McKinsey&Company

MCKINSEY GLOBAL INSTITUTE

THE PRODUCTIVITY PUZZLE: A CLOSER LOOK AT THE UNITED STATES

MARCH 2017

DISCUSSION PAPER

James Manyika | San Francisco
Jaana Remes | San Francisco
Jan Mischke | Zurich
Mekala Krishnan | Boston

MCKINSEY GLOBAL INSTITUTE
RESEARCH. INSIGHT. IMPACT.

MCKINSEY GLOBAL INSTITUTE

Since its founding in 1990, the McKinsey Global Institute (MGI) has sought to develop a deeper understanding of the evolving global economy. As the business and economics research arm of McKinsey & Company, MGI aims to provide leaders in the commercial, public, and social sectors with the facts and insights on which to base management and policy decisions. The Lauder Institute at the University of Pennsylvania ranked MGI the world's number-one private-sector think tank for the second consecutive year in its 2016 Global Think Tank Index.

MGI research combines the disciplines of economics and management, employing the analytical tools of economics with the insights of business leaders. Our "micro-to-macro" methodology examines microeconomic industry trends to better understand the broad macroeconomic forces affecting business strategy and public policy. MGI's in-depth reports have covered more than 20 countries and 30 industries. Current research focuses on six themes: productivity and growth, natural resources, labor markets, the evolution of global financial markets, the economic impact of technology and innovation, and urbanization.

Recent reports have assessed the economic benefits of tackling gender inequality, a new era of global competition, Chinese innovation, and digital globalization. MGI is led by four McKinsey & Company senior partners: Jacques Bughin, James Manyika, Jonathan Woetzel, and Frank Mattern, MGI's chairman. Michael Chui, Susan Lund, Anu Madgavkar, Sree Ramaswamy, and Jaana Remes serve as MGI partners. Project teams are led by the MGI partners and a group of senior fellows and include consultants from McKinsey offices around the world. These teams draw on McKinsey's global network of partners and industry and management experts. Input is provided by the MGI Council, which coleads projects and provides guidance; members are Andres Cadena, Sandrine Devillard, Richard Dobbs, Katy George, Rajat Gupta, Eric Hazan, Eric Labaye, Acha Leke, Scott Nyquist, Gary Pinkus, Sven Smit, Oliver Tonby, and Eckart Windhagen. In addition, leading economists, including Nobel laureates, act as research advisers.

The partners of McKinsey fund MGI's research; it is not commissioned by any business, government, or other institution. For further information about MGI and to download reports, please visit **www.mckinsey.com/mgi**.

PREFACE

Few topics in economics today in most large economies generate as much debate as the productivity puzzle. In the United States, productivity growth has declined sharply since 2004 yet digital technology has been widely apparent during this period. Even more startling, last year productivity growth measures flirted with negative territory. The answer to this puzzle holds the key to future prosperity because now more than ever our economy depends on productivity improvements for long-term economic growth.

Economists have proposed competing explanations for declining productivity growth and so far have failed to reach a consensus. That has left decision makers in both the public and private spheres without a clear perspective from which to chart a path forward. This paper serves as a framing paper to facilitate preliminary discussion about the research we are undertaking this year into productivity and economic growth, both in the United States and more broadly in developed economies. In this paper, we focus on the United States and take stock of the current productivity debate while providing additional insights from a micro view drawn from our ongoing research. We then highlight key questions that inform our research agenda for understanding the productivity growth slowdown. Throughout this paper and in our ongoing research, we draw on a large body of MGI studies about productivity and global growth as well as digitization, automation, and many industry specific studies.[1] Rather than outline in detail the findings of all these reports, we make reference to them where most appropriate; the details can be found in the reports themselves.

The perspectives in this working paper were developed by James Manyika, a senior partner of McKinsey & Company and a director of MGI; Jaana Remes, a partner of MGI; Jan Mischke, a senior fellow at MGI; and Mekala Krishnan, a fellow at MGI. We would like to thank Ryan Luby and Octavio Figueroa for their contribution to our analysis, Sree Ramaswamy, Tera Allas, and Jacques Bughin for their input and guidance, and Tim Beacom for help with this paper, as well as senior editor Anna Bernasek, editorial production manager Julie Philpot, graphics specialist Marisa Carder, and director of external relations Rebeca Robboy.

Special thanks also go to our academic advisers who helped shape this discussion paper: Richard N. Cooper, Maurits C. Boas Professor of International Economics at Harvard University; Martin N. Baily, Bernard L. Schwartz Chair in Economic Policy Development and Senior Fellow, Economic Studies, Center on Regulation and Markets at the Brookings Institution; and Nicholas Montalbano, research assistant at the Brookings Institution. In addition, we would like to thank John Fernald, Senior Research Adviser at the Federal Reserve Bank of San Francisco; John Haltiwanger, the Dudley and Louisa Dillard Professor of Economics and Distinguished University Professor of Economics at the University of Maryland-College Park; Catherine Mann, OECD Chief Economist and Head of the Economics Department; Mark Zandi, Chief Economist of Moody's Analytics; and Cliff Waldman, Chief Economist at the MAPI Foundation, for sharing their insights with us.

We welcome comments on this paper and acknowledge that any errors are our own.

Jacques Bughin
Director, McKinsey Global Institute | Brussels

James Manyika
Director, McKinsey Global Institute | San Francisco

Jonathan Woetzel
Director, McKinsey Global Institute | Shanghai

March 2017

[1] For MGI's published research about productivity and growth, please see www.mckinsey.com/mgi/our-research/productivity-competitiveness-and-growth; for all other MGI research please see www.mckinsey.com/mgi/our-research.

THE PRODUCTIVITY PUZZLE: A CLOSER LOOK AT THE UNITED STATES

INTRODUCTION

Companies and governments around the world today are focused on one imperative: how to kick-start growth after a period of prolonged weakness. Productivity growth has always been the key to raising per capita GDP, wages, and living standards.[2] Now, as low birth rates slow the expansion of the labor force, increasing productivity, the output we get from every hour worked, is more crucial than ever to promote GDP growth. Yet productivity growth has been diminishing in the United States, Western Europe, and Japan for some time, baffling economists, policy makers, and even business leaders.

The downshift in productivity growth in the United States has been remarkable. For decades, labor productivity had been growing at an average pace of 2.1 percent year over year. Then in 2004, the rate of productivity growth began to decelerate, falling to an average of 1.2 percent, year over year, during the decade to 2014 (including a brief spike in 2009 and 2010 following the financial crisis). Since 2011, that rate has declined further to 0.6 percent (Exhibit 1). Quarter-over-quarter labor productivity growth in the business sector was even negative for three quarters between the end of 2015 and the first half of 2016.[3] Disappearing productivity growth raises alarms, coming at a time when the United States, and indeed many leading economies, increasingly depend on productivity to drive economic growth. To put that in context, over the last 50 years the largest economies (G20) averaged about 3.5 percent in GDP growth with roughly 1.8 percent coming from productivity growth and 1.7 percent from the expansion of the labor supply. Over the next 50 years, labor supply growth will slow down to about 0.3 percent across these countries and for some, labor supply has already peaked.[4] In recent years, US productivity growth has generated about 80 percent of total GDP growth, compared with around 35 percent in the 1970s, when the rest came from growth in labor supply.[5] Therefore not only does sluggish productivity matter for economic growth now, it matters for America's economic growth and prosperity for the next several decades.

Declining productivity growth has various possible explanations but most fall into three camps. The first camp argues that productivity is increasingly difficult to measure and that as a result we have failed to capture productivity growth that has been occurring all along. The second "secular stagnation" camp argues that a shortage of demand and investment opportunities, even in a low-interest-rate environment, is the binding constraint on growth, essentially choking off productivity growth. The third camp is divided over the impact of technological innovation on the economy. Some argue today's innovations are not as transformational as those in the past. Others believe that the Solow Paradox of the 1980s is at work again, and that the slowdown is really a lag in the realization of productivity benefits following the introduction of new waves of technologies, for example smartphones, that we can see everywhere but not in the productivity statistics. There are defensible arguments behind these theories and each has varying levels of evidence around it. They are also not mutually exclusive—each may play a role in unlocking the solution to the puzzle. So

---

2 We will focus the analysis in this paper on labor productivity rather than capital or multifactor productivity. For an economy that does not have large flows of cross-border investment income, standard of living and wages ultimately depend on labor productivity. For more details, see *Global growth: Can productivity save the day in an aging world?* McKinsey Global Institute, January 2015.

3 Based on Bureau of Labor Statistics measure of output per hour worked.

4 *Global growth: Can productivity save the day in an aging world?* McKinsey Global Institute, January 2015.

