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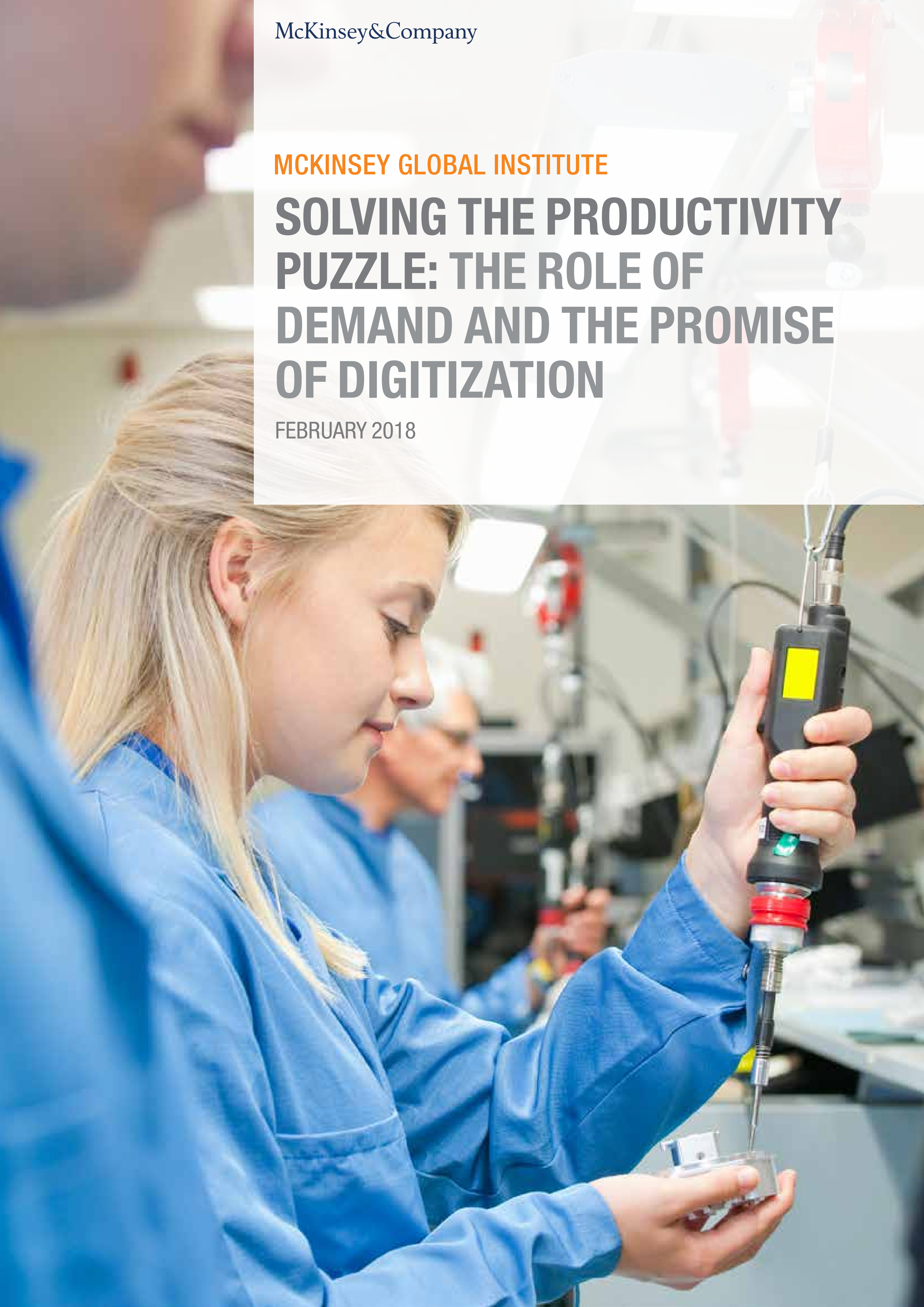
SOLVING THE PRODUCTIVITY PUZZLE: THE ROLE OF DEMAND AND THE PROMISE OF DIGITIZATION

FEBRUARY 2018



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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. Advice and input to MGI research are provided by the MGI Council, members of which are also involved in MGI's research. MGI council members are drawn from around the world and from various sectors and include Andrés Cadena, Sandrine Devillard, Richard Dobbs, Tarek Elmasry, 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 to MGI research.

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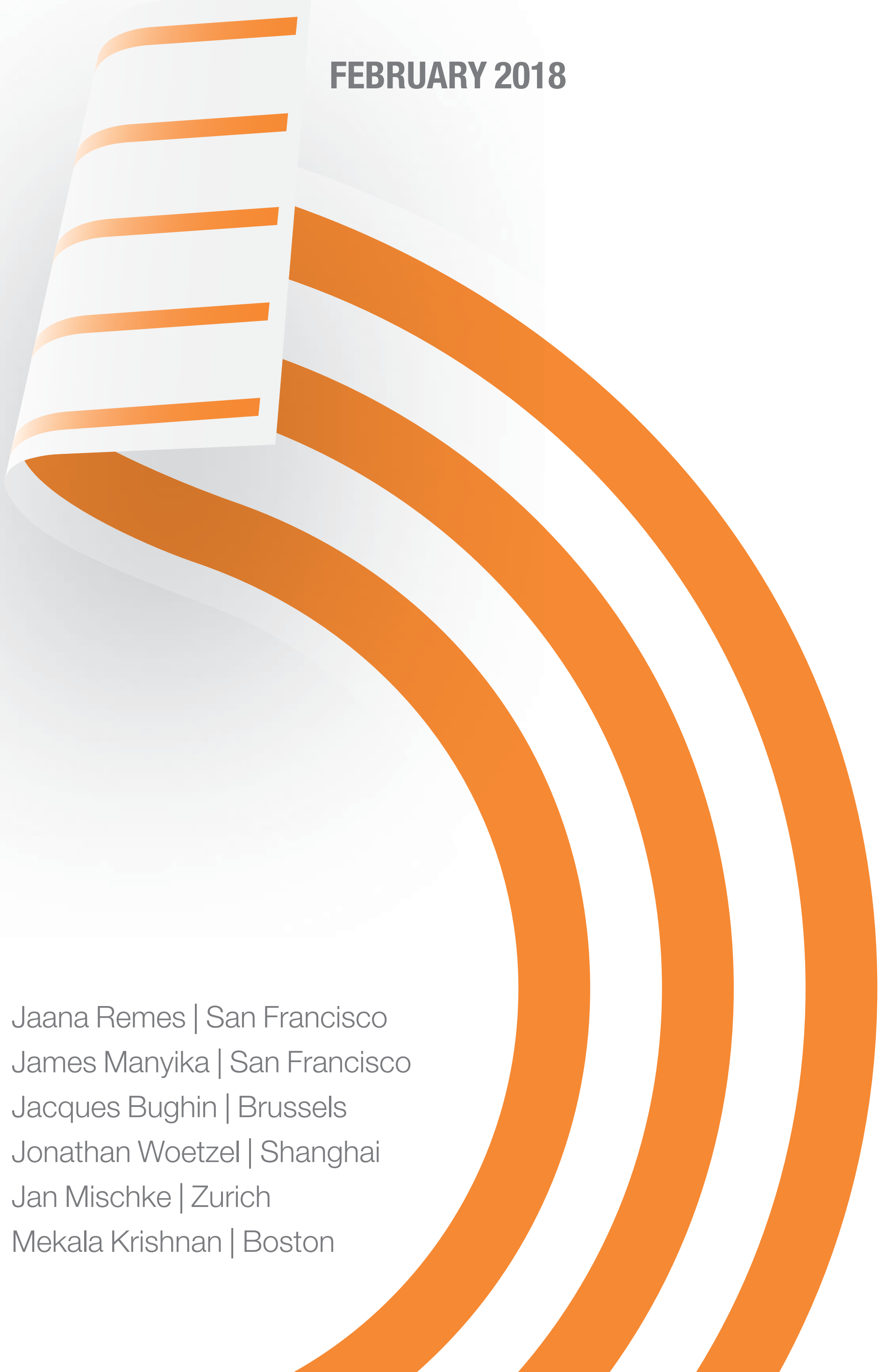

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PREFACE

Few topics in economics today generate as much debate as the productivity-growth slowdown in advanced economies. While productivity growth has been declining in the United States and across much of Western Europe since a boom in the 1960s, that decline accelerated after the financial crisis. Exceptionally weak productivity growth in recent years has raised alarms at a time when advanced economies depend on productivity growth more than ever to promote long-term economic growth and prosperity. In an age of digital disruption, when companies are focused on implementing digital solutions and harnessing innovations such as automation and artificial intelligence, disappearing productivity growth is even more puzzling. Yet for some time now, the only consensus about what is behind this weakness is that there is no consensus, leaving decision makers in both the private and public spheres without a clear perspective from which to chart a path forward.

This report is our attempt to help fill that gap. It expands on a March 2017 discussion paper, *The productivity puzzle: A closer look at the United States*, that examined the slowdown from a micro and sectoral perspective. It also builds on decades of McKinsey Global Institute research focused on productivity growth from a supply perspective. This report extends our analysis of the productivity-growth decline from the United States to Western Europe, uses a multisector approach that integrates supply and demand factors, and focuses on the slowdown since the mid-2000s, as productivity growth remains near historic lows in this period. Looking closely at this recent period allows us to identify short-term factors that are likely to be resolved and long-term trends that are likely to remain in place, helping us to determine the potential for productivity growth in the future. A final goal of our year-long research effort into understanding the productivity-growth slowdown is to provide a way forward to restart productivity-enabled growth, one that reckons with new forces at work in a digital age.

This research was led by Jaana Remes, a partner of the McKinsey Global Institute; James Manyika, a senior partner of McKinsey & Company and chairman of MGI; Jacques Bughin, a senior partner of McKinsey & Company and a director of MGI; Jonathan Woetzel, a senior partner of McKinsey & Company and a director of MGI; Jan Mischke, an MGI partner; and Mekala Krishnan, a senior fellow at MGI. The project team included Manuel Ariztia, Marc Canal, Samuel Cudre, Susie Gomm, Octavio Figueroa, Abhishek Gupta, Mac Muir, and Ravi Ram.

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We are grateful for all of the input we have received, but the final report is ours, and all errors are our own. This report contributes to MGI's mission to help business and policy leaders understand the forces transforming the global economy, identify strategic locations, and prepare for the next wave of growth. As with all MGI research, this work is independent and has not been commissioned or sponsored in any way by any business, government, or other institution. We welcome your comments on the research at **MGI@mckinsey.com**.

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IN BRIEF

SOLVING THE PRODUCTIVITY PUZZLE: THE ROLE OF DEMAND AND THE PROMISE OF DIGITIZATION

Labor productivity growth is near historic lows in the United States and much of Western Europe. While growth in labor productivity has been slowing since the 1960s in many of these countries, the sharp drop to an average of 0.5 percent in 2010–14 from 2.4 percent a decade earlier has been particularly concerning. We attempt to shed light on this puzzle with economy-wide analyses, industry case studies, and corporate surveys, and draw implications for the future.

- We find there has been a job-rich but productivity-weak recovery, with low value added but high hours worked growth, and a broad-based decline with a distinct lack of productivity-accelerating sectors. While there are many schools of thought, we find three waves explain those patterns and the decline.
- *Wave 1: The waning of a productivity boom* that began in the 1990s dragged down productivity growth by about one percentage point. Around 2005, a decade-long productivity boom from a PC, software, and database system ICT revolution and the restructuring of domestic operations and global supply chains was ending. By then, retail supply chain management tools were broadly implemented and manufacturing offshoring momentum slowed.
- *Wave 2: Financial crisis aftereffects*, including weak demand and uncertainty, caused another percentage point drag. After the crisis hit, sectors such as financial services went from boom to bust, and companies reacted to weak demand and uncertainty by holding back investment, driving capital intensity growth down to the lowest rates since World War II. Weak demand further depressed productivity growth through negative economy of scale effects and downshifts in product and service mix. For example, in finance, growth in loan volumes dropped by about 10 percentage points or more across many countries.
- *Wave 3: Digitization, often involving a transformation of operating and business models*, promises significant productivity-boosting opportunities but the benefits have not yet materialized at scale. This is due to adoption barriers and lag effects as well as transition costs; the net effect on productivity in the short term is unclear. For example, in retail, online sales are two times more productive than store sales yet remain on average about 10 percent of total sales volume and come with transition costs like declining footfall in stores. Our surveys and sector analysis show that transition costs can include an initial duplication of structures and investment, cannibalization of incumbent business, and the diversion of management attention.
- The waves had different effects on countries. Sweden and the United States had a particularly strong ICT boom that waned, while the United Kingdom had experienced a financial services boom that ended with the crisis. Germany and France started from more moderate productivity-growth rates and experienced smaller declines mostly related to capital intensity. Italy and Spain started with zero productivity growth at the turn of the century and did not decline further.
- We expect productivity growth to recover and see the potential for at least 2 percent growth a year over the next ten years, with 60 percent coming from digital opportunities. However, while crisis-related aftereffects are diminishing, long-term drags on demand for goods and services may persist and hold back productivity from changing demographics, declining labor shares, rising income inequality, polarization of labor markets, and declining investment rates. Digital may amplify these demand leakages while potentially creating other barriers to productivity growth, such as winner-take-most effects on industry structure. Capturing the productivity potential of advanced economies will require a dual focus that promotes sustained demand growth and digital diffusion.

Capturing the labor productivity potential of advanced economies

PRODUCTIVITY GROWTH MATTERS FOR MATERIAL LIVING STANDARDS BUT HAS DROPPED TO HISTORIC LOWS

BROAD-BASED DECLINE

>65%

of sectors with lower productivity growth today than ten years ago

CRITICAL ROLE OF INVESTMENT

>50%

of the decline in many countries is from decreasing capital per hour worked growth; at its lowest level post war

TOO FEW JUMPING SECTORS

<5%

of sectors in the postcrisis period with accelerating productivity growth compared with up to **50%** a decade earlier

We examine supply and demand factors across seven countries and six sectors

- Auto
- Finance
- Retail
- Technology
- Tourism
- Utilities

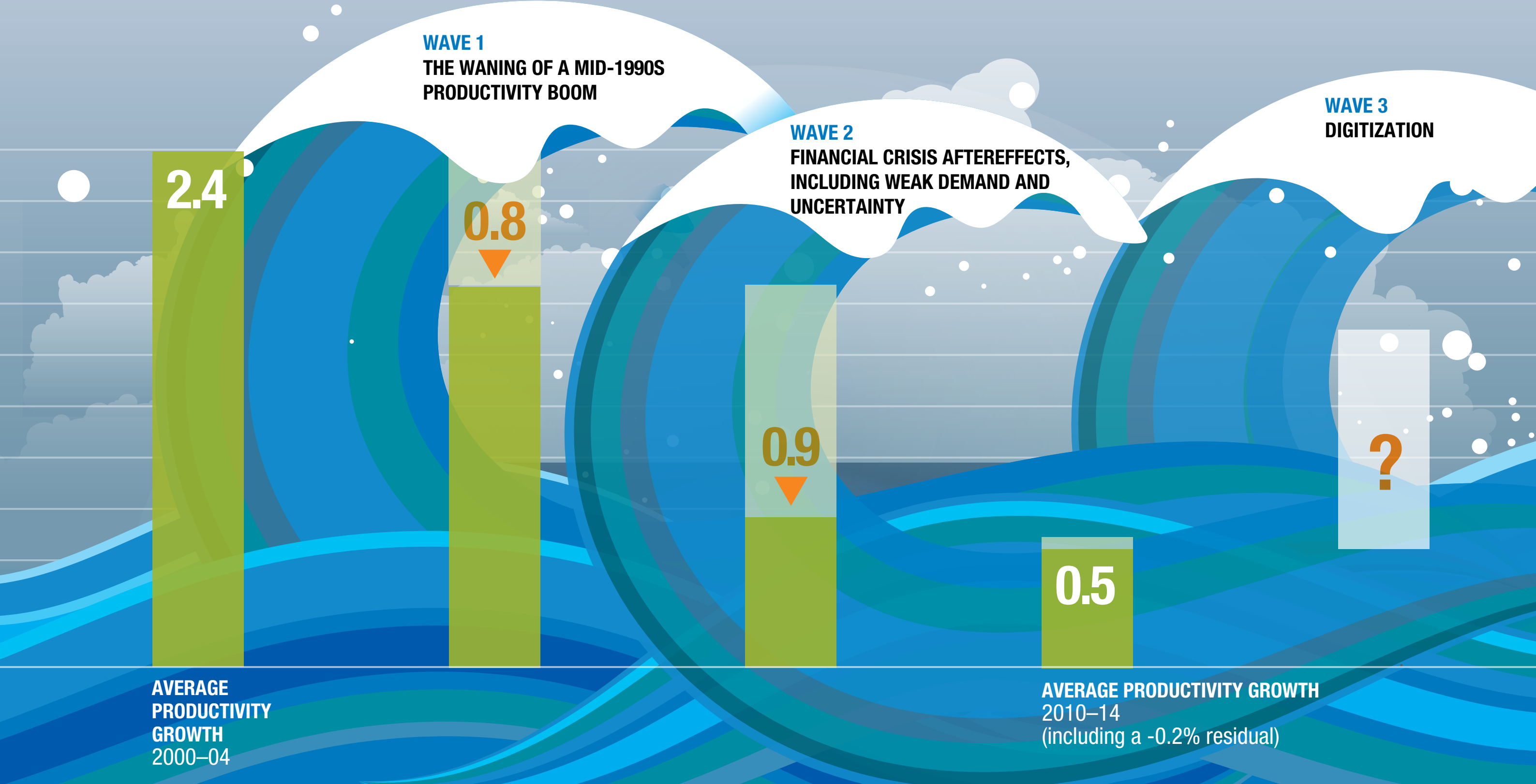
- France
- Germany
- Italy
- Spain
- Sweden
- United Kingdom
- United States

WHAT IS BEHIND EXCEPTIONALLY WEAK PRODUCTIVITY GROWTH?

Two waves dragged down productivity growth on average close to one percentage point each. A third wave contains the promise of significant productivity-boosting opportunities, but the benefits have not yet materialized at scale. This is due to adoption barriers, lags, and transitions costs.

🟩 PERCENTAGE POINTS

▼ IMPACT ON PRODUCTIVITY GROWTH



BEYOND TRADITIONAL SUPPLY-SIDE APPROACHES, POLICY MAKERS NEED TO FOCUS ON PROMOTING DEMAND AND DIGITAL DIFFUSION

PROMOTE SUSTAINED DEMAND GROWTH

- Focus on productive investment as a fiscal priority
- Grow the purchasing power of low-income consumers with the highest propensity to consume
- Unlock private business and residential investment
- Support worker training and transition in an era of automation

PROMOTE DIGITAL DIFFUSION

- Digitize public services and leverage public procurement and investment in R&D
- Invest in digital infrastructure and ecosystems, and the education of digital specialists and consumers
- Ensure global connectivity for all, including SMEs
- Clarify regulation and standards

This could unlock productivity growth of

2%+

a year over the next ten years

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EXECUTIVE SUMMARY

Nine years into recovery from the Great Recession, labor productivity-growth rates remain near historic lows across many advanced economies. Productivity growth is crucial to increase wages and living standards, and helps raise the purchasing power of consumers to grow demand for goods and services. Therefore, slowing labor productivity growth heightens concerns at a time when aging economies depend on productivity gains to drive economic growth.[1] Yet in an era of digitization, with technologies ranging from online marketplaces to machine learning, the disconnect between disappearing productivity growth and rapid technological change could not be more pronounced.

> While productivity growth has been declining since a boom in the 1960s in the United States and much of Western Europe, that decline accelerated after the financial crisis.

2%+
productivity-growth potential per year over the next ten years

In this report, we shed light on the recent slowdown in labor productivity growth in the United States and Western Europe and outline prospects for future growth (see Box E1, "Our methodology"). We find that three waves collided to produce a productivity-weak but job-rich recovery: the waning of a productivity boom that began in the 1990s, financial crisis aftereffects, including weak demand and uncertainty, and digitization. The first two waves have dragged down productivity growth by 1.9 percentage points on average across countries since the mid-2000s, from 2.4 percent to 0.5 percent. In particular, financial crisis aftereffects include weak demand, uncertainty, excess capacity, contraction and expansion of hours, and, in some sectors, a boom-bust cycle. The third wave, digitization, is fundamentally different from the first two because it contains the potential to reignite productivity growth but the benefits have not yet materialized at scale. This is due to adoption barriers and lag effects as well as transition costs. As financial crisis aftereffects recede and more companies incorporate digital solutions, we expect productivity growth to recover; the good news is that we are seeing an uptick today in economic variables like productivity and GDP growth across many countries. We calculate that the productivity-growth potential could be at least 2 percent per year across countries over the next decade. However, capturing the productivity potential of advanced economies may require a focus on promoting both demand and digital diffusion in addition to more traditional supply-side approaches. Furthermore, continued research will be needed to better understand and measure productivity growth in a digital age.

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[1] *Global growth: Can productivity save the day in an aging world?* McKinsey Global Institute, January 2015. Please note that in this report, we often refer to labor productivity as simply "productivity"; we specify other types of productivity, such as total factor productivity, when referring to them.

Box E1. Our methodology

We analyze the productivity-growth slowdown across a sample of seven countries: France, Germany, Italy, Spain, Sweden, the United Kingdom, and the United States. These countries were chosen to cover a large and diverse portion of GDP in advanced economies, representing about 65 percent. We do not include any analysis of emerging markets, which have a different productivity-growth dynamic compared to mature markets. In addition to country aggregate analysis, we analyze six sectors across our sample of economies to identify what patterns are similar across sectors and what features are sector-specific, in order to understand what drives aggregate productivity trends. We chose these sectors—automotive manufacturing, finance, retail, technology, tourism, and utilities—because they represent a large and diverse share of the economies in our sample countries and played a significant role in explaining the recent slowdown. In our analysis across countries and sectors, we assess the evidence for today's leading explanations for the productivity-growth slowdown.[1] We find evidence of a non-measurement-related productivity-growth slowdown and therefore focus our work in this report on explaining the productivity slowdown as measured.[2]

We take an integrated analytical approach across supply and demand to assess the linkages and "leakages" around the virtuous cycle of economic growth (from production of goods and services, leading to incomes for households and profits for companies, in turn resulting in continued demand for goods and services). This allows us to diagnose why productivity growth has slowed, particularly as many of the leading explanations today take a supply-focused view rather than an integrated one. In our analysis, we often compare the turn of the century (2000–04)—a five-year period before the start of the recent productivity-growth slowdown in the United States that encompasses the late boom of 2000, recession of 2001, and recovery period—with the postrecession years (2010–14), a somewhat stable period a decade later (though encompassing the double dip recession in Europe). Looking closely at the recent slowdown allows us to identify short-term factors behind the productivity-growth slowdown that are likely to be resolved, as well as long-term trends that are likely to remain in place, helping us to determine the potential for productivity growth in the future.[3]

While our methodology allows us to provide a much better understanding of the productivity-growth slowdown and the implications for the future, questions for further research surely remain such as how to better measure the digital economy and understand the economic impact of digital transitions.

---

[1] These include: mismeasurement; financial crisis–related factors such as weak investment postcrisis and the rise of zombie firms; and structural shifts such as the rate of technological diffusion, the increasing concentration of businesses, and declining business dynamism together with a growing divergence of productivity among firms, a mix shift toward less productive sectors, a maturation of global supply chains, and secular stagnation. For more detail about each explanation, please see Chapter 1.

[2] For more details, see Chapter 1, Box 3, "How significant could the mismeasurement of productivity growth be?"

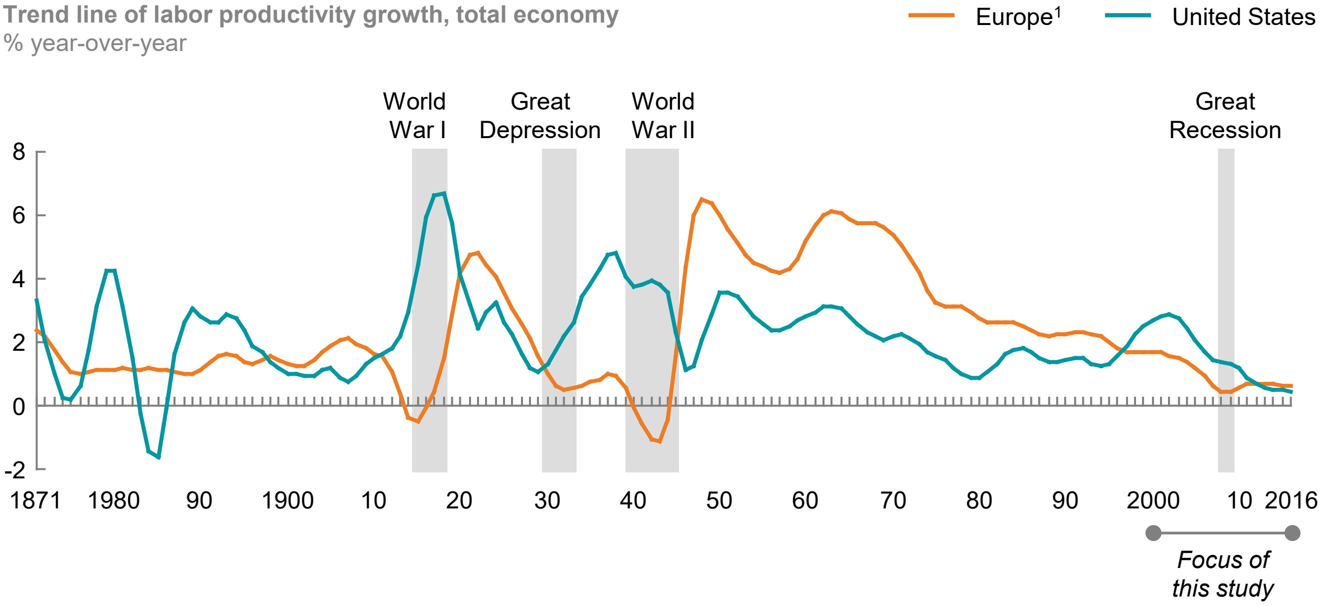
[3] While we are aware that choosing specific years involves some degree of arbitrariness, after assessing the pros and cons of multiple periods, we determined that concentrating on the period following the crisis allowed us to isolate different factors at the sector level across many different countries more easily. We also conduct robustness tests to assess how much these years impact our results. See the technical appendix for a detailed discussion of our methodology.

PRODUCTIVITY GROWTH REMAINS NEAR HISTORIC LOWS, FOLLOWING A JOB-RICH, PRODUCTIVITY-WEAK RECOVERY

While labor productivity growth has been declining across the United States and Western Europe since a boom in the 1960s, it decelerated further after the financial crisis to historic lows (Exhibit E1). We focus this study on the slowdown since the early 2000s and identify three major patterns of the productivity-growth slowdown across our sample of countries: low “numerator” (value added) growth accompanied by robust “denominator” (hours worked) growth, creating a job-rich but productivity-weak recovery across most countries; too few and too small “jumping” sectors; and the critical importance of declining capital intensity growth across countries (see Box E2, “Patterns of the productivity-growth slowdown”). These patterns indicate that the productivity-growth slowdown is broad-based across countries and sectors, point to a set of common, overarching factors at work, and reveal the importance of demand-side as well as supply-side factors.

Exhibit E1

Productivity growth has fluctuated over time; it has been declining since the 1960s and today stands near historic lows



1 Simple average of France, Germany, Italy, Spain, Sweden, and the United Kingdom.

NOTE: Productivity defined as GDP per hour worked. Calculated using Hodrick Prescott filter. Drawn from similar analysis in Martin Neil Baily and Nicholas Montalbano, *Why is productivity growth so slow? Possible explanations and policy responses*, Brookings Institution, September 2016.

SOURCE: A. Bergeaud, G. Cette, and R. Lecat, "Productivity trends in advanced countries between 1890 and 2012," *Review of Income and Wealth*, volume 62, number 3, 2016; McKinsey Global Institute analysis

While we find many similar patterns of the productivity-growth slowdown across our sample of countries, there are also notable differences. Sweden and the United States experienced a strong productivity boom in the mid-1990s and early-2000s followed by the largest productivity-growth decline, and much of that decline predated the financial crisis. France and Germany started from more moderate levels and experienced less of a productivity-growth decline, with most of the decline occurring after the crisis. Productivity growth was close to zero in Italy and Spain for some time well before the crisis, so severe labor shedding after the crisis actually accelerated productivity growth.

While many key economic variables such as GDP growth and investment as a share of GDP, as well as productivity growth, have started to pick up recently in the United States and Europe, productivity growth remains low relative to historical levels, with many countries in our sample seeing around 1 percent productivity growth or less.

Box E2. Patterns of the productivity-growth slowdown

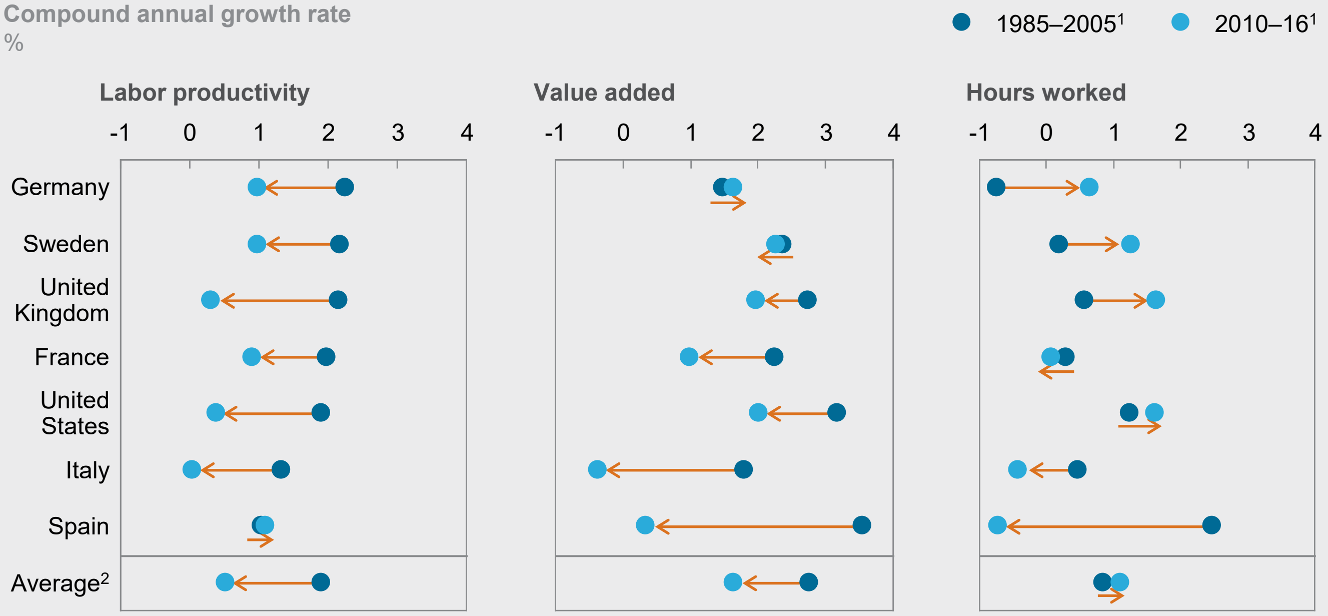
Any explanation of the productivity puzzle should take into account the micro patterns of the slowdown and not just the headline aggregate productivity numbers. We find three major micro patterns. First, the recovery from the financial crisis has been “job-rich” and “productivity-poor” with low “numerator” (value added) growth accompanied by robust “denominator” (hours worked) growth (Exhibit E2).[1] The broad-based pattern of job-rich but productivity-weak recovery across most countries raises the question of why companies are increasing employment without corresponding increases in productivity growth (see Chapter 3 for more details). It also highlights the importance of examining demand-side drivers for slow value-added growth and low productivity growth.

Second, looking across more than two dozen sectors, we find few “jumping” sectors today, and the ones that are accelerating are too small to have an impact on aggregate productivity growth.[2] For example, only 4 percent of sectors in the United States were classified as jumping in 2014, compared with an average of 18 percent over the last two decades, and they contributed only 4 percent to value added.[3] The distinct lack of jumping sectors we have found across countries is consistent with an environment in which digitization and its benefits to productivity are happening unevenly.

Third, since the Great Recession, capital intensity, or capital per hour worked, in many developed countries has grown at the slowest rate in postwar history. Capital intensity indicates access to machinery, tools, and equipment and is measured as capital services per hour. An important way productivity grows is when workers have better tools such as machines for production, computers and mobile phones for analysis

Exhibit E2

In many countries, exceptionally low productivity-growth postrecession reflects slowing value-added growth with robust growth in hours worked



1 Looking at these periods allows us to identify short-term factors behind the productivity-growth slowdown that are likely to be resolved, and long-term trends that are likely to remain in place.
2 Weighted average across France, Germany, Italy, Spain, Sweden, United Kingdom, and United States, based on 2016 GDP (2016 $ million).
NOTE: Order of countries based on fastest to slowest productivity growth in the 1985–2005 period.

SOURCE: The Conference Board (May 2017 release); McKinsey Global Institute analysis

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[1] That is not to say economies experienced a jobs boom but that solid job growth continued over a long time through and beyond the period from 2010 to 2014. While some considered this recovery “jobless” early on (see, for example, Natalia A. Kolesnikova and Yang Liu, *Jobless recoveries: Causes and consequences,* Federal Reserve Bank of St. Louis, 2011), because it took so long for unemployment to recover, we find that hiring has been exceptionally steady over a long period. The time periods in this exhibit were chosen to allow us to compare a long-term trend (1985 to 2005, ending prior to the crisis, to eliminate the impact of the crisis) with the most recent trends in the recovery (the period of the particularly low productivity growth).

[2] A sector is classified as “jumping” in year Y if its compound annual growth rate of productivity for years Y-3 through Y is at least three percentage points higher than it was for 1995 to 2014 as a whole (a “long-term” average).

[3] Similar trends are also seen in Europe. Less than 5 percent of sectors in France, Germany, Sweden, and the United Kingdom are classified as jumping today. See Chapter 2 for more details.

and communication, and new software to better design, produce, and ship products, but this has not been occurring at past rates. A decomposition of labor productivity shows that slowing growth of capital per hour worked contributes about half or more of the productivity-growth decline in many countries (Exhibit E3).[4]

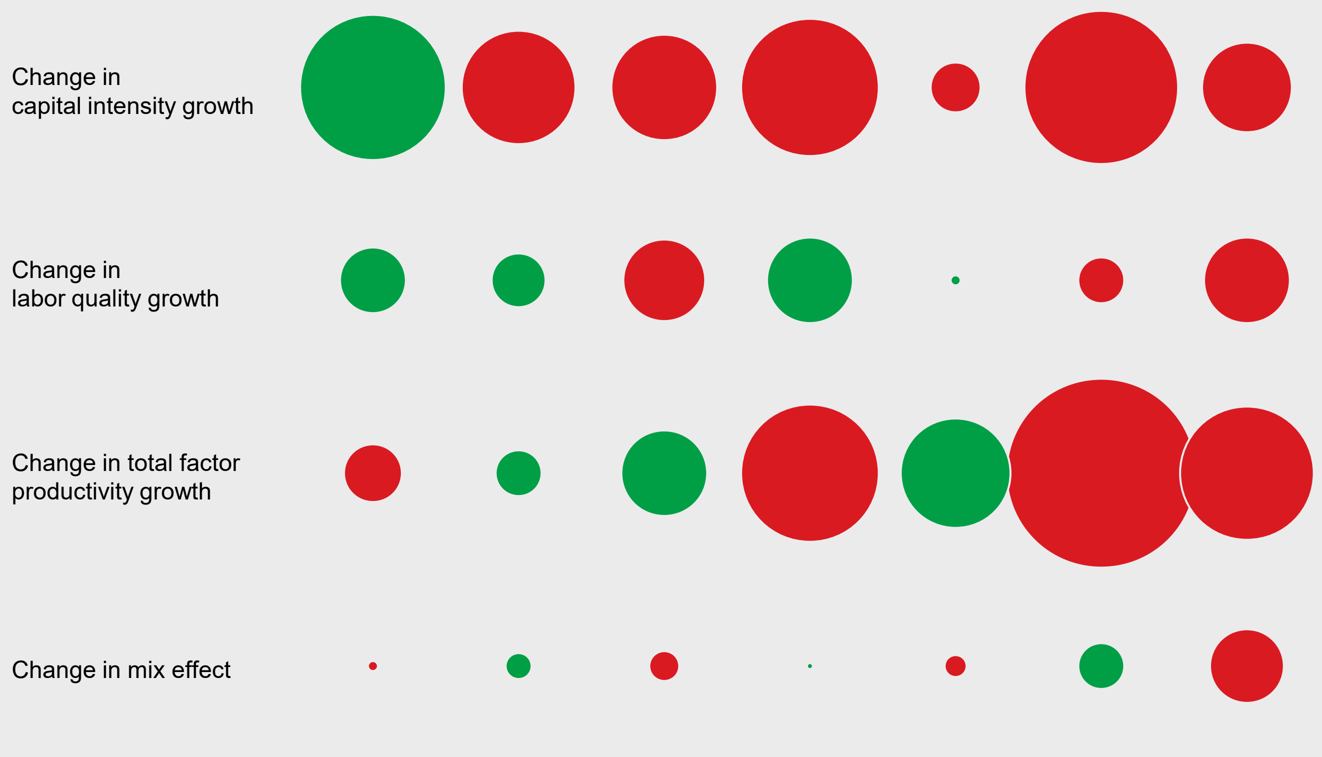
Exhibit E3

Slow productivity growth was accompanied by a decline in capital intensity growth, as well as declining total factor productivity growth in some countries

Contribution to the decline in productivity growth, 2000–04 vs. 2010–14[1]
Percentage points

🔴 Decreases productivity growth
🟢 Increases productivity growth
● Size of bubble = 0.5

	Spain	France	Germany	Sweden[2]	Italy[3]	United States[4]	United Kingdom
Labor productivity growth (as measured), 2000–04 (%)	**0.0**	**1.5**	**1.7**	**2.9**	**0.0**	**3.6**	**2.3**



	Spain	France	Germany	Sweden[2]	Italy[3]	United States[4]	United Kingdom
Labor productivity growth (as measured), 2010–14 (%)	**1.4**	**1.0**	**0.9**	**0.9**	**0.6**	**-0.2**	**-0.2**

1 See technical appendix for details on methodology.
2 EU KLEMS data on total factor productivity (TFP) was significantly different compared with other data sources such as The Conference Board and Penn World Tables. Hence, we take the average TFP of the three databases and calculate labor quality as a residual.
3 In Italy, the period analyzed is 2010–13 instead of 2010–14 due to data limitations.
4 US data are for the private business sector only; Europe data are for the total economy.
NOTE: Order of countries based on fastest to slowest productivity growth in 2010–14.

SOURCE: EU KLEMS (2016 release); BLS Multifactor Productivity database (2016 release); McKinsey Global Institute analysis

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[4] We acknowledge that this analysis represents a decomposition and is not a causal analysis, and is sensitive to the underlying growth accounting formulation. The choice of time periods reflects both the specific trends we want to highlight and constraints from data availability. Comparing the productivity growth in the 2000 to 2004 period with the recent slowdown (2010 to 2014 period) allows us to identify short-term factors behind the productivity-growth slowdown that are likely to be resolved, helping to determine the potential for productivity growth in the future. We were also constrained by a longer-term comparison due to data availability issues across countries in EU KLEMS. For further details, please see the technical appendix. Other researchers have also found large contributions from capital intensity growth and total factor productivity growth in the United States, see for example Alexander Murray, *What explains the post-2004 US productivity-growth slowdown?* CSLS Research Report 2017-05, 2017.

THE WANING OF A BOOM STARTING IN THE 1990S AND FINANCIAL CRISIS AFTEREFFECTS HAVE DRAGGED DOWN PRODUCTIVITY GROWTH TO HISTORIC LOWS WHILE DIGITIZATION IS UNDER WAY

Two waves have dragged down productivity growth by 1.9 percentage points on average across countries since the mid-2000s: the waning of a boom that began in the 1990s with the first information and communications technology (ICT) revolution, and a subsequent phase of restructuring and offshoring, which reduced productivity growth by about one percentage point. Financial crisis aftereffects, including weak demand and uncertainty, reduced it by another percentage point. A third wave, digitization, contains the promise of significant productivity-boosting opportunities but the benefits have not yet materialized at scale. This is due to adoption barriers and lag effects as well as transition costs; the net effect on productivity in the short term is unclear (Exhibit E4). We do not attempt to quantify the impact of digitization. Today we find that companies are allocating substantial time and resources to changes and innovations that do not yet have a direct and immediate impact on output and productivity growth.

