4 percent. But the enhanced productivity growth from this investment proved short-lived when productivity growth subsided to a low level after 2004 (Byrne, Fernald, and Reinsdorf 2016).

Given that labor productivity and TFP growth have risen and fallen unpredictably in the past, it is likely premature to conclude that the United States or other advanced economies have reached an upper limit to productivity. If we knew the innovations that would reshape an economy in the future, they would already be in place. At many moments in history it appeared that innovations were exhausted, but then a new wave of innovations began. Nevertheless, the historical perspective does give a sense of how much technological progress is necessary to boost productivity growth to pre-1974 rates.

RECESSION HANGOVER

The accounts of declining productivity growth discussed above do not necessarily lend themselves to any particular policy remedy. For example, if measured productivity growth fell simply because of mismeasurement, the implied policy response would be to improve measurement (although policy measures to enhance actual productivity growth would still be welcome). Through the rest of this section, we discuss reasons for the decline that indeed suggest policy remedies, beginning with the implications of cyclical economic downturns for productivity growth.

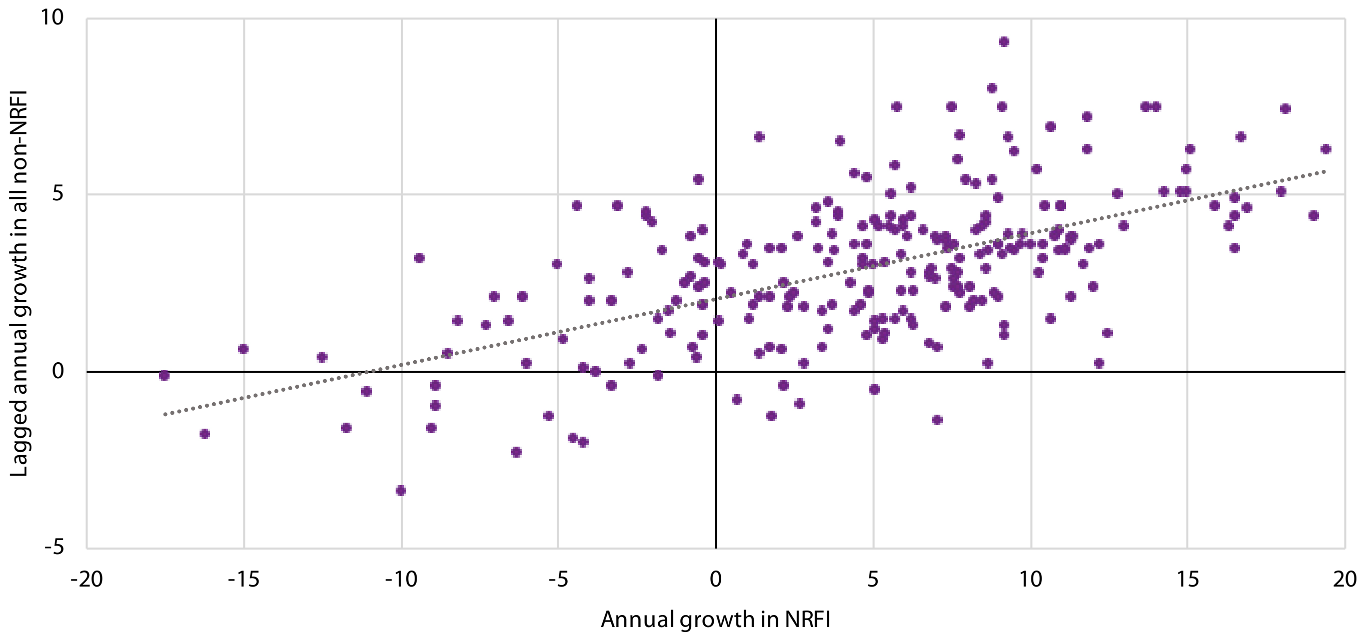
Recessions tend to slow productivity growth, although this dynamic has not always been widely appreciated. Macroeconomic theory often draws a sharp line between explorations of long-run growth and the booms and busts of business cycles. This distinction is based in the assumption that those ebbs and flows of activity take place around a trend driven by the fundamentals of productivity growth. More recently, though, research has shown several ways in which recessions leave longer-run scars on output and productivity growth. Whereas such research certainly would not explain a slowdown in productivity growth beginning in 2004–05, it might help explain the protracted slow period of TFP growth particularly after the Great Recession.

The idea that demand shocks can have long-run effects traces back to Campbell and Mankiw (1988), who noted the persistence of shocks to GDP. Blanchard, Cerutti, and Summers (2015) show that, across a wide range of countries, reductions in economic output caused by demand shocks (and thus should logically be temporary) tend to be very long-lived. Fatás and Summers (2016) find that the initial shock to output in 2009 can explain deviations from predicted output in later years, which suggests that the financial crisis shock was permanent. Countries not only stayed mired in recessions, but also those recessions appeared to lower potential output.

There are several reasons a recession can persistently depress output levels and growth. First, firms tend to invest more when they see the potential for more customers, and rising output growth in one year tends to predict faster investment growth the next year—a dynamic captured by the accelerator theory.[6] Because many firms sell on world markets, a global slump that depressed firms' expectations for demand would place an even bigger strain on investment growth (Council of Economic Advisers [CEA] 2017, chap. 2).

FIGURE 7.

Growth in Nonresidential Fixed Investment and All Other Components of GDP, 1948–2016



Source: Bivens 2017.
Note: NRFI refers to nonresidential fixed investment. Data are from the BEA National Income and Product Accounts (NIPA).

Bivens (2017) notes the potential for a high-pressure economy—characterized by rapid growth—to increase potential output, and focuses on the relationship between output growth in one year and investment in the next. We show that relationship in figure 7. When growth is faster, investment the next year is faster as well. This correlation suggests that recessions (especially drawn-out recessions with slow recoveries) can generate lower investment. Lower investment reduces capital per worker and can also reduce the pace at which firms either generate or use new innovations.

The unemployment rate is typically high following a recession, leaving plentiful labor available for firms to hire if firms want to expand their production. The availability of labor and slow wage growth in the initial years after the Great Recession may help explain why firms simply did not need to make investments in productivity-enhancing technology or capital. Reifschneider, Wascher, and Wilcox (2015) find that both TFP and capital deepening dropped substantially following the financial crisis of 2008, with capital deepening contributing roughly half to the decline in productivity growth observed. Firms were failing to invest; this directly lowered productivity growth as capital deepening slowed, but it also slowed TFP growth since new innovations were not being developed or put into use.