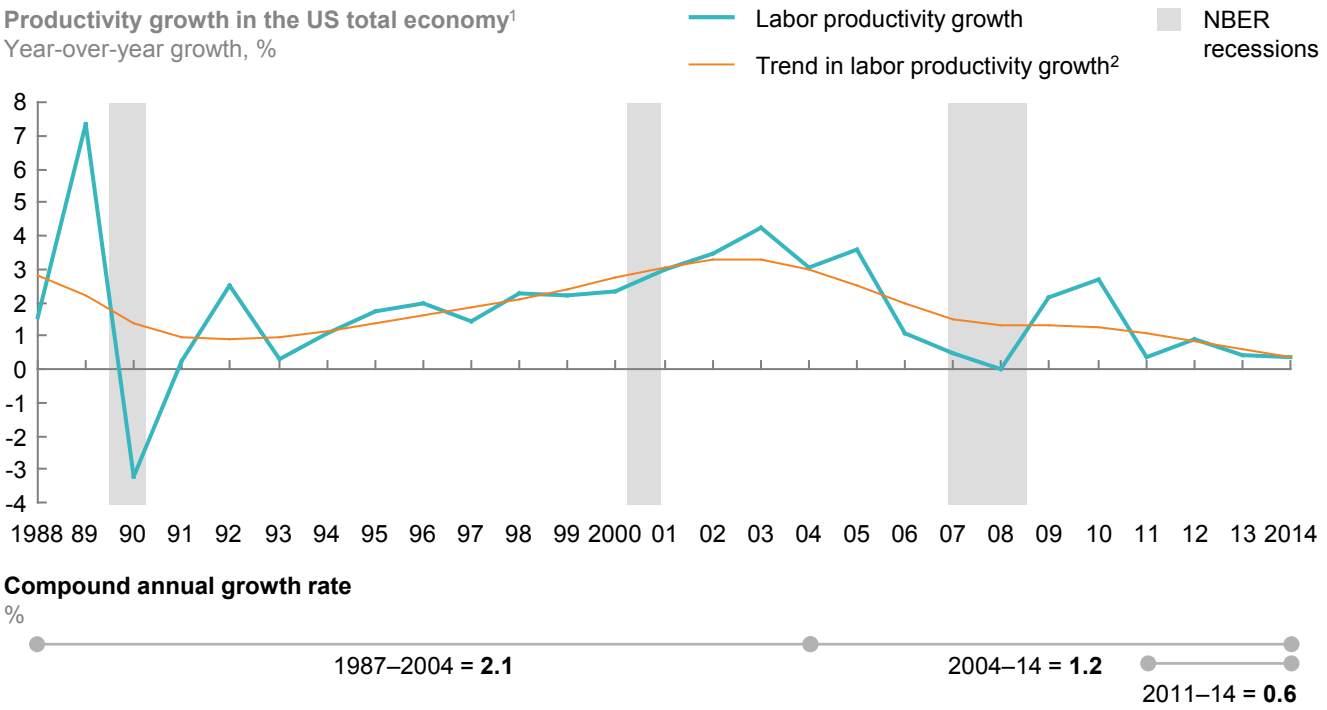
5 James Manyika and Vikram Malhotra, "Productivity and growth: The enduring connection," *Wall Street Journal*, February 16, 2011.

far, though, economists have failed to reach consensus on the causes of the productivity growth slowdown or indeed the relative significance of the various arguments.[6]

Far from mere academic interest, establishing the source of the slowdown is important for both the public and private sectors. Without understanding the forces behind slowing productivity growth, companies cannot set realistic expectations about future growth and policy makers cannot apply the correct policy tools to nudge economic growth into higher gear. Today there is a need for a better way of understanding and interpreting the mechanics of productivity. This discussion paper focuses on the United States, although many of the trends apply to other advanced economies. In the first part of this paper, we take stock of the productivity debate, and in the second part, we provide additional insights from taking a micro view of the US economy. Finally, from our ongoing research into productivity, growth, innovation, and industries we outline areas policy makers could address to boost productivity while highlighting questions for further research which we intend to tackle over the coming year.

Exhibit 1

Labor productivity growth in the US has declined to 0.6 percent since 2011



1 Productivity is defined as value added per hour worked. Based on BLS total economy measure of real value-added output. Data is only available through 2014.
2 Trend line constructed using a Hodrick Prescott filter.

SOURCE: BLS; McKinsey Global Institute analysis

THREE POSSIBLE EXPLANATIONS FOR THE PRODUCTIVITY GROWTH SLOWDOWN AND THE EVIDENCE FOR THEM

There are three leading explanations for the productivity slowdown in the United States. They include: the mismeasurement of productivity in increasingly important sectors, the rise of secular stagnation, and the impact of technological innovation. Researchers have found varying levels of evidence to support each of these explanations, yet there is still a

6 Martin Neil Baily and Nicholas Montalbano, *Why is productivity growth so slow? Possible explanations and policy responses*, Brookings Institution, September 2016.

lack of consensus around the relative importance of each in explaining the productivity growth slowdown.

The mismeasurement of productivity in increasingly important sectors

Our understanding of the economy is only as good as our measurement. When it comes to measuring productivity, economists face a particular challenge. It seems likely that the advent of new consumer services, often provided free of charge—such as mobile GPS systems, Google, a host of smartphone-based applications, and cloud-based services—have contributed to productivity in ways we cannot capture. In addition, while measuring the output of physical goods tends to be more straightforward, measuring the output of services is harder. Correctly assessing the value of capital goods is another challenge, particularly for information and communication technology equipment and software capital that have become an increasingly important factor of production.

While it seems reasonable to assume that our ability to correctly measure productivity changes has been limited, what is less clear is the extent to which measurement has contributed to the recent productivity growth slowdown in the United States. Robert Gordon, among others, has described the dramatic consumer benefits from past waves of innovation that were similarly missed in productivity growth measures.[7] David M. Byrne, John G. Fernald, and Marshall B. Reinsdorf have assessed the role played by mismeasurement and find no evidence that mismeasurement has worsened in recent times.[8] Adjusting price deflators for computers, communications and specialized equipment, semiconductors, and software, as well as including intangibles, they find could add about 0.2 percentage points to labor productivity growth between 2004 and 2014. However, they believe the mismeasurement contribution from these factors was actually higher—roughly 0.5 percentage points—between 1995 and 2004, because of the higher share of domestic production of many of these products in this period. Jan Hatzius and his colleagues find different trends.[9] Sizing the impact of poorly defined price indexes in information technology (IT) hardware and software, they find that the contribution of mismeasurement has increased to around 0.3 percentage points today from 0.1 to 0.2 percentage points between 1995 and 2004. They attribute the difference in results in particular to alternative assumptions about software pricing effects, and the growing share of software and digital product industries in the economy. Regardless, all these estimates at best account for a fraction of the roughly 1.5-percentage-point decline in productivity growth observed between 1995 and 2004, relative to the post-2004 period.

A challenge with the mismeasurement explanation is that our capacity to correctly measure productivity gains varies widely between sectors, making it hard to draw economy-wide conclusions. For example, we may have been able to track the productivity evolution of the automotive industry, but for service sectors such as health care, the true value of improved medical care is likely not correctly captured in national accounts. Furthermore, if measurement is an issue with services, it may worsen as the economy continues its shift away from manufacturing to a broad range of service industries.[10]

---

7 Robert J. Gordon, *The rise and fall of American growth: The US standard of living since the Civil War*, Princeton University Press, 2016.

8 David M. Byrne, John G. Fernald, and Marshall B. Reinsdorf, *Does the United States have a productivity slowdown or a measurement problem?* Federal Reserve Bank of San Francisco, working paper 2016-03, April 2016.

9 Jan Hatzius et al., "Productivity paradox v2.0 revisited," *US Economics Analyst*, Goldman Sachs, September 2016.

10 Increasing share of service industries, with bigger productivity measurement challenges, does not necessarily mean that the gap between actual and measured productivity gains is rising. For example, the health care advances of the past 100 years led to large gains in life expectancy and quality that went unrecorded in productivity statistics. To assess the impact of mismeasurement on the productivity slowdown, one needs to size the missed productivity improvements today compared with those of past decades.