The importance of these waves was not equal across countries (Exhibit E5). The first wave mattered more in Sweden and the United States, where the productivity boom had been more pronounced, while financial crisis aftereffects were felt more broadly across countries.[2]

> A third wave, digitization, contains the promise of significant productivity-boosting opportunities but the benefits have not yet materialized at scale. This is due to adoption barriers and lag effects as well as transition costs; the net effect on productivity in the short term is unclear.

Coming into the crisis, a boom that began in the 1990s with the first ICT revolution and a restructuring and offshoring phase waned

An initial ICT-enabled productivity boom, starting in the second half of the 1990s, was particularly strong in Sweden and the United States. The productivity boom in the ICT sector itself reflected a wave of rapid innovation in semiconductor design and manufacturing processes that raised productivity in the sector significantly and translated into higher-quality and higher-value products of downstream computer equipment producers. It also benefited sectors like retail, as large-format retailers like Walmart used technology to transform supply chains and the rest of the industry followed.[3] The global industry restructuring following the 2001 tech downturn helped sustain productivity gains across manufacturing as production shifted to Asia and nearshore assembly locations in Mexico and Eastern Europe, and manufacturing production employment declined in the United States and Western Europe. In addition, rapid declines in ICT equipment prices encouraged an investment boom in other sectors such as professional and business services, as well as strong growth in the ICT services and software sector, and boosted productivity growth as these industries integrated new technology into their business processes and systems.

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[2] For an overview of the methodology used to conduct this sizing, see the technical appendix. This analysis ends at 2014 due to lack of data availability across countries after that date. Please note that this analysis is based on sector-level data. Firm-level trends, some of which we discuss throughout the report, can also play a role in influencing productivity growth.

[3] *How IT enables productivity growth: The US experience across three sectors in the 1990s*, McKinsey Global Institute, November 2002.

Exhibit E4

The waning of a mid-1990s productivity boom and financial crisis aftereffects have contributed roughly equally to the decline in productivity growth

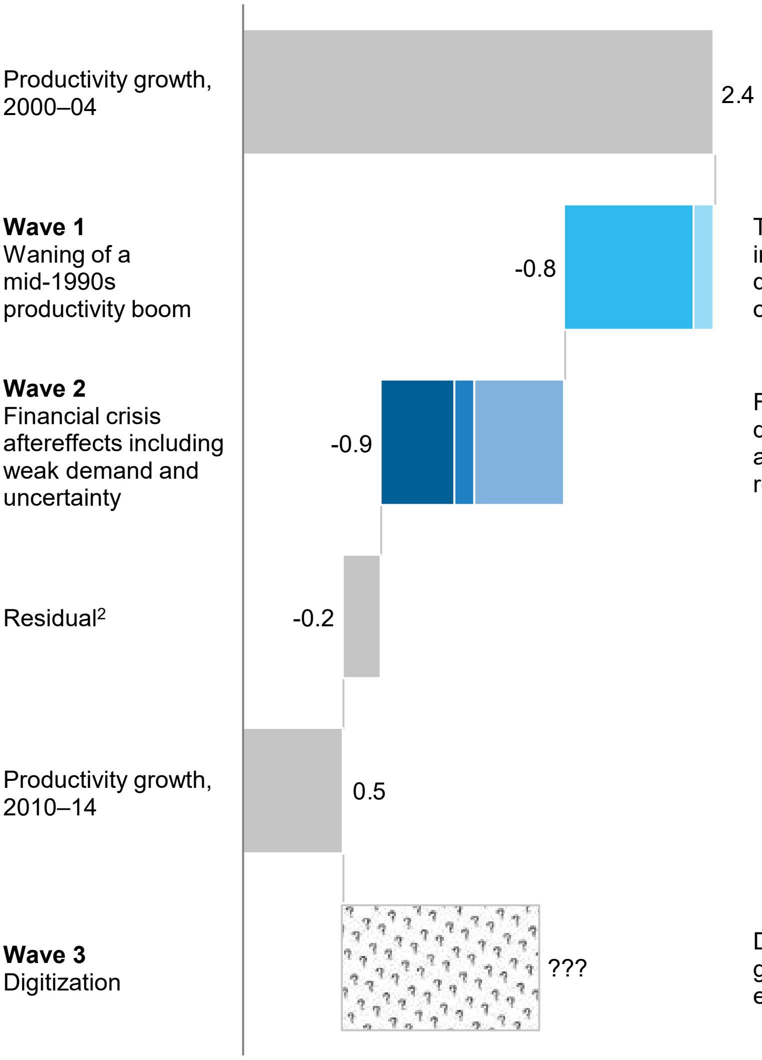
Contribution to the decline in productivity growth in 2010–14 vs. 2000–04[1]

Simple average of France, Germany, Sweden, United Kingdom, and United States

Percentage points

Wave 1
- 🟦 The first ICT revolution
- 🟦 Restructuring and offshoring

Wave 2
- 🟦 Sectors experiencing boom and bust (finance, real estate, construction)
- 🟦 Hours contraction and expansion
- 🟦 Excess capacity, slow demand recovery, uncertainty



The waning of the mid-1990s productivity boom includes the waning impact from a PC, software, and database system ICT revolution, and the restructuring of domestic operations and global supply chains

Financial crisis aftereffects encompass weak demand, uncertainty, excess capacity, contraction and expansion of hours, and a boom/bust in finance, real estate, and construction

Digitization offers the promise to boost productivity growth, yet comes with adoption barriers and lag effects as well as transition costs

[1] US data are for the private business sector only; Europe data are for the total economy.

[2] Includes impact of reallocation (share of total labor and relative price movement) across sectors ("mix effect") and sectors not considered in our analysis. May include some of the impact from transition costs of digital. For further details, see technical appendix.

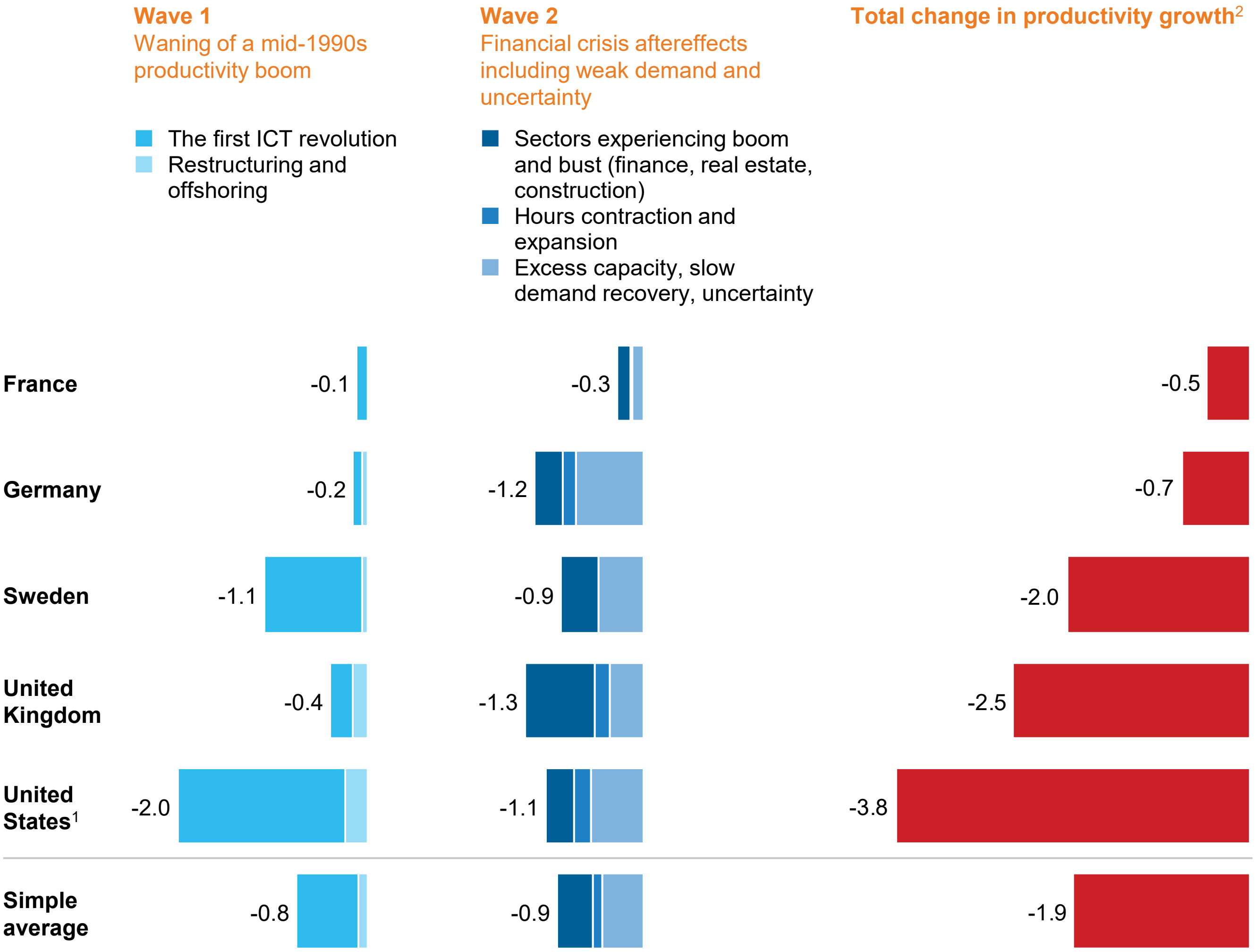
NOTE: Italy and Spain are excluded from this analysis because their productivity growth between these time periods did not decrease. We did not attempt to size the impact from Wave 3 (Digitization). While digitization contains the promise of significant productivity-boosting opportunities, it comes with lag effects and adoption barriers as well as transition costs. The net effect on productivity is unclear. Numbers may not sum due to rounding.

SOURCE: EU KLEMS (2016 release); BLS Multifactor Productivity database (2016 release); McKinsey Global Institute analysis

Exhibit E5

The impact of each wave varies across countries

Percentage point contribution to the decline in productivity growth in 2010–14 vs. 2000–04



1 US data are for the private business sector only; Europe data are for the total economy.

2 Total change in productivity growth also includes the impact of reallocation (share of total labor and relative price movement) across sectors ("mix effect") and sectors not considered in our analysis. May include some of the impact from transition costs of digital. For further details. see technical appendix.

NOTE: Italy and Spain are excluded from this analysis because their productivity growth between these time periods did not decrease. We did not attempt to size the impact from Wave 3 (Digitization). While digitization contains the promise of significant productivity-boosting opportunities, it comes with lag effects and adoption barriers as well as transition costs. The net effect on productivity is unclear. Numbers may not sum due to rounding.

SOURCE: EU KLEMS (2016 release); BLS Multifactor Productivity database (2016 release); McKinsey Global Institute analysis

By the mid-2000s, the productivity-growth benefits from that first wave of ICT innovation had matured. The retail and wholesale supply chain revolution had largely run its course. Productivity growth in the tech sector itself declined by roughly 14 percentage points in the United States from 2000–04 to 2010–14. The composition of the tech industry had shifted toward skilled labor intensive, less scalable software services. And tech manufacturing became more fragmented and innovation more complex as the proliferation of electronic devices and applications broadened the demands on performance beyond just processor speed.[4] For example, the shift in demand toward smartphones requires managing sometimes dozens of sensors from fingerprint recognition and GPS to multiple cameras,

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[4] Some researchers also question whether Moore's law still holds, or takes more effort. See, for example, Kenneth Flamm, "Has Moore's law been repealed? An economist's perspective," *Computing in Science and Engineering*, IEEE, 2017; Nicholas Bloom et al., *Are ideas getting harder to find?* NBER working paper number 23782, September 2017; and *Moore's law: Repeal or renewal?* McKinsey & Company, 2013.

all requiring efficient power consumption to save battery time. Virtual world gaming, artificial intelligence, and autonomous driving have dramatically expanded the performance demands on Graphics Processor Units (GPUs). The breadth and depth of innovation is vast, making it harder both to accurately measure improvements and to achieve past pace of improvements given the scale in many specialized chips is lower and cost declines slower.[5]

At the same time, the productivity gains from globalization and offshoring as well as efficiency gains from restructuring post-2001 were plateauing. While we found this trend had a smaller impact on productivity growth across countries than the waning of the ICT-enabled boom, it did affect certain sectors. In the auto sector in the United States, the productivity improvements from restructuring and job declines after the 2001 downturn and of regional footprint optimization across NAFTA tapered off by the mid-2000s. In Germany, regional offshoring to Eastern European countries continues today.

Financial crisis aftereffects, including weak demand and heightened uncertainty, created a dynamic of declining productivity growth

50%
drop in production volumes in the US auto sector between 2007 and 2009

Demand for goods and services across countries and industries dropped sharply during the financial crisis as people lost jobs, income contracted, and the credit impulse reversed.[6] For example, in the US auto sector, production volumes of vehicles fell by about 50 percent between 2007 and 2009 (data from IHS Markit, 2017), while in retail demand growth slowed by roughly one percentage point compared with the pre-crisis period (data from BLS). This fall in demand for goods and services resulted in significant excess capacity and a pullback of investment. At the same time, in many countries, companies reacted to the demand shock by cutting hours worked, particularly in sectors like manufacturing, retail, finance, and construction. The contraction of hours was so dramatic in the United States that it briefly increased productivity growth in 2009 and 2010.

By the end of 2009, the crisis reached a turning point, with GDP levels bottoming out in the United States. However, the depth of the crisis, deleveraging by households and corporations, weak animal spirits, and structural demand drags such as rising inequality and declining labor share of income resulted in a prolonged recovery that by some measures continues today.[7] Some European countries also experienced double-dip recessions in 2011.

A combination of factors in this slow recovery period created a dynamic of declining productivity growth: a slow increase in demand, excess capacity, and economic, political, and regulatory uncertainty, all in an environment of low wage growth. This cocktail contributed to the trend of weak growth in productive capital coupled with a rebound in hours worked growth. The decline in the growth rate of capital intensity, the lowest in the postwar period, reflects a substantial decline in equipment and structures investment during the crisis with a slow recovery while intangible investment, such as R&D and software, recovered more quickly after a brief and smaller dip in 2009.[8] As hours worked had significantly contracted during the crisis and capacity was underutilized, companies met slowly rising demand by filling excess capacity and adding hours. For example, in the

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[5] Other research has also pointed to the importance of the waning of this first ICT-enabled boom. See, for example, John Fernald and Bing Wang, “The recent rise and fall of rapid productivity growth,” *FRBSF Economic Letter,* Federal Reserve Bank of San Francisco, September 2015. Others have questioned whether mismeasurement could explain the productivity-growth decline, given the exceptionally thorny challenges of measuring output of rapidly changing tech industries. For a good overview, see David Byrne, Stephen Oliner, and Daniel Sichel, *Prices of high-tech products, mismeasurement, and pace of innovation*, NBER working paper number 23369, April 2017.

[6] The credit impulse is measured as acceleration or deceleration in debt-to-GDP ratios and thus indicative of the role of borrowing in impacting demand. See, for example, Michael Biggs and Thomas Mayer, *Bring credit back into the monetary policy framework!* Political Economy of Financial Markets policy brief, August 2013.

[7] See Chapter 1, Box 2, “How the Great Recession was different.”

[8] Companies typically see R&D investment as longer term. In many industries with rapid speed of technological change, competitive pressure kept investment a priority for companies.

auto sector in the United States, growth in hours worked surged after 2010, but total hours still remained below pre-crisis levels in 2015, and capacity utilization returned to pre-crisis levels in 2012, limiting the need for significant new investment before then.[9] Once capacity utilization picked up, though, a reason for continued weak investment was the persistent slow recovery in demand. Normalizing capital-to-output ratios across countries indicates that the investment recovery kept pace with the recovery in demand, but since demand growth was weak, capital services growth remained weak, too.[10]

Slow wage growth dampened the need to substitute capital for labor. Low wage rates in retail in the United States, for example, seem consistent with comparatively slow investment in technologies like automated checkouts and redeploying freed-up resources in low-productivity occupations like greeters.[11] In addition, stagnant wages had implications for limiting demand growth. In our sector analysis, we found weak demand dampened productivity growth through other channels than investment, such as economies of scale and a subsector mix shift (see Box E3, "Additional ways weak demand hurt productivity growth during the recovery").

The slow recovery, together with political and regulatory uncertainty in the aftermath of the crisis, may be continuing to restrain investment today.[12] There is debate around how far the recovery has progressed. For instance, while we have witnessed an extended period of job growth, employment rates are still well below pre-crisis levels in some countries, notably the United States, where the unemployment rate is around historic lows but labor force participation has not fully recovered.[13] Household investment remains subdued, and business investment as a share of GDP has only slowly recovered to rates seen before the crisis, and has still not fully recovered in parts of Europe. Real investment in structures and equipment remains below trend lines in many countries. Indeed, the latest economic data highlight the fact that capital intensity growth remains noticeably weak across countries. Demand and uncertainty are key drivers. We have found from our global surveys of business that 47 percent of companies that are increasing their investment budgets are doing so because of an increase in demand, yet 38 percent of respondents say risk aversion is the key reason for not investing in all attractive opportunities.[14] However, the good news is that the latest data from Europe and the United States indicate that economic growth is

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[9] Capacity utilization data based on IHS Markit, 2017.

[10] For other explanations of the slowdown, see *Uneven growth: Short – and long-term factors*, IMF World Economic Outlook, April 2015; Gustavo Adler et al., *Gone with the headwinds: Global productivity*, IMF staff discussion note number 17/04, April 2017; *Business investment developments in the euro area since the crisis*, Occasional Paper Series, number 167, European Central Bank, January 2016; Georg Erber, Ulrich Fritsche, and Patrick Christian Harms, "The global productivity slowdown: Diagnosis, causes and remedies," *Intereconomics,* volume 52, number 1, January/February 2017; and Diego Anzoategui et al., *Endogenous technology adoption and R&D as sources of business cycle persistence*, NBER working paper number 22005, February 2016; Claudio Borio, "Secular stagnation or financial cycle drag?" National Association for Business Economics, 33rd Economic Policy Conference 5–7 March 2017, Washington, DC; Bart van Ark and Kirsten Jäger, *Recent trends in Europe's output and productivity growth performance at the sector level, 2002-2015,* working paper.

[11] See, for example, Sebastian Vanderzeil, Emma Currier, and Michael Shavel, *Retail automation: Stranded workers? Opportunities and risks for labor and automation*, Investor Responsibility Research Center, May 2017. For a review of findings related to the role of minimum wages in impacting employment, see David Neumark, *Employment effect of minimum wages*, IZA World of Labor, May 2014. Interestingly, even when retailers are investing in automation, they have tended to move existing workers to other jobs such as food service to keep store service levels up and improve customer engagement.

[12] For a measure of uncertainty, see the Economic Policy Uncertainty Index (www.policyuncertainty.com) and see Scott R. Baker, Nicholas Bloom, and Steven J. Davis, "Measuring economic policy uncertainty," *The Quarterly Journal of Economics,* volume 131, issue 4, November 2016. Research has also shown that long-run uncertainty, which is influenced by policy uncertainty, influences both investment and hiring, but the former is more impacted by it than the latter. This is due to lower depreciation rates and higher adjustment costs of investment relative to hiring. See Jose Maria Barrero, Nicholas Bloom, and Ian Wright, *Short and long run uncertainty*, NBER working paper number 23676, August 2017.

[13] Participation is also low due to long-run trends such as aging; see Danny Yagan, *Employment hysteresis from the Great Recession*, NBER working paper number 23844, September 2017.

[14] *McKinsey Quarterly* survey, March 2017.

Box E3. Additional ways weak demand hurt productivity growth during the recovery

We identify two channels in which weak demand hurt sector productivity growth during the recovery in addition to holding back investment:

Economies of scale. In finance, productivity-growth declined, particularly in Spain, the United Kingdom, and the United States, due to contractions in lending volumes that banks were unable to fully offset with staff cuts due to the need for fixed labor (for example, to support branch networks and IT infrastructure). The utilities sector, which has seen flattening demand growth due to energy efficiency policies, as well as a decline in economic activity during the crisis, was similarly not able to downsize labor due to the need to support electricity distribution and the grid infrastructure.

The shape of demand and subsector mix shift. Consumer preferences boosted productivity growth in both the auto and retail sectors from the mid-1990s to the mid-2000s through a shift to higher value-per-unit, more productive goods. Today that trend has slowed. The German and US auto sectors have experienced a trend of customers purchasing higher-value-added SUVs and premium vehicles. This boosted productivity growth by 0.4 to 0.5 percentage point in the auto sector in the early 2000s. That trend has slowed slightly in both countries, contributing only 0.3 percentage point to productivity growth in 2010–14. Similarly, in retail, we estimate that consumers shifting to higher-value goods, for example higher-value wines or premium yogurts, contributed 45 percent to the 1995–2000 retail productivity-growth increase in the United States. This subsequently waned, dragging down productivity growth.

picking up and performance was marginally stronger in 2015 to 2017 compared with the previous period.

The benefits of digitization have not yet materialized at scale and come with adoption barriers, lags, and transition costs

While the first wave of ICT investment starting in the mid-1990s was mostly from using technology to deliver supply-chain, back-office, and later front-office efficiencies, today we are experiencing a new way of digitization that comes with a more fundamental transformation of entire business models and end-to-end operations. We may be experiencing a renewal of the Solow Paradox of the 1980s, with the digital age around us but not yet visible in the productivity statistics.

There are several reasons that the impact of digital is not yet evident in the productivity numbers. These include lag effects from technological and business readiness to reaching adoption at scale, costs associated with the absorption of management's time and focus on digital transformation, and transition costs and revenue losses for incumbents that can drag sector productivity during the transition; the net impact today of digitization is unclear.[15] On the lag effects, we have found that digitization has not yet reached scale, with a majority of the economy still not digitized. MGI has calculated that Europe overall operates at only 12 percent of digital potential, and the United States at 18 percent, with large sectors

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[15] See also Jacques Bughin and Nicolas van Zeebroeck, *Getting digital "bucks": How the interplay of disruption and types of strategic responses shapes digital investment payoffs and solves the Solow paradox,* working paper, December 2017; Erik Brynjolfsson, Daniel Rock, and Chad Syverson, *Artificial intelligence and the modern productivity paradox: A clash of expectations and statistics*, NBER working paper number 24001, November 2017.

lagging in both.[16] While the ICT, media, financial services, and professional services sectors are rapidly digitizing, other sectors such as education, health care, and construction are not. We also see the lack of scale in our sector deep dives. In retail, for example, we found that the growing share of sales taking place online in the United States added roughly 0.5 percentage point to productivity growth in the sector per year, as those forms of retail are more productive than traditional forms yet those sales are about 10 percent of retail volume.[17]

About
10%
share of
online sales
in retail

History shows that technological diffusion takes time and comes with barriers to adoption.[18] An MGI review of the historical rate of adoption of 25 previous technologies over the past half century shows that the time from commercial availability to 90 percent adoption ranges from approximately eight to 28 years.[19] This was demonstrated by the first Solow Paradox of the mid-1970s and 1980s, for example, and the ICT boom in the 1990s. Productivity growth in the United States slowed in the former period, despite innovations at the time in the area of microelectronics and communications technology.[20] Productivity gains were not automatic and did not occur in all industries that invested heavily in ICT. Instead, real productivity gains required significant changes in business process, as well as managerial and technical innovation.[21]

The challenge of adoption in the current digital wave may be even harder because of the broad range of uses of digital that not only help improve current processes but fundamentally transform business models and operations. For example, in retail, the first ICT revolution was focused on getting the right goods to the right place at the right time. With digitization, the transition to online requires building a new channel with a new supply-chain structure to deliver goods directly to customers and determining what combination of stores and online presence is optimal. Digital also requires significant up-front investment and new skills in data analysis; our survey shows fear of technological obsolescence as well as gaps in digital technical and organizational capabilities as barriers. The current wave of digitization also requires customers to embrace developments such as mobile banking, online shopping, autonomous driving, and resolving questions with a bot. Finally, some incumbents have reasons to actively delay adoption, whether for fear of cannibalization or, in some cases, the challenges of large-scale transformations.

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[16] Potential is defined by comparing each sector against a frontier sector defined as the US ICT sector. This analysis uses a set of 18 metrics of digitization spanning assets, usage, and labor. 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, payment and business models, and 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. *Digital Europe: Pushing the frontier, capturing the benefits*, McKinsey Global Institute, June 2016; *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015.

[17] Impact on retail productivity growth calculated based on the mix shift between online and offline retail, assuming today's level of relative productivity between the two segments. Based on data from Euromonitor International, Retailing data (2018 edition) and S&P Capital IQ.

[18] Boyan Jovanovic and Peter L. Rousseau, "General purpose technologies," in *Handbook of Economic Growth*, volume 1B, Philippe Aghion and Steven Durlauf, eds., Elsevier, 2005. Take the advent of steam power, for example. Productivity growth was quite rapid, at 2 to 3 percent, when steam power was introduced around 1870 but fell with the arrival of electrification in the 1890s, to 1 to 2 percent in the United States. It was only in the period after 1915, which saw the diffusion of machines operated by stand-alone secondary motors and the widespread establishment of centralized power grids, that electricity finally pervaded businesses and households, and productivity growth began to rise. Then productivity growth rose to 3 percent. See also Paul David, *Computer and dynamo: The modern productivity paradox in a not-too distant mirror,* The Warwick Economics Research Paper Series, 1989.

[19] *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017. See also Diego Comin and Bart Hobijn, "An exploration of technology diffusion," *American Economic Review,* volume 100, number 5, December 2010.

[20] Paul David, *Computer and dynamo: The modern productivity paradox in a not-too distant mirror,* The Warwick Economics Research Paper Series, 1989.

[21] *How IT enables productivity growth: The US experience across three sectors in the 1990s*, McKinsey Global Institute, November 2002.

While new digital entrants as well as fast-moving incumbents may increase profits and productivity, others can experience a transition that drags down productivity. As they lose revenue to attackers and their growing digital arms cannibalize revenues further, some companies may end up with duplicate structures and processes, and underutilized capacity in their traditional operations. For example, in retail, when firms increase their online presence and stores or entire malls suffer declining footfall, that cannot readily be remedied.[22] In a recent survey we conducted, companies with digital transformations under way said that 17 percent of their market share from core products or services was cannibalized by their own digital products or services.[23] Industry productivity benefits will then materialize mostly as incumbent businesses restructure or exit, and adoption costs are outweighed by benefits as digitization reaches scale.

> In a recent survey we conducted, companies with digital transformations under way said that 17 percent of their market share from core products or services was cannibalized by their own digital products or services.

COUNTRY VARIATIONS PROVIDE GREATER INSIGHT INTO THE PRODUCTIVITY-GROWTH SLOWDOWN

We find three broadly similar groups of countries: Sweden, the United Kingdom, and the United States, which have experienced the largest productivity-growth decline in our sample; France and Germany, which experienced a less dramatic drop in productivity growth but a continuing long-term decline; and Italy and Spain, with no decline (Exhibit E6). These variations are mainly associated with the strength of the boom prior to the financial crisis, the extent of the crisis itself, and differences in labor market flexibility.

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[22] See also Jacques Bughin and Nicolas van Zeebroeck, *Getting digital “bucks”: How the interplay of disruption and types of strategic responses shapes digital investment payoffs and solves the Solow paradox*, working paper, December 2017; Jacques Bughin, Laura LaBerge, and Anette Mellbye, “The case for digital reinvention,” *McKinsey Quarterly*, February 2017; and Jacques Bughin and Nicolas van Zeebroeck, “The right response to digital disruption,” *MIT Sloan Management Review*, April 2017.

[23] *McKinsey Digital Global Survey 2017: How digital reinventors are pulling away from the pack*, McKinsey & Company, October 2017.

Exhibit E6

The patterns and factors behind the productivity-growth decline reveal similarities and differences across countries

Percentage points

Low or no effect · Moderate effect · Large effect

Decline in productivity growth

		United States	United Kingdom	Sweden	Germany	France	Italy	Spain
Decline in productivity growth[2]		-3.8[1]	-2.5	-2.0	-0.7	-0.5	0.6	1.4
Low "numerator" (value added) growth[3]		-1.2	-0.8	-0.1	0.1	-1.3	-2.2	-3.2
High "denominator" (hours worked) growth[3]		0.4	1.1	1.1	1.4	-0.2	-0.9	-3.2
Few jumping sectors[4]		-46[1]	-30	-28	-7	-14	0	10
Broad-based productivity-growth decline across sectors[5]		88[1]	87	83	67	70	34	50
Contribution of factors in growth accounting decomposition[2]	Capital intensity	-1.5[1]	-0.5	-1.2	-0.7	-0.9	-0.2	1.4
	Labor quality	-0.2[1]	-0.5	0.5	-0.4	0.2	0.0	0.3
	Total factor productivity	-2.3[1]	-1.2	-1.2	0.5	0.2	0.8	-0.2
	Sector mix shift	0.2[1]	-0.4	0.0	-0.1	0.1	0.0	0.0
Impact of waves on productivity growth[2]	Waning of a mid-1990s productivity boom	-2.0[1]	-0.4	-1.1	-0.2	-0.1	n/a	n/a
	Financial crisis aftereffects	-1.1[1]	-1.3	-0.9	-1.2	-0.3	n/a	n/a
Top sectors contributing to the decline in productivity growth	Arts, entertainment, and other services					●		
	Construction			●				
	Finance and insurance		●					
	Information/communication services	●	●			●		
	Manufacturing	●	●	●	●	●		
	Real estate				●			
	Retail and wholesale	●		●				
	Transportation and storage				●			

1 US data are for the private business sector only; Europe data are for the total economy.
2 2010–14 vs. 2000–04.
3 2010–16 vs. long-term (1985–2005).
4 Share of jumping sectors, 2014 vs. 2004.
5 Share of sectors with lower productivity growth in 2010–14 vs. 2000–04.
NOTE: Numbers may not sum due to rounding.

SOURCE: McKinsey Global Institute analysis

A SECTOR VIEW HIGHLIGHTS A 2 PERCENT PLUS POTENTIAL FOR THE FUTURE

Our sector analysis provides an alternative lens to examine the macro trend of declining productivity growth. We find the three waves played out in different ways and to different degrees across sectors (Exhibit E7). Few sectors illustrate how this perfect storm impacted productivity growth across countries as well as the retail sector. By the time the crisis hit in 2007, the retail sector was at the tail end of a productivity boom that began around 1995. Then weak demand resulting from the financial crisis and recovery made matters worse in two ways: through an overall reduction in sales without a corresponding reduction in labor, and a switch to lower value-per-unit products and brands. As demand began to recover and wages across countries remained low, retailers hired more than they invested. In the middle of this slow recovery and challenging demand environment, the rise of Amazon and the wave of digital disruption occurring in the retail industry added about 0.5 percentage point per year to productivity growth from the shift to more productive online channels, accompanied by transition costs, duplicate structures, and drags on footfall in traditional stores.[24] The tourism sector provides a counterexample. It shows how productivity growth has been slow but steady across many countries from the incorporation of new technology, new business models, increasing consolidation, new competitors, and growing demand. (Please see Chapter 4 for an analysis of each individual sector.)

60%
of productivity-boosting opportunities will come from digital

As financial crisis aftereffects continue to dissipate, we expect productivity growth to recover from current lows across sectors and countries. Our sector deep dives reveal significant potential to boost productivity growth both from a continuation of more typical productivity opportunities such as operational efficiency gains and from new avenues enabled by digital technologies. Digital automation is just one channel in which digitization will impact productivity growth; digital flows and platforms can also accelerate globalization and global competition, and digital features can substantially increase customer value.[25] Over all, we estimate that the productivity-boosting opportunities could be at least 2 percent on average per year over the next ten years, with 60 percent coming from digital opportunities.[26] While low productivity growth of today may lead to concern about the future, research indicates that past productivity performance is a poor indicator of future productivity growth.[27]

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[24] Impact on US retail sector. Impact calculated based on the mix shift between online and offline retail, assuming today's level of relative productivity between the two segments. Based on data from Euromonitor International, Retailing data (2018 edition) and S&P Capital IQ.

[25] *Global flows in a digital age: How trade, finance, people, and data connect to the world economy*, McKinsey Global Institute, April 2014.

[26] Our estimate for the productivity-growth potential builds on extensive past MGI research on sector opportunities for improving productivity through technologies that are already implemented today or have a clear path to deployment at scale by 2025. These include benefits from digitization (e.g., big data, Internet of Things, automation, AI) as well as non-digital opportunities such as mix shifts in products and channels, continued consolidation, etc. See *Global growth: Can productivity save the day in an aging world?* McKinsey Global Institute, January 2015; *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015; *Digital Europe: Pushing the frontier, capturing the benefits*, McKinsey Global Institute, June 2016; and *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017. See the technical appendix for more details.

[27] See Erik Brynjolfsson, Daniel Rock, and Chad Syverson, *Artificial intelligence and the modern productivity paradox: A clash of expectations and statistics,* NBER working paper number 24001, November 2017.

Exhibit E7

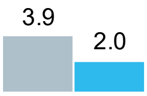
Across sectors, two waves—waning of a mid-1990s productivity boom and financial crisis aftereffects—slowed productivity growth; a third wave, digitization, offers promise but comes with lag effects and transition costs

● Contribution to overall productivity growth slowdown (%)[1]

Productivity growth
Compound annual growth rate (%)

▨ 2000–04 🟦 2010–14

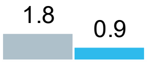
Automotive[2]



4

- Wave 1
  - Benefits of US restructuring post-2001 and NAFTA-wide footprint optimization waned
- Wave 2
  - Excess capacity and low profits as demand dropped, slowing investment in equipment and structures (not R&D); slow demand recovery was met with hours expansion
  - About 0.2 percentage point productivity drag from slower shift to higher-value vehicles
- Wave 3
  - Investment in digital currently under way (autonomous vehicles, connectivity, electric vehicles, industry 4.0) but still subscale; highly or fully autonomous cars not yet commercially available but could represent up to 15% of sales by 2030

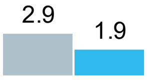
Finance[2,3]



18

- Wave 1
  - n/a
- Wave 2
  - Slow growth in lending/deposit volumes due to deleveraging, weak credit demand, stricter regulation, together with difficulty streamlining fixed labor
  - Regulatory changes, settlements dampened value-added growth and occupied management attention
- Wave 3
  - Digitization, fintech are reshaping front and back end of banks, yet transformation takes time
  - Potential to boost productivity from online and automation (e.g., up to 60% of total costs of retail and commercial banking could benefit from automation and shift to online banking)
  - Strong customer willingness to move to digital products (e.g., only about 13% of North American customers obtain an account online but 56% are willing to do so)

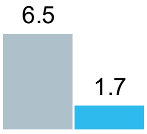
Retail[2,4]



17

- Wave 1
  - Benefits from ICT-enabled supply-chain efficiencies and business process transformations reached saturation
- Wave 2
  - Weak demand reduced sales growth (by ~3 percentage points on average) without easy options to scale down labor
  - Shift to higher value-per-unit goods waned, dragged down productivity growth
  - Low wages limited automation (e.g., checkouts) and allowed redeployment into low-value tasks (meeter-greeter)
- Wave 3
  - Online is twice as productive as offline yet makes up only ~10% of total retail
  - Shift to online involves transition costs (e.g., revenue loss for incumbents' stores)

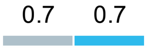
Technology[2]



18

- Wave 1
  - Mobile and graphics use broadened performance requirements and added complexity without Moore's law improvement dynamics
  - Benefits from restructuring and manufacturing offshoring after 2001 waned
- Wave 2
  - n/a
- Wave 3
  - Rapid innovations and performance improvements across broad range of industries, devices, applications (e.g., virtual reality, autonomous/electric vehicles, crypto-currencies)
  - Continued growth of software and services (e.g., cloud services) with robust productivity growth, including driven by AI and machine learning (a growing measurement challenge across broadening performance dimensions)

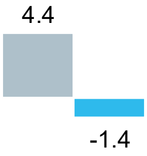
Tourism



n/a

The exception, with slow but sustained productivity growth from industry restructuring and consolidation (airlines and hotels), early introduction of digital (e.g., online transactions), and new business models (Airbnb, TripAdvisor); helped by robust yet at times volatile demand

Utilities[2]



15

- Wave 1
  - Efficiency gains from increasing competition after liberalization in the 1990s/2000s in electricity generation and retail subsectors waned along with incentives for the transmission and distribution subsector to drive efficiency, e.g., performance-based ratings schemes
- Wave 2
  - Energy efficiency efforts and the financial crisis eroded electricity demand (e.g., demand growth declined by ~3.5 percentage points in Europe between 2000–04 vs. 2010–14), while labor in transmission and distribution (60% of employment) could not be streamlined
- Wave 3
  - Smart meters and grids, digital productivity tools for employees, and automation of back-office processes could boost profitability by as much as 20 to 30%; however, investments are still subscale and come with a learning curve
  - Solar and wind technologies have higher labor productivity but legacy plants cannot yet be decommissioned, resulting in transition costs and revenue losses

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1 Productivity-growth data in the bar charts are the simple average of all seven countries in our sample. However, the contribution to the overall productivity-growth slowdown is the simple average of only those countries in which the sector contributed to a slowdown (vs. an increase) in productivity growth. The contribution cannot be added up across sectors since the sample of countries varies by sector. For an overview of the sector codes used for each sector, please see sector infographics in Chapter 4.
2 US data are for the private business sector only; Europe data are for the total economy.
3 These data include both finance and insurance due to data availability issues across countries.
4 These data include both retail and wholesale trade due to data availability issues across countries.

SOURCE: BLS Multifactor Productivity database (2016 release); Eurostat (June 2017 release); EU KLEMS (2016 release); WTTC; McKinsey Global Institute analysis

CAPTURING THE PRODUCTIVITY POTENTIAL OF ADVANCED ECONOMIES MAY REQUIRE A FOCUS ON PROMOTING BOTH DEMAND AND DIGITAL DIFFUSION

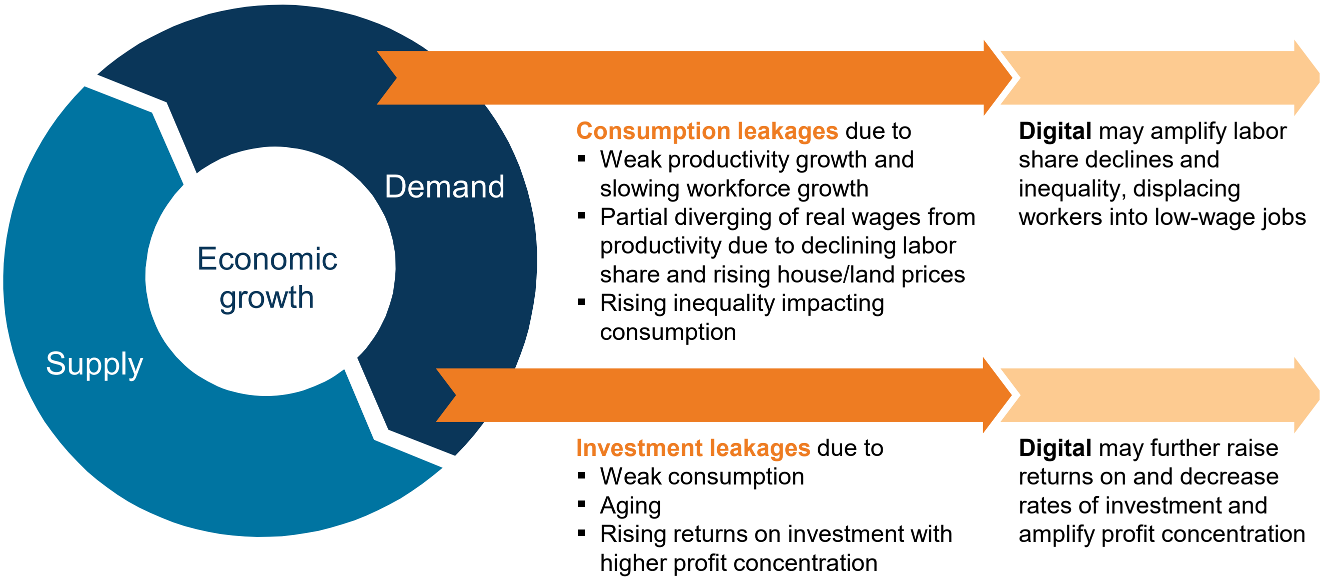
There is no guarantee that the productivity-growth potential we identify will be realized without taking action. While we expect financial crisis–related drags to dissipate, long-term drags may continue, such as a rise in the share of low-productivity jobs and slackening demand for goods and services due to changing demographics and rising income inequality; all of these factors may be further amplified by digitization. At the same time, the nature of digital technologies could fundamentally reshape industry structures and economics in a way that could create new obstacles to productivity growth.