Other research finds that the shock to demand following the Great Recession explains a substantial portion of the decline in TFP growth, since lower demand led to a reduced implementation of new technologies (Anzoategui et al. 2019). If this effect simply constitutes a temporary postponement of technology implementation, it could be followed by a burst of productivity that implements all the accumulated technological improvements. But if this effect constitutes a reduction in innovation itself, it would represent a permanent downward shift in the level of output—and if some innovations are never made, possibly even a loss of productivity growth over time.[7]

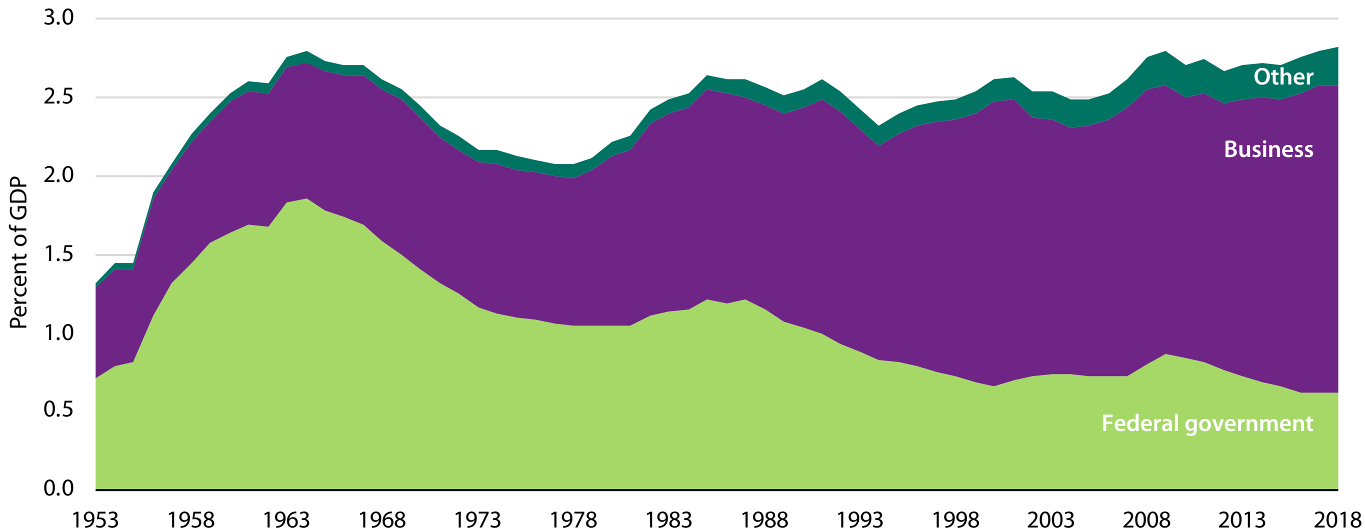
The policy implications of these ideas are relatively straightforward. To avoid the losses in investment and innovations that recessions can generate, macroeconomic policy should aggressively pursue countercyclical policy to either avoid or shorten recessions wherever possible. The Hamilton Project released a book jointly with the Washington Center for Equitable Growth with a set of policy proposals that would strengthen the automatic fiscal stabilizers of the United States to ensure that fiscal policy provides more demand when it is needed in the economy, and less when it is not needed (Boushey, Nunn, and Shambaugh 2019). These policies, along with robust countercyclical fiscal and monetary policy more broadly, are important to avoid protracted downturns and boost investment and confidence if a recession does strike, thereby lifting productivity growth over time.

INSUFFICIENT R&D

R&D spending, both by firms and by governments, is a fundamental driver of innovation and productivity growth that can generate new innovations and new products.

FIGURE 8.

U.S. Spending on R&D by Funding Source, 1953–2018



Source: National Center for Science and Engineering Statistics (NCSES) 2020.

Note: “Other” includes funding for U.S. R&D by nonfederal government, higher education, and other nonprofit organizations. Data for 2017 and 2018 are preliminary and may be subject to revision.

As shown in figure 8, federal R&D spending, while still substantial, has declined since both 1960 (1.6 percent of GDP) and 1980 (1.1 percent). In 2018 the business sector funded R&D in the amount of 2.0 percent of GDP, with the federal government following at 0.6 percent of GDP (including through spending at federal facilities and grants to higher education and other institutions); other sources amounted to 0.2 percent of GDP.[8]

Rising business spending has offset this decline in government-funded R&D spending, but the two categories of funding are not identical: the federal government tends to spend on basic R&D while the business sector spends on technologies that are closer to market (Sargent 2020).[9] Investments that are more focused on basic research tend to have larger impacts on long-run productivity growth (Popp 2019).

Research shows that our innovation process has become more costly relative to its benefits: the United States has added many multiples of its effective number of researchers since the 1930s while experiencing a slowdown of research productivity growth (Bloom et al. 2020). This could be because of the shift toward applied R&D (Arora, Belenzon, and Patacconi 2018) or simply because less-costly innovations have been explored and today’s challenges require more-expensive lab equipment and scientists. Either explanation suggests a decline in basic R&D funding from the federal government is a drag on both TFP growth and GDP growth.

To the extent that insufficient government R&D funding is responsible for the productivity growth decline, enhanced R&D investments are the clear policy prescription. A substantial boost in federal R&D spending has the potential to increase TFP and output growth. John Van Reenen (2020) makes this case in a Hamilton Project policy proposal calling for an increase in federal R&D spending of half a percentage point of GDP—roughly $100 billion—to be allocated toward major national challenges like climate change and public health.