It is also important to distinguish between areas of the US economy that we are probably measuring incorrectly, such as quality in health care and education, and areas that we may not be capturing at all, which include a broad range of household activities that fall outside the market economy included in GDP measures. Recent examples include services we do not directly pay for such as Google search, Facebook, and Skype. McKinsey & Company research focused on search found that the unmeasured value of search in the United States, that is the part not included in GDP, was about 27 percent of the total value it created for users.[11] In another study, MGI focused on Skype and found that it generated enormous consumer surplus that was not measured anywhere.[12] Forty percent of international call minutes in 2013 were Skype-to-Skype calls, equivalent to $37 billion of lost revenue for telecom firms. Again, this is not a new phenomenon: the advent of free radio and TV channels significantly broadened households' access to information. While we know there are new, growing areas of economic activity that are not being captured in our measurement of productivity, estimates by Byrne, Fernald, and Reinsdorf suggest that adding the welfare gains from "free" digital services could add perhaps three-tenths of a percent of GDP per year to well-being, a small number compared with the productivity growth slowdown.[13] Syverson estimates that even the largest, most conservative estimates of the surplus generated by digital technologies can explain at best a third of the slowdown in growth.[14]

Secular stagnation: Weak investment in an era of ultralow interest rates

Some economists explain weak GDP growth—and with it slow productivity growth—via the state of the macro economy.[15] According to this analysis, the United States seems to be caught in a vicious cycle: the economy is out of balance because of an excess propensity to save relative to a lower propensity of businesses, households, and the public sector to invest. There may be structural forces at work that are dampening consumer demand: an increasing share of income going to high-income households that are less likely to spend that income and an increasing proportion of older households that may have already acquired their house and other consumer durables.[16] In a slow growth economic environment with weak demand and consumption, and some would argue regulatory uncertainty, businesses are more hesitant to invest despite very low interest rates. Slowing consumption and diminished investment limit aggregate demand, and in turn diminish productivity growth. This affects income growth for households and in turn further depresses demand and results in a vicious cycle of economic stagnation.

Despite ultralow interest rates in the United States, investment has been relatively low since the financial crisis. Gross domestic investment as a share of GDP dropped in 2009 to its lowest level since 1950 and, although it has recovered somewhat, remains below historical norms (Exhibit 2). Potential explanations for this decline include: falling prices for capital goods (except for structures where prices tend to rise faster than consumer price indexes), shifts in industry mix toward more asset-light sectors, corporate short-termism, constraints on housing markets, public policy shifts, and globalization that has accelerated shifts in investment across borders. But a weak macro outlook and slower growth around the world

---

11 *The impact of internet technologies: Search*, McKinsey & Company, July 2011.

12 *Playing to win: The new global competition for corporate profits*, McKinsey Global Institute, September 2015.

13 David M. Byrne, John G. Fernald, and Marshall B. Reinsdorf, *Does the United States have a productivity slowdown or a measurement problem?* Federal Reserve Bank of San Francisco, working paper number 2016-03, April 2016.

14 Chad Syverson, *Challenges to mismeasurement explanations for the U.S. productivity slowdown*, NBER working paper number 21974, February 2016.

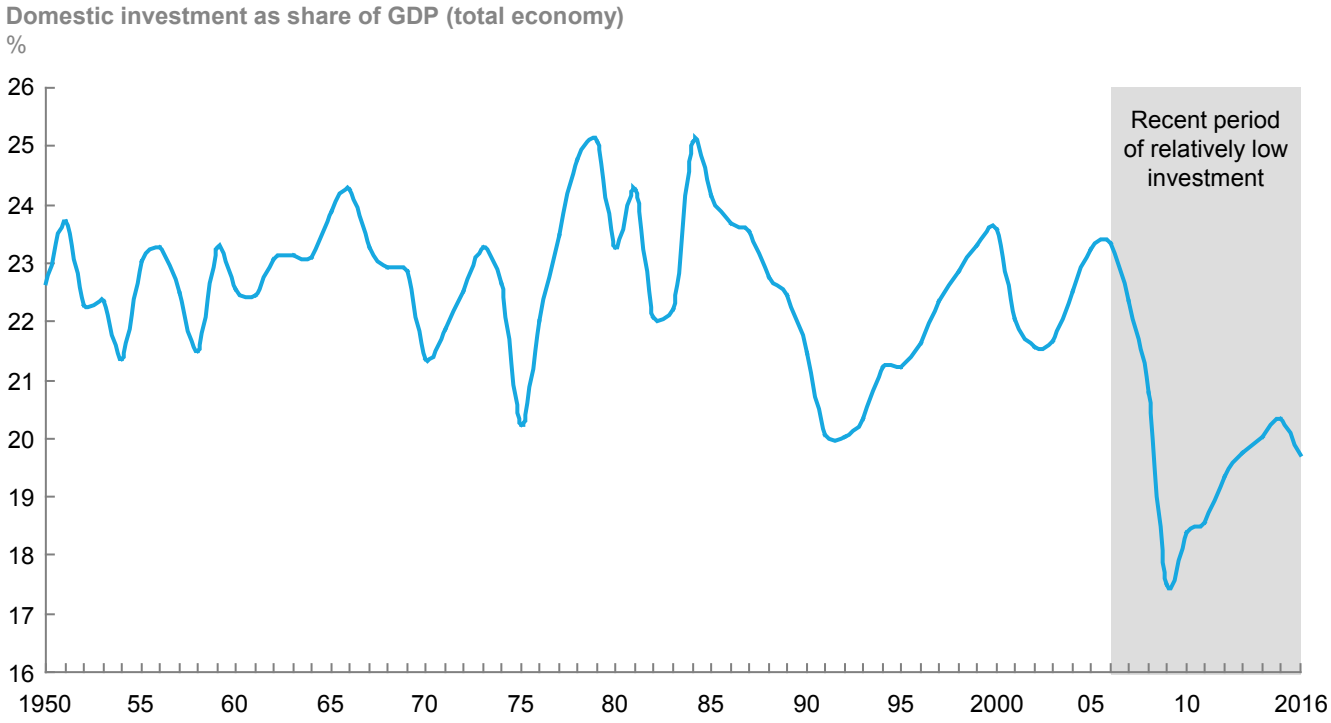
15 See for example, Lawrence H. Summers, "The age of secular stagnation: What it is and what to do about it," *Foreign Affairs*, February 15, 2016; for a compilation of views on the topic see Coen Teulings and Richard Baldwin, "Secular stagnation: Facts, causes, and cures," Vox, September 2014; Barry Eichengreen, "Secular stagnation: The long view," *American Economic Review*, volume 105, number 5, May 2015; Robert J. Gordon, "Secular stagnation: A supply-side view," *American Economic Review*, volume 105, number 5, May 2015.

16 *Poorer than their parents? Flat or falling incomes in advanced economies*, McKinsey Global Institute, July 2016.

are likely among the key factors that have changed business appetite for investment after the crisis.[17]

Exhibit 2

Investment has been declining in the US despite ultralow interest rates



SOURCE: BEA; McKinsey Global Institute analysis

A prolonged lack of investment causes real damage to the economy, dampening demand in the short run and hollowing out productive capacity in the long run. Investment is directly linked to productivity growth, given the productivity boost potential from new machinery, equipment, and technology. For example, Martin Baily and Nicholas Montalbano have found that a decline in capital deepening could explain as much as 0.7 percentage points of the 1.9-percentage-point decline in productivity growth between the periods of 1995–2004 and 2004–15 in the private business sector.[18] Our analysis finds that capital intensity growth declined sharply between 2009 and 2011 and became zero to negative from 2011 to 2014 (Exhibit 3).

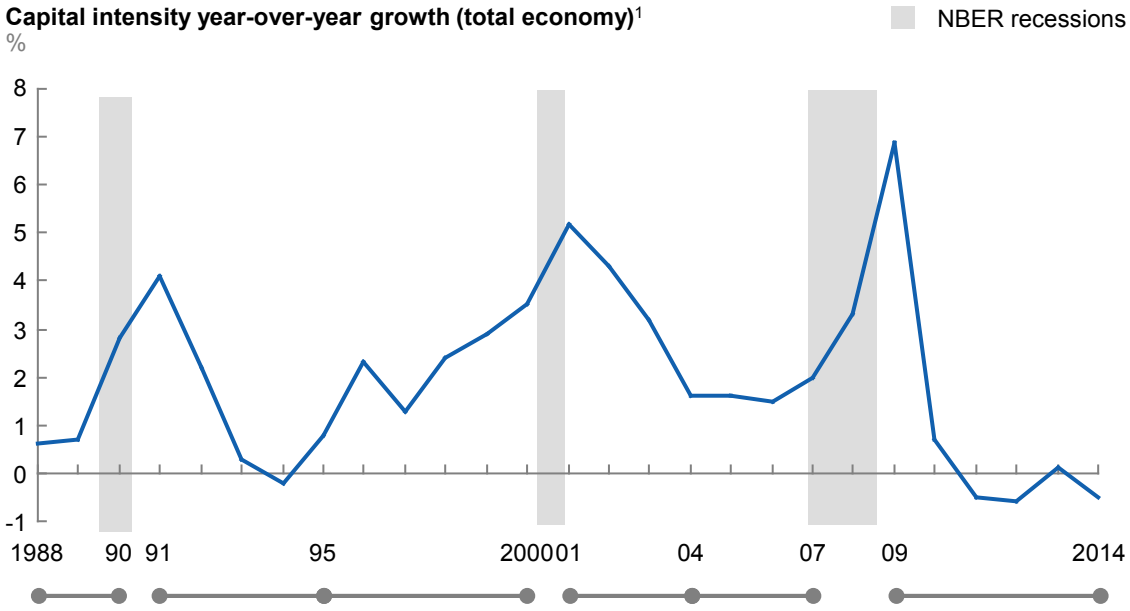
Better understanding of the investment slowdown, the drivers of firm and household investment decisions that policy makers can influence, as well as trends in deleveraging and household savings will be critical to assess whether structurally weak demand is likely to remain a key constraint on US productivity growth.