The amplification of demand drags and the potential industry-breaking effects of digital may limit the productivity-growth potential of advanced economies

While we found that weak demand hurt productivity growth in the aftermath of the financial crisis, looking ahead, there is concern that some demand drags may be more structural than purely crisis-related. There are several "leakages" along the virtuous cycle of growth (Exhibit E8). Broad-based income growth has diverged from productivity growth, because declining labor share of income and rising inequality are eroding median wage growth, and the rapidly rising costs of housing and education exert a dampening effect on consumer purchasing power.[28] It appears increasingly difficult to make up for weak consumer spending via higher investment, as that very investment is influenced first and foremost by demand, and rising returns on investment discourage investment relative to earnings. Demographic trends may further diminish investment needs through an aging population that has less need for residential and infrastructure investment. These demand drags are occurring while interest rates are hovering near the zero lower bound. All of this may hold back the pace at which capital per worker increases, impact company incentives to innovate, and thus impact productivity growth, slowing down the virtuous cycle of growth.

Exhibit E8

Long-term demand leakages could act as a drag on productivity growth and may be further amplified by digital



Consumption leakages due to
- Weak productivity growth and slowing workforce growth
- Partial diverging of real wages from productivity due to declining labor share and rising house/land prices
- Rising inequality impacting consumption

Digital may amplify labor share declines and inequality, displacing workers into low-wage jobs

Investment leakages due to
- Weak consumption
- Aging
- Rising returns on investment with higher profit concentration

Digital may further raise returns on and decrease rates of investment and amplify profit concentration

SOURCE: McKinsey Global Institute analysis

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[28] See Chapter 5 for a more detailed discussion of declining labor share of income.

Digitization may further amplify those leakages, for example as automation may compress labor share of income and increase income inequality by hollowing out middle-class jobs and may polarize the labor market into "superstars" vs. the rest. It may also raise returns on investment and thus reduce rates of investment. Cannibalization of incumbent revenues puts pressure on nominal demand. And the rate of technological labor displacement is set to rise. Unless displaced labor can find new highly productive and high-wage occupations, workers may end up in low-wage jobs that create a drag on productivity growth.[29] Our ability to create new jobs and skill workers will impact prospects for income, demand, and productivity growth.

Digital technologies may also dampen their own productivity promise through other channels. Various digital technologies are characterized by large network effects, large fixed costs, and close to zero marginal costs. This leads to a winner-take-most dynamic in industries reliant on such technologies, and may result in a rise in market power that can skew supply chains and lower incentives to raise productivity. For example, some digital platforms benefit from a growing user base, as social networks with more users allow for more connections, while larger pools of search data generate better and more targeted results. While the potential economic costs and approaches to regulation of network industries are well established, the nature of digital platforms is sufficiently different to warrant further policy consideration (see Chapter 5 for a further discussion).

Independent of platform economies, rising corporate concentration throughout the economy may reduce competitive pressure and translate into weaker incentives to innovate and invest in raising productivity, although we have not found evidence of that yet. While the empirical evidence suggests that the link between concentration and either competitive intensity or productivity growth may not be a strong one, this is another often-cited concern today.[30] Importantly, in our sector deep dives, we have found no evidence that rising business concentration has hurt productivity growth so far. However, going forward, that may not be the case. There may be a tipping point where the initial benefits from industry consolidation, from factors such as economies of scale and reducing the need for staff, and from restructuring operations may give way to costs as competitive pressure declines with the rise of market power. Rising corporate concentration could also further increase income inequality and compress labor share of income.

New digitally enabled business models can also have dramatically different cost structures that change the economics of industry supply significantly and raise questions about whether the majority of companies in the industry and the tail will follow the frontier as much as in the past. For example, in retail, productivity growth in the late 1990s and early 2000s was driven by Tier 2 and 3 retailers replicating the best practices of frontier firms like Walmart. Today, it is unclear if many of Amazon's practices can be replicated by most other retailers, given Amazon's large platform and low marginal cost of offering additional products on its platform. On the other hand, platforms like Amazon, TripAdvisor, and Airbnb offer the potential for new, small, and niche players to compete effectively with larger players, fundamentally changing the structure of the industry. It is unclear then what the net productivity impact of such changes in industry structure and economics will be, depending, for example, on the share of the market different players are able to gain and their relative productivity levels.

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[29] See also Michael A. Landesmann and Robert Stehrer, "Technology diffusion, international competition and effective demand," *Revue d'economie industrielle*, number 105, 2004; *Jobs lost, jobs gained: Workforce transitions in a time of automation*, McKinsey Global Institute, November 2017.

[30] Jason Furman and Peter Orszag, *A firm-level perspective on the role of rents in the rise in inequality*, presentation at Columbia University, October 2015; Germán Gutiérrez and Thomas Philippon, *Declining competition and investment in the US*, March 2017.

Finally, digitization may reduce price transparency and market efficiency as the customization of price, product, and terms proliferates through the use of consumer data, potentially reducing the incentives for companies to focus on efficiency gains as they extract more of the consumer surplus.

A new paradigm for policy in a digital age may be warranted

Unlocking the productivity potential of advanced economies may require a focus on promoting both demand and digital diffusion, in addition to interventions that help remove traditional supply-side constraints such as red tape.[31] To incentivize broad-based change, companies need competitive pressure to perform better, a business environment and institutions that enable change and creative destruction, and access to infrastructure and talent. Yet additional emphasis on digital diffusion and demand is warranted.

There are many opportunities today for policy makers to help boost productivity growth in advanced economies that focus on demand and digital diffusion. Demand may deserve attention to help boost productivity growth not only during the recovery from the financial crisis but also in terms of longer-term structural leakages and their impact on productivity. Suitable tools for this longer-term situation include: focusing on productive investment as a fiscal priority; growing the purchasing power of low-income consumers with the highest propensity to consume; unlocking private business and residential investment; and supporting worker training and transition programs to ensure that periods of transition do not disrupt incomes.

On digital, action is needed both to overcome adoption barriers of large incumbent business and to broaden the adoption of digital tools by all companies and citizens. Actions that can promote digital diffusion include: leading by example and digitizing the public sector; leveraging public procurement and investment in R&D; driving digital adoption by small and medium-sized enterprises (SMEs); investing in hard and soft digital infrastructure and clusters; doubling down on the education of digital specialists as well as consumers; ensuring global connectivity; and addressing privacy and cybersecurity issues. Furthermore, regulators and policy makers will need to understand the differences in the nature of digital platforms and networks from the network industries of the past, and develop the tools to identify non-competitive behavior that could harm consumers.

Other stakeholders have a role to play, too. How do companies, labor organizations, and even economists respond to the challenge of restarting productivity growth in a digital age? Companies will need to develop a productivity strategy that includes the digital transformation of their business model as well as their entire sector and value chain, and not just focus on operational efficiency. In addition, they may have to rethink their employee contract in order to develop a strategy, potentially together with labor organizations, where people and machines can work side by side and workers and companies can prosper together. Economists can play a key part by developing new and improved ways to measure productivity and by developing models that can assess the impact of technology on markets and prices.

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[31] William Lewis, *The power of productivity: Wealth, poverty, and the threat to global stability*, University of Chicago Press, 2004; John B. Taylor, "Slow economic growth as a phase in a policy performance cycle," *Journal of Policy Modeling,* volume 38, issue 4, July–August 2016; Steven J. Davis, "Regulatory complexity and policy uncertainty: Headwinds of our own making," prepared for Hoover Institution conference on "Restoring Prosperity," Stanford University, February 9–10, 2017.

• • •

While productivity growth in advanced economies has been slowing for decades, the sharp downturn following the financial crisis has raised alarms. We find that the most recent slowdown is the product of two waves, the waning of a 1990s productivity boom and financial crisis aftereffects, while a third wave, digitization, is under way. As financial crisis aftereffects continue to recede and digitization matures, productivity growth should recover from historic lows. How strong the recovery is, however, will depend on the ability of companies and policy makers to unlock the benefits of digitization and promote sustained demand growth. There is a lot at stake. A dual focus on demand and digitization could unleash a powerful new trend of rising productivity growth that drives prosperity across advanced economies for years to come.

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1. AN OVERVIEW OF THE PRODUCTIVITY-GROWTH SLOWDOWN

The decline in labor productivity growth in the aftermath of the financial crisis in many advanced economies has been significant. To put that in perspective, if productivity in the United Kingdom had returned to its pre-recession growth trend, it would be 20 percent higher than its current level, while in the United States, it would be 13 percent higher, income would be higher, and economic growth would be stronger.[32] Productivity growth has always been critical for income growth (see Box 1, "Why productivity growth matters"). Today, however, slowing productivity growth together with an aging population raises concerns that advanced economies may be trapped in a vicious cycle of economic underperformance. A new understanding and tool kit may be required to restore a virtuous cycle of growth. In this chapter, we examine aggregate productivity trends in the United States and across a sample of six Western European economies. We then outline the leading explanations in today's debate on the productivity-growth slowdown. Finally, we lay out the integrated analytical approach we take in this report across countries and sectors that allows us to pinpoint the driving forces behind the slowdown.

> Productivity would be 20% higher today in the United Kingdom and 13% higher in the United States if productivity had returned to its pre-recession growth rate.

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[32] Please note that in this report, we often refer to labor productivity as simply "productivity"; we specify other types of productivity, such as total factor productivity, when referring to them. UK analysis based on "UK productivity introduction: Jan to Mar 2017," Office for National Statistics, July 2017. Similar to that approach, US values calculated based on applying the pre-recession growth trend between 1994 and 2007, using data from The Conference Board Total Economy Database (May 2016 release).

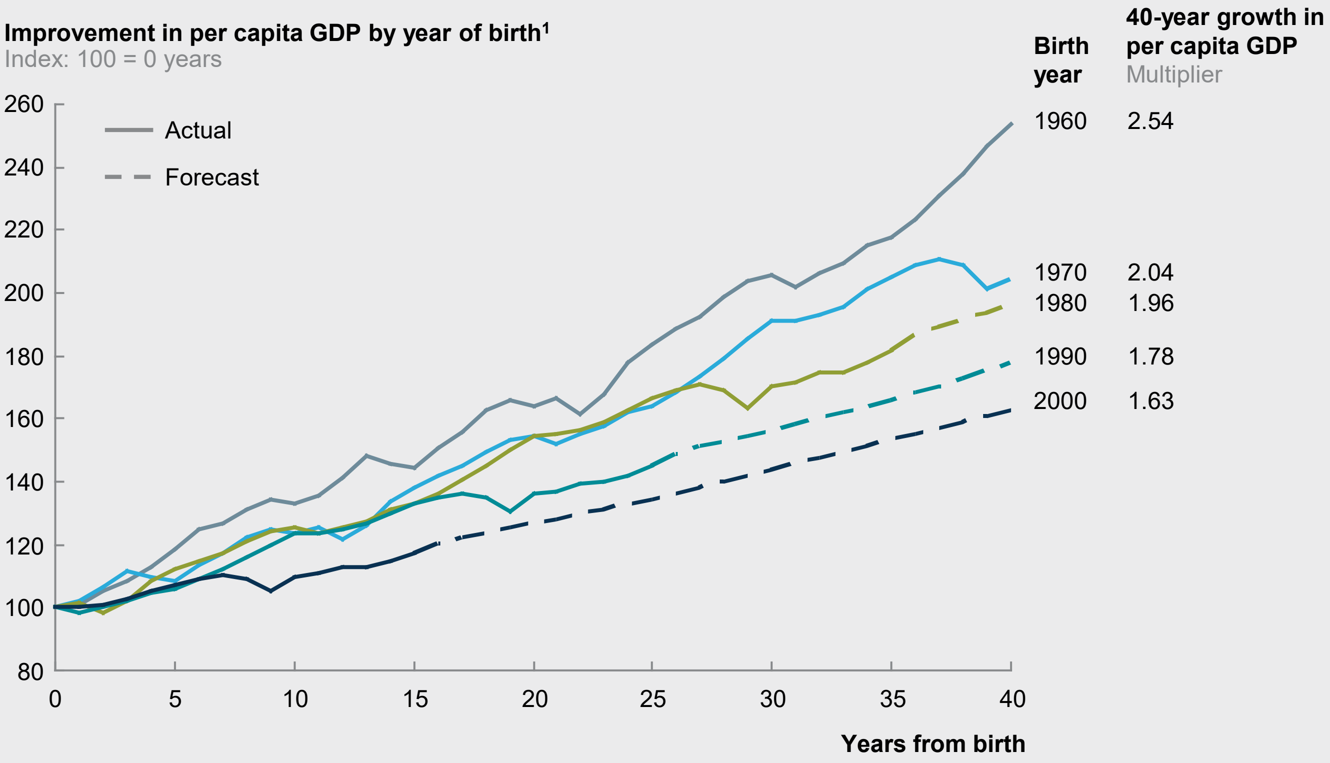
Box 1. Why productivity growth matters

Productivity growth—getting more value for each hour worked—is a key way to increase well-being and per capita GDP. As productivity rises, so too does the opportunity for real income to rise. The higher productivity of companies also helps broaden the quality and quantity of goods and services available to consumers. Therefore, productivity is crucial for raising incomes, expanding the economy, and increasing the material well-being of society (Exhibit 1).[1]

Exhibit 1

Without a productivity boost, younger generations will experience slower increases in their standard of living

Improvement in per capita GDP by year of birth[1]
Index: 100 = 0 years



Birth year	40-year growth in per capita GDP Multiplier
1960	2.54
1970	2.04
1980	1.96
1990	1.78
2000	1.63

1 We assume 1.7% productivity growth, in line with the historical rate from 2015 on. The share of the working-age population will decline with UN projections (66% in 2009; 60% in 2030).

SOURCE: US Bureau of Economic Analysis; US Census Bureau; Moody's Economy.com; McKinsey Global Institute analysis

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[1] Per capita GDP growth indicates improvements in material living standards and is itself a key economic indicator. For our work here, we anchor our analysis in GDP per hour worked.

While improvements in material living standards are important, the size of the overall economy matters, too.[2] In a world where demographic headwinds are slowing the pace at which employment growth can occur, productivity growth becomes crucial to increase overall economic growth. For example, in the past 50 years, almost a third of the 2.8 percent annual GDP growth in advanced economies was derived from population growth and an increase in the working-age population, which grew by around 60 percent in these countries.[3] The remainder was derived from labor productivity growth. These demographic forces are changing dramatically, leaving productivity as a single engine to fuel growth as labor supply growth slows sharply. Over the next 50 years, labor supply growth will slow down to about 0.1 percent per year across these countries.[4] This means productivity growth would need to increase 47 percent to sustain past rates of GDP growth.

As productivity expands the economy, it creates economic surplus that can be passed on to businesses as higher profits, to consumers as lower prices that raise purchasing power or increase consumer surplus, and to workers in the form of higher pay. The rise in profits for companies and wages for workers in turn increases demand for goods and services, which encourages companies to increase production to meet that demand, creating a virtuous cycle of economic growth. While productivity growth increases value to workers, owners, and consumers, it does not determine how that value is distributed across these three groups. Today, there are important questions about the distribution of higher value in advanced economies and the share going to workers, a topic we address later in this report.[5]

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

[3] Ibid.

[4] Similar trends are seen across a sample of the largest economies (G20). Over the last 50 years, the largest economies (G19 and Nigeria) averaged about 3.6 percent in GDP growth, with roughly 1.8 percent coming from productivity growth and 1.7 percent from the expansion of employment (numbers may not sum due to rounding). Over the next 50 years, labor supply growth will slow down to about 0.3 percent across these countries; for some, labor supply has already peaked. That means in order to maintain historic growth levels, the contribution to growth from productivity would have to roughly double. See *Global growth: Can productivity save the day in an aging world?* McKinsey Global Institute, January 2015.

[5] For example, many advanced economies have seen an increasing deviation between the pace of productivity growth and wage growth, and a decline in the labor share of income. For additional details, see Chapter 5.

PRODUCTIVITY GROWTH BEGAN SLOWING ACROSS THE UNITED STATES AND EUROPE PRIOR TO THE FINANCIAL CRISIS BUT DECELERATED FURTHER IN THE AFTERMATH

Labor productivity growth has been declining in the United States and across Western Europe since the 1960s, and this decline has accelerated since the financial crisis and in the unusually slow recovery (see Box 2, "How the Great Recession was different").[33] While the trend of declining labor productivity growth is shared across our sample of countries, there are some important variations (Exhibit 2).

Since the 1950s, productivity growth in the United States has been punctuated by two boom periods, where productivity grew above 2 percent, the long-term average between 1850 and 2015.[34] The first period was during a postwar construction boom in the 1950s and 1960s while the second was during 1995 to 2005 due to a tech-enabled boom followed by a phase of restructuring especially in manufacturing triggered by the 2001 economic downturn.[35]

2%
the long-term productivity-growth average of the United States

In Europe, the 1950s and 1960s productivity boom was more pronounced, including a period of "catch-up" growth with the United States, characterized by the adoption and adaptation of best-practices and technology, as well as heavy investment and reconstruction.[36] As a result, productivity levels in the United States and Europe began to converge. Even though both the United States and Europe saw relatively low productivity growth in the 1970s through to the 1990s, many European countries continued to grow labor productivity faster than the United States, even surpassing the productivity levels in the United States by 1995.[37] However, the tech-enabled productivity boom of 1995 to 2005 was less pronounced in Europe than the United States, and there was more variation among European countries.[38] For example, Sweden experienced strong productivity growth in the mid-1990s and early 2000s linked to a wave of liberalization after a financial crisis in the 1990s. In contrast, Spain experienced weak productivity growth, which was virtually zero from the mid-1990s to 2008 as a sustained economic boom occurred with unprecedented increases in employment. Italy has also had exceptionally low productivity growth since the early 2000s.

Following the financial crisis, productivity growth has slowed across countries, but here too we find variations. During the crisis in the United States, employment declined faster than output, boosting productivity growth initially. In contrast, most Western European countries saw a much less pronounced decline in employment than output and recorded negative productivity growth during the crisis. Spain stands out in Western Europe, though, as having experienced faster productivity growth due to massive labor shedding following the boom-bust cycle, although more recently productivity growth has begun declining again.

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[33] Drawn from similar analysis in Martin Neil Baily and Nicholas Montalbano, *Why is productivity growth so slow? Possible explanations and policy responses*, Brookings Institution, September 2016.

[34] Antonin Bergeaud, Gilbert Cette, and Rémy Lecat, "Productivity trends in advanced countries between 1890 and 2012," *Review of Income and Wealth*, volume 62, issue 3, September 2016.

[35] For more details on the second boom period, see Chapter 3.

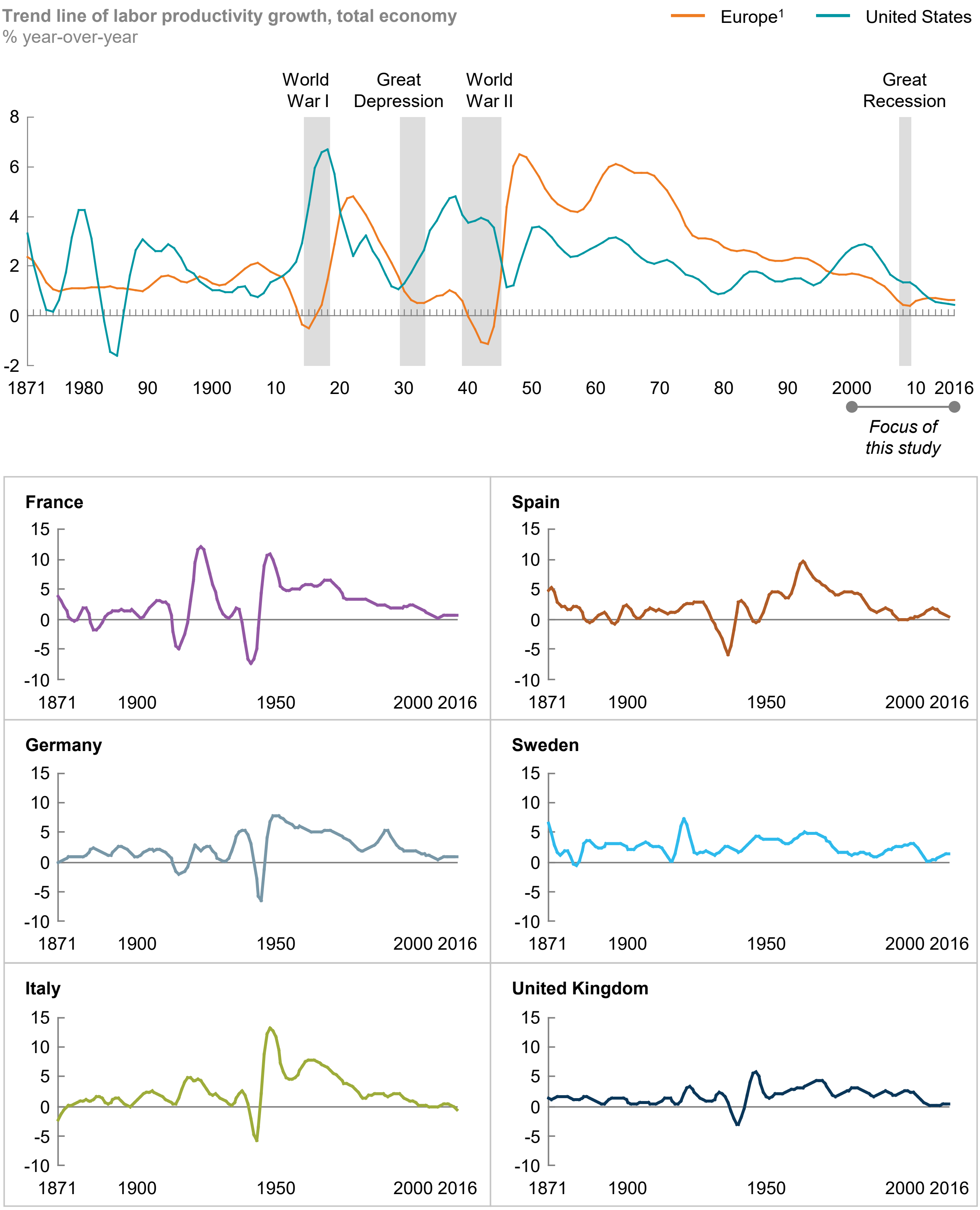
[36] Marcel P. Timmer et al., "Productivity and economic growth in Europe: A comparative industry perspective," *International Productivity Monitor*, number 21, spring 2011.

[37] The higher productivity growth in Europe in this period could be attributed to the decline in labor force participation and hours worked per person relative to the United States, which may have contributed to a capital-labor substitution and raised productivity levels. See Marcel P. Timmer et al., "Productivity and economic growth in Europe: A comparative industry perspective," *International Productivity Monitor*, number 21, spring 2011. The authors also find that even though Europe experienced relatively strong growth in labor productivity, growth in total factor productivity was lower.

[38] *Reaching higher productivity growth in France and Germany*, McKinsey Global Institute, October 2002; *Beyond austerity: A path to growth and renewal in Europe*, McKinsey Global Institute, October 2010; Gilbert Cette, John Fernald, and Benoit Mojon, *The pre-Great Recession slowdown in productivity*, Federal Reserve Bank of San Francisco working paper number 2016-08, April 2016. These reports find that a combination of factors may have contributed to a less pronounced productivity boom in Europe, including low service-sector productivity potentially driven by the scale of operations, product, land, and labor market barriers, lower levels of R&D investment, as well as changes in real interest rates that may have triggered resource misallocation, particularly in Italy and Spain.

Exhibit 2

Productivity growth has fluctuated over time; it has been declining since the 1960s and today stands near historic lows



1 Simple average of France, Germany, Italy, Spain, Sweden, and the United Kingdom.

NOTE: Productivity defined as GDP per hour worked. Calculated using Hodrick Prescott filter. Drawn from similar analysis in Martin Neil Baily and Nicholas Montalbano, *Why is productivity growth so slow? Possible explanations and policy responses*, Brookings Institution, September 2016.

SOURCE: A. Bergeaud, G. Cette, and R. Lecat, "Productivity trends in advanced countries between 1890 and 2012," *Review of Income and Wealth*, volume 62, number 3, 2016; McKinsey Global Institute analysis

Box 2. How the Great Recession was different

For millions of people across the United States and Western Europe, the Great Recession upended their lives and seemed different from any recession they had experienced before. That difference is borne out by the numbers.[1]

First, it was the deepest crisis in the postwar period across our sample of countries in terms of the drop in GDP (Exhibit 3). Hours worked also contracted across countries, though the contraction was not as pronounced as GDP except in Spain and the United States. In the case of the United States, the decline in per capita GDP, consumption, and investment was about double the size of the average for postwar recessions and triggered the deepest fall in hours worked growth in the postwar period.[2]

The extent of the downturn has contributed to a slow demand recovery. In the United States it has taken almost a decade to close the gap of 10 million jobs created by the Great Recession. In comparison, it took half that time to close the jobs gap after the 1981 and 1990 recessions.[3]

The Great Recession continues to demonstrate a slow return to pre-crisis capital services and intensity growth. Capital intensity growth, the capital available per hour worked, is among the lowest recorded over more than 100 years in both the United States and Europe (Exhibit 4).[4] At

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[1] For a comparison of this recession with the Great Depression, see Barry Eichengreen, *Hall of mirrors: The Great Depression, the Great Recession, and the uses—and misuses—of history*, Oxford University Press, 2015.

[2] Lee E. Ohanian, *Accounting for the Great Recession*, Federal Reserve Bank of Minneapolis, 2011.

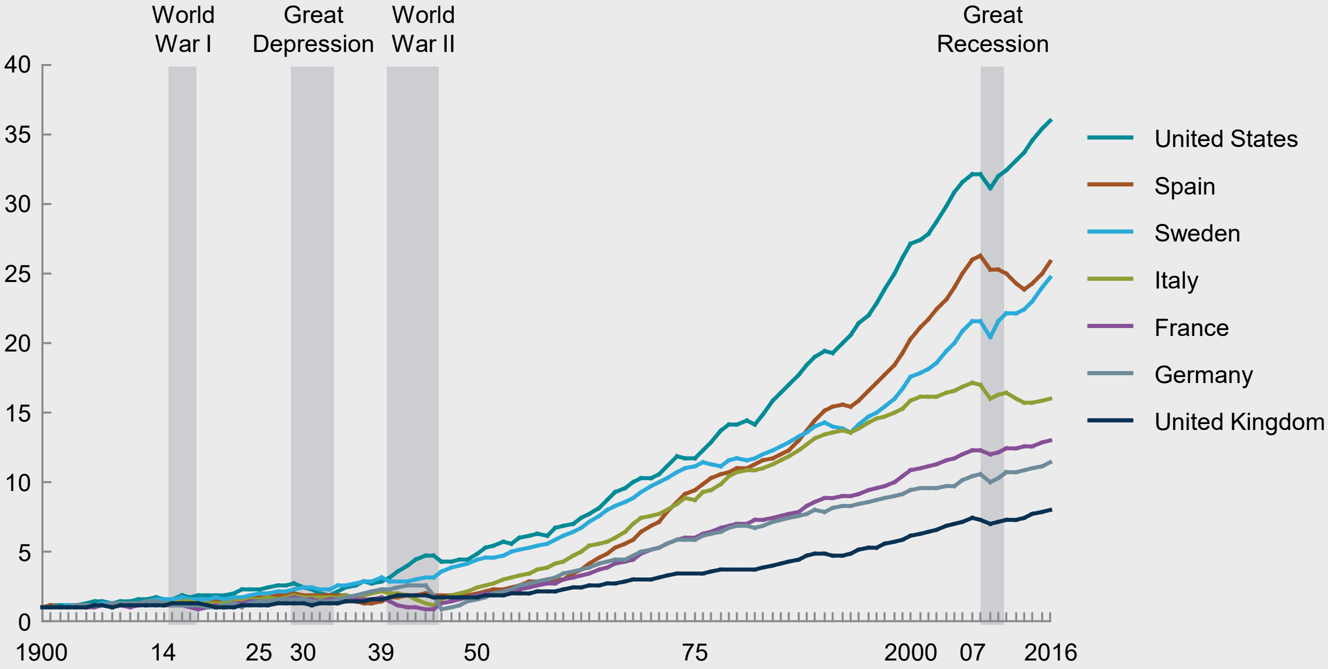
[3] Diane Whitmore Schanzenbach et al., *The closing of the jobs gap: A decade of recession and recovery*, The Hamilton Project at the Brookings Institution, August 2017.

[4] Capital intensity or capital per hour worked worker indicates access to machinery, tools, and equipment and is measured as capital services per hour.

Exhibit 3

GDP contracted significantly during the Great Recession, more than in any other period since World War II

GDP, Index (1900 = 1)



NOTE: Maddison Project Database (2018 release) used through 1950; Conference Board data used subsequently.

SOURCE: Jutta Bolt et al., *Rebasing "Maddison": New income comparisons and the shape of long-run economic development*, Maddison Project Database, version 2018, www.rug.nl/ggdc/historicaldevelopment/maddison/research; Maddison Project working paper number 10; The Conference Board Total Economy Database (May 2017 release); McKinsey Global Institute analysis the same time, employment rates in countries like France, Spain, and the United States remain below levels experienced prior to the Great Recession.[5]

Beyond the sheer depth of the crisis, long-term drags on demand like declining labor shares of income and rising inequality (see Chapter 5 for a more comprehensive discussion) may well have prolonged the recovery, particularly as monetary policy responses were reaching the zero lower bound and fiscal expansion was constrained by sequestration in the United States and austerity policies in Europe.

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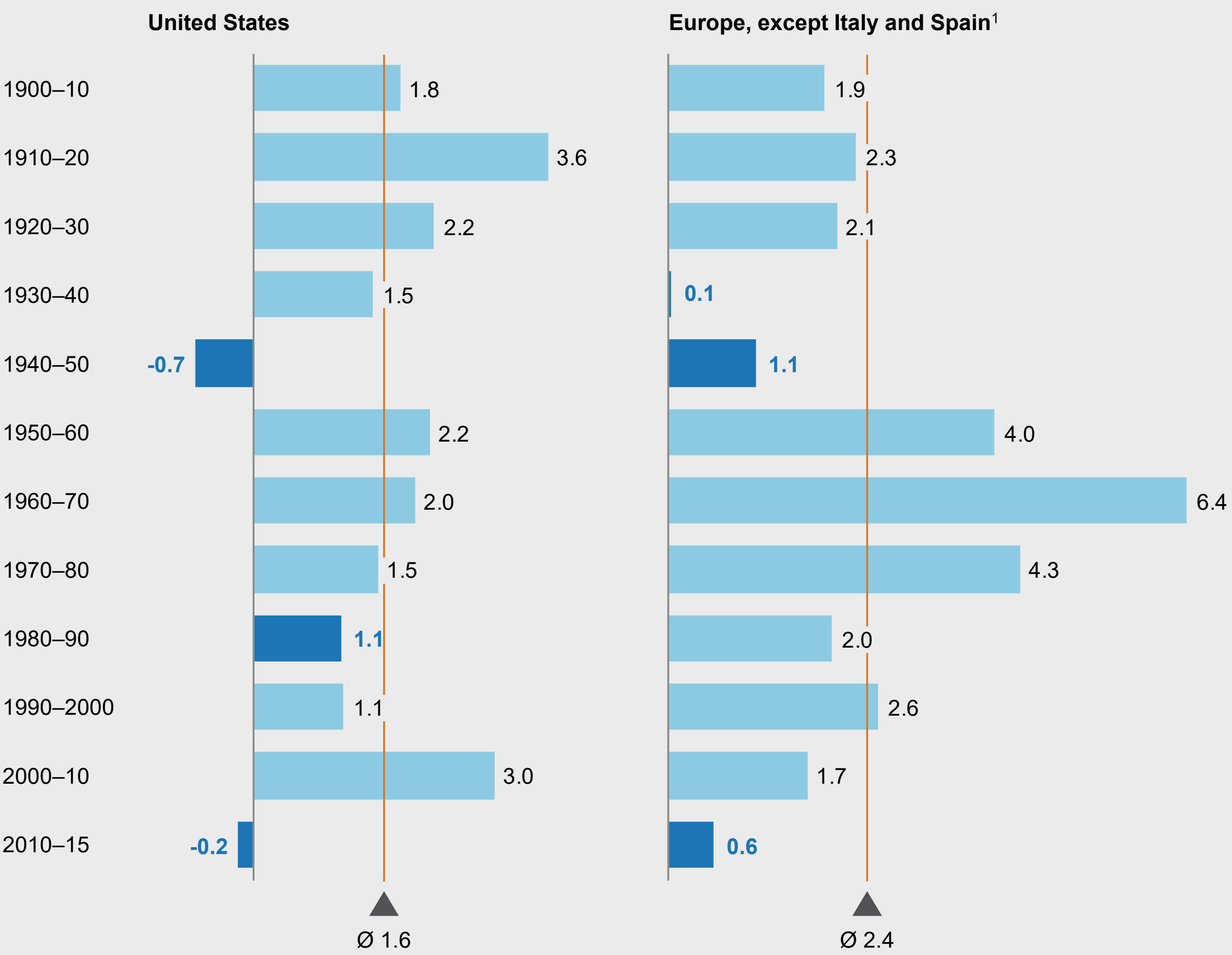
[5] The drop in labor force participation levels has a demographic component as large cohorts of baby boomers reach retirement age. However, evidence from the United States shows that the gap compared to pre-crisis levels is larger than suggested by demographics, indicating the sustained impact of the recession. See Danny Yagan, *Employment hysteresis from the Great Recession*, NBER working paper number 23844, September 2017.

Exhibit 4

The recent period of declining capital intensity growth is among the weakest since 1900

Capital intensity (capital services per hour worked) growth
Compound annual growth rate
%



1 Simple average of France, Germany, Sweden, and the United Kingdom. Italy and Spain excluded since their labor productivity trends are different from those of other European countries.

SOURCE: A. Bergeaud, G. Cette, and R. Lecat, "Productivity trends in advanced countries between 1890 and 2012," *Review of Income and Wealth*, volume 62, number 3, 2016; McKinsey Global Institute analysis

Recently, there has been a modest pick-up in productivity growth; however, many countries in our sample are still seeing about 1 percent productivity growth or less. Similarly, GDP growth has been strengthening. Performance was marginally stronger in 2014–17 across many other key economic variables despite the unusually slow recovery from the Great Recession. For example, the ratio of investment to GDP has increased marginally across most of the countries in this period. The one area that has not improved much after 2014 across countries has been capital intensity growth, which remains low.

LEADING EXPLANATIONS FOR THE SLOWDOWN

While there are many possible explanations for the productivity-growth slowdown, the only consensus about the drivers of the decline is that there is no consensus. In this section, we discuss the leading explanations in today's productivity debate.

The mismeasurement of productivity

The measurement of productivity raises many difficult challenges. Output, the numerator in productivity measures, is extremely hard to measure in services, particularly in public services such as health and education. Quality improvements in many areas, especially tech and software, are hard to capture. New consumer services, often provided free of charge—such as mobile GPS, Google, a host of smartphone-based applications, and cloud-based services—have contributed to productivity in ways we are currently not measuring. Other digital measurement issues related to capturing productivity include the difficulty of quantifying the benefits of increasing voice-over-IP and data traffic in telecoms, for example, as well as rising online sales. Finally, non-digital issues, such as globalization of value chains and profit shifting, and investment in intangibles, are making matters worse.

It is important to note that the 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 past productivity statistics. The same can be said of the other mismeasurement issues discussed above; to assess the impact of mismeasurement on the productivity-growth slowdown, one needs to size the missed productivity improvements not only today but in comparison with those of past decades.

It is also important to distinguish between areas of the economy that we are probably measuring incorrectly, such as those described above, 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 such as Google search, Facebook, and Skype, whose value is only partially captured via their advertising revenues.[39] Again, this is not a new phenomenon: the advent of free radio and TV channels significantly broadened households' access to information. Robert Gordon, among others, has described the dramatic consumer benefits from past waves of innovation that were similarly missed in productivity-growth measures.[40]

Therefore, while it seems reasonable to assume that our ability to correctly measure productivity changes has been limited, the extent to which mismeasurement can explain the recent productivity-growth slowdown is less clear.

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[39] 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 at least 27 percent of the total value it created for users. See *The impact of internet technologies: Search*, McKinsey & Company, July 2011. MGI focused on Skype and found that it generated enormous consumer surplus that was not measured anywhere. Forty percent of international call minutes in 2013 were Skype-to-Skype calls, equivalent to $37 billion of lost revenue for telecom firms. See *Playing to win: The new global competition for corporate profits*, McKinsey Global Institute, September 2015.

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

We find clear evidence of a non-measurement-related productivity-growth slowdown and therefore focus our work in this report on explaining the productivity-growth slowdown as measured. To start, there is incongruence in the time between the relatively sharp decline in productivity growth prior to and after the crisis vs. measurement effects that play out over longer periods. As we discuss in Chapter 2, we find that the slowdown has been broad-based across sectors of the economy, indicating that sector-specific mismeasurement explanations are insufficient to explain the economy-wide observed slowdown. Similarly, as we discuss in Chapter 3, we identify three waves that explain the productivity slowdown via clear non-measurement-related channels. Finally, our review of the literature finds that while mismeasurement is significant, it is not sufficient to explain the full extent of the slowdown (see Box 3, "How significant could the mismeasurement of productivity growth be?")

Financial crisis–related effects include weak balance sheets, credit constraints, zombie firms, capital misallocation, weak demand, and uncertainty

Some researchers have identified various financial crisis–related effects as having an impact on productivity growth. Researchers at the IMF found that the global financial crisis led to "productivity hysteresis"—persistent productivity losses from a seemingly temporary shock.[41] As the crisis hit, both households and businesses had significant debt and began a process of deleveraging. The reduction in demand restricted investment. Banks became less willing to lend and companies sought to repair their balance sheets, further restricting investment. Other researchers have focused on capital misallocation across firms and sectors before and after the global financial crisis.[42] In addition, the OECD has found a rise in "zombie firms"—old firms that have persistent problems meeting their interest payments—stifling average labor productivity.[43] Our research confirms the impact of weak postcrisis demand and a prolonged recovery on capital intensity growth as one of the primary drivers of the productivity slowdown, while we found less evidence for a similarly strong role of capital market issues like balance sheet weakness, or credit constraints.

Structural shifts in the economy

Several explanations for the productivity-growth slowdown involve structural shifts. These include: the rate of technological diffusion, a maturation of global supply chains, a shift to services, changing industry structure and dynamics, and secular stagnation.

- **A technological innovation slowdown or the Solow Paradox redux?** Technological innovation has been critical to increasing productivity growth throughout history. For example, the IT boom played a crucial role in boosting US productivity growth between the mid-1990s and early 2000s. Yet today there is disagreement around the impact current technological innovation is having on the economy and what potential it has to once again boost productivity growth. Skeptics such as economist Robert Gordon argue that current technological advances are not substantial enough to drive strong productivity growth.[44] Instead, Gordon points to developments 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. An alternative explanation

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[41] The IMF also pointed to structural headwinds that existed prior to the crisis, including a dwindling ICT boom, fading structural reform (for example, waning of the liberalization wave of network industries during the 1990s and early 2000s), decelerating technology diffusion, an aging workforce, slowing global trade, and weaker human capital accumulation. For more details, see Gustavo Adler et al., *Gone with the headwinds: Global productivity*, IMF staff discussion note number 17/04, April 2017.

[42] Claudio Borio et al., *Labour reallocation and productivity dynamics: Financial causes, real consequences*, BIS working paper number 534, Bank for International Settlements, January 2016; Gita Gopinath et al., *Capital allocation and productivity in Southern Europe*, NBER working paper number 21453, August 2015, revised March 2017.

[43] Müge Adalet McGowan, Dan Andrews, and Valentine Millot, *The walking dead? Zombie firms and productivity performance in OECD countries*, OECD Economics Department Working Papers, number 1372, January 2017.

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

Box 3. How significant could the mismeasurement of productivity growth be?

Various researchers have attempted to size the portion of the productivity growth shortfall explained by mismeasurement. While there appear to be significant challenges, a review of the literature suggests that mismeasurement is likely to account for at most a third of the recent slowdown.[1]

For example, 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.[2] 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 point to US labor productivity growth between 2004 and 2014. However, they believe the mismeasurement contribution from these factors was actually higher—roughly 0.5 percentage point—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.[3] 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 point today, from 0.1 to 0.2 percentage point between 1995 and 2004. They attribute the difference 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 two-percentage-point decline in US productivity growth observed between 1995 and 2004, relative to the post-2004 period.