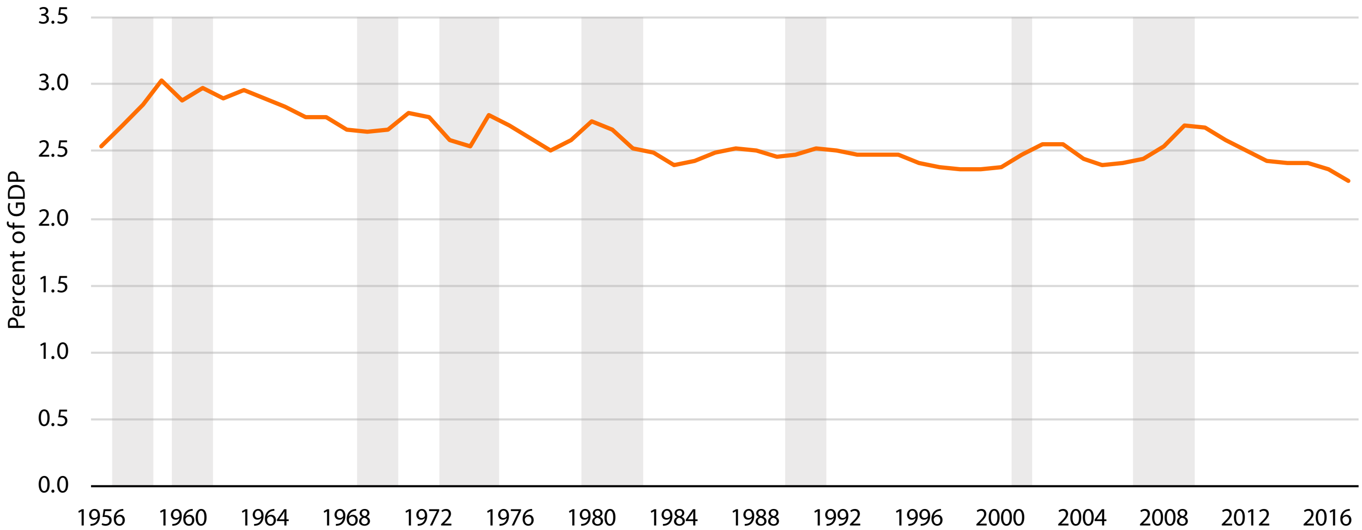
INFRASTRUCTURE AND PUBLIC CAPITAL

R&D augments the stock of ideas that entrepreneurs and existing businesses leverage to transform the economy and drive economic growth. But that stock of ideas alone is not sufficient to facilitate high levels of productivity. An array of public goods support productivity, allowing markets to function effectively and creating the conditions in which innovators can be successful. In addition, as explained above, labor productivity is a function of TFP, physical capital, and human capital. An increase in public capital can increase the overall capital stock and hence labor productivity; by making other assets more productive, this increase can also raise private investment (CEA 2016).[10]

Physical infrastructure is the most visible example of public capital. Transportation infrastructure in particular is a crucial precondition for high levels of economic activity: roads, railways, airports, seaports, and public transit all help markets to function effectively (Schanzenbach, Nunn, and Nantz 2017). Figure 9 shows federal spending over time on transportation and water infrastructure. In 1960 the federal

FIGURE 9.

Federal Infrastructure Spending, 1956–2017



Source: Congressional Budget Office (CBO) 2018.

Note: Federal infrastructure spending refers to public spending on transportation (highways, mass transit, rail, aviation, and water transportation) and water infrastructure (water utilities and resources). Shaded bars denote recessions.

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government spent 2.9 percent of GDP on transportation and water infrastructure, falling to 2.3 percent of GDP in 2017.

This decline is not entirely reflective of a failure to make necessary public investments. Mid-20th century America was installing a transit network that now requires more maintenance than new construction requires. Sometimes an emphasis on the jobs associated with building new infrastructure overshadows the important question of how much the new physical asset can actually increase output and welfare. But the decline in infrastructure investment, in conjunction with evidence of infrastructure deficits in some areas, indicate the importance of rigorously evaluating potential opportunities to improve public infrastructure (Schanzenbach, Nunn, and Nantz 2017; Turner 2019).

Falling public capital investment may itself be the result of other policy failures, as revealed by the extraordinarily high price of building transportation infrastructure in the United States (Levy 2018; Nunn, Parsons, and Shambaugh 2019b). New construction, especially in areas of high density, is often burdened by unnecessary impediments that substantially raise its cost (Nunn, Parsons, and Shambaugh 2019b; Shoag 2019).

An increase in public capital spending—if informed by rigorous cost-benefit analysis— could increase the public capital stock and encourage increased private investment, boosting labor productivity as a result. If those increases are designed to be supportive of broader TFP growth (e.g., public lab construction or broadband access), they could provide an even greater economic boost.

CHALLENGES IN THE INTELLECTUAL PROPERTY REGIME

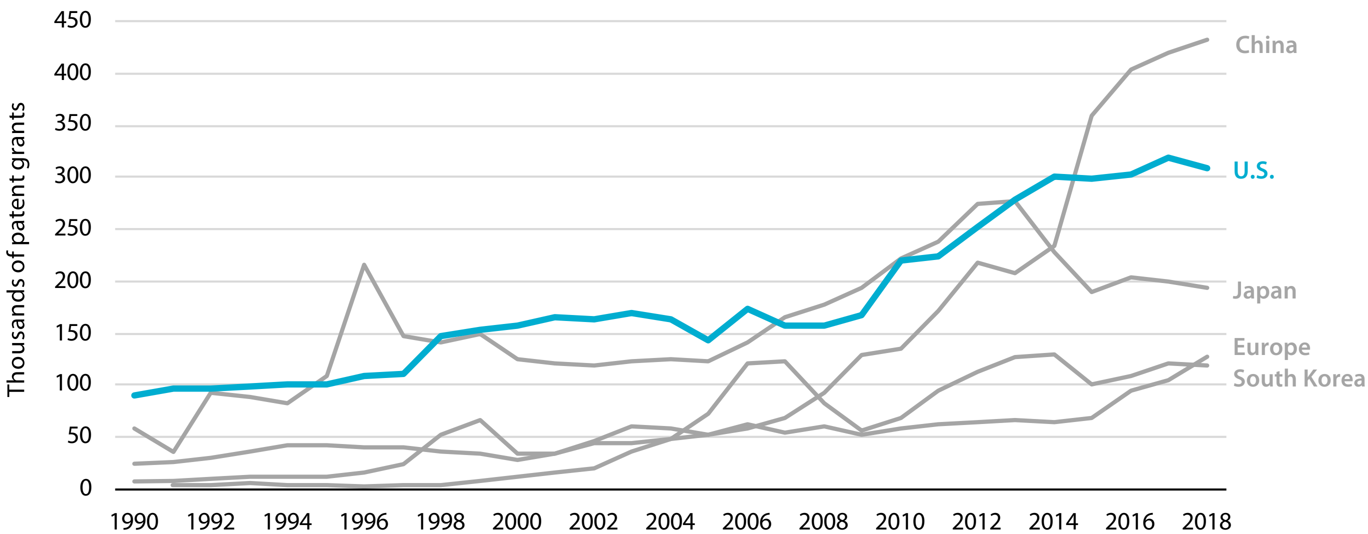
As discussed above, long-run TFP growth is largely driven by improvements in technological possibilities. Accomplishing this requires effort: labor and capital must be devoted to exploring and developing new frontiers. In some cases that effort is freely made, such as in the world of open source software development (Belenzon and Schankerman 2015). In other cases it is directly rewarded (without government intervention) through marketplace success; for example, a firm that is first to develop a winner-take-all technology may thereby derive a first-mover advantage.