[17] *Secular stagnation and low investment: Breaking the vicious cycle*, McKinsey Global Institute, April 2016; Olivier Blanchard, Guido Lorenzoni, and Jean-Paul L'Huillier, *Short-run effects of lower productivity growth: A twist on the secular stagnation hypothesis*, Peterson Institute for International Economics, policy brief, February 2017. In this work, Blanchard et al. link low US GDP growth with lower optimism for the future. Specifically, they estimate that downward revisions of productivity growth may have contributed 0.5 to 1.0 percent a year to the decline in GDP growth since 2012. The mechanisms described for such a decline include reduced consumer spending with lower expectations of future income growth, as well as a decline in firm investment with lower expected demand growth.

[18] Martin N. Baily and Nicholas Montalbano, *Why is productivity growth so slow? Possible explanations and policy responses*, Brookings Institution, September 2016.

Exhibit 3

Capital intensity growth has been exceptionally weak since 2009



Capital intensity compound annual growth rate %	1987–90	1991–95	1995–2000	2001–04	2004–07	2009–14
	1.4	0.8	2.5	3.0	1.7	-0.1

1 Capital intensity is the ratio of capital services to hours worked. Time periods are constructed to exclude recessions. Data is based on BLS measures for the total economy, which is available through 2014.

SOURCE: BLS Multifactor Productivity data; McKinsey Global Institute analysis

The technological innovation slowdown or the Solow Paradox redux

Technological innovation has been critical to increasing productivity growth in the past but today there is disagreement around the impact current technological innovation is having on the economy. Skeptics such as economist Robert Gordon believe that current technological advances are not great enough to drive strong productivity growth.[19] Instead, he points to historical innovations such as the advent of the Industrial Revolution and the use of electricity as having a far greater impact on productivity growth than current technological innovations. Our research continues to show that it is not a lack of productivity-enhancing technologies that is constraining productivity growth.[20] MGI's ongoing in-depth industry research has found that technological opportunities remain strong in the United States, particularly in advanced manufacturing, energy-intensive manufacturing, energy extraction, and transportation as well as in large sectors such as education, health care, construction, and government, where productivity has lagged. Work by Martin Baily, James Manyika, and Shalabh Gupta has found this is not because of a lack of opportunities for innovation and change but because of a lack of incentives for change and institutional rigidity.[21]

An alternative explanation comes in the form of the Solow Paradox. Robert Solow famously said in the late 1980s, "You can see the computer age everywhere but in the productivity

19 Robert J. Gordon, *The rise and fall of American growth: The US standard of living since the Civil War*, Princeton University Press, 2016.

20 See for example Erik Brynjolfsson and Andrew McAfee, *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*, Norton, 2014; and Joel Mokyr, "The next age of invention: Technology's future is brighter than pessimists allow," *City Journal*, winter 2014.

21 Martin N. Baily, James Manyika, and Shalabh Gupta, "US productivity growth: An optimistic perspective," *International Productivity Monitor*, number 25, spring 2013.

statistics." Today we could be living in round two of the Solow Paradox as technological innovations like smartphones and the internet of things seem to be everywhere but in the productivity numbers.[22]

The original Solow Paradox was resolved in the late 1990s when sectors such as semiconductors and computer manufacturing grew rapidly, and sectors such as retail began to use technology to put in place productivity-enhancing innovations.[23] The moderate productivity growth of the 1980s was followed by a period of rapid productivity growth between 1995 and 2004. It was in this period that the productivity gains from technology-enabled business process changes were broad enough to show up in aggregate productivity growth numbers.[24] However, there are researchers such as Acemoglu, Autor, Dorn, Hanson, and Price who find that some aspects of the Solow Paradox may remain unresolved particularly as an explanation for manufacturing outside technology-producing sectors themselves.[25]

We find evidence for the Solow Paradox redux from MGI's industry research, for example, *The internet of things: Mapping the value beyond the hype*. In this research we sought to understand how such technologies can drive economic value. We found that productivity improvements do not result from information technology alone but from a combination of IT with process, organizational, and managerial changes, including an embrace of data-driven decision making and a focus on interoperability between different IoT systems—all of which take time to implement.[26] Moreover, the deployment of the IoT technology in large sectors of the economy, where much of its potential impact is expected, is only getting under way.[27]

The first wave of the Solow Paradox demonstrated how IT-enabled gains in productivity were not automatic and did not occur in all industries that made heavy IT investments. Instead, real productivity gains required significant changes in business processes. Moreover, in research we conducted in the late 1990s and early 2000s with Martin Baily, Barry Bosworth, and Robert Solow as academic advisers, we found that it was only when relatively large sectors in the economy, such as retail, took advantage of these technologies and made the related business process changes that the impact was significant enough to affect the national productivity numbers.[28] We found that productivity-enhancing uses of IT share three characteristics: they are used to transform sector-specific business processes, they are deployed in a sequence that builds capabilities over time, and they co-evolve with managerial and technical innovation. Changing organizations is hard work, and rising competitive pressure, whether from Wal-Mart in retail or AMD in semiconductors, was a key catalyst for change in those industries that saw the biggest jumps in productivity.

A better understanding of what technology and digitization trends look like by sector and what is keeping productivity stagnant in those sectors is critical to our understanding of the productivity growth slowdown. Is it a matter of time before these sectors, especially the large ones, catch up in their adoption of technology or could there be structural issues at work, such as a lack of competition that may temper the drive for productivity growth?

---

22 Michael Spence, "Automation, productivity, and growth," Project Syndicate, August 26, 2015. https://www.project-syndicate.org/commentary/automation-slows-productivity-growth-by-michael-spence-2015-08.

23 *US productivity growth, 1995–2000*, McKinsey Global Institute, October 2001.

24 The technology-enabled productivity gains of the late 1990s came about only in sectors that implemented complementary business process innovations, often as a result of increasing competitive pressure. Today, we are likely to need performance pressure to encourage companies to fully capture technology-enabled productivity improvement opportunities.

25 Daron Acemoglu, David Autor, David Dorn, Gordon H. Hanson, and Brendan Price, "Return of the Solow Paradox? IT, productivity, and employment in US manufacturing," *American Economic Review*, volume 104, number 5, May 2014.

26 *The internet of things: Mapping the value beyond the hype*, McKinsey Global Institute, June 2015.

27 Martin N. Baily and James Manyika, "Reassessing the internet of things," Project Syndicate, August 6, 2015.

28 *US productivity growth, 1995–2000*, McKinsey Global Institute, October 2001.

ADDITIONAL INSIGHTS FROM TAKING A MICRO VIEW

We take a closer look at the evidence at the firm and sector level related to the productivity puzzle. We identify six characteristics that provide further insight into the productivity growth slowdown: declining value-added growth, a shift in employment toward lower productivity sectors, a relatively small number of sectors experiencing jumps in productivity, weak capital intensity growth across all types of capital, uneven rates of digitization across sectors (especially the large and often relatively low-productivity ones), and slowing business dynamism. We believe these features suggest ways to boost productivity as well as raise additional questions about the productivity growth slowdown and point to future research.