Various other mismeasurement issues have also been highlighted in the literature, related to the digital economy and beyond. Some researchers have sized the measurement impact of creative destruction, which may result in overstated inflation as old products disappear and are replaced by better products, and their findings similarly suggests that while mismeasurement exists and may have increased since the mid-1990s, the magnitude of the increase is insufficient to explain the slowdown.[4] Others examine deflators in the telecom industry and find they do not include mobile or fixed broadband, among other issues.[5] While such issues exist and there are growing areas of economic activity that are not being captured in our measurement of productivity, these appear not to be at sufficient scale to explain the slowdown, even if they were to be considered part of GDP rather than consumer surplus.[6]

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[1] See Chad Syverson, *Challenges to mismeasurement explanations for the US productivity slowdown*, NBER working paper number 21974, February 2016. Various authors have suggested a similar conclusion from a review of the literature. See Nadim Ahmad, Jennifer Ribarsky, and Marshall Reinsdorf, *Can potential mismeasurement of the digital economy explain the post-crisis slowdown in GDP and productivity growth?* OECD Statistics Working Papers, number 2017/09, July 2017, and Gustavo Adler et al., *Gone with the headwinds: Global productivity*, IMF staff discussion notes, number 17/04, April 2017. Ahmad et al., for example, find that if mismeasurement is occurring, it cannot explain the magnitude of the observed slowdown in GDP or productivity growth. They do caution that this may not be true for future growth as the size of the digital economy increases. Another estimate by Nakamura et al. finds that accounting for free digital content through the lens of a production account would boost productivity growth but again, not sufficiently to account for the slowdown. Productivity growth would be higher by 0.07 percentage point between 1995 and 2005, and about 0.11 percentage point between 2005 and 2015. See Leonard I. Nakamura, Jon D. Samuels, and Rachel H. Soloveichik, *Measuring the "free" digital economy within the GDP and productivity accounts*, Federal Reserve Bank of Philadelphia working paper, October 2017.

[2] 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. Other work by Byrne and co-authors also suggests that accounting for mismeasurement could lead to different patterns in sector-level growth, leading to a smaller decline in productivity growth in the tech sector and a larger decline in other sectors. See David Byrne, Stephen Oliner, and Daniel Sichel, *Prices of high-tech products, mismeasurement, and pace of innovation*, NBER working paper number 23369, April 2017.

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

[4] For additional details, see Philippe Aghion et al., *Missing growth from creative destruction*, Federal Reserve Bank of San Francisco, working paper number 2017-04, November 2017.

[5] Diane Coyle, *Do-it-yourself digital: The production boundary and the productivity puzzle*, ESCoE discussion paper number 2017-01, June 2017.

[6] Chad Syverson, *Challenges to mismeasurement explanations for the U.S. productivity slowdown*, NBER working paper number 21974, February 2016. Similarly, estimates by Byrne, Fernald, and Reinsdorf suggest that adding the welfare gains from "free" digital services could add perhaps 0.3 percent of GDP per year to well-being, a small number compared with the productivity-growth slowdown. See 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.

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 statistics." 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.[45] The moderate productivity growth of the 1980s was followed by a period of rapid productivity growth between 1995 and 2004. In this period, the productivity gains from technology-enabled business process changes were broad enough to show up in aggregate productivity-growth numbers.[46] Today, we find evidence that we are in round two of the Solow Paradox. Industries face a new wave of technological change from digitization, and companies are grappling with digital transformations that are complex, are time-consuming, increasingly involve greater automation of operations and the use of artificial intelligence, and come with a fundamental transformation of entire business models and culture and often with transition costs (see Chapter 3 for more details).[47]

- **Maturation of global supply chains.** There has been a slowdown in global trade, in part due to the recession, but also as trade liberalization efforts have waned and global supply chains have matured (as has China's integration into global trade). Researchers have argued that past globalization and the restructuring of supply chains that accompanied it could have boosted productivity growth by increasing exposure to foreign competition. In addition, imported inputs can help enhance the quality and variety of goods that companies use in the production process.[48] But by the mid-2000s, that globalization had matured, and the expansion of benefits of global supply-chain integration on productivity growth slowed. Our research confirms this as a driver of the productivity slowdown, albeit one of the smaller ones, but one that had an impact, especially in the United States.

0.4P.P.
How much mix shift has dragged down long-term productivity growth

- **A hollowing-out of industry and a shift to service- and public-sector activities.** A long-term structural shift is under way in the economy toward service industries such as health care and education and away from manufacturing. Many of these service industries are characterized by low measured productivity levels and growth. As originally observed by the economist William Baumol, unless there is sufficient demand elasticity in the most productive sectors, the least productive ones will amass the most resources over time. Therefore, as this shift occurs, the corresponding decline in productivity growth may be inevitable.[49] We find a small effect from mix shift over the long term of 0.4 percentage point per year, but this has not changed over time. While it remains a long-term drag, it does not explain the recent slowdown (see Chapter 2 for more details).

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[45] *US productivity growth, 1995–2000*, McKinsey Global Institute, October 2001; *How IT enables productivity growth: The US experience across three sectors in the 1990s*, McKinsey Global Institute, November 2002.

[46] 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.

[47] Erik Brynjolfsson, Daniel Rock, and Chad Syverson, "Artificial intelligence and the modern productivity paradox: A clash of expectations and statistics," NBER working paper number 24001, November 2017.

[48] See, for example, "Global trade: What's behind the slowdown?" in *Subdued demand—symptoms and remedies*, IMF World Economic Outlook, October 2016, and Gustavo Adler et al., *Gone with the headwinds: Global productivity*, IMF staff discussion note number 17/04, April 2017.

[49] "Is productivity growth becoming irrelevant?" Adair Turner, Project Syndicate, July 2017.

- **Changing industry structure and dynamics: Declining business dynamism, increasing concentration of businesses, and growing divergence between leaders and laggards.** 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.[50] Another important dynamic is increasing concentration of firms over the past two decades. Research has found that more than 75 percent of industries in the United States have seen their concentration levels rise from the late 1990s.[51] Productivity performance across firms has also diverged.[52] Between 2001 and 2007, labor productivity growth at the frontier was 4 to 5 percent per year while that of non-frontier firms was roughly 1 percent per year.[53] Since then, growth at the frontier has declined to 1 percent per year, and productivity growth of non-frontier firms has been at or close to zero. While we find evidence of changing industry structure and dynamics, this cannot explain the recent slowdown. The timing of the decline in dynamism and the increase in concentration does not match the timing of the recent productivity-growth slowdown. At various times in the past, declining business dynamism has actually been linked to an increase in productivity growth, and our sector deep dives suggest that rising concentration can also be an enabler of rather than a barrier to productivity growth (see Chapter 5 for more details).[54]

- **Secular stagnation: Weak demand in an era of ultralow interest rates.** Some economists explain weak GDP growth—and slow productivity growth—in the context of the state of the macro economy.[55] According to this analysis, the United States and Western European countries seem 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. Structural forces may be dampening consumer demand and investment, with 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 already have acquired a house, as well as longevity driving an increased propensity of households to save. In a slow economic environment with weak demand and consumption, businesses could also be more hesitant to invest despite very low interest rates. Slowing demand and investment could in turn diminish productivity growth. This in turn could affect income growth for households and further depress demand, resulting in a vicious cycle of economic stagnation.

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[50] Ryan A. Decker et al., *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.

[51] Gustavo Grullon, Yelena Larkin, and Roni Michaely, *Are US industries becoming more concentrated?* October 2016.

[52] Dan Andrews, Chiara Criscuolo, and Peter N. Gal, *Frontier firms, technology diffusion and public policy: Micro evidence from OECD countries*, OECD Productivity Working Papers, number 02, November 2015; Dan Andrews, Chiara Criscuolo, and Peter N. Gal, *The best versus the rest: The global productivity slowdown, divergence across firms and the role of public policy*, OECD Productivity Working Papers, number 05, November 2016. Other researchers, such as Andy Haldane, chief economist at the Bank of England, have also found evidence of divergence for firms in the United Kingdom. See "Productivity puzzles," speech by Andy Haldane, Bank of England, at London School of Economics, March 2017.

[53] In the OECD's analysis, global frontier firms are defined as the top 5 percent of firms based on productivity within each sector and year across countries. A fixed total number of firms is used across time to account for varying total sample size.

[54] 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 Walmart that in fact contributed to a substantial increase in productivity growth.

[55] 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.

Our research confirms weak demand as an important barrier to productivity growth in recent years. While we expect crisis-related effects to continue to dissipate, long-term trends like aging, rising inequality, and declining labor share of income, which have been acting as a drag on demand for decades, may continue and could be exacerbated by digitization (see chapters 3 and 5 for more detail).

WE USE A MULTISECTOR AND COUNTRY APPROACH THAT INTEGRATES SUPPLY AND DEMAND FACTORS

To provide a fact base for what is behind the slowdown in productivity growth, and prospects to boost growth going forward, we analyze the productivity-growth slowdown in seven countries: France, Germany, Italy, Spain, Sweden, the United Kingdom, and the United States. They were chosen to cover a large portion (65 percent) of GDP in advanced economies, and to enable us to analyze economies with different underlying structures and test how much of the observed decline is structural vs. country-specific.

65%
the share of GDP of all advanced economies represented by our country sample

In addition to our country analysis, we analyze six sectors across our sample of countries to identify what patterns are similar across sectors and what features are sector-specific. The sectors are automotive manufacturing, finance, retail, technology, tourism, and utilities. We chose these sectors because they represent a large and diverse share of the economies in our sample countries and played a significant role in explaining the recent slowdown (Exhibit 5). The characteristics of these sectors also provide a lens for understanding productivity in a digital age.

We take an integrated analytical approach across supply and demand to understand the reasons for the productivity-growth slowdown. Taking this dual approach allows us to assess the linkages and "leakages" around the virtuous cycle of economic growth (from production of goods and services, leading to incomes for households and profits for companies, in turn resulting in continued demand for goods and services). This allows us to diagnose why productivity growth has slowed (particularly as many of the explanations prevalent today take either a supply- or demand-focused view), and identify actions needed to restart productivity-enabled growth.

In particular, we focus on the slowdown since the mid-2000s as productivity growth has been exceptionally weak during this time. We anchor our analysis in a comparison between the turn of the century (2000–04), a relatively stable period, and the postrecession years (2010–14), a somewhat stable postcrisis period a decade later. Looking closely at the recent slowdown allows us to identify short-term factors behind the productivity-growth slowdown that are likely to be resolved and long-term trends that are likely to remain in place, allowing us to determine the potential for productivity growth in the future.[56]

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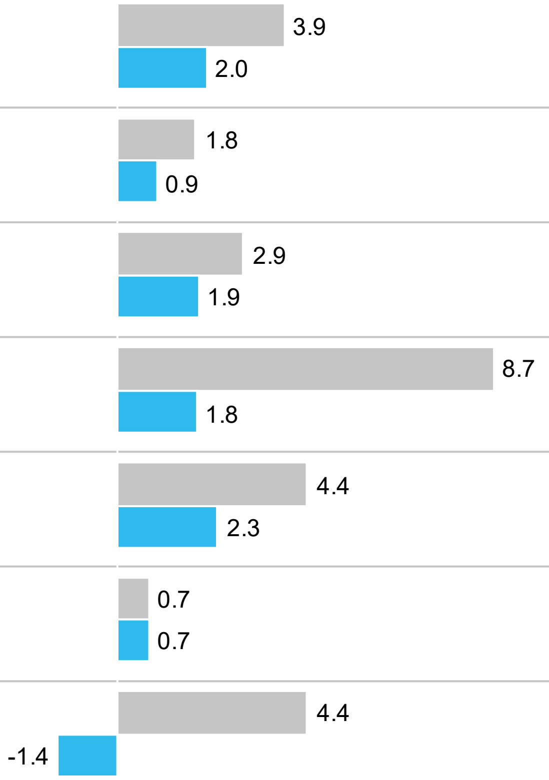
[56] While we are aware that choosing specific years involves some degree of arbitrariness, after assessing the pros and cons of multiple time periods, we determined that the period following the crisis allowed us to isolate different factors at the sector level across many different countries more easily. We also conduct robustness tests for how much these years impact our results. See the technical appendix for a detailed discussion.

Exhibit 5

Our six deep-dive sectors make up a significant share of value added and hours worked



	Share of the economy, 2014 %		Productivity growth Compound annual growth rate[1] %		Contribution to the overall productivity-growth slowdown %
	Value added	Hours worked	Simple average across countries ■ 2000–04	🟦 2010–14	Average across countries experiencing a slowdown in productivity growth[2]
Automotive[3]	1–5	1–2	3.9	2.0	4
Finance and insurance	4–8	2–6	1.8	0.9	18
Retail and wholesale trade	10–14	13–19	2.9	1.9	17
Tech (manufacturing)[4]	1–3	1–2	8.7	1.8	10
Tech (services)[5]	2–5	1–3	4.4	2.3	8
Tourism[6]	2–5	3–7	0.7	0.7	n/a[8]
Utilities[7]	2–3	0–1	4.4	-1.4	15

1 For an overview of the sector codes used for each sector, please see sector infographics in Chapter 4.
2 Simple average of countries where the industry contributed to a slowdown in productivity growth only.
3 Automotive defined as "Transport equipment" for EU countries and "Transportation equipment" for the United States.
4 Tech manufacturing defined as "Electrical and optical equipment" for EU countries and "Computer and electronic products" for the United States.
5 Tech services defined as "IT and other information services" for EU countries and "Data processing, internet publishing, and other information services," "Computer systems design and related services," and "Publishing industries, excluding internet (includes software)" for the United States.
6 Number of jobs used in lieu of hours worked due to data availability.
7 Utilities defined as "Electricity, gas, steam and A/C supply" for EU countries and "Utilities" for the United States.
8 Data not available from growth accounting statistics.
NOTE: US data are for the private business sector only for all sectors except tourism; Europe and tourism data are for the total economy.

SOURCE: BLS Multifactor Productivity database (2016 release); Eurostat (June 2017 release); EU KLEMS (2016 release); WTTC; McKinsey Global Institute analysis

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Exceptionally weak productivity growth in recent years has raised alarms at a time when advanced economies depend on productivity growth more than ever to promote long-term economic growth and prosperity. Yet for some time now, the only consensus about what is behind this weakness is that there is no consensus, leaving decision makers in both the private and public spheres without a clear perspective from which to chart a path forward. We hope to address this gap in understanding with our multicountry and sector analysis. In the next chapter, we describe the patterns of the productivity-growth slowdown we find across countries and sectors. These patterns provide a micro view of productivity growth and thus add another dimension to understanding the factors behind the slowdown. Any explanation of the slowdown in productivity growth should be able to reconcile the observed aggregate trends and microlevel patterns.

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2. PATTERNS OF THE SLOWDOWN

A decomposition of aggregate productivity-growth numbers reveals common patterns that provide greater insight into the slowdown. Any explanation of the slowdown should address these micro patterns and not just the headline aggregate productivity numbers. We identify a job-rich, productivity-weak recovery across countries characterized by declining growth of capital per worker. At the sector level, we find too few "jumping" sectors—sectors with accelerating productivity growth—and the ones that are jumping are too small to have an impact on aggregate productivity growth. These patterns indicate that the productivity-growth slowdown is broad-based across countries and sectors, point to a set of common, overarching factors at work, and reveal the importance of demand-side as well as supply-side factors.

Yet the patterns also highlight important differences between countries. When the financial crisis hit, Sweden and the United States were at the tail end of a productivity boom, while Italy and Spain were experiencing low productivity growth. In the aftermath of the crisis, the extent of the slowdown varied. Since the early 2000s, Sweden, the United Kingdom, and the United States have suffered the sharpest decline, France and Germany saw less of a slowdown, and Italy and Spain experienced an increase in productivity growth. From our sector analysis, we find the productivity-growth slowdown has been broad-based, but manufacturing, retail and wholesale trade, and information and communication services stand out across countries as having contributed more to the slowdown than other industries. Understanding both the common patterns and the differences points to why productivity growth has been declining, and in this chapter we explore both.

WE IDENTIFY A JOB-RICH, PRODUCTIVITY-WEAK RECOVERY

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 underlying differences in the composition of the resulting productivity-growth number. Improvements in productivity can be achieved by boosting efficiency, in other words 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, which in turn fuel demand for more and better goods and services.[57]

The recovery from the financial crisis has been "job rich" with low "numerator" (value added) growth accompanied by robust "denominator" (hours worked) growth (Exhibit 6).[58] In France, value-added growth has been low relative to historical trends while growth in hours worked has remained closer to historical trends. The United States has also seen low value-

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[57] The importance of this decomposition has also been pointed out by Acemoglu et al., who have examined this in detail in manufacturing. See Daron Acemoglu et al., "Return of the Solow Paradox? IT, productivity, and employment in US manufacturing," *American Economic Review*, volume 104, number 5, May 2014.

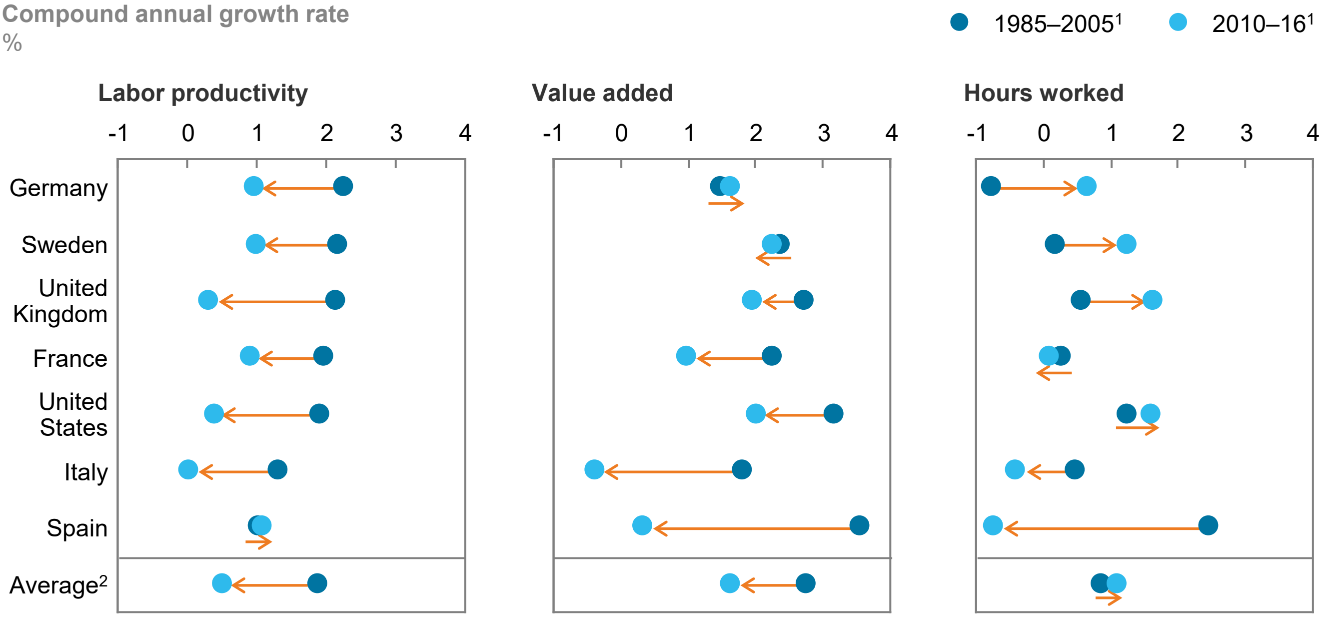
[58] That is not to say economies experienced a jobs boom but that solid job growth continued over a long time through and beyond the 2010 to 2014 period. While some considered this recovery "jobless" early on (see, for example, Natalia A. Kolesnikova and Yang Liu, *Jobless recoveries: Causes and consequences*, Federal Reserve Bank of St. Louis, 2011), because it took so long for unemployment to recover, we find that hiring has been exceptionally steady over a long period. The time periods in this exhibit were chosen to allow us to compare a long-term trend (1985 to 2005, ending prior to the crisis, to eliminate the impact of the crisis) with the most recent trends in the recovery (the period of the particularly low productivity growth).

added growth, but growth in hours worked has increased slightly relative to historical trends. In Germany and Sweden, value-added growth has been roughly on par with many prior periods, perhaps because they were not directly exposed to a debt crisis, and they instead recorded high growth in hours worked between 2010 and 2016 relative to historical trends. The United Kingdom faced a double whammy of both numerator and denominator effects. While value-added growth is on a par with or lower than prior periods, growth in hours worked is much above long-term averages and in line with the highest growth ever recorded for the economy. In contrast, Italy and Spain have recorded negative growth in hours worked as many younger and low-skill workers lost jobs after the crisis brought the boom to a sudden end. This resulted in relatively strong productivity growth despite low value-added growth. Today, growth in hours worked is starting to pick up in Italy and Spain, resulting in a downward trend in productivity growth. The broad-based pattern of job-rich but productivity-weak recovery across most countries raises the question of why companies are increasing employment and hours without corresponding increases in productivity growth (see Chapter 3 for more details). Also, it highlights the importance of examining demand-side drivers for slow value-added growth in the postrecession period.

Exhibit 6

In many countries, exceptionally low productivity-growth postrecession reflects slowing value-added growth with robust growth in hours worked

Compound annual growth rate
%



1 Looking at these periods allows us to identify short-term factors behind the productivity growth slowdown that are likely to be resolved, and long-term trends that are likely to remain in place.
2 Weighted average across France, Germany, Italy, Spain, Sweden, United Kingdom, and United States, based on 2016 GDP (2016 $ million).
NOTE: Order of countries based on fastest to slowest productivity growth in the 1985–2005 period.

SOURCE: The Conference Board (May 2017 release); McKinsey Global Institute analysis

A SECTOR ANALYSIS ACROSS COUNTRIES REVEALS A LACK OF JUMPING SECTORS AND A BROAD-BASED SLOWDOWN

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. For example, in the United States, 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 that rapid productivity growth was occurring in smaller sectors such as computer and electronic products. Together, these large and rapid growth sectors drove the productivity boom. The same trend can be found in Europe. For example, finance and insurance in Spain and the United Kingdom grew strongly, as did retail and wholesale trade in Sweden, contributing to a large share of jumping sectors in the mid-2000s. Today, the picture is very different in Europe and the United States, with exceptionally few jumping sectors, and accelerating sectors that are too small to have a major impact on aggregate productivity growth (Exhibit 7).[59]

>65%
of all sectors experienced a productivity growth decline

Not only do we see a distinct lack of productivity-igniting sectors, but we also see a broad-based slowdown of productivity growth across sectors after 2010 (Exhibit 8). More than 65 percent of sectors experienced a productivity-growth slowdown in all countries, with the exception of Italy and Spain. In the United Kingdom and the United States, that rate was close to 90 percent; in France, Germany, and Sweden, close to or more than 70 percent. By contrast, in Italy and Spain, productivity-growth postcrisis accelerated in many sectors.

While most sectors experienced declining productivity growth in five out of seven countries in our sample, some sectors contributed disproportionally to the slowdown either because they represent a large share of the economy or because they saw an exceptionally large decline in productivity growth after 2000–04 (Exhibit 9). Three sectors—manufacturing, retail and wholesale trade, and information and communication services—together contributed between 54 and 84 percent of the productivity-growth decline across all countries except Italy and Spain.[60] Retail and wholesale represents a large part of the economy that has seen a moderate decline in productivity growth; manufacturing a large part of the economy that has seen a significant decline in productivity growth; and information and communications services a relatively small part of the economy that has experienced a relatively large decline in growth. Another sector that contributed to the productivity-growth decline in the boom-bust countries of Spain, the United Kingdom, and the United States has been financial services, where a credit contraction as a result of the crisis drove declining productivity growth (for further details on what has driven the trends in these sectors, see Chapter 4).

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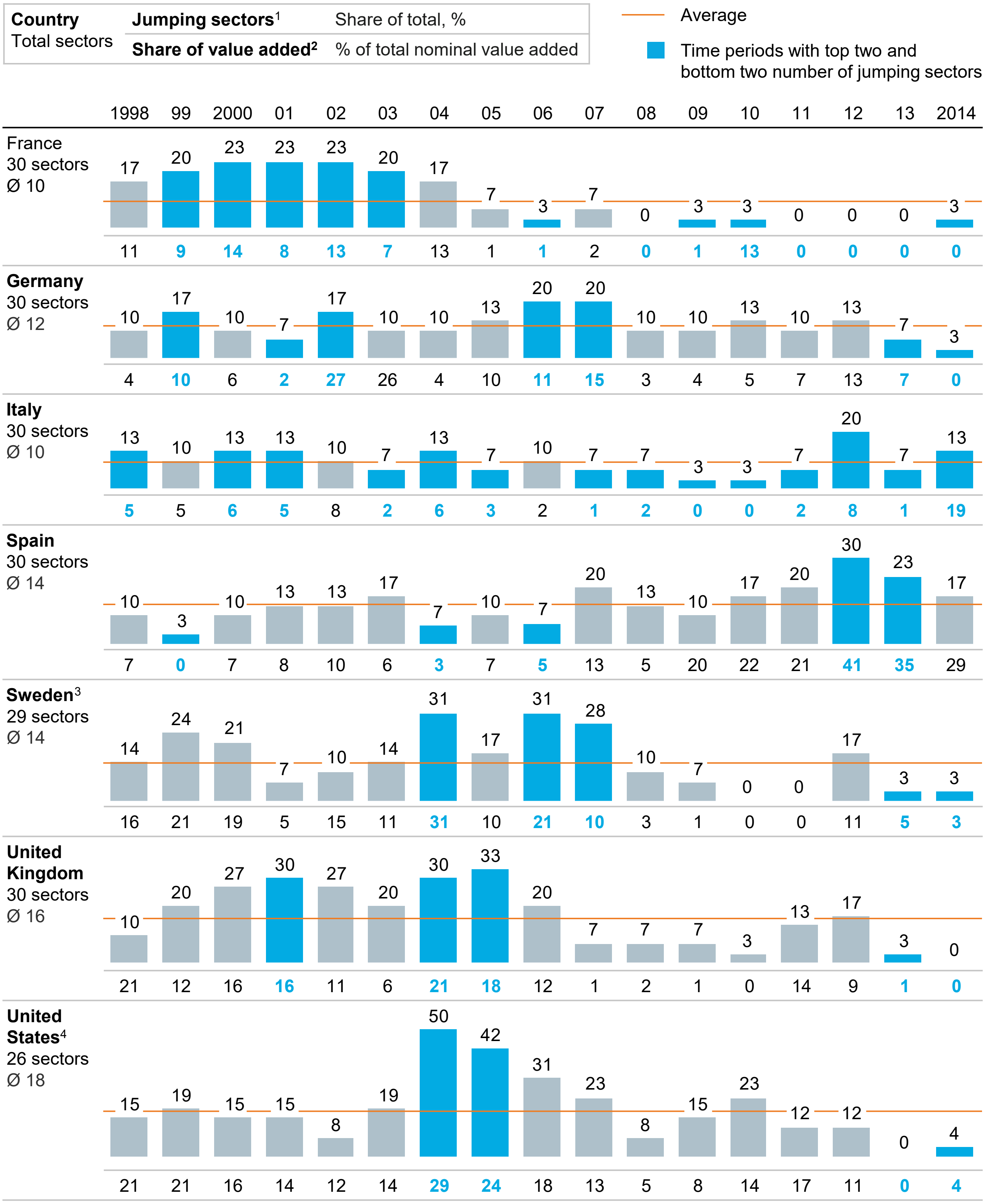
[59] Our findings suggest that the reason it is so hard to predict is that productivity growth is by nature “jumpy” and dependent on underlying sector dynamics and technologies. Research by others shows that past productivity performance has been a poor predictor of future performance. See Erik Brynjolfsson, Daniel Rock, and Chad Syverson, *Artificial intelligence and the modern productivity paradox: A clash of expectations and statistics*, NBER working paper number 24001, November 2017.

[60] Calculated as a share of the total “within effect” contribution of sectors, that is, the contribution due to productivity growth in each sector rather than labor movement across sectors. Other researchers have also found similar contributions from these sectors in the United States. See Alexander Murray, *What explains the post-2004 US productivity-growth slowdown?* CSLS Research Report 2017–05, 2017.

Exhibit 7

Shifts in aggregate productivity growth are the result of individual sectors accelerating and decelerating at different times



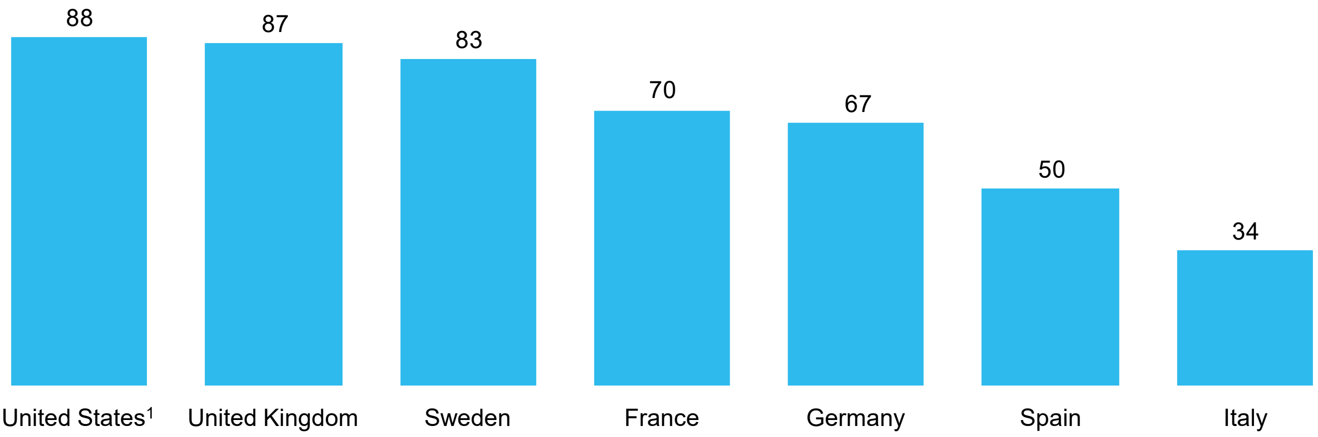
1 A sector is classified as "jumping" in year Y if its compound annual growth rate of productivity for years Y-3 through Y is at least 3 percentage points higher than it was for 1995–2014 as a whole.
2 Based on share in Year Y.
3 Real productivity data are missing for the chemicals and chemical products sector for Sweden in the EU KLEMS 2016 release.
4 US data are for the private business sector only; Europe data are for the total economy.

SOURCE: EU KLEMS (2016 release); BLS Multifactor Productivity database (2016 release); McKinsey Global Institute analysis

Exhibit 8

The productivity-growth decline has been broad-based across most sectors of the economy

Share of sectors with lower labor productivity growth in 2010–14 relative to 2000–04
%



[1] US data are for private sector business only while Europe data are for the total economy.
NOTE: Consists of a sample of ~30 sectors for Europe (based on most granular data available across most countries), and 60 sectors for the United States.

SOURCE: EU KLEMS (2016 release); BLS Multifactor Productivity database (2016 release); McKinsey Global Institute analysis

Exhibit 9

Manufacturing, retail and wholesale trade, finance and insurance, and information and communication services contributed significantly to the decline, but with variations by country

Contribution to productivity-growth difference between 2000–04 and 2010–14 from productivity growth in each sector[1]
Percentage points

🟩 >0.2 🟩 0 to 0.2 🟧 0 to -0.2 🟥 < -0.2 ⬜ n/a

	Subsector	Western Europe						
		France	Germany	Italy	Spain	Sweden	United Kingdom	United States[2]
Primary industries	Agriculture, forestry, & fishing	0.0	-0.1	0.1	0.1	-0.2	0.0	-0.1
	Mining & quarrying	0.0	0.0	0.1	0.0	-0.1	-0.2	0.0
	Electricity, gas, & water supply	-0.1	-0.1	-0.2	-0.2	0.1	-0.2	-0.2
Manufacturing	Total manufacturing	-0.3	-0.3	0.2	0.1	-1.1	-0.6	-1.7
	▪ Electrical & optical equipment	-0.1	-0.1	0.0	0.0	-0.5	0.0	-0.5
	▪ Transport equipment	-0.1	0.0	0.0	0.0	-0.2	0.0	-0.1
	▪ Chemicals & chemical products	0.0	-0.2	0.0	0.0	n/a[4]	-0.2	-0.3
	▪ Other	-0.2	-0.1	0.2	0.1	-0.4	-0.4	-0.7
Sectors experiencing a boom and bust	Finance & insurance	0.1	0.3	0.1	-0.4	0.1	-0.5	-0.3
	Real estate	-0.1	-0.3	0.5	0.4	0.4	0.3	0.1
	Construction	-0.1	0.0	0.1	0.6	-0.4	-0.2	-0.1
Consumer-facing services	Wholesale & retail trade	0.1	-0.2	0.1	0.1	-0.3	-0.2	-0.6
	Transportation & storage	0.0	-0.2	-0.1	0.2	0.1	0.0	-0.2
	Accommodation & food service activities	0.1	0.1	0.1	0.2	0.0	-0.1	-0.1
High-skilled services, and administrative and support services	Information & communication services	-0.2	0.1	-0.3	-0.1	-0.2	-0.4	-0.6
	▪ Publishing, broadcasting, & telecom	-0.1	-0.1	-0.3	-0.1	-0.2	-0.3	-0.2
	▪ IT & other information services	0.0	0.2	0.0	0.0	-0.1	-0.1	-0.4
	Professional, scientific, technical, administrative, & support service activities	0.0	0.1	0.1	0.6	0.0	0.0	-0.4
Other private services	Arts, entertainment, recreation, & other activities	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
Public or quasi-public services	Public administration & defense	0.0	0.0	-0.1	-0.1	0.0	0.0	n/a[4]
	Education	0.1	0.0	0.0	-0.1	-0.1	0.0	0.0
	Health & social work	0.0	-0.1	-0.1	0.0	-0.1	-0.1	0.0
	Total industries[3]	**-0.5**	**-0.7**	**0.6**	**1.4**	**-2.0**	**-2.5**	**-3.8**

1 Impact of productivity growth in each sector on total economy productivity growth. Calculated as the productivity growth of each sector multiplied by its share of total economy value added in nominal terms. Excludes impact of reallocation (share of total labor and relative price movement) across sectors. 2010–13 considered for Italy due to data limitations.
2 US data are for the private business sector only; Europe data are for the total economy. Industries have been mapped as closely as possible between the US NAICS classifications available from the BLS to the ISIC classifications available from EU KLEMS, based on granularity of data available.
3 Based on productivity growth trends in each sector, and reallocation across sectors with different productivity levels. Reallocation effect not shown, therefore the sum of the impact from each sector may not add to the total.
4 Data not available.
NOTE: Numbers may not sum due to rounding.

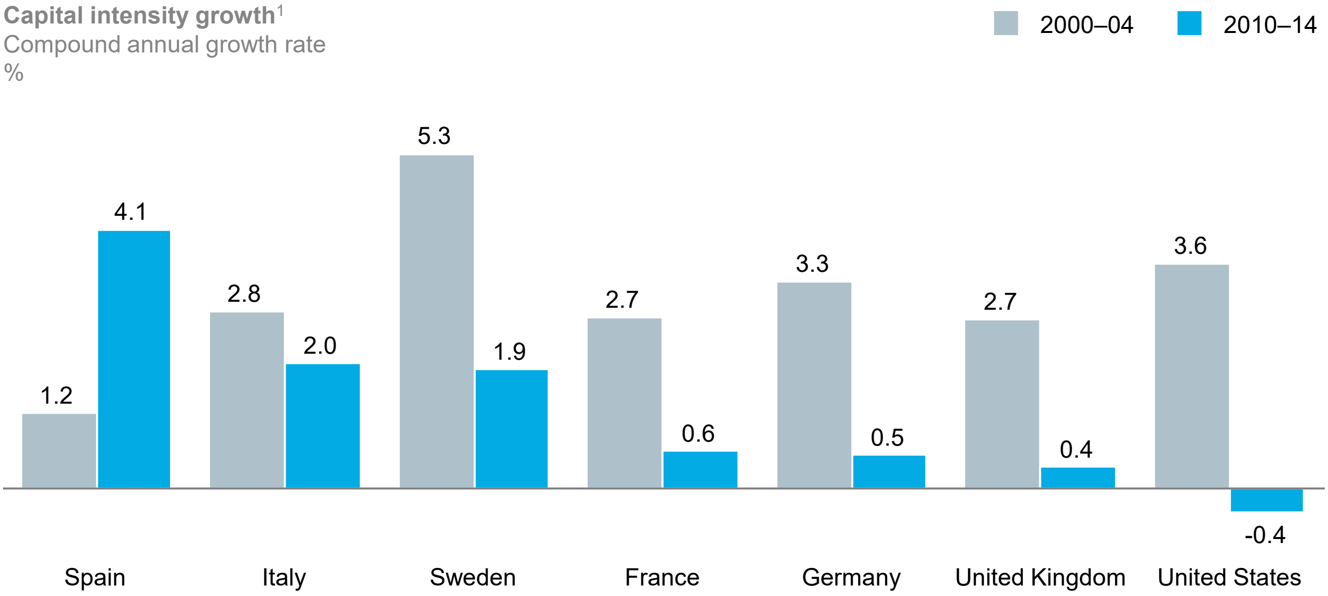
SOURCE: EU KLEMS (2016 release); BLS Multifactor Productivity database (2016 release); McKinsey Global Institute analysis

DECLINING CAPITAL INTENSITY GROWTH CHARACTERIZES THE SLOWDOWN

One important way in which productivity grows is through better tools for workers, such as machines for production, computers and mobile phones for analysis and communication, and new software to better design, produce, and ship products. Since the Great Recession, growth in the average "tool kit" available to workers in developed countries has slowed. Measured as capital intensity or capital per hour worked, the average tool kit has been rising at an exceptionally low rate, playing a key role in declining productivity growth in most countries (Exhibit 10).[61] (See Box 4, "A decomposition of labor productivity reveals that weak capital intensity growth accounts for at least half of the measured productivity-growth decline across countries.") Spain is the exception to this trend due to widespread and dramatic job shedding from 2010 to 2014 as a result of the financial crisis. Italy too experienced labor shedding, and as a consequence has seen a lower decline in capital intensity growth compared to other countries in our sample. The capital intensity growth decline reflects a substantial decline in equipment and structures investment while intangible investment, in areas such as R&D and software, recovered more quickly after a brief and smaller dip in 2009.[62]

Exhibit 10

With the exception of Spain, capital intensity growth (growth of capital services per hour worked) has slowed across economies



1 Capital intensity is capital services per hour worked.

NOTE: Order based on fastest to slowest capital intensity growth in 2010–14. In Italy, the period analyzed is 2010–13 instead of 2010–14 due to data limitations.

SOURCE: EU KLEMS (2016 release); BLS Multifactor Productivity database (total economy, 2016 release); McKinsey Global Institute analysis

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[61] Capital intensity or capital per hour worked worker indicates access to capital like machinery, tools, and equipment and is measured as capital services per hour.

[62] Companies typically see R&D investment as longer term. In industries with rapid speed of technological change, competitive pressure kept investment a priority for companies.

Box 4. A decomposition of labor productivity reveals that weak capital intensity growth accounts for at least half of the measured productivity-growth decline across countries

Labor productivity growth can be decomposed into four factors: capital intensity growth, labor quality growth, total factor productivity (TFP) growth, and change in the mix of labor across sectors with different productivity.[1] Labor quality measures the impact of shifts in factors like education on the productivity of workers.[2] Total factor productivity, often used as a proxy for technological progress, reflects the output of goods and services produced from inputs including labor, capital, energy, materials, and purchased services. This factor decomposition reveals that in all countries experiencing a slowdown, weak capital intensity growth accounts for about half or more of the measured labor productivity-growth decline (Exhibit 11). Slow growth in capital intensity has been an economy-wide phenomenon. Seventy percent or more of sectors in France, Germany, Sweden, the United Kingdom, and the United States saw a lower capital deepening contribution to productivity growth in 2010–14 relative to 2000–04. For Spain, this number was about 50 percent.

Another particularly significant factor for Sweden, the United Kingdom, and the United States has been slowing TFP growth. In other parts of continental Europe, TFP growth has been relatively low or even negative over the last decade for most countries, but has not slowed down (and in some cases increased) and therefore has not contributed to the low labor productivity growth today.[3]

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[1] This analysis is based on the Solow growth accounting framework using data primarily from EU KLEMS and the Bureau of Labor Statistics. Note that this decomposition is a technical accounting, with capital intensity growth reflecting increases in capital relative to labor, labor quality growth reflecting improvements in labor (for example, through skilling), and total factor productivity growth calculated as the residual once these effects are accounted for. Building on this decomposition, we will outline our analyses and interpretation of the causes behind these patterns and the decline in measured labor productivity growth in Chapter 3. In a growth accounting framework, the contribution of capital services per hour worked growth on labor productivity growth is weighted by the capital share of total income. We have also calculated the contribution from productivity growth of each sector (a "within" effect, which weights the contribution of a sector's labor productivity growth by its share of nominal GDP) and the impact of labor and relative price movements across sectors with different productivity levels (a "mix effect"). This was done using the Generalized Exact Additive Decomposition methodology. See Jianmin Tang and Weimin Wang, "Sources of aggregate labour productivity growth in Canada and the United States," *Canadian Journal of Economics*, volume 37, number 2, May 2004, and Ricardo de Avillez, "Sectoral contributions to labour productivity growth in Canada: Does the choice of decomposition formula matter?" *International Productivity Monitor*, number 24, fall 2012. For further details on the calculations done here, please see the technical appendix. For further details on capital services, see *Measuring productivity—OECD manual: Measurement of aggregate and industry-level productivity growth*, OECD, 2001.