But sometimes investments are only profitable with the help of public policy. A core policy tool is granting an inventor an exclusive (temporary) right to make use of their invention—in other words, a patent. During this period of exclusivity, the inventor monopolizes the invention and earns higher profits than they would have otherwise earned without the patent; this raises the private return to innovation. In so doing the patent addresses a classic public goods problem: when innovators cannot reap the rewards of their efforts (because competitors can immediately benefit from those same efforts), too little innovation occurs. Figure 10 shows the rapidly increasing number of new patents granted by the major patent offices across the globe.

The social benefit of the patent system—an increased incentive to innovate—comes with some costs, however. The first cost is the familiar downside of allowing any form of monopoly to occur, which is associated with higher prices and reduced supply relative to a competitive market. This also can weigh

FIGURE 10.

Total Patent Grants by Filing Office, 1990–2018



Source: World Intellectual Property Organization (WIPO) 2019.

Note: Europe refers to the European Patent Office. South Korea refers to the Republic of Korea.

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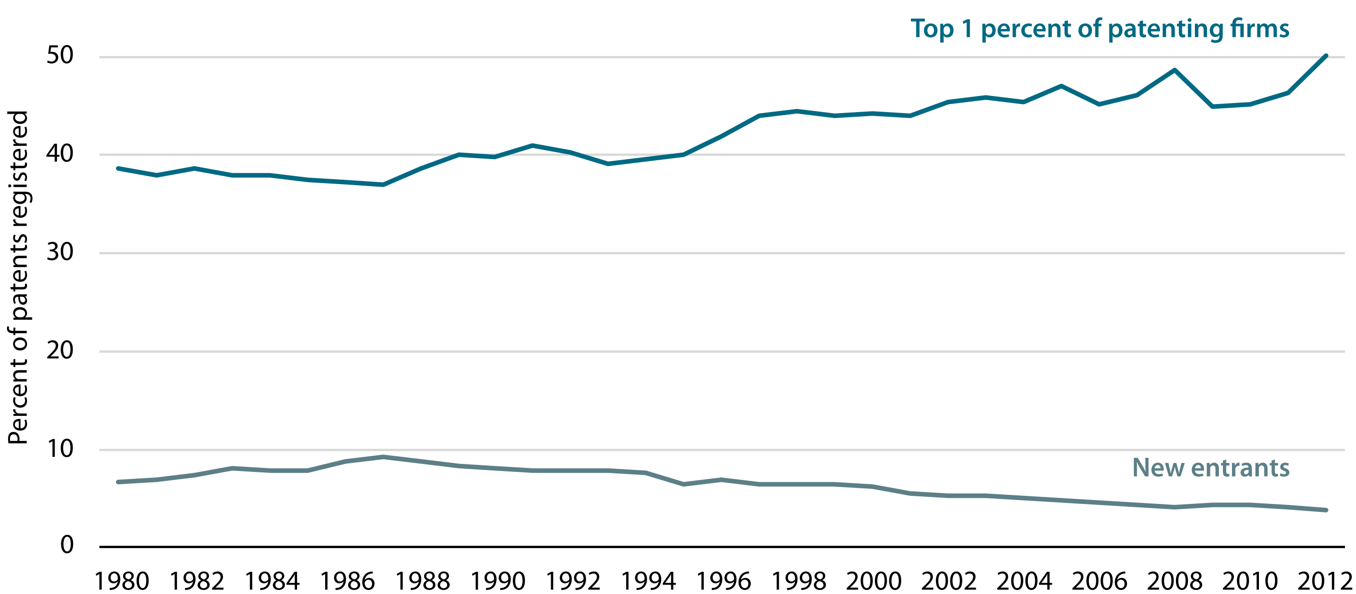
FIGURE 11.

Registry of Patents, 1980–2012



Source: Akcigit and Ates 2019.

Note: "Top 1 percent of patenting firms" refers to the share of patents registered by the top 1 percent of innovating firms with the largest patent stocks. "New entrants" refer to the share of patents registered by firms that patent for the first time.

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on innovation and productivity, since subsequent inventors cannot use the patented good or process in their own work without paying the initial inventor. The balance between incentives to innovate and the costs these incentives generate is challenging to measure (Ouellette and Williams 2020).

A second cost is less familiar, arising from the cumulative burden that patents can pose for potential innovators. An inventor creating a new product or process risks accidentally treading on other patents if they are insufficiently careful in reviewing current patents. In some areas there are so many patents granted that it is difficult to innovate without at least tangentially touching other patents. So-called patent thickets (Shapiro 2001) can be difficult to navigate, presenting unpredictable risks of litigation to innovators. In some cases it can be difficult to simply determine who has the rights to what invention (Ouellette and Williams 2020).

Some researchers emphasize the headwind that a patent thicket may have created for business dynamism and, ultimately, productivity growth (Akcigit and Ates 2019). The intense use of intellectual property protection by market leaders can limit the diffusion of knowledge. Figure 11, reproduced from the work of Akcigit and Ates (2019), depicts the rising share of patents registered to the top patent-holding firms, and conversely, the declining share of patents registered to new entrants. This inequality can place a substantial burden on those entrants who must contend with entrenched incumbent firms that already possess other market advantages (Shambaugh et al. 2018).

REGULATION

Another potential cause of diminished productivity growth consists of regulatory impediments. Regulatory impacts on productivity could take multiple forms. The first is a deliberate trade-off between measured productivity and other policy goals. For example, environmental protections could be made stricter in ways that reduce GDP (e.g., limiting certain types of production). Given that some of the benefits of environmental protections are not captured in GDP, this might be a good trade-off, but one that nevertheless may lower GDP growth in some cases and possibly lower output per hour as well.