We have a numerator problem: Value-added growth has been declining

Not all productivity growth is the same. A simple decomposition of labor productivity into its two components, value added as the numerator and hours worked as the denominator, reveals there can be underlying differences in the composition of the resulting productivity growth number. Improvements in productivity can be achieved by efficiency gains, reducing inputs for a given output, or increasing the volume or value of output for any given input. An economy needs both to spur robust growth and prosperity. Efficiency gains are important not only for cost competitiveness at the company, sector, and national levels but also for facilitating the movement of labor and capital to new and growing sectors. Meanwhile, value-added growth, improving the quality and volume of goods and services, facilitates a virtuous cycle of growth whereby increases in value added drive rising incomes that in turn fuel demand for more and better goods and services. The importance of this decomposition has also been pointed out by Acemoglu, Autor, Dorn, Hanson, and Price who have examined this in detail in manufacturing.[29]

Looking closely at productivity growth, we find differences in the role the denominator, hours-worked growth, and the numerator, value-added growth, have played in recent years. For example, the period between 1995 and 2004 is considered an era of high growth with annual productivity growth averaging about 3 percent.[30] However, we have found two distinct periods within this decade. The first is from 1995 to 2000 when productivity growth spiked, driven primarily by an increase in growth of real value-added output. Value-added output growth for the total economy, which averaged 3.4 percent annually from 1991 to 1995, increased to 4 percent from 1995 to 2000, a period of booming consumer and IT spending. As a result, productivity growth increased from 1.4 percent to 2.0 percent. The subsequent era of 2001 to 2004 was a period of continued high productivity growth, averaging 3.6 percent a year. However, the underlying driver was a decline in hours-worked growth, which fell to negative 0.2 percent partly as a result of the tech crash and the restructuring wave in manufacturing of the early 2000s. So while these two periods are typically treated as a single period of booming productivity growth, we prefer to separate them as the implications for investment, industry evolution, and job expansion are very different.

Taking a sectoral view, we find that different sectors have driven productivity growth at different times and for different reasons (Exhibit 4).[31] In the late 1990s, productivity growth was driven by sectors such as computers and related electronics, retail, wholesale, finance, and insurance, with a virtuous cycle of increasing value added growth (the numerator effect) and jobs growth. In contrast in the 2000s, the largest contributions to productivity growth

---

[29] Daron Acemoglu, David Autor, David Dorn, Gordon H. Hanson, and Brendan Price, "Return of the Solow Paradox? IT, productivity, and employment in US manufacturing," *American Economic Review*, volume 104, number 5, May 2014.

[30] David M. Byrne, Stephen D. Oliner, and Daniel E. Sichel, *Is the technology revolution over?* Finance and economics discussion series, Federal Reserve Board, March 2013; John G. Fernald, *Productivity and potential output before, during, and after the Great Recession*, Federal Reserve Bank of San Francisco, working paper, September 2012.

[31] *Growth and renewal in the United States: Retooling America's economic engine*, McKinsey Global Institute, February 2011.

were driven by declining employment (the denominator effect), primarily in sectors such as information, computers and related electronics, and other manufacturing.

What is striking about productivity growth after the recession ended in 2009 has been low value-added output growth compared with past periods.[32] Growth in real value-added output has declined to 2.2 percent between 2009 and 2014. This compares to growth of roughly 3 to 4 percent in prior time periods. So far there is a lack of consensus about the reason for that stagnation. Is it due to a debt overhang from the recession? Or rising inequality reducing the share of those most likely to spend their income—in other words is consumer and household demand the problem? Or perhaps tightening regulation reducing company incentives to invest? Could mismeasurement of real consumer benefits from lower-cost digital goods be a factor?

A shift in employment to lower productivity sectors

Understanding the components of aggregate trends is important because industries vary widely in their productivity levels and growth patterns. One longer-term trend behind slower productivity growth, for example, is the shift in employment from manufacturing to service-sector jobs (Exhibit 5). We calculate that this shift reduced productivity growth by 0.2 percentage points every year for the private business sector between 1987 and 2014, as employment transitioned from high-productivity manufacturing sectors to lower-productivity sectors such as health care and administrative and support services.

The shift in the composition of the economy to service sectors raises important questions for productivity growth going forward. What are the drivers of productivity growth in the service sector and how can productivity in these industries be enhanced going forward? What are the implications for the measurement of productivity as the economy shifts toward services with more difficult productivity measurement challenges?[33]

A sectoral analysis reveals a distinct lack of productivity-igniting sectors

The productivity performance of businesses and sectors does not slow down or speed up in unison. Rather, shifts in aggregate productivity growth are the result of individual sectors accelerating and decelerating at different times. The productivity boom of 1995 to 2000 was characterized by an exceptional combination of sectors experiencing a productivity acceleration: large employment sectors such as retail and wholesale experienced accelerating productivity at the same time as rapid productivity growth was occurring in sectors such as computer and electronic products (Exhibit 6). Together, these large and rapid growth sectors drove the productivity boom. In contrast what is striking about the recent productivity growth slowdown is the distinct lack of accelerating sectors and the fact that the few that are accelerating are relatively small in terms of employment. During the boom, the number of accelerating sectors for many years was above 20 out of 60 sectors analyzed, in some years making up as much as 30 to 40 percent of total hours worked. In 1995, for example, these included sectors such as retail trade, wholesale trade, finance, and computer and electronic products. Recently only six sectors recorded significant productivity growth acceleration, and those sectors made up only 2 to 7 percent of total hours worked, and 5 to 8 percent of value added. These sectors included oil and gas extraction, petroleum and coal manufacturing, and transportation.

---

[32] The recession is characterized as having ended in 2009 based on the business cycle time periods laid out by the National Bureau of Economic Research. The NBER characterized June 2009 as the end date for the financial crisis based on various monthly indicators of economic activity, including GDP, real manufacturing and trade sales, and hours of work in the total economy. In characterizing the recession as having ended in 2009, the NBER indicates a trough in the business cycle, and the subsequent start of a recovery. But this does not imply that the economy returned to normal capacity at that time. For more information see http://www.nber.org.

[33] See earlier discussion of measurement of service sectors.

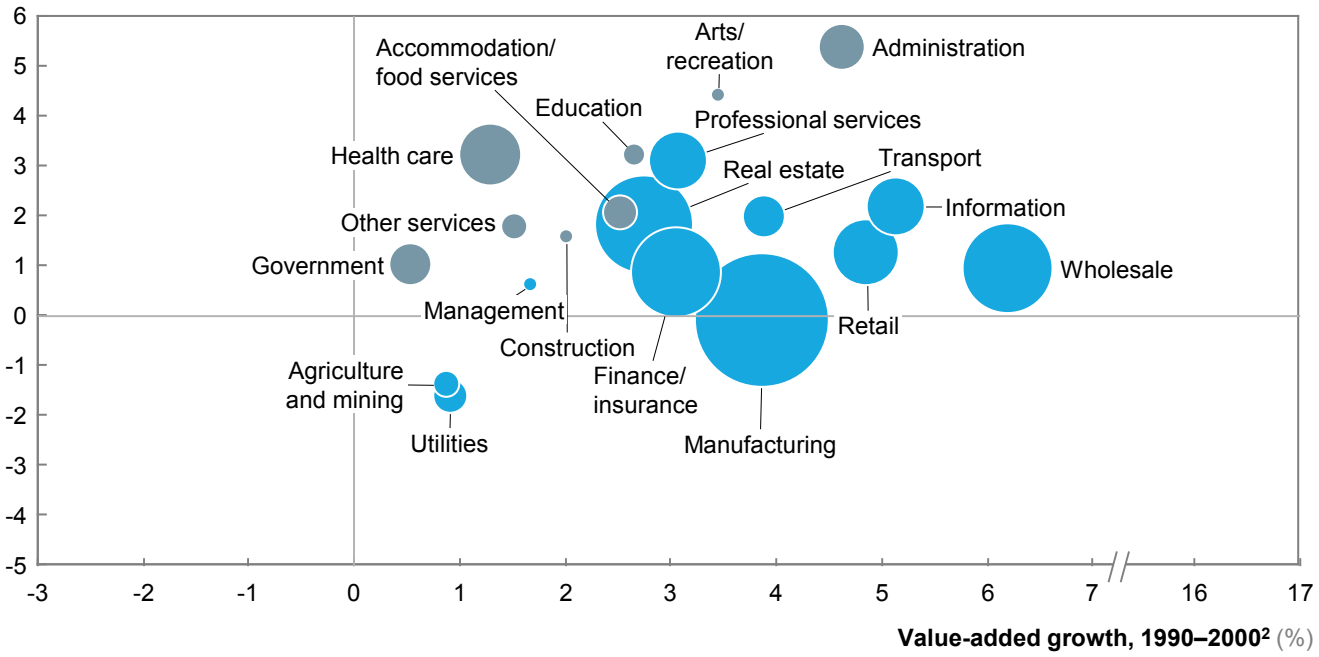
Exhibit 4

US productivity growth

Compound annual growth rate, % — Size represents productivity contribution[1] — Negative — Positive

In the 1990s, productivity growth was driven by sectors with a virtuous cycle of job growth and increasing value added