[2] Labor quality is typically measured in growth accounting frameworks through the impact of shifts in education, age, and gender on the efficiency of hours worked. Growth in labor services is calculated as the growth rate of each demographic group, weighted by its share of total wages. Labor quality growth is the difference between growth in labor services and growth in hours worked. For additional details, see EU KLEMS methodological materials.

[3] R&D investment may also play a role in explaining the relatively low TFP growth levels of many European countries in the long term compared with the United States. Research suggests that there is a gap between US and European firms in levels of corporate R&D investment and in the ability to translate that investment into productivity gains. Such differences remain even after controlling for the sectoral composition of European vs. US firms. See, for example, Davide Castellani et al., *R&D and productivity in the US and the EU: Sectoral specificities and differences in the crisis*, Henley Business School discussion paper number JHD-2016-03, May 2016; Michele Cincera and Reinhilde Veugelers, *Differences in the rates of return to R&D for European and US young leading R&D firms*, KU Leuven, Faculty of Economics and Business, December 2013; and Reinhilde Veugelers et al., "The impact of Horizon 2020 on innovation in Europe," *Intereconomics*, volume 50, number 1, January/February 2015.

Exhibit 11

Slow productivity growth was accompanied by a decline in capital intensity growth, as well as declining total factor productivity growth in some countries

Contribution to the decline in productivity growth, 2000–04 vs. 2010–14[1]
Percentage points

	Spain	France	Germany	Sweden[2]	Italy[3]	United States[4]	United Kingdom
Labor productivity growth (as measured), 2000–04 (%)	**0.0**	**1.5**	**1.7**	**2.9**	**0.0**	**3.6**	**2.3**
Labor productivity growth (as measured), 2010–14 (%)	**1.4**	**1.0**	**0.9**	**0.9**	**0.6**	**-0.2**	**-0.2**

1 See technical appendix for details on methodology.
2 EU KLEMS data on total factor productivity (TFP) were significantly different compared with other data sources such as The Conference Board and Penn World Tables. Hence, we take the average TFP of the three databases and calculate labor quality as a residual.
3 In Italy, the period analyzed is 2010–13 instead of 2010–14 due to data limitations.
4 US data are for the private business sector only; Europe data are for the total economy.
NOTE: Order of countries based on fastest to slowest productivity growth in 2010–14.

SOURCE: EU KLEMS (2016 release); BLS Multifactor Productivity database (2016 release); McKinsey Global Institute analysis

The TFP growth decline was concentrated in a few sectors such as manufacturing, retail and wholesale trade, information and communication services, and finance and insurance. In the United States, we find the main sectors behind the recent slowdown were manufacturing (notably computer and electronic products, and chemicals, including pharma), information and communication services, and retail and wholesale trade.[4] For the technology-related sectors, one explanation may be that the United States saw a real productivity boom in the decade around 2000, resulting in exceptionally strong benchmark years. The slowdown in the United Kingdom was predominantly related to the financial sector slowdown following the financial crisis and a period of deleveraging and reregulation, but manufacturing and information and communication services also had a negative impact.[5]

This decomposition also reveals that in some countries, the rate at which labor skills and other quality measures are rising is slowing down and played a minor role in suppressing productivity growth.[6] A small drag on productivity resulted from labor quality shifts in Germany and the United Kingdom; both countries integrated large numbers of low-skill workers into the labor force over the past decade.

We also identify a small impact from shifting labor shares between sectors. In 2010–14 relative to 2000–04, the mix effect has been a slight drag in the case of the United Kingdom, neutral for other European countries, and a small positive factor for the United States. In the United Kingdom, this was mainly due to a boom of real estate pre-crisis shifting employment to the sector, which has high measured productivity. Mix shifts within sectors—for example, between different formats in retail, or across different firms within sectors—also have an impact on productivity growth but are not included in the analysis of employment shifts between sectors. Over the long term, we also identify a small impact from mix shift. Our estimates reveal that mix shift acted as a 0.4 percentage point drag per year in the United States between 1987 and 2014 (Exhibit 12). However, the shift away from manufacturing has largely happened, with less than one in ten working in that industry. Differences we see now in the contribution of industry mix to productivity growth are mostly due to the rate of growth of low- vs. high-productivity services. The impact is relatively small and varies by country and time period. Going forward, the mix shift could drag down productivity growth depending on the relative productivity of sectors and their growth.

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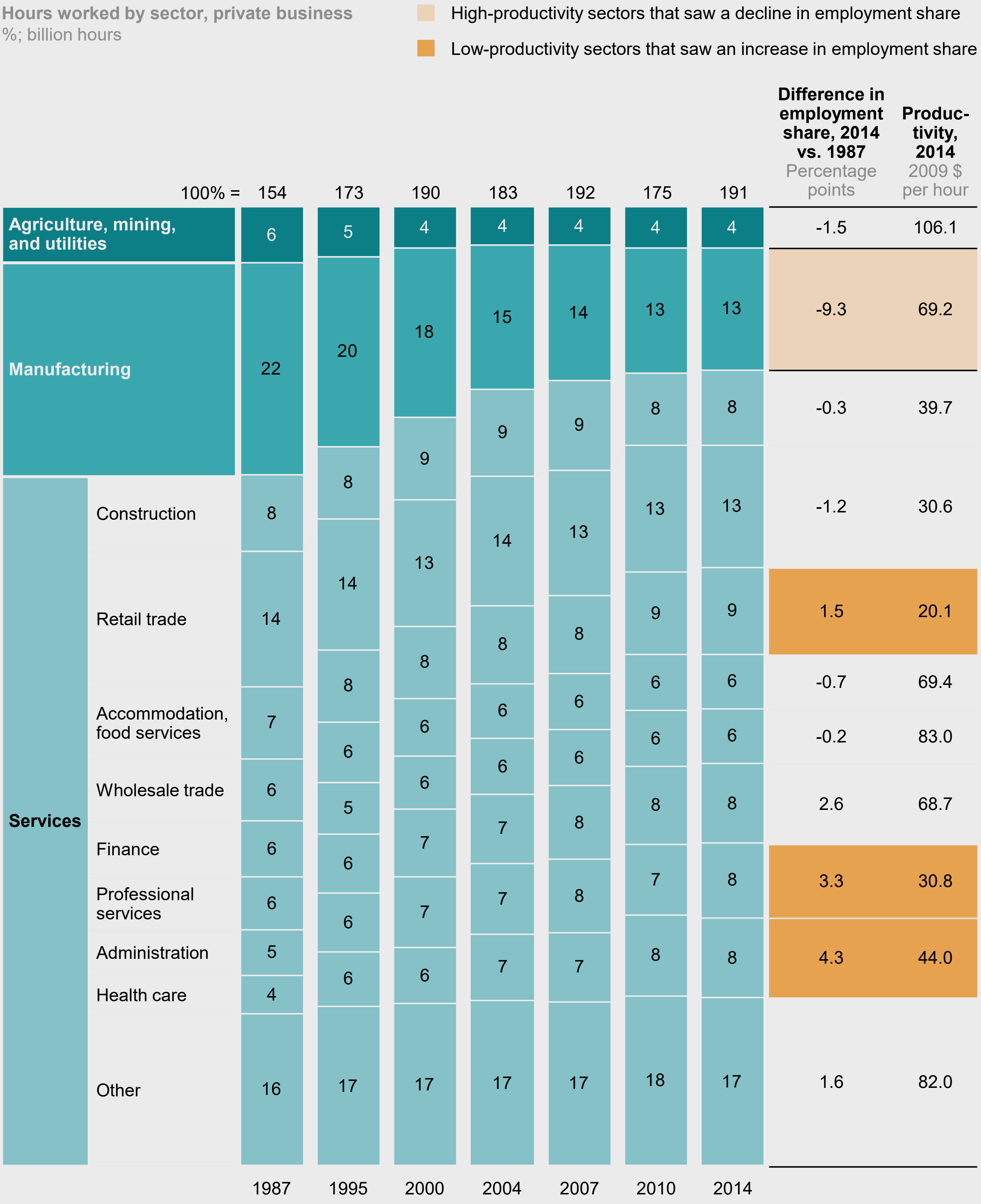
[4] Other researchers have also found large contributions from capital intensity growth and total factor productivity growth in the United States. See, for example, Alexander Murray, *What explains the post-2004 US productivity-growth slowdown?* CSLS Research Report 2017–05, 2017.

[5] Note that we did not conduct a sectoral decomposition of TFP growth in Sweden due to data discrepancies in aggregate TFP growth numbers in EU KLEMS relative to other sources like The Conference Board and Penn World Tables.

[6] One reason for the decline observed in some countries could be the pace at which workers with different skills enter the workforce. The number of low-skill workers in the workforce declined in the early 2000s in these countries. Recently, that trend has either continued at a slower pace or, in some cases, reversed, with low-skill workers being added to the workforce. Aging may also affect the quality of the labor supply, by impacting the skills and experience of the workforce. A mature workforce with more experience could be associated with higher productivity. However, workforce skills depend on knowledge acquired before entering the labor market, and as job requirements change with time, older workers may be disadvantaged. The impact of these trends on productivity growth is debated, with some researchers finding that aging could slow TFP growth by 0.2 percentage point per year over the next two decades, while others find a limited relationship between aging and productivity growth. See, for example, Daron Acemoglu and Pascual Restrepo, “Secular stagnation? The effect of aging on economic growth in the age of automation,” *American Economic Review*, volume 107, number 5, May 2017; Shekhar Aiyar and Christian H. Ebeke, *The impact of workforce aging on European productivity*, IMF working paper number 16/238, December 2016; and Axel Börsch-Supan and Matthias Weiss, “Productivity and age: Evidence from work teams at the assembly line,” *The Journal of the Economics of Ageing*, volume 7, April 2016.

Exhibit 12

A shift toward low-productivity sectors held back US productivity growth between 1987 and 2014



−0.4 percentage point per year
Drag on productivity growth due to mix shift, 1987–2014

NOTE: Based on BLS data for the private business sector. Numbers may not sum due to rounding.

SOURCE: BLS Multifactor Productivity database (2016 release); McKinsey Global Institute analysis

BEYOND BROAD SIMILARITIES ACROSS COUNTRIES, THERE ARE IMPORTANT DIFFERENCES

We find three broadly similar groups of countries: Sweden, the United Kingdom, and the United States, which have experienced the largest productivity-growth decline in our sample; France and Germany, which experienced a less dramatic drop in productivity growth but a continuing long-term decline; and Italy and Spain, with no decline (Exhibit 13). These variations are mainly associated with the strength of the boom prior to the financial crisis, the extent of the crisis itself, and differences in labor market flexibility.

Sweden, the United Kingdom, and the United States experienced a period of exceptionally rapid productivity growth right after the turn of the century. In Sweden and the United States, it was an ICT and restructuring boom, while in the United Kingdom, it was a pre-crisis boom in the financial industry. The common patterns in these countries have been a decline in productivity growth in manufacturing, information and communication services, wholesale and retail in Sweden, the United Kingdom, and the United States, and a decline in the finance and insurance sector in the United Kingdom and the United States. These countries also share a decline in TFP growth that has occurred across these sectors. What differentiates Sweden is that it has experienced a relatively robust recovery due to accelerating value-added growth. Many of the financial-sector reforms put in place after the 1990s recession induced by the financial sector helped improve the robustness of Sweden's financial sector when the financial crisis hit.[63] In contrast, both the United Kingdom and the United States have seen rapid job growth but anemic value-added growth after 2010.

France and Germany experienced less of a boom ahead of the crisis, and therefore the later decline in productivity growth was not as pronounced. In the manufacturing industry, France and Germany saw a productivity-growth slowdown, but it was less pronounced than in Sweden, the United Kingdom, and the United States. The countries have different patterns in hours and value-added growth, though. Germany has seen consistently robust hours growth since the mid-2000s, particularly from integrating low-skill workers into the labor market following labor market reforms that were instituted in the early 2000s and continue today.[64] France, in contrast, has experienced weak value added and weak hours-worked growth as it struggles with long-due labor market reforms.

As discussed earlier, Italy and Spain are similar in that economic growth came to a halt in both countries following the financial crisis. Investment collapsed, but widespread labor shedding drove up productivity and kept capital intensity growth strong. (More recently, productivity growth has begun to fall again.) As a result, these countries are often exceptions in our country sample.

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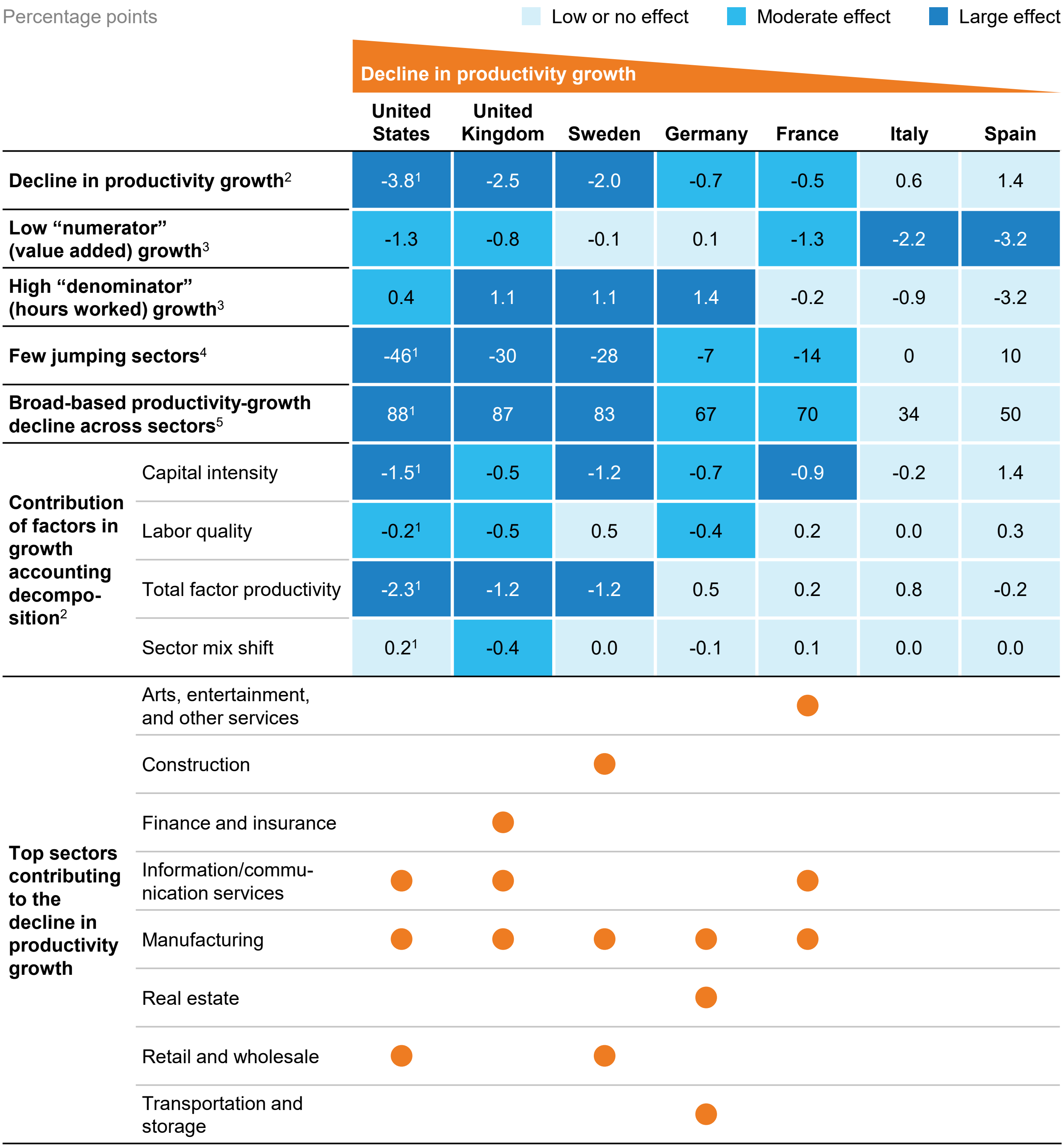
[63] *Debt and deleveraging: Uneven progress on the path to growth*, McKinsey Global Institute, January 2012.

[64] Jacob Funk Kirkegaard, *Making labor market reforms work for everyone: Lessons from Germany*, Peterson Institute for International Economics, policy brief number 14-1, January 2014; *A window of opportunity for Europe*, McKinsey Global Institute, June 2015; *Driving German competitiveness in the digital future*, McKinsey Global Institute, July 2017.

Exhibit 13

The patterns behind the productivity-growth decline reveal similarities and differences across countries



Percentage points

Low or no effect · Moderate effect · Large effect

Decline in productivity growth

		United States	United Kingdom	Sweden	Germany	France	Italy	Spain
Decline in productivity growth[2]		-3.8[1]	-2.5	-2.0	-0.7	-0.5	0.6	1.4
Low “numerator” (value added) growth[3]		-1.3	-0.8	-0.1	0.1	-1.3	-2.2	-3.2
High “denominator” (hours worked) growth[3]		0.4	1.1	1.1	1.4	-0.2	-0.9	-3.2
Few jumping sectors[4]		-46[1]	-30	-28	-7	-14	0	10
Broad-based productivity-growth decline across sectors[5]		88[1]	87	83	67	70	34	50
Contribution of factors in growth accounting decomposition[2]	Capital intensity	-1.5[1]	-0.5	-1.2	-0.7	-0.9	-0.2	1.4
	Labor quality	-0.2[1]	-0.5	0.5	-0.4	0.2	0.0	0.3
	Total factor productivity	-2.3[1]	-1.2	-1.2	0.5	0.2	0.8	-0.2
	Sector mix shift	0.2[1]	-0.4	0.0	-0.1	0.1	0.0	0.0
Top sectors contributing to the decline in productivity growth	Arts, entertainment, and other services					●		
	Construction			●				
	Finance and insurance		●					
	Information/communication services	●	●			●		
	Manufacturing	●	●	●	●	●		
	Real estate				●			
	Retail and wholesale	●		●				
	Transportation and storage				●			

1 US data are for the private business sector only; Europe data are for the total economy.
2 2010–14 vs. 2000–04.
3 2010–16 vs. long-term (1985–2005).
4 Share of jumping sectors, 2014 vs. 2004.
5 Share of sectors with lower productivity growth in 2010–14 vs. 2000–04.
NOTE: Numbers may not sum due to rounding.

SOURCE: McKinsey Global Institute analysis

•••

The patterns of the productivity-growth slowdown point to broad-based factors at work across countries and sectors. They highlight the need to understand demand as well as supply factors, most critically in the case of declining capital intensity growth. In addition, the patterns highlight the critical role capital has played in the slowdown and the unusual dynamic of a job-rich, productivity-poor recovery. However, the differences are important to consider. For example, why has the decline in productivity growth been steeper for countries like Sweden, the United Kingdom, and the United States? While the productivity slowdown has occurred across sectors, manufacturing, retail, and technology stand out as having contributed much more to the slowdown than others. We believe these patterns should be taken into account in any explanation of the productivity-growth slowdown, and we turn to that in the next chapter.

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3. WHY PRODUCTIVITY GROWTH IS NEAR HISTORIC LOWS

As the United States and Western Europe headed into the worst recession since the Great Depression, a productivity boom was ending that had grown out of the first information and communication technology revolution, which began in the mid-1990s, together with a restructuring and offshoring phase. When shocks from the financial crisis hit and the aftereffects persisted, many companies found themselves in an unfamiliar environment of sustained weak demand and heightened uncertainty that held back investment.[65] To further complicate corporate investment decisions, a wave of digitization that continues today swept across economies, containing the promise of accelerating productivity growth while raising the daunting prospect of fundamental transformation of business models, management, and corporate culture that could upend entire industries. These three waves collided in the aftermath of the financial crisis to create a perfect storm that drove productivity growth down to historic lows across countries and sectors.

> When shocks from the financial crisis hit and the aftereffects persisted, many companies found themselves in an unfamiliar environment of sustained weak demand and heightened uncertainty that held back investment.

80%
drop in productivity growth from 2000–04 to 2010–14

In this chapter, we analyze the relative impact of these waves on productivity growth in the United States and Western Europe from the turn of the century (2000–04) to the postrecession years (2010–14). Today, all countries and industries are in the midst of digitization, and we analyze why digitization has not yet shown up in the productivity numbers.

TWO WAVES DRAGGED DOWN PRODUCTIVITY GROWTH BY 1.9 PERCENTAGE POINTS ON AVERAGE ACROSS COUNTRIES BEGINNING IN THE MID-2000S

Productivity growth averaged 2.4 percent per year from 2000 to 2004 across our sample of countries but dropped by about 80 percent to an average of 0.5 percent per year from 2010 to 2014.[66] Three waves collided during that time: a waning of a productivity boom that began in the 1990s, financial crisis aftereffects, including weak demand and uncertainty, and digitization whose productivity benefits have not yet materialized at scale and come with adoption barriers, lags, and transition costs (see Box 5, “The difference between the

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[65] Other researchers have also pointed to the role of the financial crisis and demand impacting growth. See, for example, *Uneven growth: Short- and long-term factors*, IMF World Economic Outlook, April 2015; Gustavo Adler et al., *Gone with the headwinds: Global productivity*, IMF staff discussion note number 17/04, April 2017; *Business investment developments in the euro area since the crisis*, Occasional Paper Series, number 167, European Central Bank, January 2016; Georg Erber, Ulrich Fritsche, and Patrick Christian Harms, “The global productivity slowdown: Diagnosis, causes and remedies,” *Intereconomics*, volume 52, number 1, January/February 2017; Diego Anzoategui et al., *Endogenous technology adoption and R&D as sources of business cycle persistence*, NBER working paper number 22005, February 2016; Claudio Borio, “Secular stagnation or financial cycle drag?” National Association for Business Economics, 33rd Economic Policy Conference, March 5–7, 2017, Washington, DC; Bart van Ark and Kirsten Jäger, *Recent trends in Europe’s output and productivity growth performance at the sector level, 2002–2015*, working paper.

[66] Simple average across the five countries in our sample that saw a decline in productivity growth: France, Germany, Sweden, United Kingdom, and United States.

first ICT boom and the current wave of digitization").[67] We found that the waning productivity boom from ICT and restructuring accounts for about half of the drag over the past decade, and financial crisis aftereffects account for the other half; we do not attempt to quantify the impact of digitization (Exhibit 14).[68] The importance of these first two waves was not equal across countries (Exhibit 15). The end of the productivity boom from the first ICT wave and restructuring mattered more in Sweden and the United States, where the boom had been more pronounced, while the financial crisis aftereffects were felt more broadly across countries.[69]

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[67] We use "restructuring" as shorthand for the restructuring of global supply chains from globalization as well as the gains from improving operational efficiency.

[68] Other researchers have also found similar evidence regarding the role of demand and the waning of the ICT boom. Work by Anzoatequi and others suggests a slowdown in TFP growth was driven by a slowdown in R&D expenditure during the crisis, as well as a slowdown in expenditure to adopt existing technologies, all of which impacted the speed of diffusion. They raise the possibility that the 2000–01 crisis similarly slowed such expenditure, which could be a driver of the pre-crisis slowdown in TFP growth. However, in addition to these effects, they also found that the productivity of R&D investment declined pre-crisis, suggesting a waning of past benefits of innovation. Finally, they find that demand shocks were key drivers of the acceleration in labor productivity growth in the mid-1990s and early 2000s through capital deepening, and that demand has contributed to the slowdown in labor productivity growth since then through both TFP growth and capital deepening. For further details, see Diego Anzoategui, Diego Comin, Mark Gertler, and Joseba Martinez, *Endogenous technology adoption and R&D as sources of business cycle persistence*, NBER working paper number 22005, February 2016, revised March 2017.

[69] For an overview of the methodology used to conduct this sizing, see the technical appendix.

Box 5. The difference between the first ICT boom and the current wave of digitization

We draw a distinction between the first ICT revolution and the current wave of digitization. By the former, we mean the client-server and connectivity revolution of the mid-1990s and early 2000s, centered on broad adoption of software and technology systems, such as corporate enterprise resource planning and database management systems, that were used to improve business processes and operations. For example, MGI research found that productivity growth in retail during this time was enabled by the use of IT investment to help with managing merchandise (for example, demand forecasting), managing supply chains (for instance, purchasing orders and monitoring vendor products), and conducting store operations (for example, managing inventory, scheduling labor, and utilizing point-of-sale systems like barcode scanners and readers).[1]

By digitization, we mean the latest digital technology—such as cloud computing, e-commerce, mobile internet, artificial intelligence, machine learning, and the Internet of Things (IoT)—that is moving beyond process optimization to fundamentally transforming business models, altering value chains, and blurring lines across industries. What differentiates this latest wave is the breadth and diversity of innovations. Beyond improving existing business operations, the innovations create new digital products and features (for example, digital books and live location tracking), introduce new ways to deliver them (for example, mobile directions and streaming video), and enable new business models (for example, Uber and TaskRabbit). The scale of the transformational potential of this latest wave of digital innovations may also be larger.

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[1] *US productivity growth, 1995–2000*, McKinsey Global Institute, October 2001; *How IT enables productivity growth: The US experience across three sectors in the 1990s*, McKinsey Global Institute, October 2002.

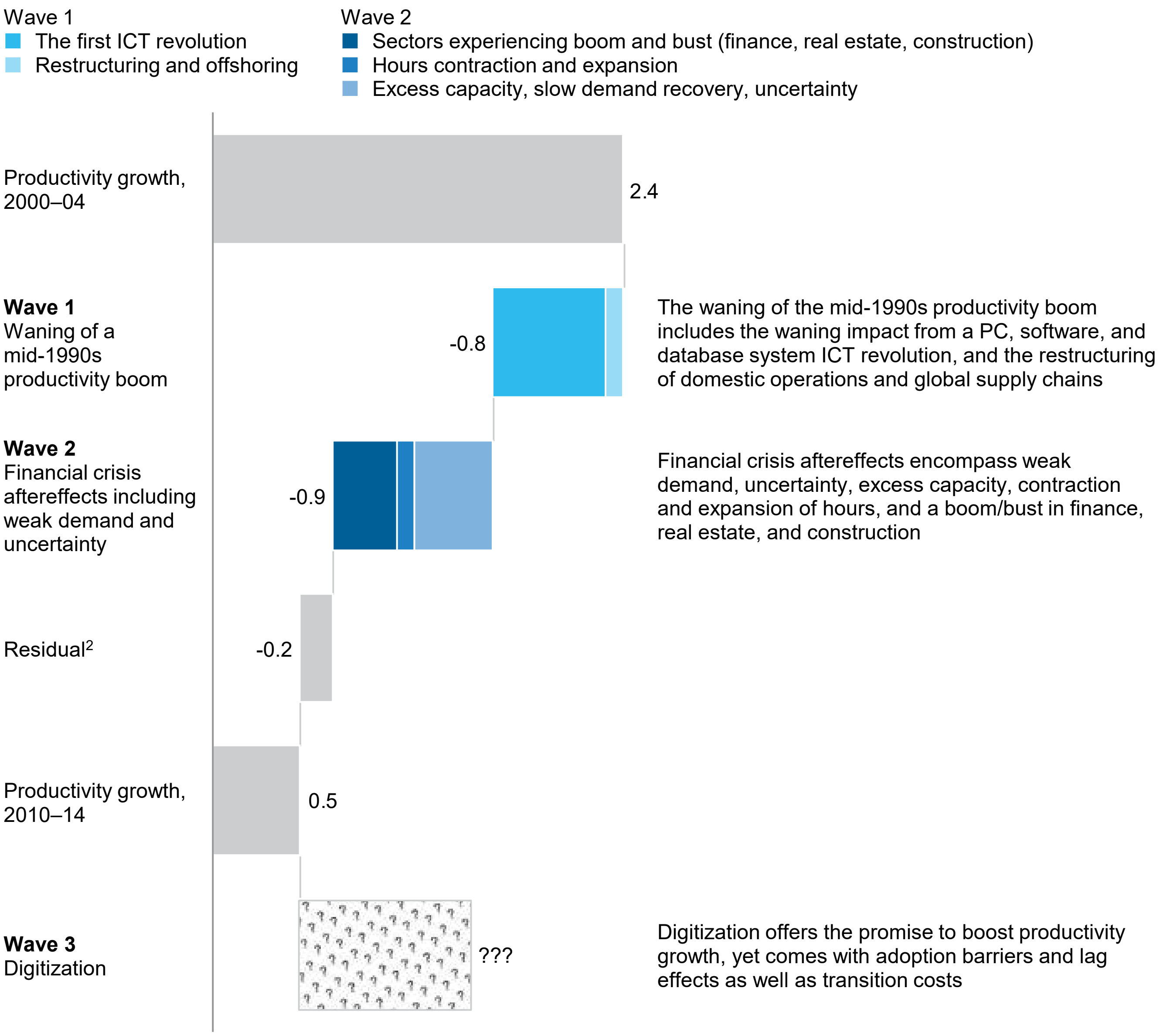
Exhibit 14

The waning of a mid-1990s productivity boom and financial crisis aftereffects have contributed roughly equally to the decline in productivity growth

Contribution to the decline in productivity growth in 2010–14 vs. 2000–04[1]

Simple average of France, Germany, Sweden, United Kingdom, and United States

Percentage points



The waning of the mid-1990s productivity boom includes the waning impact from a PC, software, and database system ICT revolution, and the restructuring of domestic operations and global supply chains

Financial crisis aftereffects encompass weak demand, uncertainty, excess capacity, contraction and expansion of hours, and a boom/bust in finance, real estate, and construction

Digitization offers the promise to boost productivity growth, yet comes with adoption barriers and lag effects as well as transition costs

[1] US data are for the private business sector only; Europe data are for the total economy.

[2] Includes impact of reallocation (share of total labor and relative price movement) across sectors (“mix effect”) and sectors not considered in our analysis. May include some of the impact from transition costs of digital. For further details, see technical appendix.

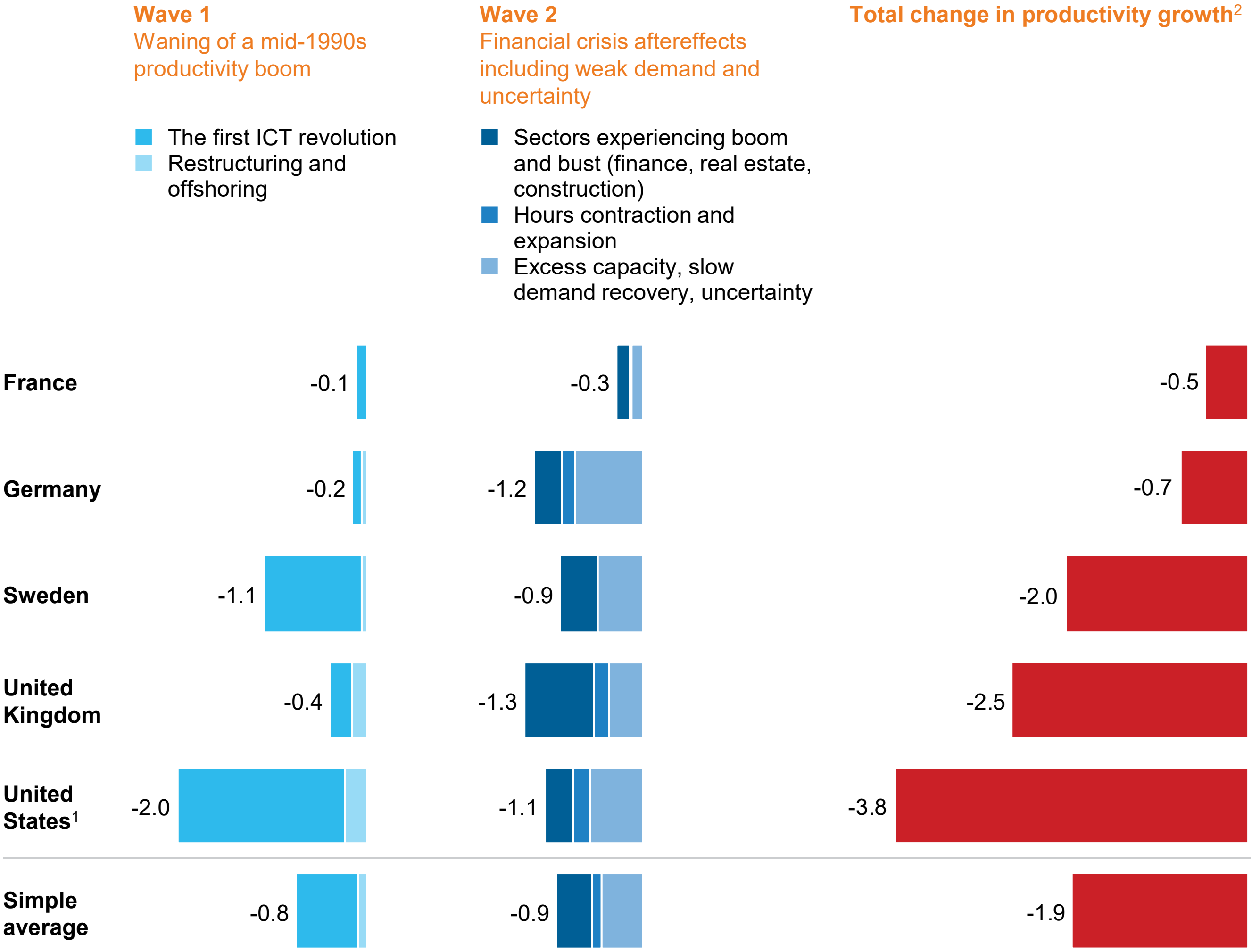
NOTE: Italy and Spain are excluded from this analysis because their productivity growth between these time periods did not decrease. We did not attempt to size the impact from Wave 3 (Digitization). While digitization contains the promise of significant productivity-boosting opportunities, it comes with lag effects and adoption barriers as well as transition costs. The net effect on productivity is unclear. Numbers may not sum due to rounding.

SOURCE: EU KLEMS (2016 release); BLS Multifactor Productivity database (2016 release); McKinsey Global Institute analysis

Exhibit 15

The impact of each wave varies across countries

Percentage point contribution to the decline in productivity growth in 2010–14 vs. 2000–04



1 US data are for the private business sector only; Europe data are for the total economy.

2 Total change in productivity growth also includes the impact of reallocation (share of total labor and relative price movement) across sectors ("mix effect") and sectors not considered in our analysis. May include some of the impact from transition costs of digital. For further details. see technical appendix.

NOTE: Italy and Spain are excluded from this analysis because their productivity growth between these time periods did not decrease. We did not attempt to size the impact from Wave 3 (Digitization). While digitization contains the promise of significant productivity-boosting opportunities, it comes with lag effects and adoption barriers as well as transition costs. The net effect on productivity is unclear. Numbers may not sum due to rounding.

SOURCE: EU KLEMS (2016 release); BLS Multifactor Productivity database (2016 release); McKinsey Global Institute analysis

A 1990S PRODUCTIVITY BOOM DRIVEN BY ICT AND RESTRUCTURING HAD LARGELY WANED COMING INTO THE FINANCIAL CRISIS

Prior to the financial crisis, productivity growth across advanced economies benefited from an unprecedented ICT revolution and restructuring wave. Yet by the time the crisis hit, that wave of productivity benefits had largely been exhausted. The initial wave of the ICT-enabled productivity boom was concentrated in the technology and retail sectors, while manufacturing was at the center of restructuring and offshoring. These three sectors felt the biggest impact. In some countries, such as Sweden and the United States, the effects of a waning productivity boom that began in the mid-1990s were more pronounced than in continental Europe.

The productivity boom from the first ICT wave was anchored in the tech, retail, and wholesale industries

The tech sector was at the heart of the unprecedented ICT boom of the 1990s, creating powerful economy-wide spillover effects, particularly in Sweden and the United States. The productivity boom in the ICT sector itself reflected both a wave of rapid innovations in semiconductor design and manufacturing that raised productivity in the tech sector significantly and translated into higher-quality and higher-value products of downstream computer equipment producers and more efficient processes for retailers.[70] The advances in microprocessor speed and memory capacity as per Moore's law translated into real value increases for customers and annual productivity growth rates in tech manufacturing in the United States of about 18 percent per year. The late 1990s saw intense competition between Intel and AMD, as well as emerging South Korean suppliers, against a backdrop of robust demand from companies investing in ICT technology to enhance their operations and in preparation for Y2K.[71] Industry restructuring following the 2001 tech downturn, focusing on both efficiency and the shift of production offshore, helped sustain productivity gains as employment declined in tech manufacturing. At the same time, a productivity boom in retail was well under way as the sector used technology to transform supply chains introduced by large-format retailers such as Walmart and Tesco.[72] In addition, rapid declines in ICT equipment prices encouraged an investment boom even in other sectors such as tourism and professional and business services. Across the economy, companies found ways to evolve business processes in an internet-enabled world, often with the help of an expanding ICT services and software sector, boosting productivity growth as computers sped up and eased many tasks, from travel booking to data analysis.

By the mid-2000s, the productivity-growth benefits from that initial wave of ICT innovation had largely matured. The tech sector was shifting from manufacturing to software and services as a large share of manufacturing had moved from advanced economies to Asia and nearshore assembly locations in Mexico and Eastern Europe. Manufacturing declined from 41 percent of US tech employment in 2000, for example, to 27 percent in 2014. Software services continued to grow robustly, but the rate of productivity improvements in the more customized, less scalable activities was slower. The semiconductor industry, a major productivity contributor during the ICT boom, found that the proliferation of electronic devices and applications led to fragmentation and more specialized needs for performance. The shift to mobile and image-rich use required chips to be optimized for graphics in much more limited power use rather than just clock speed. Smartphones only made up about 4 percent of the total devices market in the United States in the mid-2000s; today, that number is close to 50 percent.[73] Specialized uses added further complexity. Think of bitcoin mining co-evolving with innovations in Field Programmable Gate Arrays (FPGAs) and dedicated ASICs arrays and expanding range of electric vehicles enabled by dramatic improvements in power semiconductor performance.[74] While competition remains strong, sustaining the pace of innovation has become more complex across more fragmented

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[70] *How IT enables productivity growth: The US experience across three sectors in the 1990s,* McKinsey Global Institute, October 2002.

[71] For a detailed description of the semiconductor industry dynamics at this time, see *US productivity growth 1995–2000*, McKinsey Global Institute, October 2001, and *Productivity led growth for Korea*, McKinsey Global Institute, March 1998.

[72] *How IT enables productivity growth: The US experience across three sectors in the 1990s*, McKinsey Global Institute, October 2002.

[73] Based on data from *IDC Worldwide Black Book Standard Edition*, 2017.

[74] The way output of tech manufacturing has been measured creates additional challenges for interpreting the productivity-growth slowdown. For more details on measurement challenges in the tech sector, see Chapter 4.

market. Productivity growth declined by roughly 14 percentage points in the US tech sector in 2010–14 compared to 2000–04.[75]

The benefits from restructuring and globalization of supply chains had waned

The benefits of globalization and the transformation of supply chains and restructuring boosted productivity growth in manufacturing at different times across countries. However, by the mid-2000s, many transformations were completed, and by 2010–14, restructuring efforts slowed, especially in the United States.

Few industries exemplify this trend as well as auto manufacturing. In the 1990s and early 2000s, the United States auto sector experienced an acceleration and expansion of vehicle content and restructuring through the regionalization of value chains, automation, and process improvements. An increase in competition from foreign original equipment manufacturers (OEMs) intensified pressure on automakers to reduce costs and restructure operations. Especially after the 2001 downturn, more intense price competition meant operational productivity improvements were critical for firms to expand content in a cost-effective way. Since then, many of the relatively "easy" efficiency gains have been realized, though enhancing operational efficiency continues to be an OEM focus.

30%
the drop in low-wage production jobs in US computer and peripheral equipment manufacturing between 2002 and 2004 due to restructuring

In the case of tech manufacturing, the waning productivity boom and the saturation of the benefits from globalization are intertwined. From 2000 to 2004, the number of jobs in tech manufacturing fell by 26,000 and 120,000, respectively, in Sweden and United Kingdom, shrinking the number of jobs by 27 percent and 30 percent over that time and indicating a restructuring of the industry and a shift in jobs to lower-cost countries during this period.[76] In another example, low-wage production jobs in the US computer and peripheral equipment manufacturing sector fell by about 30 percent, from 55,000 to 39,000, between 2002 and 2004. This trend has since slowed, however, and it is unlikely that we will see as dramatic a shift in global value chains in the near future. The slowing of this trend can also be seen in the import penetration numbers for tech manufacturing in the United States. From 1997 to 2005, import penetration increased in computer and electronic products from 36 percent to 49 percent, whereas from 2010 to 2015 it increased at a much slower rate, from 56 percent to 59 percent.