The second type of regulatory impact stems from poor design of a given regulation. A policy might be intended to serve a certain purpose but have an incidental (perhaps unintentionally), negative impact on productivity. For example, occupational licensing rules are sometimes more burdensome than is necessary to protect public health and safety, which results in unnecessary barriers to entry into some labor markets and thereby impairs economic efficiency (Kleiner 2015; White House 2015).

A third type of regulatory impact arises from the collective weight of many individual regulations. Much as the cumulative effect of patents is sometimes said to constitute a patent thicket that is difficult for innovators to navigate (as described above), the array of regulations can create similar burdens for people and businesses. Each of these individual regulations may carry benefits that exceed their (narrowly defined) costs, but together they introduce frictions in the productive redeployment of labor and capital or in the innovation process itself. For example, research by Gutiérrez and Philippon (2017a, 2017b) finds that federal regulations in the aggregate are associated with greater market concentration and declining business investment.

The existence of these regulatory effects does not imply the desirability of wholesale deregulation, in part because regulations can often be growth-enhancing. For example, the long-run cognitive damage of lead poisoning can do more damage to long-run GDP than can regulations to limit lead exposure (Aizer et al. 2018), and financial regulation to make banks safer could limit some loans but still help avoid costly financial crises in the process. These considerations highlight the importance of using cost-benefit analysis when devising and scrutinizing regulations, ensuring that regulations accomplish their goals in minimally distortionary ways.

DECREASED MARKET COMPETITION AND SLOWING DYNAMISM

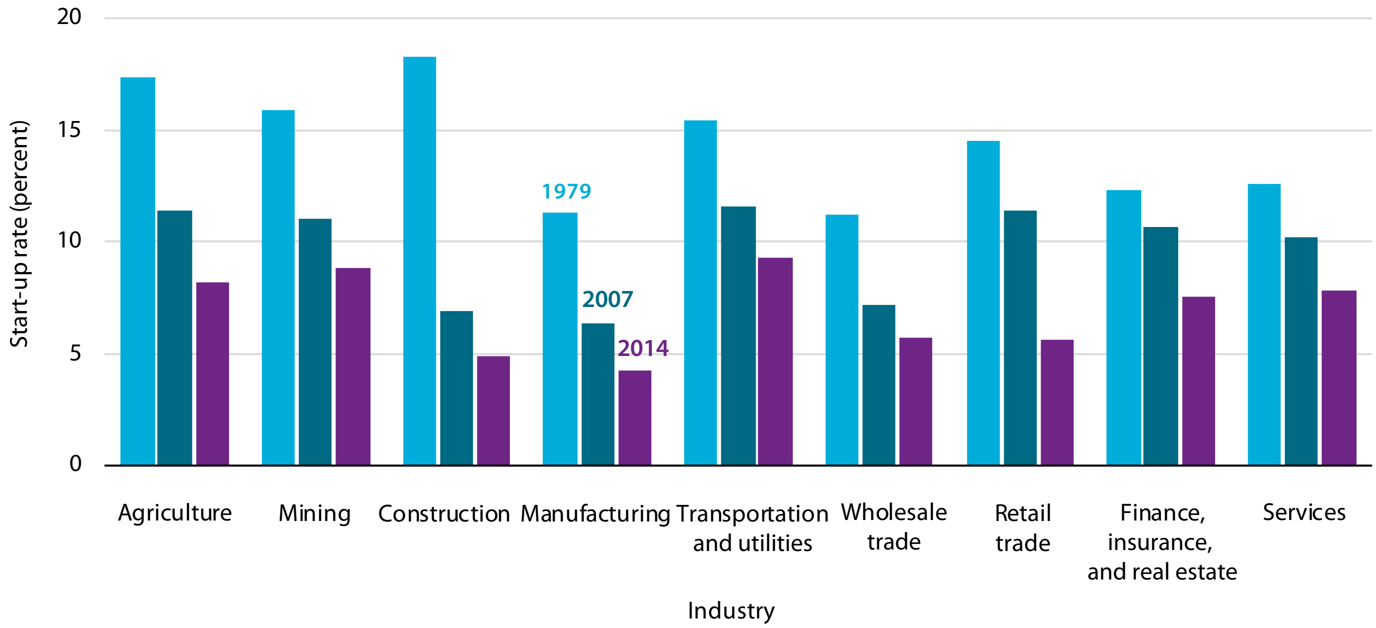
As discussed at more length in a previous Hamilton Project analysis, U.S. markets have been characterized by diminished competition and increased concentration over the past few decades (Shambaugh et al. 2018). Both product and labor markets are concentrated to worrying degrees and product market concentration has clearly increased over time.

In a closely related development, markets have also become less dynamic in that they feature less mobility, less job creation, and fewer business start-ups. Both diminished dynamism and diminished competition have negative implications for workers' wages (Shambaugh, Nunn, and Liu 2018; Shambaugh et al. 2018).

This is also important for understanding sluggish productivity growth. Without dynamic markets, productivity growth suffers. Many of the firms with the highest growth in labor productivity are young firms, suggesting that start-ups are a key support for robust productivity growth (Alon et al. 2018). Highly concentrated markets that are challenging for start-ups to enter can limit start-ups as a core contributor to productivity growth. In addition, reallocating workers from low-productivity to high-productivity firms is necessary for robust overall productivity growth. A lack of business formation can contribute to fewer options for worker mobility

FIGURE 12.

Start-up Rates by Industry, Selected Years



Source: U.S. Census Bureau 1977–2014.

Note: Start-up rates are calculated by dividing the number of firms aged less than one year by the total number of firms within an industry in each year.

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and similarly constrain productivity growth (Foster, Grim, and Haltiwanger 2016).

However, figure 12 shows the rate of business formation has fallen over time. This decline in start-up rates has occurred in every major industry since 1979. For instance, the share of new firms in manufacturing fell from 11.3 percent in 1979 to 4.2 percent in 2014, while the share of new firms in services fell from 12.6 to 7.8 percent. Employment shares of younger firms have fallen as well, meaning more and more workers are employed by older (and possibly less-dynamic) firms (Shambaugh et al. 2018).