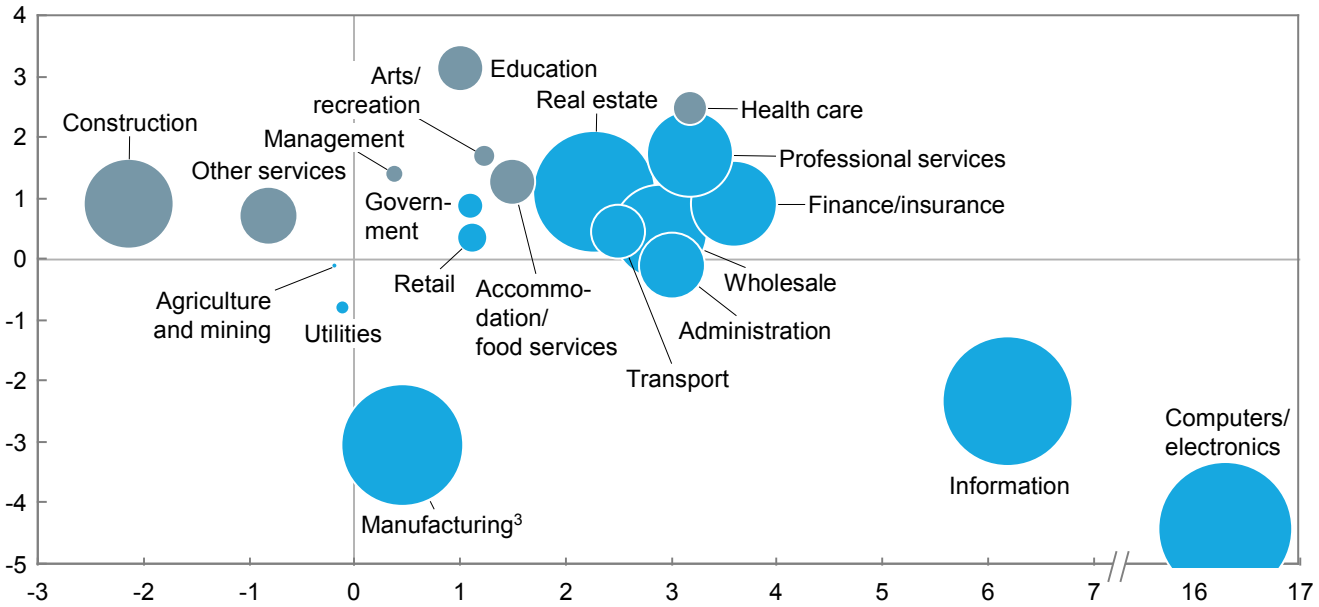
Employment growth, 1990–2000 (%)



Value-added growth, 1990–2000[2] (%)

Since 2000, the largest contributions to productivity gain have been driven by declining employment

Employment growth, 2000–08 (%)



Value-added growth, 2000–08[2] (%)

1 Productivity contribution for 1990–2000 calculated using Moody's Economy.com data.
2 Value-added growth is the contribution of each sector to total GDP growth.
3 Manufacturing sector excluding computers/electronics sector.

SOURCE: BEA; Moody's Economy.com; *Growth and renewal in the United States: Retooling America's economic engine*, McKinsey Global Institute, February 2011; McKinsey Global Institute analysis