The utilities sector is another example of the waning of a liberalization-driven restructuring wave by the mid-2000s. During the 1990s and 2000s, European countries deregulated parts of the power sector, opening them up for competition. This included generation, which allowed many suppliers to provide power to a grid, and resellers who could sell electricity to consumers. In the United States, deregulation began in the late 1990s and varied by state. This meant that the value chain around the electricity distribution networks, still owned by a regulated monopoly, were rapidly transforming. The competition in generation and reselling helped drive operational efficiency gains. For example, providers focused on issues such as route optimization while conducting maintenance and bundling inspections. The use of performance-based ratings schemes, particularly in Europe, where revenues were

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[75] Other researchers have also pointed to the importance of the waning of the ICT boom. See, for example, John Fernald and Bing Wang, "The recent rise and fall of rapid productivity growth," *FRBSF Economic Letter*, Federal Reserve Bank of San Francisco, 2015. They find that the recent slowdown in total factor productivity growth in the United States predates the financial crisis. They link the slowdown to the pause or end of the boom associated with information technology—in industries that both produce and use the technology. Recent evidence also finds that prices for high-tech products may have fallen more rapidly than captured in official GDP statistics, implying a reallocation of TFP growth across sectors. As a consequence, the research finds that TFP has grown at a faster rate for high-tech sectors than suggested by official statistics, and has grown at a slower pace in other parts of the economy. These adjustments still imply a slowdown in TFP growth in the tech sector, but the magnitude of the slowdown is smaller by about two percentage points between 1995–2004 and 2010–15, as compared with the official statistics. For details, see David Byrne, Stephen Oliner, and Daniel Sichel, *Prices of high-tech products, mismeasurement, and pace of innovation*, NBER working paper number 23369, April 2017.

[76] Based on data from EU KLEMS for the electrical and optical equipment sector.

dependent on achieving operational efficiency gains, also drove productivity improvements in the sector. However, much of these changes had been completed by the mid-2000s.

FINANCIAL CRISIS AFTEREFFECTS, INCLUDING WEAK DEMAND AND HEIGHTENED UNCERTAINTY, FURTHER HELD BACK PRODUCTIVITY GROWTH

The Great Recession was not as severe as the Great Depression, but in many ways the most recent economic downturn has been different from other recessions in the past half century.[77] The depth of the downturn was the most severe of any recession in the postwar era. Then the recovery was slow, linked with deleveraging by households and corporations, and characterized by uncertainty and low expectations for future growth on the part of individual consumers as well as companies, all of which played a role in constraining demand.[78] Longer-term factors such as slowing population growth and aging, as well as rising inequality and declining labor shares of income, may have contributed to the slow recovery, too.[79]

⅓

the increase in household debt relative to income in Spain, the United Kingdom, and the United States between 2000 and 2007

Early on, some economists considered the recovery "jobless" because employment took so long to recover, and indeed, employment is still below pre-crisis levels in countries such as Spain and the United States.[80] But since 2010, steady hiring has continued to expand employment and hours have continued to grow for longer than in most previous recoveries, creating what we term a "job-rich" recovery. This sustained rate of growth in hours, while demand and investment remained weak, has drained productivity growth across countries.

Unlike the ICT-enabled productivity boom, which was more pronounced in Sweden and the United States, the aftereffects of the financial crisis were felt across all countries. The broad-based impact helps explain the patterns we outlined in the previous chapter: weak numerator and strong denominator growth, together with declining capital intensity growth that created a job-rich but productivity-weak recovery.

The crisis created a severe demand shock that led companies to cut hours and investment

Demand for goods and services across countries and industries dropped sharply in the financial crisis as incomes contracted, people lost jobs, and the credit impulse reversed.[81] Real private consumption growth on the part of households declined from 3.9 percent between the mid-1990s and early 2000s to 1.0 percent between 2005 and 2010 in the United States, and from 3.9 percent to 0.2 percent in the United Kingdom in the same periods. In the pre-recession years, consumer spending on real estate, cars, and other consumer goods was boosted by a dramatic acceleration in household debt. Between 2000 and 2007, household debt relative to income rose by one-third or more in Spain, the United Kingdom, and the United States.[82] This was accompanied by, and contributed to, rising housing prices. When housing prices started to decline and the financial crisis hit, the struggle to keep up with and reduce this debt amplified a sharp contraction in

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[77] See Chapter 1, Box 2, "How the Great Recession was different."

[78] Similar to our observation of the critical role of demand, uncertainty, and low investment in dragging down productivity growth in "wave 2" of our analysis based on sector and firm level understanding, Carlin and Soskice argue with a more theoretical underpinning that the economy might have shifted from a "Wicksellian" to a "Keynesian" equilibrium, characterized by near-zero inflation, real interest rates, wage growth, and nominal interest rates near the zero lower bound, where aggregate demand and uncertainty constrain investment and productivity growth; see Wendy Carlin, David Soskice, "Stagnant productivity and low unemployment: Stuck in a Keynesian equilibrium," *Oxford Review of Economic Policy*, volume 34, numbers 1–2, 2018.

[79] See Chapter 5 for more details.

[80] See Natalia A. Kolesnikova and Yang Liu, *Jobless recoveries: Causes and consequences*, Federal Reserve Bank of St. Louis, 2011.

[81] Measured as acceleration/deceleration in debt-to-GDP ratios and thus indicative of the role of borrowing in impacting demand. See, for example, Michael Biggs and Thomas Mayer, *Bring credit back into the monetary policy framework!* Political Economy of Financial Markets policy brief, 2013.

[82] *Debt and (not much) deleveraging*, McKinsey Global Institute, February 2015.

consumption.[83] After 2007, households in these countries hard hit by the crisis began paying down debt. In the United States auto sector, production volumes of vehicles fell by about 50 percent between 2007 and 2009 (data from IHS Markit, 2017), while in retail, demand growth slowed by roughly one percentage point compared with the pre-crisis period (data from BLS).

The sharp fall in demand for goods and services resulted in significant excess capacity, a contraction of jobs and workers' hours, and a pullback of investment. In most countries, companies reacted to the demand shock by cutting hours worked, through both cutting jobs, as in the United States, and contracting the hours of each worker, as in Germany, particularly in hard-hit manufacturing and the boom-bust sectors of finance, real estate, and construction. The contraction of hours was so dramatic in the United States that it briefly increased productivity growth in 2009 and 2010. Capacity utilization fell, for example, from 79 percent in 2007 to 65 percent in 2009 in United States manufacturing, and 84 to 72 percent in the same period in European manufacturing.[84] With low demand and excess capacity, investment, particularly in equipment and structures, fell significantly (Exhibit 16). This was particularly true in Spain, the United Kingdom, and the United States, the three countries with the biggest real estate booms prior to the crisis.[85] For example, real investment in structures—including investment by companies as well as household investment in residential real estate—fell 23 percent and 26 percent between 2007 and 2009 in the United States and the United Kingdom, respectively.[86]

26%
the decline in investment in structures in the United Kingdom between 2007 and 2009

It is notable that investment in intellectual property (which includes investment in R&D and software) largely bucked the trend and either continued to grow or quickly rebounded across countries. In technology and innovative industries with large R&D budgets, the race to stay competitive in a fast-evolving market did not slow down with GDP. The pressure to adapt and adopt emerging digital technologies was another powerful incentive to innovate that was felt across most industries. Yet, as we discuss below, the weak economic environment as well as other factors slowed investment in machinery, equipment, and buildings and the speed at which productivity benefits from such investment came to fruition.

A weak demand recovery impacted productivity growth in other ways, such as through a shift to lower value-per-unit consumer goods

By the end of 2009, the crisis reached a turning point, with GDP levels in the United States bottoming out. However, the unusual depth of the crisis resulted in a prolonged recovery. In Europe, the recovery was further complicated by the sovereign debt crisis and a double-dip recession in 2011.

Households lost jobs or income and adjusted their consumption baskets by shifting to lower-value products. In the auto sector, in the early 2000s, customers shifted to purchasing higher-value-added SUVs and premium vehicles in both the United States and Germany, boosting productivity growth by 0.4 to 0.5 percentage point in the sector. Today, that trend has slowed in both countries, contributing only 0.3 percentage point to productivity growth

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[83] Researchers highlight various mechanisms by which this could occur. Indebted households may be holding back consumption in order to reduce their leverage, may be constrained from additional borrowing given tight lending conditions, or may be unable to refinance existing mortgages to take advantage of lower interest rates. See, for example, Karen Dynan, *Is a household debt overhang holding back consumption?* Brookings Papers on Economic Activity, spring 2012.

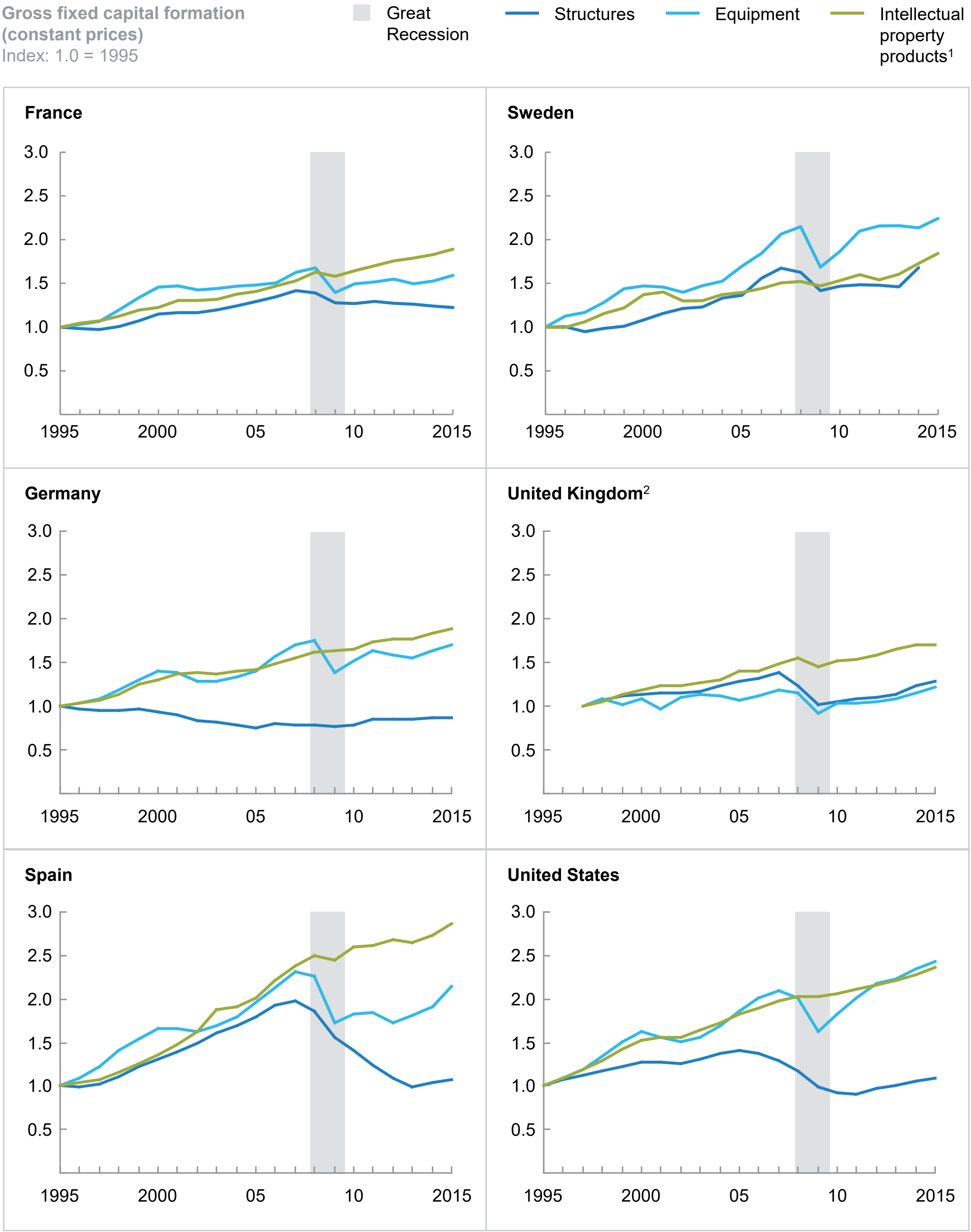
[84] US numbers based on data on industrial production and capacity utilization published by the Federal Reserve; European data based on business and consumer survey data published by Eurostat for EU-28 countries.

[85] *Debt and deleveraging: The global credit bubble and its economic consequences*, McKinsey Global Institute, July 2011.

[86] The decline in household investment may also have had spillover effects to other parts of the economy, as households may have spent less on the home-related durables and home improvement sectors. See Efraim Benmelech, Adam Guren, and Brian T. Melzer, *Making the house a home: The stimulative effect of home purchases on consumption and investment*, NBER working paper number 23570, July 2017.

Exhibit 16

Investment in structures and equipment fell significantly during the crisis while intellectual property investment was less affected



1 “Computer software and databases,” “Research and development,” and “Other intellectual property products.”
2 UK data starts in 1997 due to data availability and is indexed to that year.

SOURCE: OECD (November 2017); EU KLEMS (2017 release) for United Kingdom only due to data availability; McKinsey Global Institute analysis from 2010 to 2014. Similarly, in retail, MGI estimates that consumers shifting to higher-value goods, for example higher-value wines or premium yogurts, contributed roughly 45 percent to the 1995–2000 US retail productivity acceleration.[87] After the recession, this trend reversed, bringing productivity growth down as the value per unit sold declined. This subsequently waned, dragging down productivity growth.

The drop in demand also reduced productivity in sectors such as finance that experienced a boom followed by a bust. In the financial sector in Spain, the United Kingdom, and the United States, productivity-growth declined as lending volumes decreased across branch networks, while it was not possible to correspondingly reduce branch footprint, IT infrastructure, and associated staff. This, and the impact of other boom-bust sectors like construction and real estate, dragged down productivity growth by roughly 0.4 percentage point on average across countries, with a notable impact in the United Kingdom of 0.7 percentage point due to the country's high exposure to financial services.

By reducing the scale economies in network industries with large fixed assets like electric utilities, demand contraction further dampened productivity growth. Demand for power flattened both because of the decline in economic activity during the crisis and because energy efficiency policies led to reduced end-user demand. This led to flat or declining productivity of the workers needed to support electricity distribution and the grid infrastructure, while the buildup of renewables added new headcount.

As demand recovered, companies expanded hours—but excess capacity, weak wages, and the sluggishness of the recovery limited investment needs

When demand started to recover, many industries had excess capacity and room to expand and hire without needing to invest in new capacity. The rebound in hours worked growth was most noticeable in sectors, such as auto, retail, professional and support services, construction, and finance, that saw hours worked contract during the crisis (Box 6,

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[87] *US productivity growth 1995–2000*, McKinsey Global Institute, October 2001.

Box 6. Changes in demand determined where jobs were lost and created

In the United States, the financial crisis resulted in job losses across many occupations, particularly those linked to cyclical demand trends and low-wage jobs. Six occupations—production jobs, office and administrative support jobs, construction jobs, transportation and material moving occupations, sales occupations, and food preparation and serving occupations—accounted for the bulk of the contraction in jobs between 2007 and 2010 (Exhibit 17). Some of the rehiring has therefore occurred in occupations that contracted as a result of a demand shortfall and has returned with demand (for example, sales, transportation, and production). Other occupations, which fell slightly or grew more slowly during the crisis, have returned to their pre-crisis robust growth. They include food preparation, business and financial operations, personal care, computer and math, and health care, while office and administrative support occupations have not been added back.[1] Also, the initially slow growth of construction jobs could be linked with the relatively slow increase in housing investment in the recovery; 2014–17 saw a stronger recovery in construction hours.[2]

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[1] Compliance occupations are sometimes discussed in this context, as the Dodd-Frank Wall Street Reform and Consumer Protection Act and other regulations were put in place after the recession. Although rapidly growing, compliance officers represent a small fraction of the US workforce, 0.2 percent in 2014. During the crisis, the number of such jobs fell, reflecting a decline in the government sector. Since then, these jobs have increased by 5 percent per year, not just in finance but across sectors such as professional, scientific, and technical services, health care, and so forth.

[2] *Reinventing construction through a productivity revolution*, McKinsey Global Institute, February 2017.

Exhibit 17

In the United States, many occupations with strong hiring in 2010–14 also saw significant contraction during the crisis

▨ Occupations with significant losses and gains

Occupation	**Share of total jobs** % of 2014 total	**Jobs added as % of total in initial year** 2003–07	2007–10	2010–14	**2014 annual wage** Index (maximum = 100)
▨ Food preparation and serving-related occupations	9.1	0.8	-0.2	1.0	19.5
▨ Sales and related occupations	10.5	0.6	-0.7	0.6	34.4
Business and financial operations occupations	5.1	0.8	0.1	0.6	64.4
Personal care and service occupations	3.1	0.2	0.1	0.6	22.2
Management occupations	5.0	-0.3	0	0.6	100.0
▨ Transportation and material moving occupations	6.8	0.2	-0.8	0.6	30.6
▨ Production occupations	6.6	-0.1	-1.4	0.6	31.5
Computer and mathematical occupations	2.8	0.3	0.1	0.4	74.6
Health-care practitioners and technical occupations	5.8	0.5	0.3	0.4	67.6
Installation, maintenance, and repair occupations	3.9	0.1	-0.3	0.3	40.2
▨ Construction and extraction occupations	3.9	0.5	-1.2	0.2	41.4
Building and grounds cleaning and maintenance occupations	3.2	0.1	-0.2	0.2	23.4
Architecture and engineering occupations	1.8	0.1	-0.2	0.1	72.5
▨ Office and administrative support occupations	16.0	0.5	-1.3	0.1	31.6
Education, training, and library occupations	6.2	0.4	0.1	0	39.1
Health-care support occupations	2.9	0.3	0.3	0	62.3
Other occupations[1]	7.2	0.5	-0.1	0.3	n/a
Total	**100.00**	**5.4**	**-5.4**	**6.4**	**n/a**

1 Includes occupations with less than 2.5% share of employment in 2014, and less than 0.1% increase in employment between 2010 and 2014.

NOTE: Includes filled jobs, whether full- or part-time, temporary or permanent. This data set includes some exclusions (for example, self-employed workers, most agricultural workers on small farms, members of the armed forces, and so on). Numbers may not sum due to rounding.

SOURCE: BLS, Quarterly census of employment and wages; McKinsey Global Institute analysis

"Changes in demand determined where jobs were lost and created").[88] The impact of this hours expansion was to slow down productivity growth by 0.1 percentage point on average across countries, in particular playing a role in Germany, the United Kingdom, and the United States.

Wages also influence whether companies increase investment. The pressure for companies to improve labor productivity by substituting capital for labor has eased as wage growth has slowed. Our interviews with companies suggest that flat wage rates in United States retail have reduced the pressure on companies to invest in technologies like automated checkout and help explain their slow rollout.[89] Low wages have also contributed to the rise of low-productivity sales and service staff such as greeters. A final factor impacting investment in certain sectors was access to funds. Our interviews suggest that OEMs in the auto sector, for example, pulled back investment on equipment during the crisis due to cash constraints, and subsequently grew investment postcrisis in line with returning demand.

Where does the recovery stand? Some crisis effects linger, while long-term drags and worries about the robustness of future growth persist

Even though most indicators suggest that the downturn is behind us, aftereffects still linger a decade after the crisis. Compared with pre-crisis trends and longer-term patterns, investment is still low, particularly in housing, but also when looking at business investment in parts of Europe (Exhibit 18).[90] While employment and hours growth is still strong, wage growth and inflation are more muted, demand for credit remains sluggish, and companies tell us they can ramp up production by some 5 to 15 percent overnight without adding resources.[91] The slow pace of the recovery and risk aversion mean that capital intensity growth remain near postwar lows. Debt formation is increasing compared to the postcrisis lows in the United Kingdom and the United States and is providing a positive credit impulse.[92] However, the level of new debt formation remains relatively low.

We find that business investment primarily follows demand and demand expectations, but that uncertainty acts as a constraint, too (see Box 7, "What drives corporate investment decisions?"). Even after the postrecession macroeconomic volatility subsided, many business leaders have been left with a sense of heightened economic, political, and technological uncertainty.[93] Corporations have incorporated broader ranges of GDP growth and political and regulatory scenarios into their projections. Our interviews with business executives strongly suggest that companies are waiting to see what happens to policies involving Brexit, for instance, and data storage domicile laws in Europe. Weak "animal spirits," reflected in low expectations for future growth on the part of individual consumers as well as companies, may be constraining demand and investment.[94]

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[88] While most of the growth in hours worked between 2010 and 2014 came from cyclical or boom-bust sectors recovering, strong hiring in public services, in particular education, health, and social work, also occurred. This points to an ongoing long-term shift in these economies toward these categories of service sectors.

[89] See, for example, Sebastian Vanderzeil, Emma Currier, and Michael Shavel, *Retail automation: Stranded workers? Opportunities and risks for labor and automation*, Investor Responsibility Research Center, May 2017. For a review of findings related to the role of minimum wages in impacting employment, see David Neumark, *Employment effect of minimum wages*, IZA World of Labor, May 2014. Interestingly, even when retailers are investing in automation, they have tended to move existing workers to other jobs such as food service to keep store service levels up to improve customer engagement.

[90] See Guntram Wolff, "German current account surplus is 'highly unusual,'" CNBC, January 18, 2018.

[91] *McKinsey Quarterly* survey, March 2017; *European business: Overcoming uncertainty, strengthening recovery*, McKinsey Global Institute, May 2017.

[92] Michael Biggs and Thomas Mayer, *Bring credit back into the monetary policy framework!* Political Economy of Financial Markets policy brief, 2013.

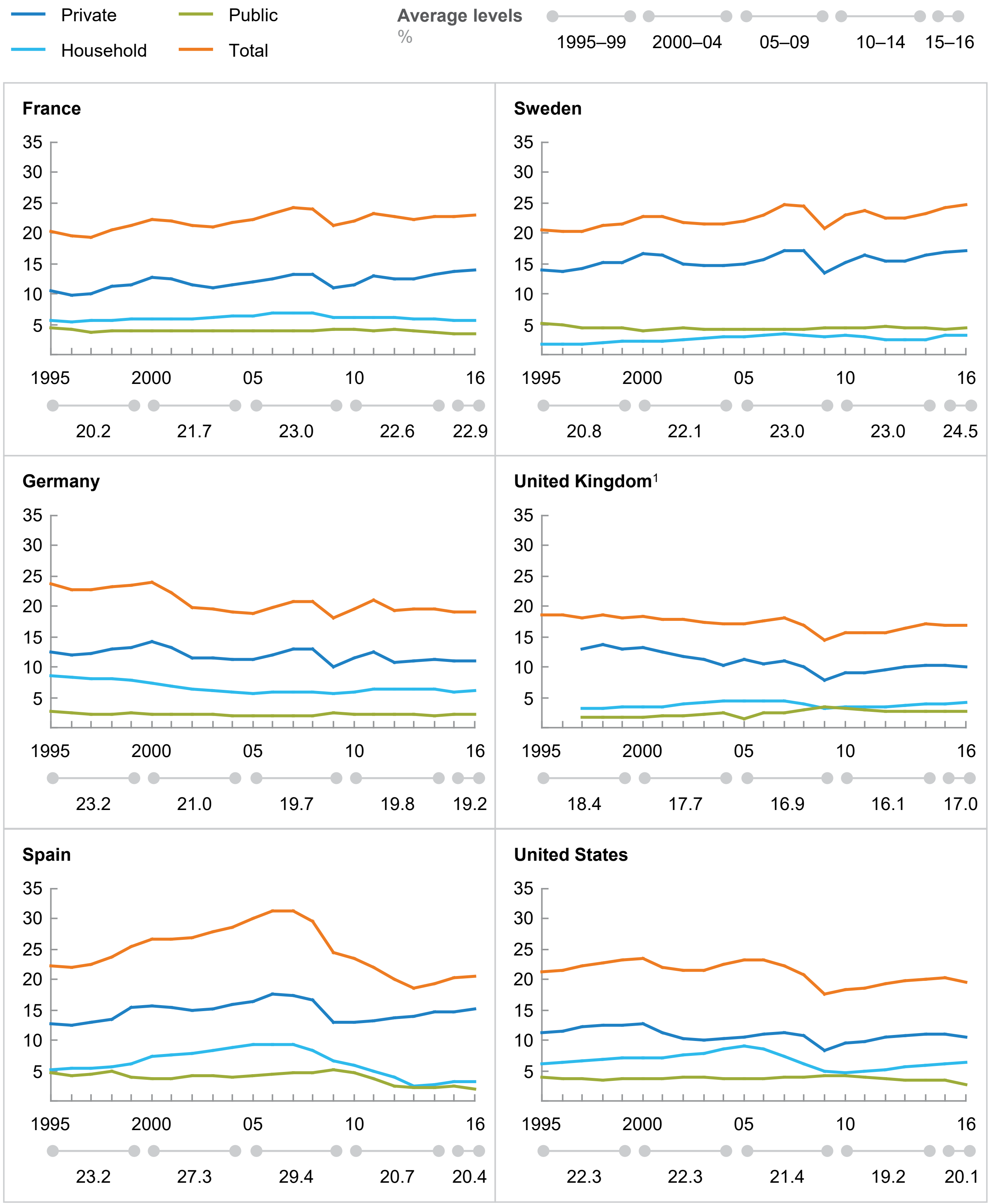
[93] For example, see Christine Lagarde, "The challenge facing the global economy: New momentum to overcome a new mediocre," speech at Georgetown University School of Foreign Service, October 2, 2014; William H. Gross, *On the "course" to a new normal*, PIMCO, September 2009; and Richard Dobbs, James Manyika, and Jonathan Woetzel, *No ordinary disruption: The four global forces breaking all the trends*, PublicAffairs, 2015.

[94] Olivier Blanchard, Guido Lorenzoni, and Jean-Paul L'Huillier, *Short-run effects of lower productivity growth: A twist on the secular stagnation hypothesis*, policy brief number 17-6, Peterson Institute for International Economics, February 2017.

Exhibit 18

Investment as a share of GDP fell during the crisis; since then it has started to recover but remains below pre-crisis levels in some countries

Gross capital formation as a share of GDP
Current prices



[1] UK data by owner group not available for 1995 and 1996.

SOURCE: AMECO (November 2017 release); McKinsey Global Institute analysis

Box 7. What drives corporate investment decisions?

Corporate surveys of our seven sample countries indicate that the main reason companies increase investment is in response to increasing demand or demand expectations. Out of those companies that increased investment, 47 percent said it was due to increasing demand expectations, and 44 percent cited increasing demand (Exhibit 19).[1] As demand started to recover, 42 percent of respondents in the United States and Europe increased their investment as a share of revenues over the last three years, while only 14 percent had decreased their budgets. In a different question, risk aversion was the primary reason given by 43 percent of companies that decreased their investment budgets.[2]

The majority of companies (69 percent) we surveyed said that, by now, their opportunity to invest equaled or exceeded what they could fund. Many forms of uncertainty factor into corporate decisions not to invest in all available opportunities; 38 percent cited risk aversion, 20 percent cited uncertainty about future relevance of technology, 9 percent risk of an economic downturn, and 11 percent political and regulatory uncertainty in their headquarters country.[3]

Two other notable factors holding back companies from investing in all attractive opportunities are a lack of management or technical capability to execute investment, and insufficient internal funds. Of notably lower relevance for respondents were interest rates and access to external finance.

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[1] We conducted two surveys of businesses to understand corporate investment behavior; the first as part of the *McKinsey Quarterly* survey, with global coverage including 555 companies from Europe and the United States, and a second covering 2,000 C-level executives in France, Germany, Italy, Poland, Spain, and the United Kingdom. *McKinsey Quarterly* survey, March 2017; *European business: Overcoming uncertainty, strengthening recovery*, McKinsey Global Institute, May 2017.

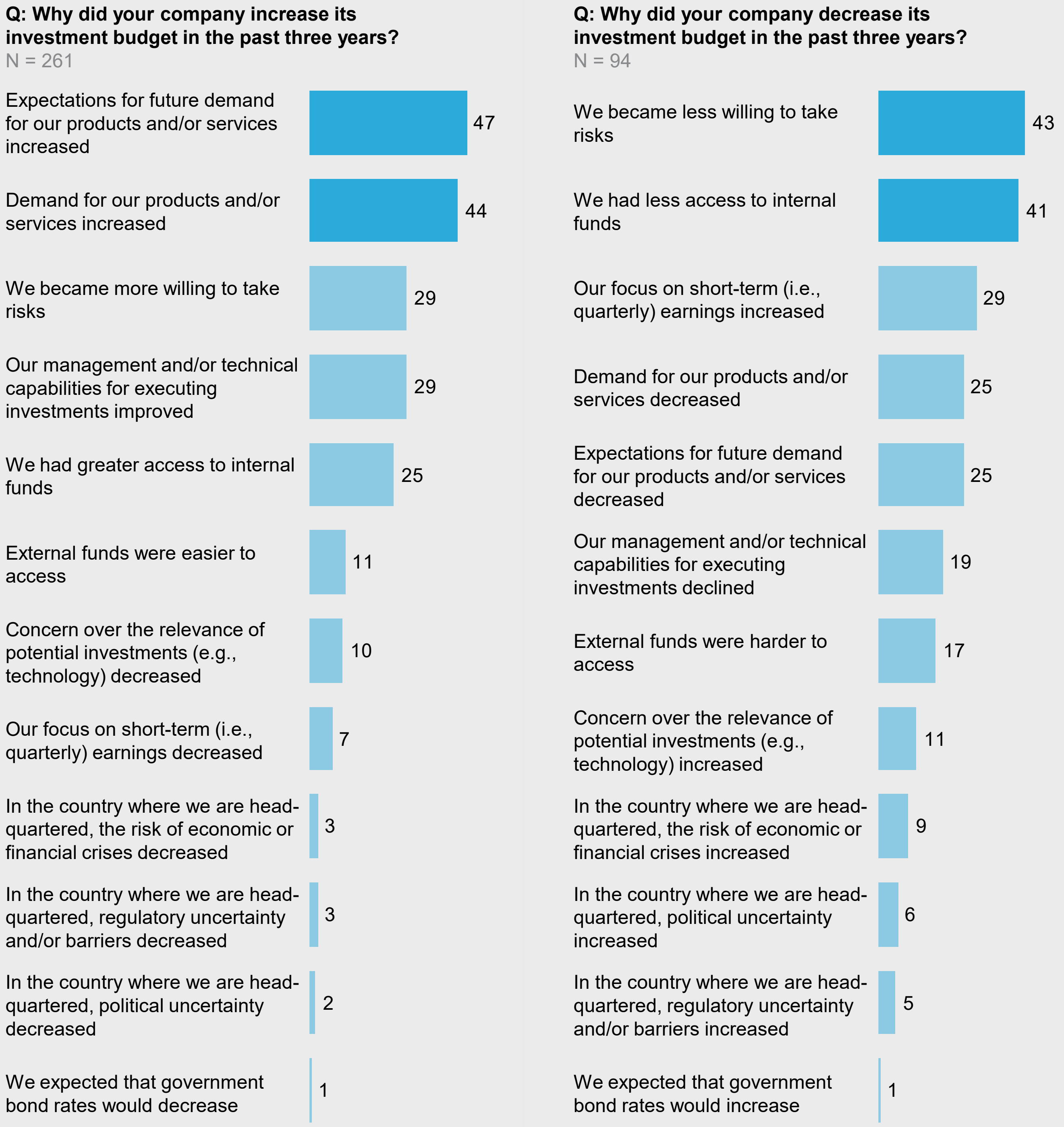
[2] A survey by the Bank of England also found that risk aversion, uncertainty, and a lack of internal funds were among the main reasons firms judged they were investing too little. See "The financial system and productive investment: New survey evidence," The Bank of England, *Quarterly Bulletin*, Q1, 2017.

[3] For a measure of uncertainty, see the Economic Policy Uncertainty Index (www.policyuncertainty.com/). According to this measure of uncertainty, based on news reports, federal tax provisions set to expire, and disagreement among economic forecasters, uncertainty increased between 2007 and 2012 in the United States before falling, though it has again been on an upward trend since 2014. Europe has displayed similar trends. For further detail, see Scott R. Baker, Nicholas Bloom, and Steven J. Davis, "Measuring economic policy uncertainty," *The Quarterly Journal of Economics*, volume 131, issue 4, November 2016. Research has also shown that long-run uncertainty, which is influenced by policy uncertainty, influences both investment and hiring, but the former is more impacted by it than the latter. This is due to lower depreciation rates and higher adjustment costs of investment relative to hiring. See Jose Maria Barrero, Nicholas Bloom, and Ian Wright, *Short and long run uncertainty*, NBER working paper number 23676, August 2017.

Exhibit 19

In the United States and Europe, increased demand drives companies to invest, while risk aversion holds investment back

Share of respondents[1]
%



69% of companies surveyed saw sufficient or more investment opportunities relative to their investment budget

[1] Excludes "Other" and "Don't know" answers. Based on respondents in France, Germany, Italy, Spain, Sweden, the United Kingdom, and the United States. Respondents permitted to select multiple responses.

SOURCE: *McKinsey Quarterly* survey, 2017; McKinsey Global Institute analysis

SOLOW PARADOX REDUX: THE BENEFITS OF DIGITIZATION ARE NOT YET AT SCALE AND COME WITH ADOPTION BARRIERS, LAGS, AND TRANSITION COSTS

In the middle of a slow recovery in demand and heightened uncertainty, most industries are facing a wave of digital disruption. Across our sector deep dives, we find that companies continue to invest money, time, and managerial attention in digital assets and capabilities and are preparing for the changes in their industries that digitization is likely to bring. Our survey of European firms finds that 55 percent see advancing technologies as having a positive impact on their business and are eager to embrace digitization and automation.[95] Yet the broad and transformative nature of digitization means that seeing the benefits in the numbers may take time as companies transform business processes and business models, acquire new organizational and management skills, and work through a period of transition marked by duplicative cost structures and revenue losses for incumbents.[96] While we have not explicitly sized the productivity impact of this digital transition, the distinct lack of jumping sectors we have found across countries is consistent with an environment in which companies are allocating substantial time and resources to changes and innovations that do not yet have a direct and immediate impact on output and productivity growth.[97] An MGI review of the historical rate of adoption of 25 previous technologies over the past half century shows that the time from commercial availability to 90 percent adoption ranges from approximately eight to 28 years (see Box 8, "A historical perspective on technological diffusion").[98]

Digitization often comes with transition costs and initial revenue losses for incumbents

30%
the expected level of software content in vehicles by 2030

Companies in the process of digital transformation often face transition costs before their investment is reflected in significant revenue or productivity gains. This occurs, for instance, when companies invest in new digital assets and capabilities that overlap with existing business processes serving the same customers and competing for the same revenue streams. Digitization is also very much the focus of managerial attention today, reducing the capacity to prioritize other productivity-enhancing measures. Furthermore, increased competition from new digital players can put pressure on prices and revenues while existing operations and personnel cannot be easily downsized.

We find examples of transition costs across sectors. The auto sector, for instance, is in the midst of a digital revolution, with OEMs seeking to add additional software features to cars and committing significant R&D funds to autonomous driving and e-vehicles. Software content in vehicles rose from 7 percent in 2000 to 10 percent in 2010. This is expected to accelerate to 30 percent of total vehicle value by 2030.[99] Yet fully autonomous cars are not yet commercially available, and e-vehicles make up a small share of sales. In utilities, we see significant buildup of more productive renewable energy production and smart grids, yet legacy structures cannot be fully decommissioned. In construction, many companies are building up new digital units in parallel to conventional business organizations. In retail, when firms increase their online presence, physical stores suffer declining traffic but cannot be quickly closed. In a recent McKinsey survey, companies with digital transformations

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[95] *European business: Overcoming uncertainty, strengthening recovery*, McKinsey Global Institute, May 2017.

[96] See also Jacques Bughin and Nicolas van Zeebroeck, *Getting digital "bucks": How the interplay of disruption and types of strategic responses shapes digital investment payoffs and solves the Solow paradox*, working paper, December 2017.

[97] James Bessen, "Technology adoption costs and productivity growth: The transition to information technology," *Review of Economic Dynamics*, volume 5, issue 2, April 2002.

[98] *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017.

[99] *Facing digital disruption in mobility as a traditional auto player*, McKinsey & Company, December 2017.

under way said that 17 percent of their market share from core products or services was cannibalized by their own digital products or services.[100]

Diffusing digital technologies takes time, and digitization is still at an early stage in many industries

Many digital technologies are relatively new, and most companies and sectors are still at an early stage of adopting them. MGI calculated that Europe overall operates at only 12 percent of digital potential, and the United States at 18 percent, with large sectors lagging behind in both.[101] This early stage is reflected in the relatively weak relationship between the degree of digitization of an industry and its productivity growth (Exhibit 20). While the ICT, media, financial services, and professional services sectors are rapidly digitizing, some of the largest sectors, such as education, health care, and construction, are lagging.

Several factors dampen the pace of digital adoption, including consumer preferences for digital vs. traditional products and services, the risks associated with major business model changes including fear of cannibalization, capability gaps, and concerns about technological obsolescence. These factors make some firms cautious about digitizing too fast, delaying adoption and the realization of the benefits of digitization. Naturally, the risk of business model changes and cannibalization is much larger for companies with large existing legacy businesses than it is for new digital-only players, creating very different incentives for incumbents than new entrants in any industry. Research suggests that cannibalization can have a significant negative impact when companies engage in a stepwise or partial digitization of business models or when companies create new digital versions of existing products and services, unbundle existing products and services, and engage in cost cutting. When a sector digitizes, the best scenario for a firm may be an aggressive digital strategy; this tends to result in less cannibalization though it cannot be avoided altogether. Incumbents typically respond to digital disruptions slowly and cautiously, often hurting revenues and profitability in the process. Until these firms adjust their strategy or go out of business, they can hurt productivity during the digital transformation of an industry.[102] Today, most companies and industries are grappling with how to adopt digital technologies into their processes and changing the way their workers do their daily jobs.

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[100] "McKinsey Digital Global Survey 2017: How digital reinventors are pulling away from the pack," McKinsey & Company, October 2017.

[101] Potential is defined by comparing each sector against a frontier sector defined as the US ICT sector. This analysis uses a set of 18 metrics of digitization spanning assets, usage, and labor. 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, payment and business models, and 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. *Digital Europe: Pushing the frontier, capturing the benefits*, McKinsey Global Institute, June 2016; *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015.

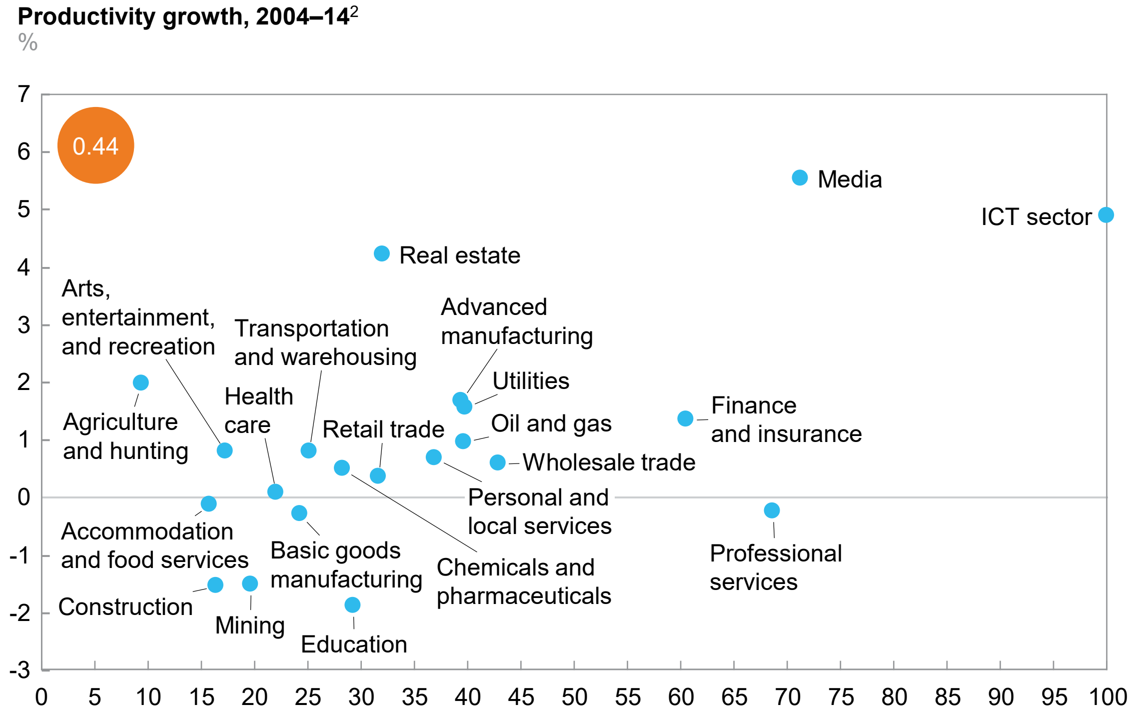
[102] Jacques Bughin and Nicolas van Zeebroeck, *Getting digital "bucks": How the interplay of disruption and types of strategic responses shapes digital investment payoffs and solves the Solow paradox*, working paper, December 2017.