Dynamic markets also facilitate the diffusion of innovations and efficient business practices throughout the economy. Since 2000 the gap between the most productive firms and all other firms has widened (Decker et al. 2018), which slows aggregate productivity growth relative to a world in which the laggard firms had been able to keep pace. Speeding the diffusion of efficient management practices and technological improvements would help boost overall productivity (Bloom and Van Reenen 2007).

A host of policy interventions can be implemented to generate more dynamism in both product and labor markets. Enhanced use of competition policy could ensure easier entry into markets. Reducing subsidies to large firms and focusing support instead on entrepreneurs and start-ups could boost start-up rates (Chatterji 2018). Limiting the use of noncompete agreements and other restrictive labor market policies could increase worker mobility and possibly start-up rates as well (Marx 2018; Starr 2019). More broadly, regulations like occupational licensing or land-use restrictions that may limit productivity growth and provide benefits to incumbents could be tightly scrutinized.

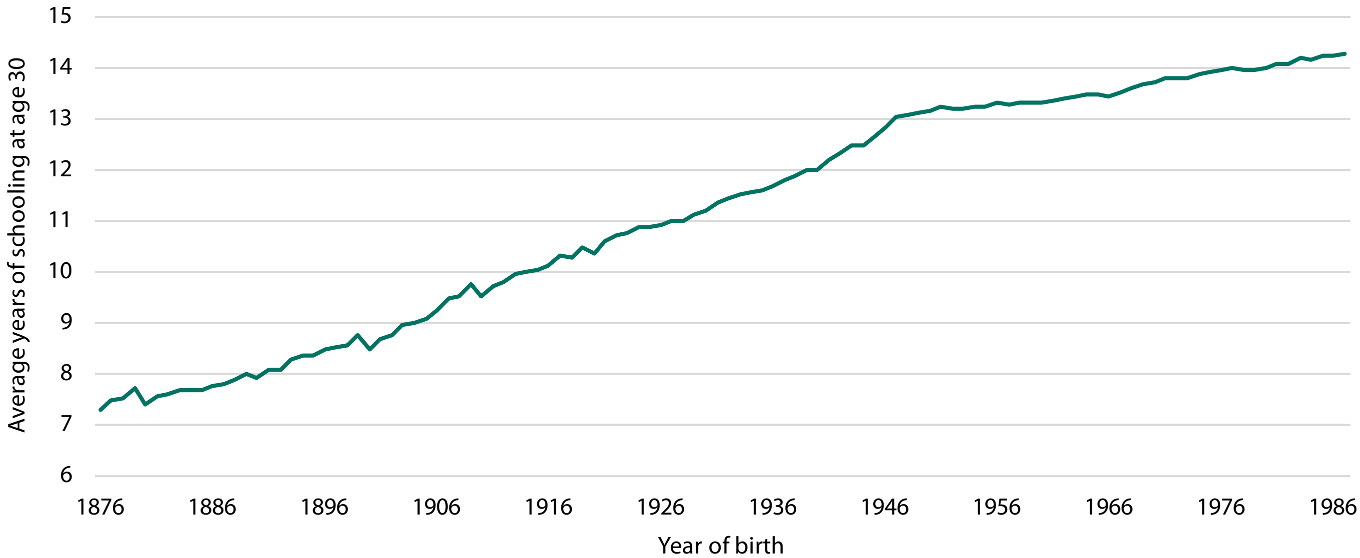
SLOWING GROWTH IN HUMAN CAPITAL AND THE LABOR FORCE

Innovation can require specialized expertise that necessitates years of training. For cohorts born from 1876 to 1951, average educational attainment rapidly increased by 0.8 years per decade, with successive generations receiving about two additional years of education relative to their predecessors. The pace of this increase has now slowed: cohorts born from 1951 to 1987 have added only about 0.3 years per decade (see figure 13, which reproduces analysis contained in Autor, Goldin, and Katz 2020). Recently there has been a slight uptick in the educational attainment of younger individuals—perhaps spurred by worse labor market options during the Great Recession (National Center for Education Statistics 2020). Improving both the quantity and quality of educational attainment is an important part of lifting productivity growth.

A slowdown in educational improvements directly lowers the contribution of changing labor force composition to labor productivity growth, as illustrated in figure 2.[11] But given the importance of highly educated workers (especially STEM workers) for generating technological innovation (Shambaugh, Nunn, and Portman 2017), slowing educational

FIGURE 13.

Educational Attainment at Age 30 by Year of Birth, 1876–1987



Source: Autor, Goldin, and Katz 2020.

Note: Data are from U.S. Census Bureau IPUMS data from 1940–2000 and CPS MORG data from 2005–18. Data are restricted to individuals born in the United States. See Autor, Goldin, and Katz (2020) for details.

improvements may also affect TFP growth in ways that are more difficult to assess.

The importance of educated workers is part of a broader challenge for the U.S. economy: developing and deploying the best talent available to solve problems that urgently require innovation. In a Hamilton Project policy proposal Lisa Cook (2020) discusses reforms that would reduce racial and gender inequalities in the innovation process, thereby widening participation in the innovation pipeline.

This slowdown in educational attainment growth occurred as the size of the labor force also grew more slowly than before. After a long period of labor force growth from the 1960s through the 1990s when the Baby Boom and women's entry into the labor force added considerably to the size of the labor force, the post-2000 era has seen slower prime-age population growth, stagnant prime-age labor force participation, and falling labor force participation overall (Nunn, Parsons, and Shambaugh 2019a). Ozimek, Fikri, and Lettieri (2019) argue that slower population growth can compound slowing productivity growth by reducing start-up rates.

Regardless of the reasons behind slowing growth in both the labor force and average educational attainment, both trends likely slow the pace of productivity growth (Shambaugh 2016). Slower growth in the prime-age labor force tends to coincide with slower growth in productivity, perhaps because of a reduction in available managerial talent (Feyrer 2007, 2011) or the rate of business formation (Karahan, Pugsley, and Şahin 2019). The aging of the workforce can also place downward pressure on productivity growth by making it more difficult to implement new innovations and processes (Feyrer 2008; International Monetary Fund [IMF] 2016).