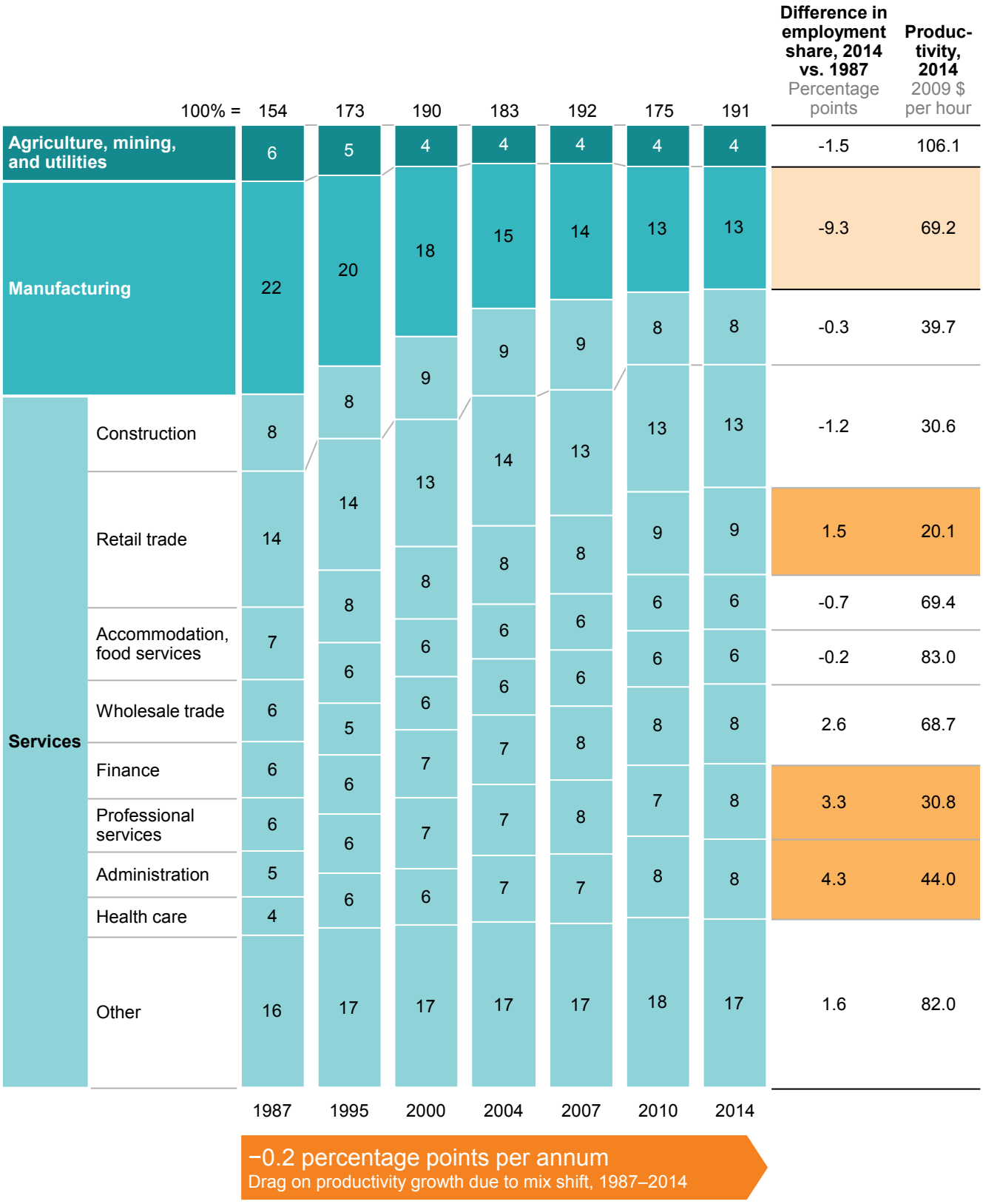
Exhibit 5

A shift toward low-productivity sectors has held back productivity growth

Hours worked by sector, private business
%; billion hours

High-productivity sectors that saw a decline in employment share

Low-productivity sectors that saw an increase in employment share

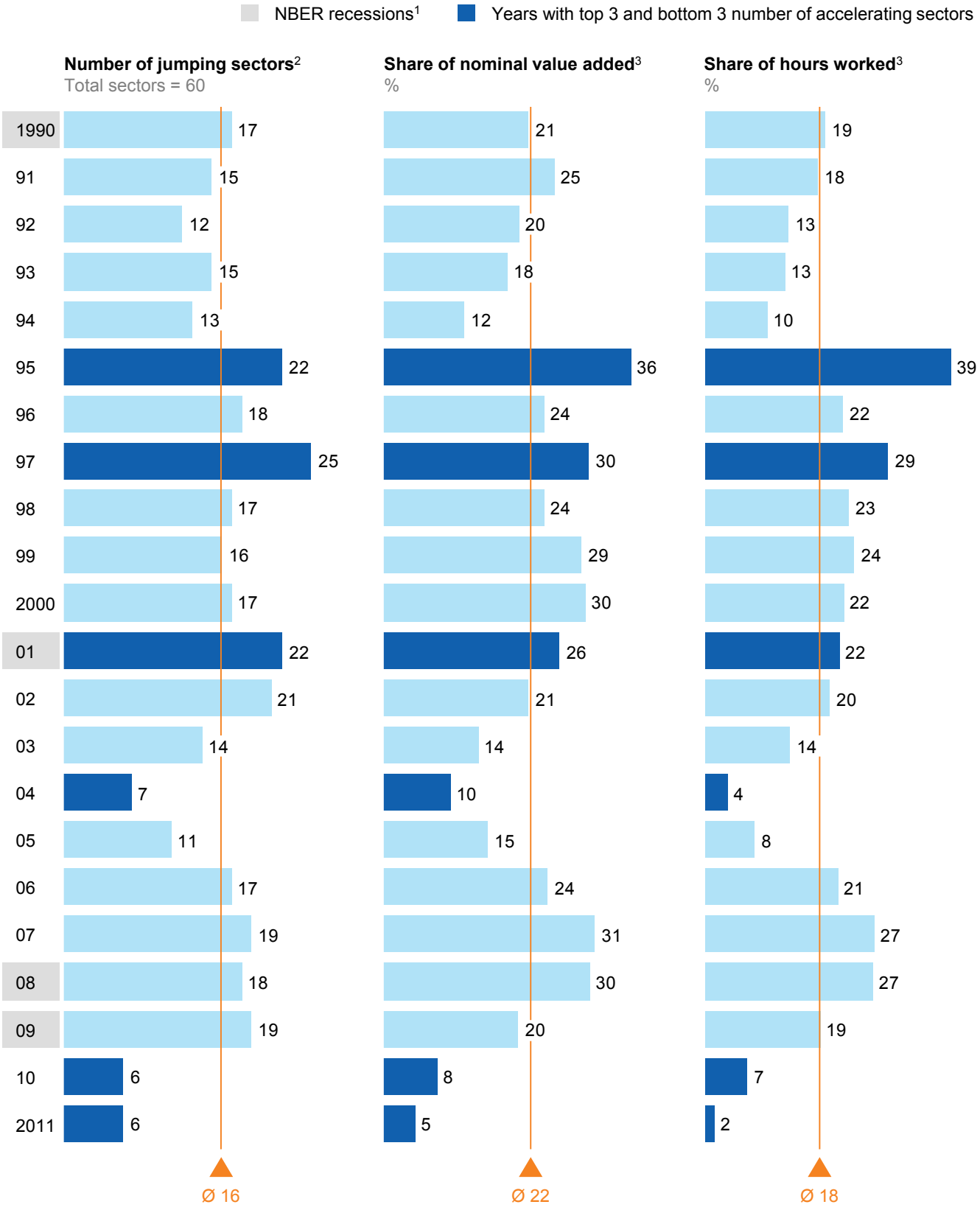


NOTE: Numbers may not sum due to rounding. Based on BLS measures for the private business sector with data only available through 2014.

SOURCE: BLS Multifactor Productivity data; McKinsey Global Institute analysis

Exhibit 6

The recent productivity growth slowdown is linked to a distinct lack of accelerating sectors



1 Indicates years for which a recession covers at least six months of the year.
2 A sector is classified as "accelerating" in year Y if its compound annual growth rate of productivity for years Y through Y + 3 is at least 3 percentage points higher than it was for years Y - 3 to Y.
3 Based on share in Year Y.
NOTE: Based on BLS measures for the private business sector. Data is only available through 2014, therefore last year shown is 2011.

SOURCE: BLS; McKinsey Global Institute analysis

This raises many questions. Is the lack of accelerating sectors simply a temporary lull that will pass as soon as some industries hit a productivity spurt? Or are there common patterns between industries that may be more permanent barriers to productivity growth? More research is needed to fully understand the sector-level trends and dynamics.

Weak capital intensity growth has occurred across all types of capital

In the period from 1995 to 2004, there was a boom in capital intensity growth across most assets, particularly in information capital and software (Exhibit 7). This period is associated with high labor productivity growth. What is striking is that the most recent period, 2009 to 2014, coincides with both exceptionally low productivity growth and low capital intensity growth across all types of assets. Thus, this period has not only been exceptional due to the lack of accelerating productivity sectors, but the low pace at which capital services per hour worked has been rising, across all forms of capital.

These trends raise important questions. Why has capital intensity growth declined across all asset types and what would it take to spur growth? What is the role of capital in driving productivity going forward?

Digitization rates are uneven across sectors—the least digitized tend to be larger sectors often with relatively low productivity

As productivity growth trends vary by sector, so do trends in digitization. A closer look at digitization across sectors reveals distinct variations and uneven progress.[34] In MGI's latest study of the topic, we calculate that the US economy is realizing only about 18 percent of its digital potential with large sectors lagging behind. Our use of the term digitization and our measurement of it encompasses: the digitization of assets, including infrastructure, connected machines, data, and data platforms; the digitization of operations, including processes, payments and business models, customer and supply chain interactions; and the digitization of the workforce, including worker use of digital tools, digitally-skilled workers, and new digital jobs and roles. While the information and communication technology, media, financial services, and professional services sectors are rapidly digitizing, other sectors such as education and health care are not (Exhibit 8). As evidence of the potential for digitization to drive productivity growth, we find that the sectors that are digitizing tend to have high productivity growth. However, these are not the largest sectors in the economy today. Indeed, the largest sectors by output and employment, and often those with relatively low productivity growth, tend to be the ones lagging in digitization. We also note that the gap between the most digitized sectors and the rest, seems to be widening.[35] Frontier sectors today have four times the level of digitization of frontier sectors 20 years ago. Yet the rest of the economy continues to significantly lag behind even historical digitization levels of frontier sectors; their level of digitization is only 60 percent that of leading sectors 20 years ago.

These trends in digitization suggest that we may be in a world of Solow Paradox redux and suggest that, just as in the first round of the Solow Paradox, until we see large sectors digitize, we will continue to see innovation everywhere but in the productivity numbers.

---

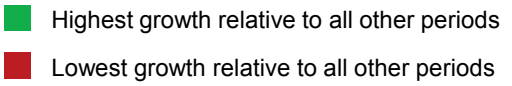
[34] *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015.

[35] Ibid.

Exhibit 7

Weak capital intensity growth has occurred across all types of capital

Compound annual growth rate, private business sector
%



		1987–95	1995–2000	2001–04	2004–07	2009–14
Labor productivity growth		1.6	3.0	3.7	1.5	0.9
Capital intensity growth[1]	Information capital[2]	6.9	16.2	8.1	6.1	1.7
	Software	13.5	14.7	7.9	4.2	1.0
	R&D	3.2	2.6	3.1	1.3	1.1
	Equipment[3]	2.2	6.7	4.1	3.0	0
	Structures	0.8	0.1	1.6	-0.5	-1.0
	Land	0.4	-1.0	0	0.3	-1.3
	Rental residential capital	-0.1	-0.1	2.7	0.7	-2.2
	Inventories	1.1	2.2	1.8	2.0	0.1

1 Based on capital services for a given form of capital divided by hours worked.
2 Includes computer and communications equipment.
3 Includes information capital equipment.
NOTE: Not to scale. Time periods in this exhibit are constructed to exclude recessions. Based on BLS measures for the private business sector, with data only available through 2014.

SOURCE: BLS Multifactor Productivity data; McKinsey Global Institute analysis

Exhibit 8

The MGI Industry Digitization Index

2015 or latest available data

Sector	Overall digitization[1]	Assets: Digital spending	Assets: Digital asset stock	Usage: Transactions	Usage: Interactions	Usage: Business processes	Usage: Market making	Labor: Digital spending on workers	Labor: Digital capital deepening	Labor: Digitization of work	GDP share %	Employment share %	Productivity growth, 2005–15[2] %
ICT											6	3	4.4
Media		1									2	1	4.5
Professional services											8	6	-0.4
Finance and insurance											7	4	0.8
Wholesale trade					4						6	4	0.6
Advanced manufacturing											3	2	1.7
Oil and gas		2									1	0.2	2.0
Utilities											2	0.4	-0.1
Chemicals and pharmaceuticals											2	1	1.0
Basic goods manufacturing											6	5	1.0
Mining											1	0.3	-0.6
Real estate	●										13	1	1.9
Transportation and warehousing	●								5		3	3	-0.7
Education	●			3							1	2	-0.6
Retail trade	●										6	11	-0.1
Entertainment and recreation											1	2	0.2
Personal and local services											5	10	0.1
Government	●										13	15	0.1
Health care		6									7	13	-0.2
Hospitality	●										3	9	-1.3
Construction											4	5	-1.5
Agriculture and hunting											1	1	0.6

1. Knowledge-intensive sectors that are highly digitized across most dimensions
2. Capital-intensive sectors with the potential to further digitize their physical assets
3. Service sectors with long tail of small firms having room to digitize customer transactions
4. B2B sectors with the potential to digitally engage and interact with their customers
5. Labor-intensive sectors with the potential to provide digital tools to their workforce
6. Quasi-public and/or highly localized sectors that lag across most dimensions

1 Based on a set of metrics to assess digitization of assets (8 metrics), usage (11 metrics), and labor (8 metrics). See original report for full list of metrics and explanation of methodology: *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015.
2 Compound annual growth rate; definition of productivity used here is GDP per worker.