Exhibit 20

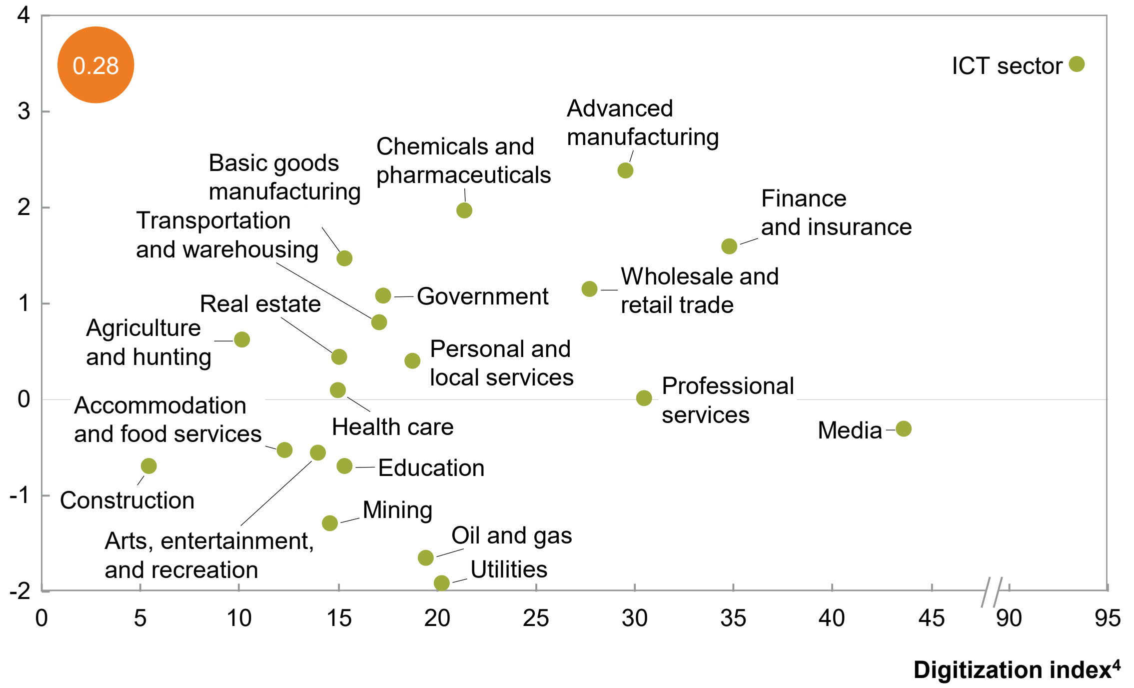
Digitization is happening unevenly across industries and is linked with productivity growth

● Correlation coefficient[1]

United States



Europe[2,3]



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1 Correlation analysis excludes ICT sector which was a significant outlier in its digitization index value. As a robustness check, we calculated the correlation coefficient for different productivity-growth time periods ranging from 2000–14. Correlation coefficient remains low across time periods.
2 US data are for the private business sector only; Europe data are for the total economy.
3 Europe productivity growth calculated as a simple average of France, Germany, Italy, Spain, Sweden, and the United Kingdom.
4 Based on a set of metrics to assess digitization of assets (8 metrics), usage (11 metrics), and labor (8 metrics); 2015 or latest available data.
NOTE: Not to scale.

SOURCE: BLS Multifactor Productivity database (2016 release); EU KLEMS (2016 release): *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015; *Digital Europe: Pushing the frontier, capturing the benefits*, McKinsey Global Institute, June 2016. McKinsey Global Institute analysis

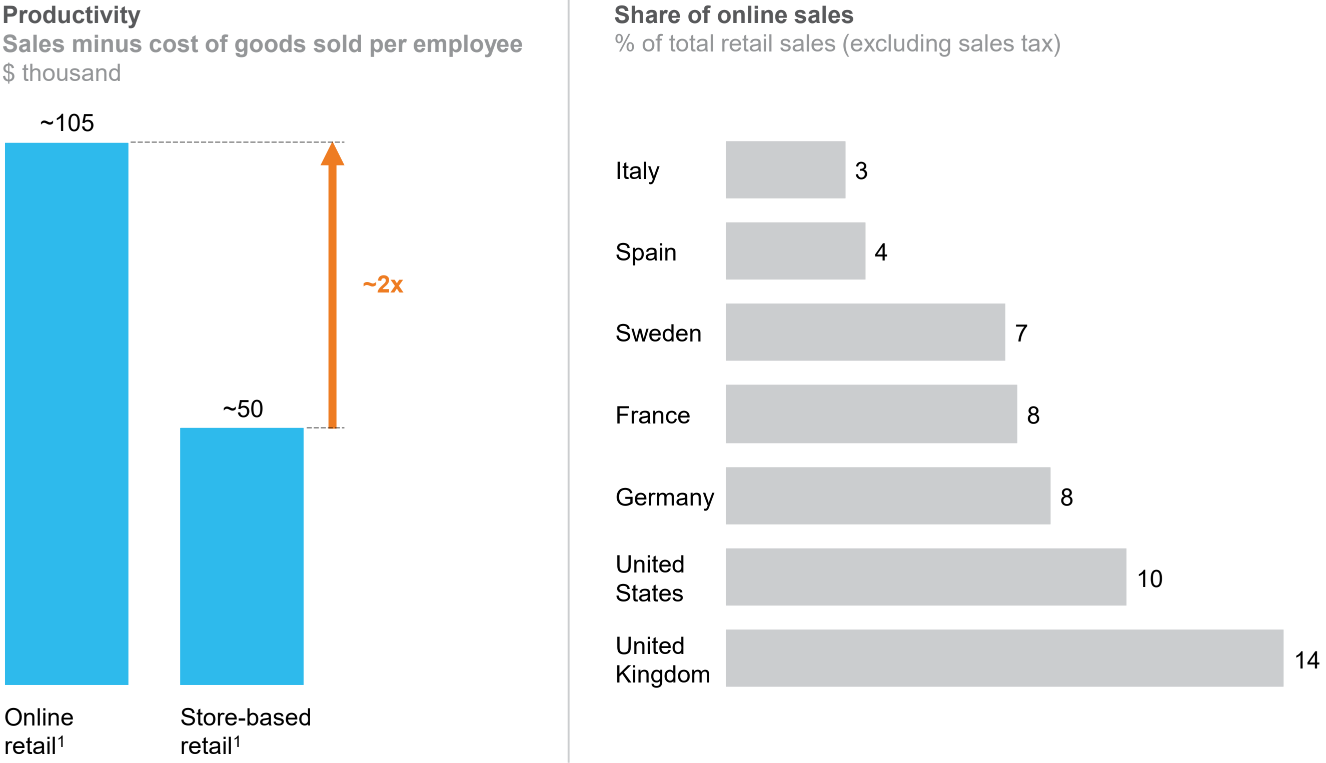
15%
the expected increase in productivity in the construction sector from digital

The low level of digital adoption means the benefits are only starting to appear. In retail, for example, we found that the growing share of sales taking place online in the United States added roughly 0.5 percentage point to productivity growth in the sector per year, as those forms of retail are up to two times more productive than traditional forms.[103] However, such sales are about 10 percent of retail volume today in most countries (Exhibit 21). In construction, we estimate that digital can raise productivity over the next ten years by 14 to 15 percent and enable broader productivity increases of 50 to 60 percent as business models and value chains adjust, yet adoption has barely started.[104] In a recent McKinsey survey of global corporations, only a small fraction of activities and offerings were reported to be digitized; less than a third of core operations were automated or digitized, and less than a third of products and services were digitized.[105]

Exhibit 21

In retail, online sales are more productive than offline but represent only a small segment of total sales

2016



Italy	3
Spain	4
Sweden	7
France	8
Germany	8
United States	10
United Kingdom	14

1 Based on company financial data for an example online retail and store-based retail company. We attempted to make adjustments to financials to make the productivity data as comparable as possible (e.g., removing non-retail share from financials).

SOURCE: Company financials from S&P Capital IQ; Euromonitor International, Retailing data (2018 edition); McKinsey Global Institute analysis

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[103] Impact on retail productivity growth calculated based on the mix shift between online and offline retail, assuming today's level of relative productivity between the two segments. Based on data from Euromonitor International, Retailing data (2018 edition) and S&P Capital IQ.

[104] *Reinventing construction through a productivity revolution*, McKinsey Global Institute, February 2017.

[105] "McKinsey Digital Global Survey 2017: How digital reinventors are pulling away from the pack," McKinsey & Company, October 2017.

Box 8. A historical perspective on technological diffusion

What can history tell us about the diffusion of new technology? Take the advent of steam power as an example. Productivity growth was quite rapid, at 2 to 3 percent, when steam power was introduced around 1870 but fell with the arrival of electrification in the 1890s to 1 to 2 percent in the United States.[1] It was only in the period after 1915, which saw the diffusion of machines operated by stand-alone secondary motors and the widespread establishment of centralized power grids, that electricity finally pervaded businesses and households and productivity growth began to rise. Then, productivity growth rose to 3 percent.

The first wave of the Solow Paradox demonstrated how IT-enabled gains in productivity were not automatic. US companies doubled their pace of IT investment between the 1970s and the mid-1990s; however, importantly, productivity gains did not occur in all industries that invested heavily in IT. Instead, real productivity gains required significant changes in business processes.[2] MGI has found that productivity-enhancing uses of IT share three characteristics:

- They are used to transform sector-specific core business processes. For example, stores in the general merchandising subsector of retail focused on IT investment for sophisticated warehouse management systems and vendor coordination systems, while in subsectors like apparel and electronics, with higher product margins and a mix of products with long and short life cycles, the "killer" applications focused on demand forecasting, assortment and allocation planning, and price and markdown management. In retail banking, the application areas focused on credit scoring software and underwriting modules, which helped automate manual steps associated with credit verification and authorization.
- They are deployed in a sequence that builds capabilities over time. The most significant productivity gains were seen when IT and business skills were developed over time so as to make the most of and build on prior investment. For example, leading retailers first automated data capture and storage, and subsequently used this data to enhance decision making in areas like merchandise planning.
- They coevolve with managerial and technical innovation. IT was used to increase efficiency or create new products and services in concert with managerial and technical innovation. For example, in retail banking, while a leading player initially used imaging technology to automate loan processing, the technology later diffused to auto dealers, capitalizing on the dealers' ability to attract customers with lower-cost loans.

Changing organizations is hard work, and rising competitive pressure, whether from Walmart in retail or AMD in semiconductors, was a key catalyst for change in those industries that saw the biggest jumps in productivity.[3] In 1987, Walmart had just 9 percent market share, but it was 40 percent more competitive than its competitors. By the mid-1990s, its share had grown to 27 percent, while its productivity advantage had widened to 48 percent. Competitors reacted by adopting many of Walmart's innovations, including those related to the diffusion of technology-related best practices like wireless barcode scanning and electronic data interchange.

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[1] Boyan Jovanovic and Peter L. Rousseau, "General purpose technologies," in *Handbook of Economic Growth*, volume 1B, Philippe Aghion and Steven Durlauf, eds., Elsevier, 2005. Paul David, *Computer and dynamo: The modern productivity paradox in a not-too distant mirror*, The Warwick Economics Research Paper Series, 1989.

[2] *How IT enables productivity growth: The US experience across three sectors in the 1990s*, McKinsey Global Institute, November 2002.

[3] *US productivity growth, 1995–2000*, McKinsey Global Institute, October 2001.

MGI research into the first ICT wave suggests that seeing the impact of new technology in the productivity numbers requires not only broad adoption of technologies but also fundamental changes to business processes and business models, as well as the development of organizational and management skills—all of which take time.[106] This has also been true with other major technologies, which have fundamentally changed how companies and industries work.

•••

The aftermath of the financial crisis created a perfect storm for historically weak productivity growth. Just as demand shocks hit, a decade-long productivity boom from ICT and restructuring was ending. In the long, slow recovery from the crisis, firms hired more than they invested, taking advantage of low wages and in the process created a job-rich but productivity-poor recovery. At the same time, industry after industry found itself in the midst of digitization, requiring firms to focus on fundamentally rethinking strategy, business processes, and models. In this chapter we have identified the common trends that have driven productivity growth to recent lows, and links to the patterns observed in Chapter 2. In the next chapter, we show how these trends played out in unique ways in each of our sectors and assess the prospects for productivity growth in the future.

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[106] *US productivity growth, 1995–2000*, McKinsey Global Institute, October 2001; *How IT enables productivity growth: The US experience across three sectors in the 1990s*, McKinsey Global Institute, October 2002. Other researchers have made a similar argument about the implementation lags associated with the benefits from digital. Jacques Bughin, Laura LaBerge, and Anette Mellbye, ”The case for digital reinvention,” *McKinsey Quarterly*, February 2017; Jacques Bughin and Nicolas van Zeebroeck, “The right response to digital disruption,” *MIT Sloan Management Review*, April 2017; Erik Brynjolfsson and Lorin M. Hitt, “Beyond computation: Information technology, organizational transformation and business performance,” *Journal of Economic Perspectives*, volume 14, number 4, fall 2000; Erik Brynjolfsson, Daniel Rock, and Chad Syverson, *Artificial intelligence and the modern productivity paradox: A clash of expectations and statistics*, NBER working paper number 24001, November 2017.

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4. A SECTOR VIEW

Our sector analysis provides an alternative lens to examine the macro trend of declining productivity growth. In each sector, we analyze productivity growth since 2000, identify the factors that may fuel growth in the future, and outline the potential constraints to that growth. We find that aggregate productivity growth does not occur in unison across sectors but is the result of sectors accelerating and decelerating at different times. During the most recent productivity-growth slowdown, we find, most sectors experienced weaker productivity growth, but the extent varies across countries (Exhibit 22). The tech sector, for instance, experienced the most dramatic drop across our sample, especially in Sweden and the United States, while tourism performance has differed by country, with average productivity gains remaining at a slow but steady level. For auto and finance, we find much more of a divergence in the productivity performance across countries.

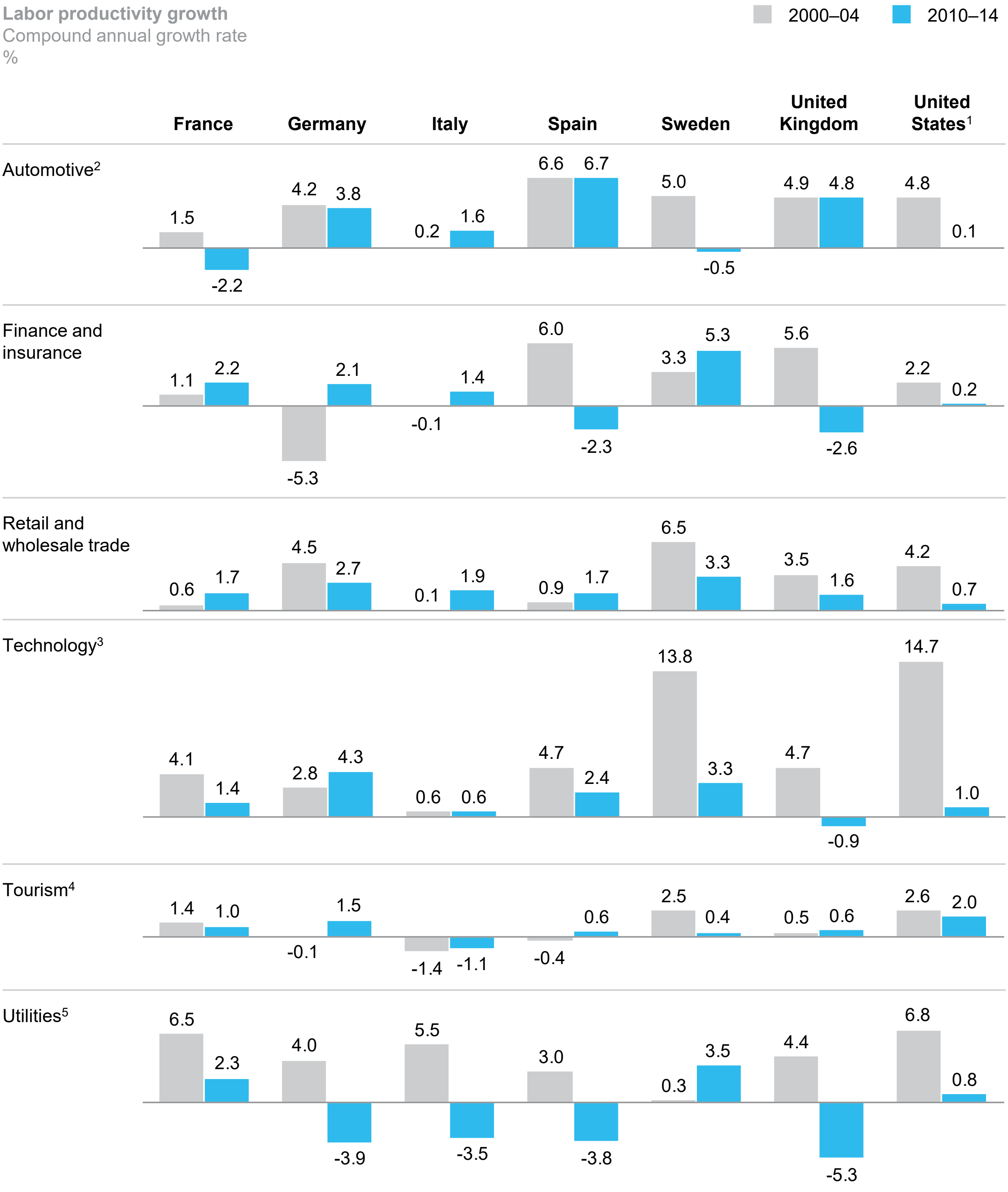
> We find that aggregate productivity growth does not occur in unison across sectors but is the result of sectors accelerating and decelerating at different times.

3.8%
productivity growth in the German auto sector in 2010–14

Common trends emerge that reinforce our explanation of the recent productivity-growth slowdown that we laid out in Chapter 3: the waning of an ICT-enabled productivity boom that began in the 1990s, financial crisis aftereffects, and digitization. Retail most clearly illustrates how this perfect storm occurred across countries. In addition, the utilities sector, with a long-term trend of increasing energy efficiency that is reducing demand for electricity, provides a good case study in how demand impacts productivity. Finally, two factors stand out across our sample of sectors as critical in determining productivity growth in the future: demand and digitization.

Exhibit 22

Most sectors and countries have seen a decline in productivity growth



1 US data are for the private business sector only for all sectors except tourism; Europe and tourism data are for the total economy.
2 Automotive defined as “Transport equipment” for EU countries and “Transportation equipment” for the United States.
3 Technology defined as “Electrical and optical equipment” and “IT and information services” for EU countries and “Computer and electronic products,” “Data processing, internet publishing, and other information services,” “Computer systems design and related services,” and “Publishing industries, excluding internet (includes software)” for the United States.
4 Number of jobs used in lieu of hours worked due to data availability.
5 Utilities defined as “Electricity, gas, steam, and A/C supply” for EU countries and “Utilities” for the United States.

SOURCE: BLS Multifactor Productivity database (2016 release), Eurostat (June 2017 release), EU KLEMS (2016 release), WTTC; McKinsey Global Institute analysis

A SECTOR VIEW

A TALE OF TWO COUNTRIES: GERMAN AUTOMAKERS FARED BETTER THAN THEIR US COUNTERPARTS IN THE PRODUCTIVITY-GROWTH SLOWDOWN

In the aftermath of the crisis, the performance of automakers diverged. Germany, Spain, and the United Kingdom experienced flat or only slightly lower productivity growth compared with 2000–04, and Italy even saw an increase in productivity growth. France, Sweden, and the United States experienced a more severe slowdown. Looking more closely at two of the world's leading auto manufacturing nations, Germany and the United States, we find that the extent of the demand shock and the response to the financial crisis explain much of the variation. We also find that this sector continues to experience strong competitive intensity, with significant potential for digital disruption.

0.5P.P.

boost to productivity growth from the shift to large and premium vehicles in the early 2000s

Germany and the United States both experienced stronger productivity growth in the early 2000s. This boom was due to a convergence of many factors: growth in more productive large and premium vehicles (which boosted productivity growth by about 0.5 percentage point in each country); an acceleration and expansion of vehicle content driven by regulations, safety standards, and fuel economy improvements, but also discretionary features, as OEMs sought to differentiate themselves and attract customers; and restructuring through a shifting of labor-intensive activities to low-cost locations, as well as automation and process improvements.

The rise of online vehicle comparison platforms increased the transparency of vehicle content while significant competition increased pressure on companies to add features to differentiate themselves and achieve operational productivity improvements. Emissions and safety regulation also played a role in feature enhancements. As an example, between 2000 and 2010, the market price of a Toyota Camry in the United States declined 1 percent a year while $1,400 of content was added and fuel efficiency improved. OEMs sought to reduce their own costs and in turn put significant pressure on suppliers to achieve 3 to 4 percent cost improvements each year to deliver additional content to consumers without increasing price. In the United States, a significant increase in competition from foreign OEMs intensified pressure on domestic automakers. Foreign OEMs in the United States scaled production, and domestic OEMs saw their share of domestic vehicle production fall.

Then came the financial crisis. In Germany, the impact on production was moderate and short, while in the United States it was severe and prolonged. Partly that was because Germany had a higher share of production from premium vehicles and exports (including, specifically, the export of premium vehicles to China). These markets proved more stable, and Germany was able to sustain more production, capacity utilization, and investment than the United States. US production of cars fell by about 50 percent during this time, from a peak of 10.5 million in 2007 to 5.6 million in 2009, while in Germany production fell by only 15 percent.[107] In Germany, capacity utilization dropped by 11 percentage points between 2008 and 2009 but rebounded immediately in 2010, while in the United States, capacity utilization began a significant drop in 2007, fell 32 percentage points between 2007 and 2009, and took until 2012 to rebound.[108] Differences in excess capacity, as well as a reduction in profits for OEMs as demand fell, meant the United States also had a much steeper decline in investment than Germany. Real investment in the United States dropped 5.4 percent per year from 2007 to 2010, while Germany maintained low but positive growth of 0.9 percent per year. R&D investment stayed relatively stronger during the crisis compared

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[107] Based on data from IHS Markit, 2017.

[108] Capacity utilization based on straight-time capacity at a one-, two-, or three-shift/three-crew structure dependent on the shift structure in a plant in a given year. This is calculated without overtime. IHS Markit, 2017.

with equipment and structures.[109] Finally, hours worked dropped by a third in the United States and about a tenth in Germany in the crisis years. German OEMs focused on shift reduction and enhancing the skills of employees; in contrast, there were a large number of plant closures in the United States. When production returned to more normal levels, US automakers had to hire back workers in greater numbers than their German counterparts, slowing down productivity gains as OEMs focused on meeting new demand and workers needed to be trained.

15%

an estimate of the proportion of new cars sold in 2030 that will be highly autonomous

Looking ahead, we find significant potential for higher productivity growth in autos from new value added per vehicle opportunities through digitization and technology trends. Competitive intensity remains high, with new players like Tesla entering the OEM market as well as tech companies like Apple and Google, and mobility providers like Uber focused on innovations such as autonomous driving. OEMs are focused on the digitization of vehicle content, increasing connectivity and adding infotainment features, as well as the evolution toward autonomous vehicles. Yet these digital trends remain subscale. Highly or fully autonomous cars are not yet commercially available. In 2016, only about 1 percent of vehicles sold were equipped with basic partial-autonomous-driving technology. But today, 80 percent of the top ten OEMs have announced plans for highly autonomous technology to be ready by 2025.[110] If technology and regulatory hurdles are overcome, McKinsey estimates that up to 15 percent of new cars sold in 2030 could be highly autonomous.[111] Software content rose from 7 percent of total vehicle content in 2010 to 10 percent in 2016 and could reach 30 percent by 2030.[112] Vehicle electrification could simplify production and reduce hours worked per vehicle, because electric vehicles have fewer components than those based on internal combustion engines. Automation, with tools such as collaborative robots, and Industry 4.0, which focuses on the use of data, analytics, and connectivity, should also help. However, OEMs are still learning how to make the most of new technologies. In a recent survey of manufacturers, only 16 percent said they had an overall Industry 4.0 strategy in place.[113] Finally, manufacturers are often as focused on agility as on efficiency: with significant uncertainty, the ability to scale production up and down as well as switch between models and locations becomes critical.

Yet uncertainties exist that may hold back the productivity-growth potential of the sector. The rise of protectionism threatens to reverse the globalization benefits of efficient supply chains, consumer adoption and government regulation of autonomous software could be slow, and some degree of value added could be transferred from the auto sector to other sectors, notably in terms of software for autonomous driving and batteries.[114] Overall demand for vehicles could peak and then decline in the United States and Europe as household formation rates drop, population growth slows, and demand for shared mobility increases.

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[109] Long product development cycles of five to seven years from design to production mean maintaining R&D during a downturn is critical for having new models available immediately after a crisis when demand returns. Firms delayed investment in equipment, particularly for maintenance and replacement, while spend on equipment for new models and innovation was less impacted.

[110] *The automotive revolution is speeding up*, McKinsey & Company, September 2017.

[111] *Automotive revolution—perspective towards 2030*, McKinsey & Company Advanced Industries Practice, January 2016. For a review of autonomous technology and the innovations needed, also see *Self-driving car technology: When will the robots hit the road?* McKinsey & Company, May 2017.

[112] *Facing digital disruption in mobility as a traditional auto player*, McKinsey & Company, December 2017.

[113] *Industry 4.0 after the initial hype. Where manufacturers are finding value and how they can best capture it*, McKinsey & Company, McKinsey Digital, 2016.

[114] Electrification of the power train could result in a simpler power train with fewer components, which could drive down hours worked in assembly. However, the broader impact on the sector when accounting for internal combustion engine production is less clear for two reasons. First, most OEMs source batteries from battery-specific suppliers, such as Panasonic, which are not "measured" as part of the automotive industry; whether this will have a larger impact on value added or hours worked and therefore productivity is unclear. Second, a reduction in emissions via vehicle electrification could increase value added, provided the benefits from reduced emissions are factored into quality adjustments for price deflators to convert nominal to real value added.

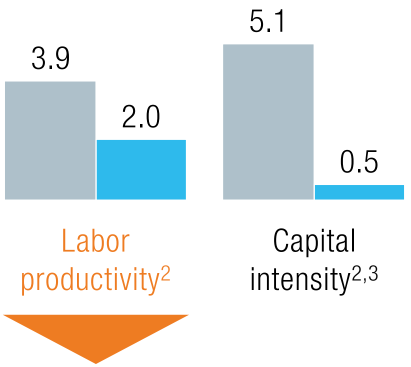
Automotive

▨ 2000–04 ■ 2010–14

The sector at a glance

Our analysis of the automotive sector includes manufacturing of parts and accessories, final assembly, and body and trailer manufacturing[1]

Compound annual growth rate (%)



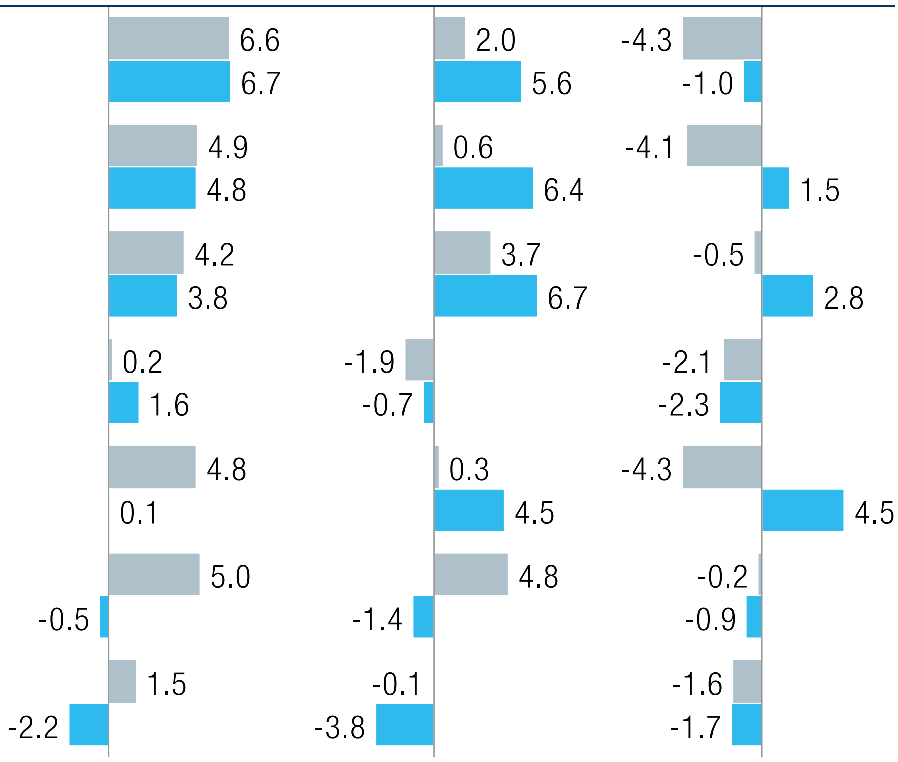
4% contribution to the productivity-growth slowdown across countries[4]

0.5 p.p. boost in productivity growth between 2000 and 2004 from shift to high-value vehicles

50% decline in vehicle production in the United States from 2007 to 2009 due to the crisis[5]

Up to **15%** of sales in 2030 could be highly autonomous[6]

Productivity-growth trends



	2014 share (%) **of**		**Compound annual growth rate** (%)					
	Gross value added	Hours worked	Labor productivity[7]		Value added		Hours worked	
			2000–04	2010–14	2000–04	2010–14	2000–04	2010–14
Spain	1.8	1.0	6.6	6.7	2.0	5.6	-4.3	-1.0
United Kingdom	1.4	1.0	4.9	4.8	0.6	6.4	-4.1	1.5
Germany	4.9	2.4	4.2	3.8	3.7	6.7	-0.5	2.8
Italy	1.2	0.9	0.2	1.6	-1.9	-0.7	-2.1	-2.3
United States	2.1	1.7	4.8	0.1	0.3	4.5	-4.3	4.5
Sweden	2.4	1.7	5.0	-0.5	4.8	-1.4	-0.2	-0.9
France	1.0	0.7	1.5	-2.2	-0.1	-3.8	-1.6	-1.7

1Automotive defined as "Transport equipment" for European countries (ISIC code 29-30) and "Transportation equipment" for the United States (NAICS code 336). Both include motor vehicles. US data are for the private business sector only; Europe data are for the total economy.

2 Simple average across countries.

3 Growth of capital services per hour worked.

4 Includes simple average of countries where the industry contributed to a slowdown in productivity growth.

5 Based on data from IHS Markit, 2017.

6 *Automotive revolution—perspective towards 2030*, McKinsey & Company Advanced Industries Practice, January 2016.

7 Order based on fastest to slowest labor productivity growth, 2010–14.

SOURCE: BLS Multifactor Productivity database (2016 release); EU KLEMS (2016 release); IHS Markit, 2017; McKinsey Global Institute analysis

Drivers of productivity growth over time

● Simple average productivity growth across countries (%)

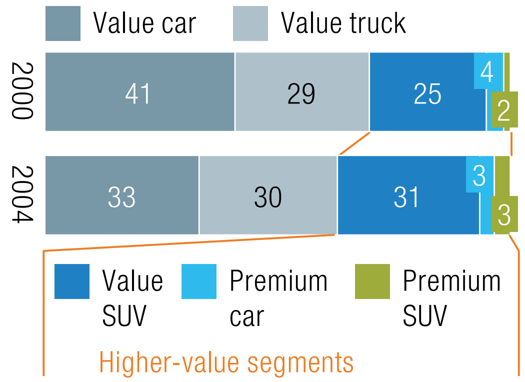
3.9

2000–04

Restructuring and demand for high-value vehicles boosted productivity due to

- Automation and restructuring of operations, globalization of value chains (e.g., NAFTA-wide footprint optimization)
- Pressure to increase efficiency, particularly in the United States, from foreign OEMs
- Shift in consumer preferences to higher-value large and premium vehicles

Share of total US production[1] (%)



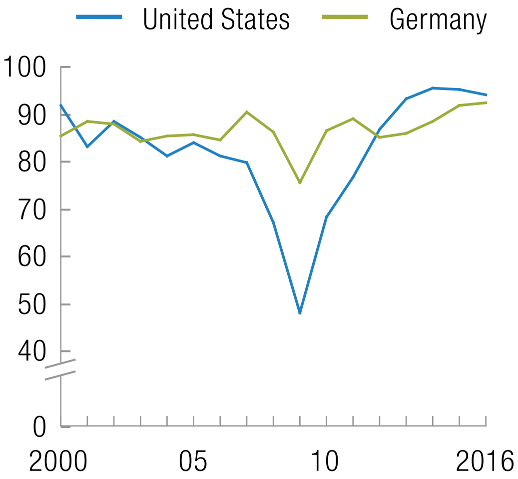
2.0

2010–14

Waning of the restructuring boom and financial crisis aftereffects slowed productivity growth

- **Wave 1**: Waning of boom from restructuring and globalization, mainly in the United States
- **Wave 2**
  - Excess capacity, weak demand, and low profits hurt investment in equipment and structures (not R&D); hours expanded when demand returned
  - Shift to premium vehicles slowed, reducing productivity growth by about 0.2 percentage point from a decade earlier
- **Wave 3**: Investment in digital under way but subscale commercialization (e.g., highly or fully autonomous cars not yet commercially available but could represent up to 15% of sales by 2030)

Capacity utilization[2] (%)



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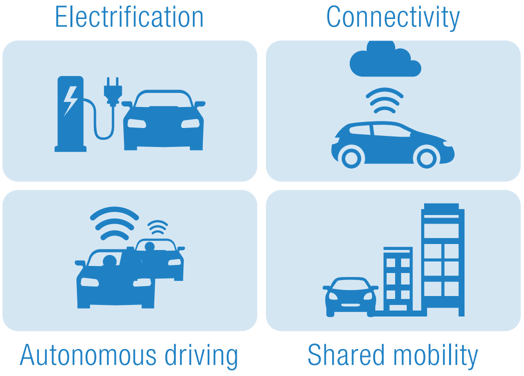
2015–25

Digital opportunities could scale with strong potential to boost growth

- Digital disruption could drive value-added growth as well as simplify production from electrification
- Continued production efficiency improvements should occur via automation and Industry 4.0
- Share mobility and changing demographics may slow demand, and benefits from autonomous vehicles may be captured by other industries

Four vectors of digital disruption[3]



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1 Based on data from IHS Markit, 2017.

2 Based on straight-time capacity at a one-, two-, or three-shift/three-crew structure dependent on the shift structure in a plant in a given year. Calculated without overtime. Based on data from IHS Markit, 2017.

3 *Automotive revolution—perspective towards 2030*, McKinsey & Company Advanced Industries Practice, January 2016.

SOURCE: BLS Multifactor Productivity database (2016 release); EU KLEMS (2016 release); IHS Markit, 2017; McKinsey Global Institute analysis

DIVERGING FORTUNES IN FINANCE: PRODUCTIVITY GROWTH DROPPED IN SOME COUNTRIES BUT ACCELERATED IN OTHERS

A striking feature of the aftermath of the financial crisis is the diverging productivity performance of the finance sector itself.[115] Some countries, such as France, Germany, Italy, and Sweden, increased productivity growth, while Spain, the United Kingdom, and the United States experienced a sharp deterioration. The extent of the financial boom and the bust that followed explains much of this divergence.

The financial boom ahead of the crisis was more extreme in Spain, the United Kingdom, and the United States. High economic growth boosted demand for credit from 1995 to 2005 across countries, except for some specific years and countries (for example, Germany during a downturn in the early 2000s). Loosening regulation encouraged large increases in leverage ratios, and relatively low interest rates drove high growth in lending. At the same time, the ICT revolution improved ease of access to financial services as well as process efficiency, increasing gross output and reducing costs.

$165B
the amount of fines and settlements banks paid in 2010–14

The impact of the crisis on financial services firms in Spain, the United Kingdom, and the United States was significant. Many were threatened with insolvency due to a significant increase in defaults on loans and a stock market crash. In Spain, the United Kingdom, and the United States, profits dropped across the three countries in total by 90 percent between 2007 and 2010.[116] In the aftermath of the crisis, these countries experienced the sharpest productivity-growth decline, associated with a decline in value-added growth. Across all three countries, growth in the volume of loans and deposits has been slower or even negative during a postcrisis period of deleveraging as banks sought to restore balance sheet health. Slower macroeconomic growth and demand for debt, stricter regulation, and more cautious lending practices put pressure on deposits and lending volumes.[117] Regulatory changes and settlements further dampened value-added growth and occupied management attention. Banks cut businesses such as proprietary trading and shouldered more than $165 billion in fines and settlements from 2010 to 2014.[118] In this environment, the sector also saw a decline in investment in structures and equipment as a share of GDP, though investment in intellectual property products (software and R&D) remained relatively robust across countries. At the same time, banks could not readily cut staff in line with the

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[115] The measurement of productivity in finance is heavily debated. For example, the Bank of England found: “The period just before the financial crisis was characterized by growth in money and credit in excess of final output price inflation. There is, therefore, a risk that some of the growth in balance sheets was reflected in higher estimates of real service provision (on both lending and deposits), when it might have been better treated as an increase in prices. For example, the number of mortgage approvals made might be one alternative (quantity) measure of some of the services provided to borrowers by banks. The total number of approvals was relatively stable between 2002 and 2007, suggesting little change in output, but the stock of mortgage lending deflated by the GDP deflator rose by almost 60 percent.” For further details, see Stephen Burgess, “Measuring financial sector output and its contribution to UK GDP,” *Bank of England Quarterly Bulletin*, Bank of England, volume 51, number 3, 2011.

[116] Based on weighted average of data on profits after taxes in USD from McKinsey Panorama.

[117] Interestingly, the United States has seen a recovery and strong growth in profits and nominal value added during this period. This is likely due to a large reduction in risk costs (from bad loans) between 2010 and 2014 of 27 percent per annum, with risk costs currently slightly below pre-crisis levels at 9 percent of revenue. By contrast, the United Kingdom and Spain still faced large risk costs in 2014 at 20 percent and 40 percent of revenues respectively, compared to 10 percent and 16 percent respectively in 2004 (based on data from McKinsey Panorama). However, these improvements in the United States did not translate into real value-added growth given real measures of output are driven to a large extent by the volume of activity, e.g. the number of loans, rather than their quality. A declining number of bad loans could then increase profitability and nominal value added but dampen real value-added growth to some extent.

[118] *The road back: McKinsey global banking annual review 2014*, McKinsey & Company, December 2014.

much deeper decline in value added and credit because of large IT infrastructure and fixed costs.[119]

In contrast, Sweden maintained high productivity growth from 2010 to 2014 due to much stronger demand thanks to a smaller shock from the crisis and a high and sustained pace of digital transformation. Sweden also went through significant restructuring and regulation setting following an earlier financial crisis, and its banking system was more resilient to external shocks. Sweden is at the forefront of some digital trends in this sector; for example, only about 30 percent of cash deposits and withdrawals in the country are teller-based, compared with up to 85 percent of deposits and 75 percent of withdrawals in Spain. France, Germany, Italy, and Sweden experienced less of a financial-sector boom-bust and leveraging-deleveraging cycle.

Looking ahead, we find two main factors that will drive productivity growth in the future: a renewed focus on growth as demand for financial products returns, and digital transformation. We expect higher growth in demand for both loans and deposits in the next ten or so years compared with 2010–14.[120] Current forecasts call for on average of 3 percent growth in deposits between 2014 and 2020, and 1.9 percent growth in loan volumes in that same period. This is mainly due to improvements in the macroeconomic environment, with confidence and demand for loans returning.

Digitization, advanced analytics, and automation can continue to raise value added and reduce labor costs along four fronts: digital customer interaction, IT modernization and process automation, and AI and big data. First, opportunities to digitize customer interaction are significant: branch networks, call centers, and monthly paper statements typically represent between 40 and 60 percent of total costs in retail and commercial banking.[121] Banks' current digital offerings lag significantly behind demand; only 13 percent of North American customers currently obtain an account online but 56 percent are willing to do so.[122] Second, banks can modernize IT through better data management and analytics to allow for a single view of the customer and adopt cloud infrastructure to drive down costs through automation and superior asset utilization. Other examples of opportunities include: robotic process automation that reduces resources needed for trading-risk calculation by 95 percent; a new algorithm for credit-card fraud detection that improves predictability by 80 percent, in 50 percent less time; and digitizing mortgage underwriting.[123] Third, security and authentication is a major trend, and blockchain is emerging as a technology that may significantly reshape efficiency. Finally, banks are finding new ways to use big data and machine learning to acquire new customers, cross-sell, and prevent fraud. For example, machine learning allows loan portfolio monitoring through early warning systems based on transactional data.