Acemoglu and Restrepo (2017) argue that an aging population may increase the use of automation techniques as a solution to declining labor availability. Their claim highlights that demography is not destiny in terms of growth, since the reactions of economic agents and policymakers can offset demographic shifts. The aging of the U.S. population will make it even more important to boost productivity growth through the channels listed above, particularly through investments in education and R&D. In addition, increasing immigration (especially of high-skilled workers) can slow population aging and raise GDP (Nunn, O'Donnell, and Shambaugh 2018), which would help offset any possible demographically-induced slowdowns. Immigrants also contribute substantially to U.S. innovation; Hunt and Gauthier-Loiselle (2010) estimate that a percentage point increase in the college-graduate immigrant population raises patents per capita by 9–18 percent.

Who Benefits from Productivity Growth?

For an economy to raise its living standards or to address urgent national challenges, it needs to be able to produce more with a given level of inputs. But any advance in productivity can displace a subset of workers even if living standards rise overall. For example, if a new type of robot were designed and built that could accomplish many tasks that humans currently perform, it would generate a welcome increase in economic output relative to the number of (human) labor hours worked. However, in the short run this could displace workers who currently perform the newly automated tasks. Historically, the labor market has found new tasks for displaced workers—some of which can be complementary to new inventions—or has slowly reduced hours worked per person without reducing total employment. At times, however, the worker displacement can be swift and painful (White House 2016).[12]

In some instances, productivity growth lowers costs and thereby increases demand for products, causing the demand for labor to increase in the industry. For example, falling costs of flat-screen TVs due to productivity increases likely increased labor demand in the manufacturing of those products relative to a scenario in which where they were niche, expensive products. In other cases, however, productivity clearly reduces labor in an industry. In 1870 nearly 50 percent of employed Americans worked in agriculture (Daly 1981), while today just 1.4 percent work in that sector (BLS 2019) despite a massive increase in the volume of food produced. The innovation and productivity that allowed so much additional output with reduced work hours has made people better off, and over time the reduced labor has generally been absorbed in other activities.

One reason that productivity enhancements are often disruptive is their tendency to be unbalanced by sector. For example, durable goods manufacturing became much more productive from 1987 to 2018, with labor productivity growth of 3.0 percent per year (BLS 2020b; authors' calculations). But accommodation and food services lagged, recording annual productivity growth of only 0.8 percent from 1987 to 2018 (BLS 2020b; authors' calculations). This unbalanced sectoral growth naturally leads to unbalanced changes in the demand for different groups of workers.

Productivity growth can also affect different groups across the economy by increasing or decreasing demand for their skills. In the 19th century the advent of textile machines reduced demand for skilled weavers. Other mass production technologies reduced demand for skilled artisans (White House 2016). These technological advances increased demand for less-skilled workers and reduced demand for high-skilled workers. In response a group known as the Luddites famously destroyed looms to protest the improving technology that threatened their livelihood.

Over recent decades the labor market has experienced increased demand for highly educated workers and reduced demand for workers with less education, contributing to increased inequality between high- and middle-earners (Goldin and Katz 2009).[13] One account of this trend—known as skill-biased technological change—emphasizes the role of technology in driving the shift in relative demand for different types of labor (Autor, Katz, and Krueger 1998; Goldin and Katz 2009).

Acemoglu and Restrepo (2019, 2020) emphasize how technology or innovation can reallocate tasks from one group to another, expanding or contracting demand for certain types of workers. Some innovations may simply create new products and tasks, thereby increasing demand for certain workers but not directly reducing demand for others. Technology shocks that reallocate tasks, though, may sufficiently reduce demand for certain workers such that their real wages fall despite technological progress and overall productivity growth. Similarly, if technology reallocates tasks toward capital, then demand for labor and wages can fall despite an increase in productivity.

These considerations underscore that productivity growth tends to create winners and losers, at least in the short run. The labor market winners can include those workers whose labor becomes more efficient, such as a traveling salesperson who could work while traveling between sales calls in an autonomous vehicle (assuming increased efficiency facilitates higher income). The losers include those whose labor is simply replaced, as in the case of truck drivers when autonomous vehicles reduce the number of drivers needed to move products. Korinek and Stiglitz (2019) note how AI-based automation could be particularly problematic from this perspective, creating a possible need to both properly divide the gains from AI and steer it in directions that are broadly beneficial.

How productivity growth will affect workers in the future depends on the precise form of technological change, as described above. But the structure of the labor market, labor market institutions, and the relevant public policy rules are also crucial. For example, a greater degree of labor market concentration appears to reduce the benefits that workers derive from productivity growth (Benmelech, Bergman, and Kim 2018). The same research finds that this effect is mitigated by unions, indicating that mechanisms for raising worker bargaining power can help more workers participate in the returns to productivity growth.

Labor market strength is an additional consideration. Maintaining tighter labor markets may boost productivity through enhanced worker reallocation (Nakamura et al. 2019). Tighter labor markets are also disproportionately beneficial to low-wage workers (Aaronson et al. 2019), making countercyclical policy important for shaping returns to work.

Policy rules that govern how market returns are distributed have an obvious function as well. Even if productivity growth tends to benefit owners of capital or a particular group of workers disproportionately, a progressive tax system, a strong social safety net, and active labor market policies can broaden participation in the benefits of productivity growth and limit the losses to workers who are displaced (Nunn, Parsons, and Shambaugh 2019a). Relatedly, policy rules that guide employer responses to economic shocks can play a constructive role. For example, an unemployment insurance system that encourages work-sharing (i.e., reductions in hours rather than layoffs) can ameliorate the most destructive consequences of worker-displacing productivity growth (Abraham and Houseman 2014). In industries where an innovation can create singular winners, robust competition policy can also ensure that gains are widely distributed (Shambaugh et al. 2018).

Productivity growth is certainly needed for broadly shared economic growth. However, without the appropriate policies and market competition to help all parties share the gains and to reemploy displaced workers, productivity growth can leave many behind.

Conclusion

As policymakers focus on the economic recovery in the wake of the COVID-19 pandemic, it is also important to develop longer-term policies that will catalyze technological innovation, boost wages, and raise living standards for American families. Improving living standards in the long run largely depends on improving labor productivity—producing more goods and services for a given number of hours worked. Increasing productivity growth is necessary to sustain economic output and power economic growth through current and future downturns. By raising economic output, productivity growth will also make it easier to restore public finances after the large burst of spending during the pandemic-induced recession. Enhanced innovation puts the United States in a better position to respond to challenges ranging from public health to climate change, and even challenges yet to be encountered.