SOURCE: BEA; BLS; US Census; IDC; Gartner; McKinsey social technology survey; McKinsey Payments Map; LiveChat customer satisfaction report; Appbrain; US contact center decision-makers guide; eMarketer; Bluewolf; Computer Economics; industry expert interviews; *The US economy: An agenda for inclusive growth*, McKinsey Global Instiute, November 2016; McKinsey Global Institute analysis

Firm-level productivity has been diverging and business dynamism has been slowing

A closer look at the dynamics of firms sheds additional light on the productivity growth slowdown. The rate of business dynamism, measured across a variety of parameters such as the pace of creation of startups, gross job creation and destruction, and the pace of job and worker reallocation, has been declining since the 1980s.[36] For example, the start-up rate, defined as the share of new firms relative to all firms, has declined from roughly 13 percent in 1981 to about 8 percent in 2013. [37] Productivity growth can increase if the share of employment and output in more productive firms increases even while employment and output fall in less productive firms. However, Decker and coauthors find that such a reallocation is happening to a lesser extent in the post-2000 period, particularly in the high-tech sector, with implications for overall productivity growth.

Beyond the decline in overall dynamism, there is evidence that the gaps between high- and low-performing companies are widening. Analysis by the OECD finds growing divergence in productivity levels of global frontier firms relative to others since 2001, which the OECD interprets as a symptom of slower productivity diffusion.[38] According to their analysis, frontier firms have continued to raise their productivity levels. This suggests it is a lack of diffusion of best practices that is driving the slowdown in productivity growth, rather than a lack of innovation of the productivity frontier. Similarly, work by Autor and others finds that there has been increasing concentration of sales within industries, widening the spread across firms.[39] Likewise, digital trends vary widely across firms. Companies are using digital tools to raise the bar in operational efficiency, customer engagement, innovation, and workforce productivity. But they vary widely in how they are pursuing such opportunities, which could be driving large differences in productivity across firms. A McKinsey survey of 150 large companies evaluated respondents on 18 practices related to digital strategy, capabilities, and culture to arrive at a metric called the "Digital Quotient". The distribution curve of this quotient reveals a striking gap between the digital leaders and laggards.[40]

Putting the above findings together would suggest that while the productivity gap between firms has been widening, the reallocation of labor from less to more productive firms has waned. However, while the evidence of slowing business dynamism and widening productivity gaps is clear, the implication for aggregate productivity growth is less so. Even though shifting resources from less productive firms to more productive can be an essential mechanism for productivity growth, industries can vary in the way these gains occur. For example, the pace of business startups and job creation in the retail sector declined significantly in the 1990s. However, this was linked to the rise of big-box stores such as Wal-Mart that in fact contributed to a substantial increase in productivity growth. Thus, while measures of dynamism declined, productivity growth in the retail sector increased. More recently, the rise of Amazon and other online retailers continues to change the retail industry today, and digitization is affecting many other industries as well. This highlights the need to look beyond the aggregate productivity numbers to industry structure and dynamics in order to better understand productivity.[41] Is the decline in dynamism the driver behind the

[36] Ryan A. Decker, John Haltiwanger, Ron S. Jarmin, and Javier Miranda, *Declining business dynamism: Implications for productivity*, Brookings Institution, September 2016; John Haltiwanger, "Job creation and firm dynamics in the United States," *Innovation Policy and the Economy*, volume 12, number 1, January 2012.

[37] Ryan A. Decker, John Haltiwanger, Ron S. Jarmin, and Javier Miranda, *Declining business dynamism: Implications for productivity*, Brookings Institution, September 2016.

[38] Dan Andrews, Chiara Criscuolo, and Peter N. Gal, *Frontier firms, technology diffusion and public policy: Micro evidence from OECD countries*, OECD, 2015.

[39] David Autor, David Dorn, Lawrence F. Katz, Christina Patterson, and JohnVan Reenen, *Concentrating on the fall of the labor share*, NBER working paper number 23108, January 2017.

[40] *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015.

[41] For example, MGI's analysis of Mexico's stagnant productivity post-NAFTA showed a striking divergence between a few rapidly improving large producers and a long tail of small and medium-sized enterprises where productivity declined. For more, see *A tale of two Mexicos: Growth and prosperity in a two-speed economy*, McKinsey Global Institute, March 2014.

slowdown of productivity growth? What is causing the widening gap in productivity levels across firms? For example, is the gap the result of digitization changing industry economics? Beyond understanding industry-level trends, it is crucial to understand industry dynamics and the role of individual firms in influencing industry productivity growth evolution.

PUTTING THE PIECES TOGETHER—FOR NOW

Clearly additional research is required to fully explain what has happened to productivity and to inform future prospects for productivity growth. However, from our initial findings and from prior research on productivity, some productivity-enhancing opportunities are clear enough to act on and should help guide policy makers and business leaders to develop initiatives that will help boost productivity, without having to wait for additional research. These opportunities include:

- **Unlocking investment.** The level of investment in the US economy is at a historic low at a time when corporate profits are at historic highs and interest rates are at historic lows. Therefore, policy makers should prioritize efforts that help unlock private-sector investment. Steps may include reducing policy uncertainty, strengthening the demand outlook, and smart tax reform and regulatory measures to remove barriers to corporate investment.[42]

- **Embracing technology and innovation.** The tech and innovation pipeline is relatively strong and with potential for more to come. For example, AI and automation have the potential to boost productivity in the future.[43] Business leaders and policy makers should invest in productivity-enhancing technologies and research in order to drive innovations for productivity gains. A key part of this will be to encourage broad adoption at scale of these technologies.

- **Building 21st-century infrastructure.** This is required broadly to improve competitiveness but is sorely needed in particular in the areas of power, roads, and digital infrastructure.[44] This is particularly important to reduce barriers to investment from multinationals and innovative firms that rank infrastructure as an important consideration in investment decisions.

- **Boosting productivity in public and regulated sectors**, such as health care and education, that have lagged in productivity growth. As these industries become larger and larger portions of the economy, bolder approaches must be explored to tackle the productivity challenge in these areas. Research by MGI and others has shown that increased competition and leveraging technology are part of the "cocktail" that enhances productivity growth.[45]

- **Tackling the labor aspects of productivity.** The jobs of the future will require developing the US talent pool and harnessing the full capabilities of the US population, for example by increasing the number of technical and analytical workers. Moreover, embracing the opportunities offered by online labor-talent platforms could enable transparency in labor markets, better match supply and demand for labor, and allow companies to transform the recruitment, engagement, and development of employees, thus increasing productivity.[46]

- **Embracing the energy productivity challenge.** Investing in new technologies that are currently reshaping the demand and supply of resources could unlock trillions of dollars

---

42 *Secular stagnation and low investment: Breaking the vicious cycle*, McKinsey Global Institute, April 2016.
43 *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017.
44 *Bridging global infrastructure gaps*, McKinsey Global Institute, June 2016.
45 *US productivity growth, 1995–2000*, McKinsey Global Institute, October 2001.
46 *Managing talent in a digital age*, McKinsey Global Institute, March 2016.

in savings for households and business, and productivity gains for resource producers.[47] This includes technologies such as automated hauling trucks and drills in mines across the world, underwater robots to repair pipelines, drones for preventative maintenance on utility lines, and the use of data analytics.

At the same time, many questions still need to be answered about the productivity growth slowdown and the potential outlook and implications for overall growth and prosperity. Key questions informing our ongoing research include:

- Why is there a distinct lack of productivity accelerating sectors?
- What is the role of digitization in productivity growth and are we in round two of the Solow Paradox? What will it take to unlock technology-enabled productivity?
- To what extent does the shift to services and sector-level dynamics in large and growing sectors impact productivity? How can productivity in these sectors be unlocked?
- Why has investment declined despite low interest rates in the short-term, and what forces could be impacting investment over the longer-term? To what extent has the level and pattern of investment had an impact on productivity growth?
- At a time when inclusive growth matters, what explains the apparent weakening in recent years in the relationship between productivity growth and wage gains?
- What is broken in the virtuous growth cycle of demand-investment-productivity-income in advanced economies and what will it take to fix it?
- All considered, what is the outlook for productivity growth?

By tackling these questions, we will continue to combine a macroeconomic view with our micro approach to productivity that we hope will be useful not only to understand the slowdown of the past but also to create a better framework for understanding productivity in the future.

[47] *Beyond the supercycle: How technology is reshaping resources*, McKinsey Global Institute, February 2017.

McKinsey Global Institute
March 2017

www.mckinsey.com/mgi

@McKinsey_MGI
McKinseyGlobalInstitute