There is no single policy that can restore U.S. productivity growth on its own, but several policies can help. Investments in human capital to foster a more-educated and more-skilled labor force can directly address the level of output per worker produced. Enhancing the technology and infrastructure available to workers can also improve productivity growth; government spending on R&D and infrastructure as well as reforms to the intellectual property system could help promote innovation and productivity growth. Finally, limiting unnecessary regulations and impediments to new business formation and taking other steps to help revive market dynamism could also spur productivity growth.

The United States is in the grip of a public health and economic crisis. Full economic recovery will require both immediate, short-term relief as well as long-term investments in productivity and innovation to ensure broad-based economic growth that is widely shared.

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Endnotes

1. It is important to note that these estimates are subject to more uncertainty than contemporary employment estimates.
2. We show hourly compensation, which includes both wages and nonwage benefits, because these data are available for a longer period than are hourly wages.
3. See Fernald et al. (2017) for a detailed investigation of the post-2004 decline in GDP growth that emphasizes the roles of lower productivity growth and lower labor force participation, particularly following the Great Recession.
4. See, e.g., Baily (1981) for an early assessment of the productivity growth slowdown facing the United States after 1973.
5. We rely on the BLS (2020b) Labor Productivity and Costs tables, which allow us to present industries that collectively represent 51.4 percent of total employment in the nonfarm business sector as of the first quarter of 2016.
6. See CEA (2017, chap. 2, box 2-7) for discussion.
7. See also Fatás (2000) for discussion of these ideas.
8. The federal government's role is smaller—0.3 percent of GDP in 2018—when allocating R&D spending by performer rather than by funder. By that categorization, higher education accounts for R&D performance equal to 0.4 percent of GDP.
9. Moreover, the private sector appears to be spending less on basic research than it previously did (Arora, Belenzon, and Patacconi 2018).
10. See CEA (2016, chap. 6) for a review of the literature of the impact of infrastructure spending on long-term growth and on private investment.
11. One reason there has not been a larger drop in the contribution of changing labor force composition to productivity growth from the 1945–73 period relative to the slowdown in human capital growth during this period is the declining labor force participation of individuals with less education. In this case, one problem (falling labor force participation) may be covering up another (a slowdown of educational attainment).
12. By the same token, productivity growth may be quite disruptive to existing firms. When an innovator develops a new technology or finds a superior means of organizing economic activity, this may undermine existing business models and render them uncompetitive (Christensen, Raynor, and McDonald 2015). Explosive growth in the new business model is then accompanied by disruption in the existing model, potentially leaving unemployment and bankruptcy in its wake.
13. The college wage premium stopped rising around 2000, remaining at a high level thereafter (Shambaugh et al. 2017).

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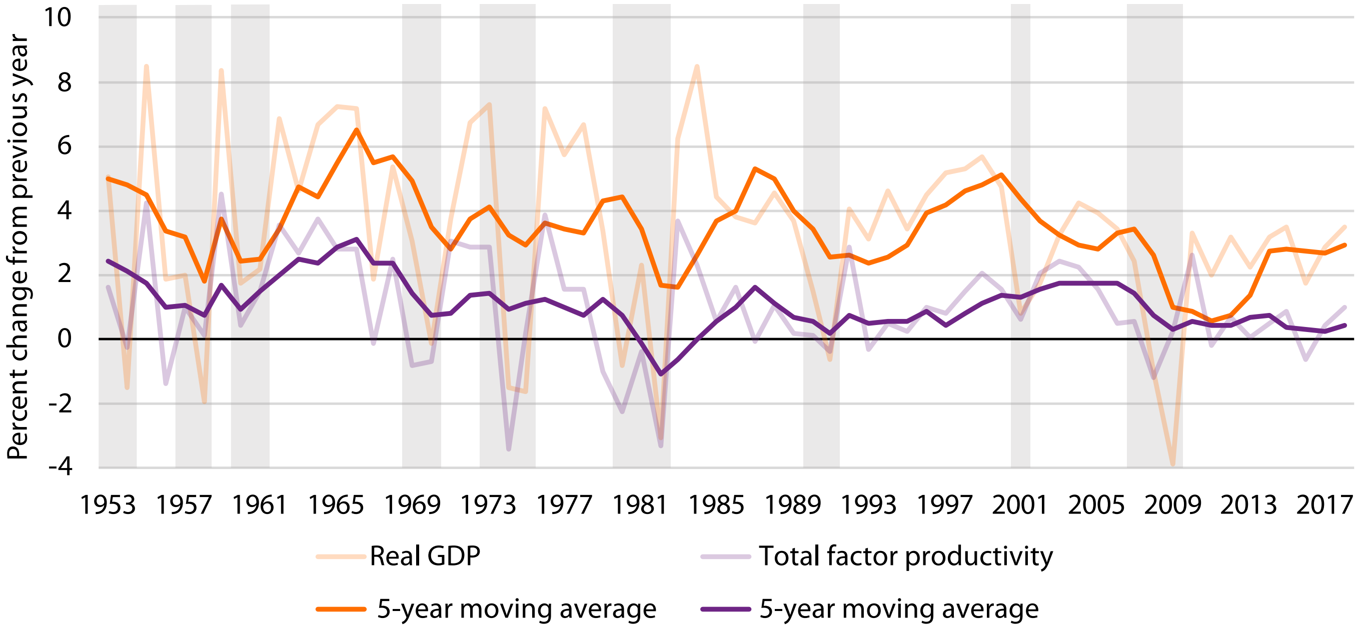
Abstract

Labor productivity growth powers economic growth. Yet growth in productivity has generally slowed over the past half century, except for a brief burst during the mid-1990s and early 2000s. Since 2004 output per hour worked has grown at a pace of just 1.4 percent—which is half its pace in the three decades after World War II. This slowdown in productivity growth is not unique to the United States: all of the major advanced economies have experienced similar declines in productivity growth. In this paper we consider explanations for the slowdown in productivity growth as well as the public policies that can help restore it.

FIGURE 3.

U.S. Real GDP and Total Factor Productivity, 1953–2018



Sources: Bureau of Economic Analysis (BEA) 2020b; BLS 2020d; authors' calculations.
Note: Data are for the private nonfarm business sector. Five-year moving averages for 1953 are calculated using data from 1949–53. Shaded bars denote recessions.

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