Most major banks have embarked on transformational agendas but have not yet reaped the full benefits. Factors influencing the pace of digital adoption and transformation include consumer preferences, the level of competition from new digital entrants, and internal barriers like the pace of retraining and redeploying staff or acquiring external talent. Continued digital transformation will help reduce costs, but in the interim it may put price pressure on incumbents as they restructure and industry revenues stumble via cannibalization and competition from new digital attackers. Estimates suggest that price pressure, and an environment of low interest rates and slow growth, could dampen total bank income, particularly in the Eurozone, by as much as 13 percent by 2020, 11 percent in the United Kingdom, and 9 percent in the United States.[124]

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[119] However, there was some contraction of the jobs in the industry. Based on data from the BLS, the finance and insurance sector contracted by 8 percent between 2007 and 2010. By 2014, some jobs had been added back, but the sector was still 6 percent below the 2007 level. Office and administrative support occupations' share of the finance and insurance sector's employment has consistently decreased over the last decade and a half, while the share of business and financial occupations, as well as sales occupations, has been increasing.

[120] Based on a simple average of growth in local currency units for France, Germany, Spain, Sweden, United Kingdom, and United States from McKinsey Panorama. There are some exceptions to this, for example, for deposits in the United States, where the 2010–14 period was one of unusual growth in deposits because demand was much less affected due to the rapid deleveraging and bailouts that occurred immediately after the crisis. However, looking forward in the United States, with the announcement of the end of quantitative easing and strong stock market returns, deposits post-2014 are beginning to shift back into investment.

[121] *A brave new world for global banking: McKinsey global banking annual review 2016*, McKinsey & Company, January 2017.

[122] McKinsey Retail Banking Consumer Survey 2016.

[123] *The phoenix rises: Remaking the bank for an ecosystem world: McKinsey global banking annual review 2017*, McKinsey & Company, October 2017.

[124] *A brave new world for global banking: McKinsey global banking annual review 2016*, McKinsey & Company, January 2017.

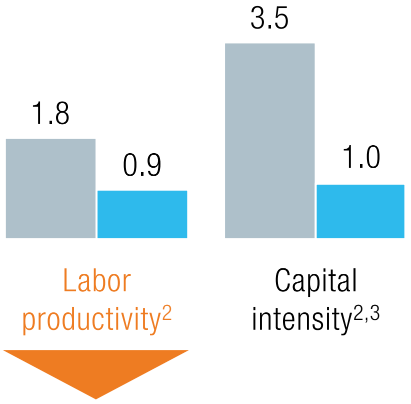
Finance

▨ 2000–04 ■ 2010–14

The sector at a glance

Our analysis of the financial sector includes activities that obtain or distribute funds other than for insurance, pension funding, or compulsory social security[1]

Compound annual growth rate (%)



18% contribution to the productivity-growth slowdown across countries[4]

90% drop in profits in Spain, United Kingdom, and United States between 2007 and 2010

Only about **13%** of North American customers obtain an account online but 56% are willing to do so[5]

Branch networks, call centers, and monthly paper statements typically represent **40–60%** of total costs in retail and commercial banking[6]

Productivity-growth trends

	2014 share (%) of		Compound annual growth rate (%)					
	Gross value added	Hours worked	Labor productivity[7] 2000–04	Labor productivity[7] 2010–14	Value added 2000–04	Value added 2010–14	Hours worked 2000–04	Hours worked 2010–14
Sweden	4.6	1.8	3.3	5.3	1.5	4.4	-1.8	-0.8
France	4.6	2.9	1.1	2.2	2.2	2.6	1.0	0.4
Germany	4.2	3.0	-5.3	2.1	-6.3	1.4	-1.1	-0.6
Italy	5.8	2.8	-0.1	1.4	-0.2	-0.1	-0.1	-1.5
United States	7.2	5.6	2.2	0.2	2.7	1.0	0.4	0.7
Spain	4.0	2.0	6.0	-2.3	6.6	-4.7	0.6	-2.5
United Kingdom	7.5	3.9	5.6	-2.6	5.0	-1.5	-0.6	1.1

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1 US data are for the private business sector only; Europe data are for the total economy. These data include both finance and insurance due to data availability issues across countries (ISIC code K for Europe and NAICS codes 521-525 for the United States).
2 Simple average across countries.
3 Growth of capital services per hour worked.
4 Includes simple average of countries where the industry contributed to a slowdown in productivity growth.
5 McKinsey Retail Banking Survey 2016.
6 *A brave new world for global banking: McKinsey global banking annual review 2016*, McKinsey & Company, January 2017.
7 Order based on fastest to slowest labor productivity growth, 2010–14.
SOURCE: BLS Multifactor Productivity database (2016 release); EU KLEMS (2016 release); McKinsey Panorama; McKinsey Retail Banking Consumer survey; McKinsey Global Institute analysis.

Drivers of productivity growth over time

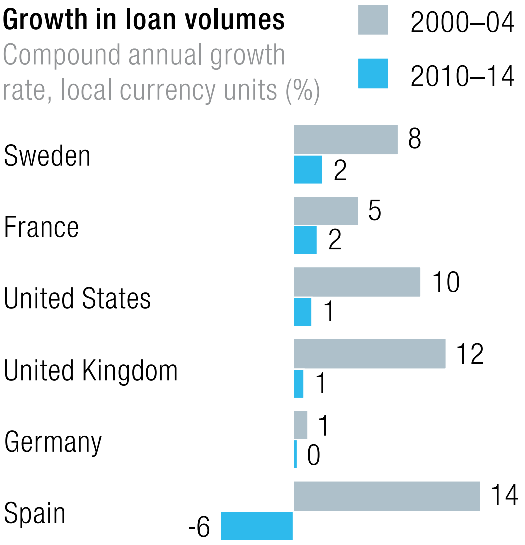
● Simple average productivity growth across countries (%)

1.8

2000–04

Demand boom in a period of loosening regulation and lending practices boosted productivity growth

- High economic growth lifted demand for credit and volume of deposits
- Loosening regulation and low interest rates drove large increases in leverage
- ICT revolution improved access to financial services and delivered leaner back-office operations



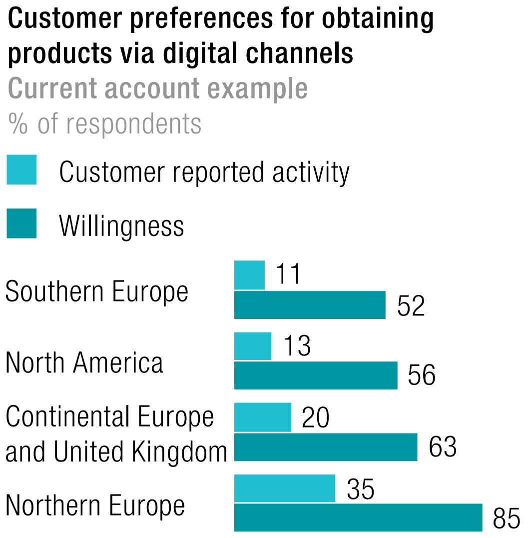
Growth in loan volumes
Compound annual growth rate, local currency units (%)

0.9

2010–14

Productivity growth declined from financial crisis aftereffects and the changed regulatory environment while digitization remained subscale

- **Wave 2**
  - Slow growth in lending/deposit volumes due to deleveraging and weak credit demand, together with difficulty streamlining fixed labor
  - Regulatory changes dampened value-added growth and occupied management attention
- **Wave 3**
  - Digitization and fintech reshaping front-end and back-end operations of traditional banks, yet transformation takes time
  - Potential to boost productivity from online and automation, with strong customer willingness to move to digital products



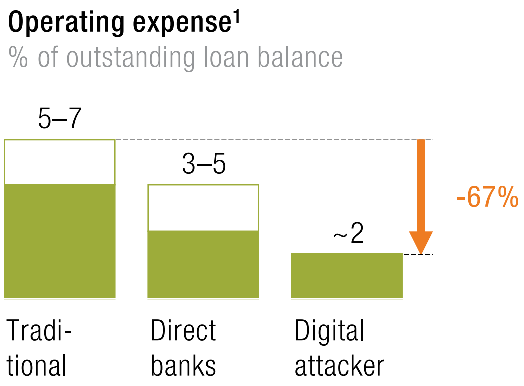
Customer preferences for obtaining products via digital channels
Current account example
% of respondents

?

2015–25

Digital opportunities could scale, with strong potential to boost growth

- Returning economic growth and increasing interest rates could lift demand for products
- Digitization reshaping front-end and back-end operations of traditional banks could drive down operational and labor costs while increasing access for consumers
- Potential growth from nascent transformative technologies, e.g., blockchain



Operating expense[1]
% of outstanding loan balance

[1] *A brave new world for global banking: McKinsey global banking annual review 2016.*

SOURCE: BLS Multifactor Productivity database (2016 release); EU KLEMS (2016 release); McKinsey Panorama; McKinsey Retail Banking Consumer survey; McKinsey Global Institute analysis

A PERFECT STORM HIT RETAIL PRODUCTIVITY GROWTH: A BOOM FADED AT A TIME OF WEAK DEMAND AND WIDESPREAD DIGITIZATION

Few industries capture all three waves that have driven productivity growth since the early 2000s as well as the retail sector: a waning productivity boom that began in the mid-1990s, financial crisis aftereffects, and digitization.

By the time the crisis hit in 2007, the retail sector was at the tail end of a productivity boom that began around 1995. This boom occurred as companies learned to use technology to transform supply chains and improve managerial and operational processes that enabled them to deliver the right products to the right stores more efficiently and accurately.[125] Large-format retailers such as Walmart, Tesco, and Carrefour were at the forefront of this supply-chain transformation, which led to changes in their wholesale and supplier networks, too. Vendor coordination systems, warehouse management systems, and new forecasting tools to align staffing with demand were just some of the IT solutions retailers employed. Much of this boom resulted from the diffusion of best practices from leading companies to other retailers, enabled by a strongly competitive environment and robust consumer spending in the late 1990s, particularly in high-value goods. By the mid-2000s, many benefits had been captured.

$18K

the additional annual amount the average full-time retail employee in the US would have earned if wages had kept pace with long-term total economy wage growth

After 2010, weak demand in the recovery from the financial crisis made matters worse. The demand momentum shifted as sales growth dropped and many consumers switched to lower-value products. Overall sales growth slowed down dramatically. In 2010–14 compared with 2000–04, retail sales growth fell by three percentage points on average across countries in our sample.[126] Some portion of store labor is fixed; therefore declining sales growth impacts productivity as labor cannot correspondingly be reduced. Similarly, in retail, we estimate that consumers shifting to higher-value goods, for example higher-value wines or premium yogurts, contributed 45 percent to the 1995–2000 retail productivity growth increase in the United States.[127] This subsequently waned, dragging down productivity growth.

As demand began to slowly recover, retailers hired workers, which impacted the pace of productivity improvements. In the United States, hiring was helped by low retail wage growth.[128] For example, annual retail wages per full-time equivalent employee in the United States grew by 6 percent per year between 2000 and 2004, a time when retail productivity growth was also booming. In such boom times, even low wage sectors like retail saw healthy wage growth, supporting demand in the economy more broadly, as well as capital deepening in the retail sector. That faded in the mid-2000s, and has remained low since then. Between 2010 and 2015, wage growth was much slower, at 2 percent per year. Had wages in retail grown since 2010 as they did between 2000–04, they would be $7,500 p.a. higher today. Assuming that retail wages in the United States had kept pace with total economy wage growth since 1948, the average retail full-time equivalent employee would be making $18,000 more per year, or about 50 percent more than they make today.[129] Interestingly, while many of the new jobs added back have been in sales occupations (which also saw the largest job losses in the crisis years), others have been in occupations like food

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[125] For more details on the boom in retail productivity growth in the US, see *US productivity growth, 1995–2000*, McKinsey Global Institute, October 2001, and *How IT enables productivity growth: The US experience across three sectors in the 1990s*, McKinsey Global Institute, November 2002.

[126] Based on data of real gross output.

[127] *US productivity growth, 1995–2000*, McKinsey Global Institute, October 2001.

[128] Furthermore, some US retailers came out of the boom with higher store density and longer-term contracts than was optimal in the postrecession environment and still had overcapacity.

[129] Calculated based on wage data from the Bureau of Economic Analysis.

preparation and serving, and health care, indicating that retailers are looking to expand the breadth of customer experiences. Real investment in equipment and structures fell in many countries during the crisis, and recovered slowly.

A final factor at play today in the retail sector is the ongoing digital disruption from e-commerce, the potential for continued automation (for example new forms of self-checkout), and the use of customer data and analytics, for example, to target sales or for automated ordering. In the middle of this slow recovery and challenging demand environment, the rise of Amazon and other online retailers and the wave of digital disruption hitting the retail industry created urgency for traditional retailers to build an online presence, resulting in transition costs and duplicative capacity.

While e-commerce has reached about 10 percent share of sales across countries, up from 2 percent in 2005, and growing rapidly, it remains a small share of total retail.[130] Pure play e-commerce can be as much as two times more productive than store-based retail as fulfillment centers allow for high employee utilization and efficient stocking and picking compared with traditional retail formats. Productivity could increase with the rising share of more productive e-commerce retailers as well as the competitive pressure they put on store-based retailers. Over the next ten years, we calculate that the growth of e-commerce could represent a one percentage point per year productivity boost in the United States as it continues to grow and companies find the right balance between online and in-store operations, something both incumbents and online retailers are still trying to figure out.[131]

We calculate a

1 P.P.

annual productivity boost from the growth of e-commerce

Automation offers another productivity opportunity. The price advantage of e-commerce is putting pressure on retail margins, which is leading retailers to look more aggressively at improving operational efficiency. This could result in the adoption of automated technologies to streamline costs. Checkout and stocking are some areas where automation could have a positive impact on labor productivity growth. Checkout consists of over 10 percent of time in retail. Self-checkouts are already prominent in convenience channels, but new self-checkout solutions—for example, the Panasonic automated checkout and Amazon Go—require less assistance and increase checkout speed. For stocking, Tally, a stock-taking robot, can identify products to set stocking needs, while Swisslog has developed guided vehicles for material transport to help in physical stocking (with employees doing the final stocking). Similarly, in inventory stock taking, Zara has begun using RFID chips to eliminate stock taking and lost products. The speed of adoption is likely to be faster in regions with higher retail wages, and we have already seen more investment in self-checkout in Europe than in the United States.

How much of these productivity opportunities are captured will depend on the evolution of mix between brick-and-mortar and e-commerce channels, where most traditional retailers are still exploring the right “Goldilocks” balance. Consumer preferences will help shape the mix, for instance even between things like home delivery vs. store pickup of e-commerce purchases, and such preferences may well vary across countries. Another factor determining productivity growth will be the extent retailers shift freed up labor from automation to improving customer experience. For example, McDonald’s introduced self-ordering kiosks and yet retained staff to greet customers and provide service to tables in some locations. Or consider, for example, the Apple store, which is highly automated but also has a surplus of employees designed to build brand image, and service customers. The degree to which these changes happen will influence the nature of employment going forward in these sectors, a point we return to in Chapter 5.

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[130] Based on data across France, Germany, Italy, Spain, Sweden, United Kingdom, and United States from Euromonitor International, Retailing data (2018 edition).

[131] Impact on retail productivity growth calculated based on the expected mix shift between online and offline retail, assuming today’s level of relative productivity between the two segments. Based on data from Euromonitor International, Retailing data (2018 edition) and S&P Capital IQ.

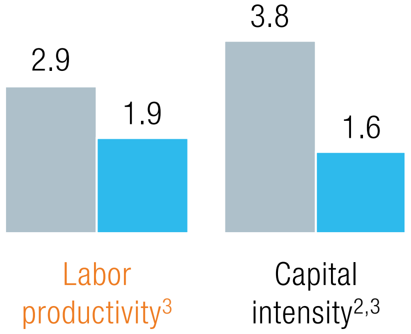
Retail

■ 2000–04 ■ 2010–14

The sector at a glance

Our analysis of the retail sector includes activities related to goods sold to the public for consumption rather than resale[1]

Compound annual growth rate (%)



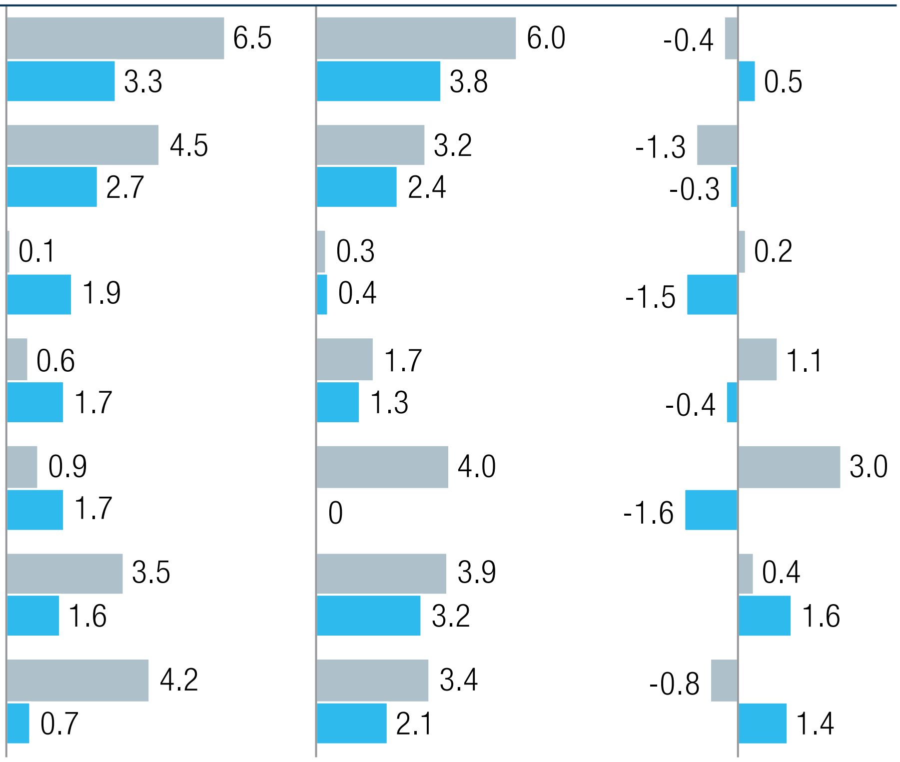
17% contribution to the productivity-growth slowdown across countries[4]

In 2010–14 vs. 2000–04, retail sales growth fell by **3** percentage points on average across countries

Online retail up to **2x** more productive than offline

but only **~10%** of total sales

Productivity-growth trends



	2014 share (%) **of**		**Compound annual growth rate** (%)					
	Gross value added	Hours worked	Labor productivity[5]		Value added		Hours worked	
			2000–04	2010–14	2000–04	2010–14	2000–04	2010–14
Sweden	10.9	12.8	6.5	3.3	6.0	3.8	-0.4	0.5
Germany	9.7	13.5	4.5	2.7	3.2	2.4	-1.3	-0.3
Italy	11.3	16.2	0.1	1.9	0.3	0.4	0.2	-1.5
France	10.2	13.5	0.6	1.7	1.7	1.3	1.1	-0.4
Spain	11.9	19.0	0.9	1.7	4.0	0	3.0	-1.6
United Kingdom	10.9	14.8	3.5	1.6	3.9	3.2	0.4	1.6
United States	13.9	18.5	4.2	0.7	3.4	2.1	-0.8	1.4

1 US data are for the private business sector only; Europe data are for the total economy. These data include both retail and wholesale trade due to data availability issues across countries (ISIC code G for Europe and NAICS codes 42, 44, 45 for the United States).
2 Simple average across countries.
3 Growth of capital services per hour worked.
4 Includes simple average of countries where the industry contributed to a slowdown in productivity growth.
5 Order based on fastest to slowest labor productivity growth, 2010–14.
SOURCE: BLS Multifactor Productivity database (2016 release); EU KLEMS (2016 release); S&P Capital IQ; Euromonitor International, Retailing data (2018 edition); McKinsey Global Institute analysis

Drivers of productivity growth over time

● Simple average productivity growth across countries (%)

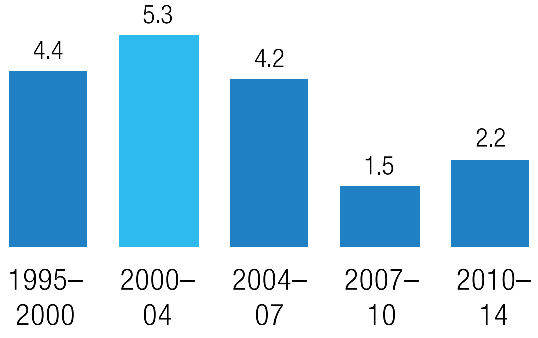
2.9

2000–04

Productivity boomed as the benefits of the first ICT revolution continued and companies evolved business practices

- New technology such as vendor coordination and warehouse management systems transformed supply chains
- Companies improved managerial and business practices
- Best practices from the frontier diffused to other firms in an environment of strong competition and robust consumer spending

Retail sales growth[1]
Compound annual growth rate (%)



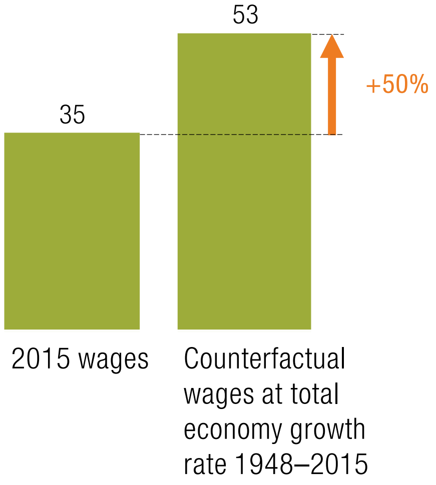
1.9

2010–14

Productivity growth slowed as all three waves hit

- **Wave 1**: Productivity gains from ICT-enabled supply-chain efficiencies and business process transformations were captured
- **Wave 2**
  - Weak demand reduced sales growth by ~3 percentage points on average without easy options to scale down labor
  - Shift to higher value-per-unit products waned, dragged down productivity growth
  - Low wages limited the drive to automate and shifted labor into low-value tasks (meeter-greeter)
- **Wave 3**: Online twice as productive as offline, yet only ~10% share, and involves transition costs

US retail annual wages
($ thousand per full-time equivalent)



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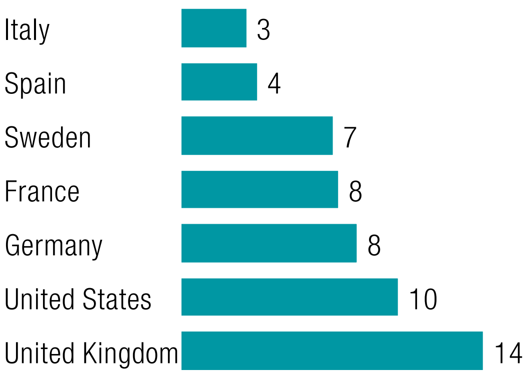
2015–25

Greater penetration of e-commerce, automation, and the use of data analytics provide productivity opportunities

- Continued change of retail business models
- New technologies (e.g., new forms of self-checkout, goods handling with robotics/drones, automated ordering) offer the potential to increase efficiency
- Use of data and analytics to increase value added
- Uncertainty exists about pace of adoption/future of new business models and technology

Share of online sales[2]
% of total retail sales (excluding sales tax)



1 Simple average across countries with available data: France, Germany, Spain, Sweden, and the United States, based on nominal gross/sectoral output in LCU.
2 Euromonitor International, Retailing data (2018 edition).
SOURCE: BLS Multifactor Productivity database (2016 release); EU KLEMS (2016 release); BEA; S&P Capital IQ; Euromonitor International, Retailing data (2018 edition); McKinsey Global Institute analysis

TECHNOLOGY STANDS OUT WITH THE SHARPEST DECLINE IN PRODUCTIVITY GROWTH, A DECLINE THAT STARTED EVEN BEFORE THE CRISIS

The tech sector, including electronics manufacturing, packaged software, and software services, plays an outsized role in productivity growth due to its own rapid rate of improvement and because it acts as a catalyst for innovation and the diffusion of tech talent. Yet it experienced the sharpest productivity-growth slowdown among our focus industries in many countries.

Our analysis mostly focuses on the United States as it represents about 60 percent of value added and about 50 percent of the employment of the industry.[132] Since 2000, the tech industry has changed in composition of value added as the share of manufacturing has declined from 47 percent to 29 percent and software services has grown from 28 percent to 43 percent in that time. The productivity dynamics in these segments are very different. Tech manufacturing is R&D- and capital-intensive and has fast technology upgrade cycles and large economies of scale, reflected in its potential for very rapid productivity improvements when quality improvements are accounted for. Software services are intensive in skilled labor working to develop customized software, a less scalable business in which productivity gains have been slower. This mix shift dragged down tech productivity growth by roughly 1 percent a year between 2000 and 2014; however, since the shift has been continuous, it has not contributed to the industry slowdown.

The decline in productivity growth was most pronounced in the tech manufacturing subsector. In the United States, tech manufacturing productivity grew about 18 percent per year from 2000 to 2004 and has declined steadily since then to 15 percent between 2004 and 2007, and to zero growth in 2010–14. In contrast, productivity growth in tech services and software was relatively robust; services grew at 2 percent a year from 2010 to 2014 and software 3.4 percent, roughly in line with long-term trends.

Two factors explain the slowdown in measured productivity growth in tech manufacturing. First, as the industry has expanded and matured, we have witnessed rising complexity of innovation. The late 1990s and early 2000s were characterized by rapid performance improvements in the core semiconductor and computer electronics products. The industry faced an ideal environment for rapid productivity gains: fierce competition between chip manufacturers Intel, AMD, and emerging South Korean suppliers, and robust demand from companies investing in ICT to enhance their business processes and prepare for Y2K.[133] This spurred innovation in the sector, manifested in increasing speed and decreasing costs (average per-bit price declines of 30 to 35 percent per year in dynamic random-access memory for several decades). Since then, tech manufacturing in the United States has evolved. For example, the share of hours worked in computer and peripheral equipment, semiconductor, and communications equipment manufacturing fell by eight percentage points between 2000 and 2014, while the share of equipment like navigation and measuring instruments increased by 11 percentage points in that time. While competitive intensity remains fierce, sustaining the pace of innovation has become more fragmented and complex as the proliferation of electronic devices and applications has broadened the demands on performance. The shift in demand toward smartphones (which make up 48 percent of United States spending on devices today compared with 4 percent in the mid-2000s) requires managing sometimes dozens of sensors from fingerprint recognition

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[132] Across our sample of seven countries.

[133] The competition between Intel and AMD was focused on microprocessors, while Korean players added capacity and competitive pressure especially in the DRAM space. For a detailed description of the semiconductor industry dynamics at this time, see *US productivity growth 1995–2000*, McKinsey Global Institute, October 2001, and *Productivity led growth for Korea*, McKinsey Global Institute, March 1998.

and GPS to multiple cameras, all requiring efficient power consumption to save battery time.[134] Virtual world gaming, artificial intelligence, and autonomous driving have dramatically expanded the performance demands on GPUs. Bitcoin mining has evolved with innovations in FPGAs; and dedicated ASIC arrays and dramatic improvements in power semiconductors have enabled an expanding range of electric vehicles. The breadth and depth of innovation is vast, yet the scale in many specialized chips lower and thus cost declines slower, making it harder to achieve the pace of improvements driven by increases in processor speed that characterized the past.[135] This may also have made it harder to accurately measure improvements.[136]

Second, the end of an offshoring and restructuring boom in tech manufacturing after the dot-com bust explains part of the decline. The 2001 downturn led to a wave of restructuring and offshoring. For example, the total number of jobs fell in the computer and peripheral manufacturing industry by about 20,000 between 2002 and 2004, reflecting both the rise of Asian hubs in global semiconductor and computer electronics production and assembly shifting to Mexico, Eastern Europe, and other lower-cost nearshore locations.[137] This transformation slowed in the mid-2000s before the Great Recession, and the number of jobs in this subsector has slowly increased by roughly 11,000 jobs between 2010 and 2016.

Looking ahead, productivity growth in tech manufacturing should remain above national averages. Demand for new technology is likely to continue to encourage rapid innovation across a range of applications. However, this is a sector in which our capacity to track improvements is challenging as products and their performance dimensions have proliferated and global value chains evolved. The tech industry in developed economies has already shifted toward services and software, where productivity growth could remain robust but not in the double-digit range that characterized the past wave and this should continue. Demand for high-productivity software and cloud services continues to rise: software represented an average of 27 percent of total IT spending in the United States from 2010 to 2014, and this is expected to rise to an average of 36 percent from 2018 to 2021.[138] As packaged software has almost zero marginal cost, this increased demand should translate into productivity increases. The rise of cloud services is also reducing barriers to entry for technology companies and allowing for capital-light business models, including in other industries. Finally, the advent of AI and machine learning will propel further advances in productivity.

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[134] Smartphone data based on data from IDC Worldwide Back Book Standard Edition, 2017.

[135] Researchers have also assessed whether Moore's law itself might no longer hold, or takes more effort. See, for example, Kenneth Flamm, "Has Moore's law been repealed? An economist's perspective," *Computing in Science and Engineering*, IEEE, 2017; Nicholas Bloom et al., A*re ideas getting harder to find?* NBER working paper number 23782, September 2017; and *Moore's law: Repeal or renewal?* McKinsey & Company, 2013.

[136] The way output of tech manufacturing has been measured creates additional challenges for interpreting productivity-growth slowdown. Because of rapid improvements in performance of new generations of products sold at similar or lower prices, US BEA has used quality-adjusted price deflators that adjust for, say, faster processor capacity of each generation of personal computers. However, the capacity to keep up with the data requirements to assess those improvements has become even harder, in particular as the tech device and application pool has broadened, value chains have globalized (with domestic production transitioning to domestic R&D), and the market share of multinationals has risen. This has led researchers to assess whether mismeasurement could explain the decline. See for example, David Byrne, Stephen Oliner, and Daniel Sichel, *Prices of high-tech products, mismeasurement, and pace of innovation*, NBER working paper number 23360, April 2017; David Byrne and Carol Corrado, *ICT asset prices: Marshaling evidence into new measures*, Finance and Economics discussion series, Washington Board of Governors of the Federal Reserve System, 2017; David Byrne, Stephen Oliner, and Daniel Sichel, *How fast are semiconductor prices falling?* NBER working paper number 21074, April 2015; Hal Varian, "A microeconomist looks at productivity: A view from the valley," presentation to the Brookings Institution, September 2016; Fatih Guvenen et al., *Offshore profit shifting and domestic productivity measurement*, NBER working paper number 23324, 2017; and Susan N. Houseman and Michael J. Mandel, *Measuring globalization: Better trade statistics for better policy*, Upjohn Press, 2015.

[137] See *New horizons: Multinational company investment in developing economies*, McKinsey Global Institute, October 2003.

[138] Based on data from IDC Worldwide Black Book Standard Edition, 2017.

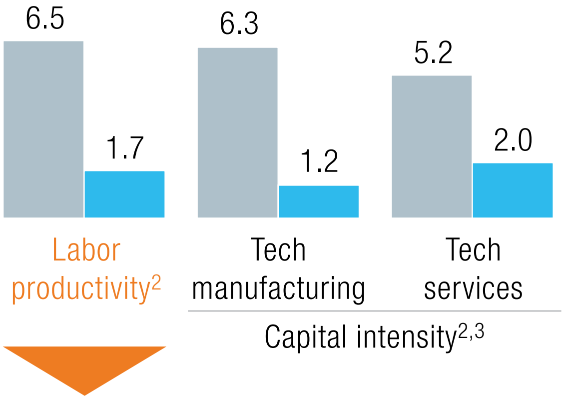
Technology

▨ 2000–04 🟦 2010–14

The sector at a glance

Our analysis of the tech sector includes manufacturing, services, and software[1]

Compound annual growth rate (%)

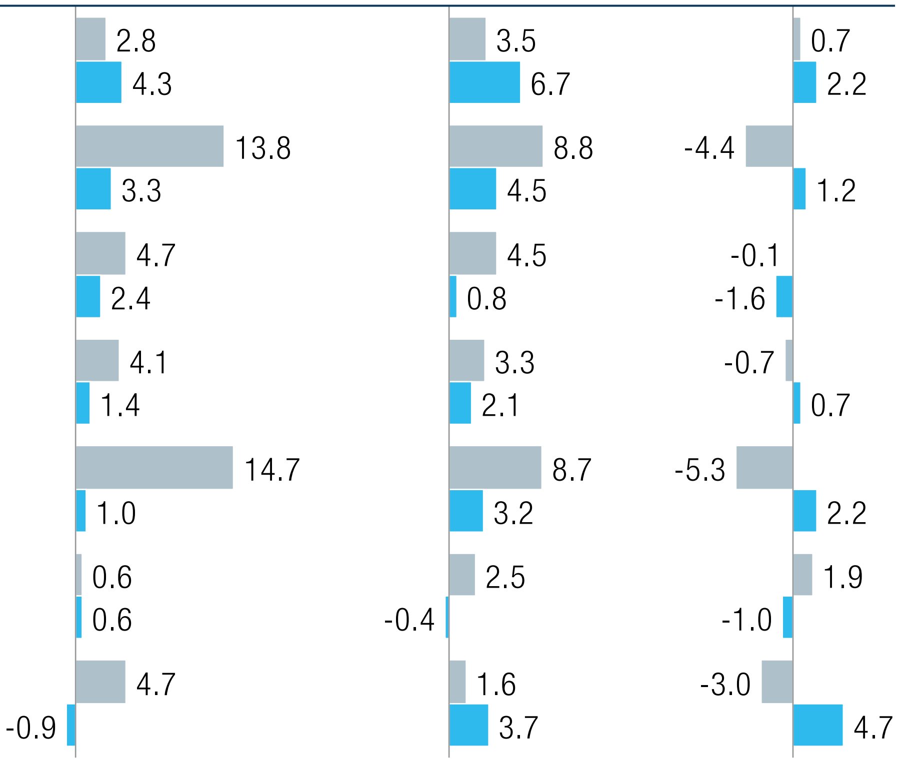


18% contribution to the productivity-growth slowdown across countries[4]

Jobs in the tech computer and peripheral manufacturing industry subsector fell by **20,000** between 2002 and 2004

Software comprised an average of **27%** of total IT spending in the US from 2010–14, expected to average **36%** from 2018–21

Productivity-growth trends



	2014 share (%) **of**		**Compound annual growth rate** (%)		
	Gross value added	Hours worked	Labor productivity[5]	Value added	Hours worked
Germany	5.6	4.1	2.8 4.3	3.5 6.7	0.7 2.2
Sweden	6.0	3.6	13.8 3.3	8.8 4.5	-4.4 1.2
Spain	2.5	2.0	4.7 2.4	4.5 0.8	-0.1 -1.6
France	3.2	2.5	4.1 1.4	3.3 2.1	-0.7 0.7
United States	6.6	3.9	14.7 1.0	8.7 3.2	-5.3 2.2
Italy	3.1	2.8	0.6 0.6	2.5 -0.4	1.9 -1.0
United Kingdom	3.7	3.4	4.7 -0.9	1.6 3.7	-3.0 4.7

1 Technology manufacturing and services defined as "Electrical and optical equipment" and "IT and other information services" for European countries (ISIC codes 26-27, 62-63); for the United States, includes "Computer and electronic products," "Data processing, internet publishing, and other information services," "Computer systems design and related services," and "Publishing industries, excluding internet (including software)" (NAICS codes 334, 511, 518, 519 and 5415). US data are for the private business sector only; Europe data are for the total economy.
2 Simple average across countries.
3 Growth of capital services per hour worked.
4 Includes simple average of countries where the industry contributed to a slowdown in productivity growth.
5 Order based on fastest to slowest labor productivity growth, 2010–14.
SOURCE: BLS Multifactor Productivity database (2016 release); IDC Worldwide Black Book Standard Edition, 2017; EU KLEMS (2016 release); press search; McKinsey Global Institute analysis

Drivers of productivity growth over time

● Simple average productivity growth across countries (%)

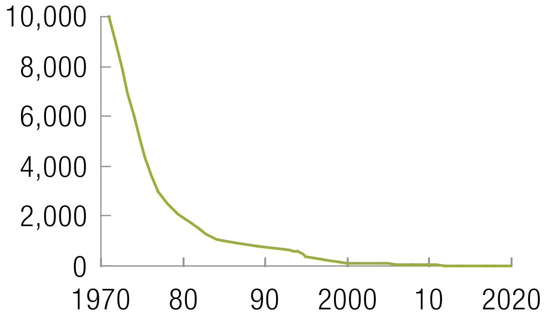
6.5

2000–04

Rapid innovation driven by fierce competition, demand along with restructuring

- Rapid performance improvements in the late 1990s and early 2000s driven by
  - Fierce competition between Intel, AMD, and emerging South Korean suppliers
  - Robust demand from companies
- Dot-com bust during 2001 downturn led to a wave of restructuring and offshoring across tech manufacturing subsectors

Semiconductor node introduction[1] (nanometer)



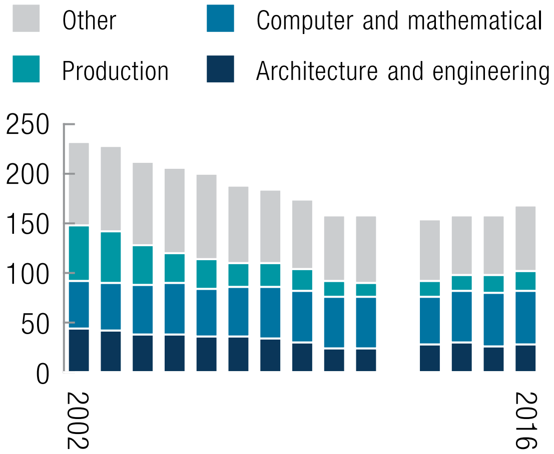
1.7

2010–14

Waning of restructuring boom, with rising complexity of innovation

- **Wave 1**
  - Benefits from restructuring and manufacturing offshoring after 2001 waned
  - Mobile and graphics use broadened performance requirements and added complexity without Moore's law improvement dynamics
- **Wave 2**: n/a
- **Wave 3**
  - Continued growth of productive cloud applications, and data- and AI-based business models
  - Continued expansion of lower productivity-growth services

Number of jobs by occupation, computer and peripheral equipment manufacturing, US example (thousand)



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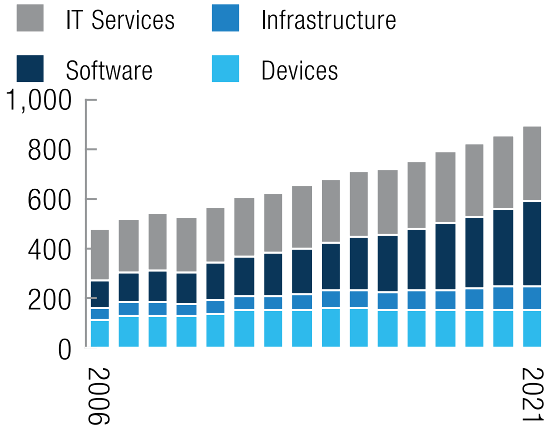
2015–25

Continued growth of software and services, with continued innovation in tech manufacturing

- Rapid innovations and performance improvements across broad range of industries, devices, applications (e.g., virtual reality, autonomous/electric vehicles, crypto-currencies)
- Continued growth of software and services (e.g., cloud services) with robust productivity growth, including driven by AI and machine learning

Total IT spend, US example ($ billion)



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[1] Refers to introduction of new technologies for semiconductor manufacture and their corresponding design rules.

SOURCE: Press search; BLS occupational data; BLS Multifactor Productivity database (2016 release); IDC Worldwide Black Book Standard Edition, 2017; EU KLEMS (2016 release); McKinsey Global Institute analysis

A COUNTEREXAMPLE: WHY PRODUCTIVITY GROWTH REMAINED STABLE IN THE TOURISM SECTOR ACROSS COUNTRIES

Across our sectors, tourism stands out, with slow but sustained productivity growth since 2000 and without a clear decline from 2010 to 2014. What explains this trend? The tourism industry is a diverse, highly labor-intensive industry that comprises transportation, accommodation, food services, and arts, entertainment, and recreation. Across many of these categories, labor productivity levels are among the lowest in the economy, even slightly below that of other service industries such as retail and education in some countries. We find that its slow but relatively steady productivity evolution since the turn of the century is explained by shifts in demand and the adoption of digital solutions.

Demand for tourism can be volatile, and since the turn of the century, there have been two major demand shocks: the 9/11 attacks in the United States, and the financial crisis. These shocks led to quick and severe drops in travel and left many airlines and hotels with excess capacity. While some of the staffing needs, such as hotel cleaning, can be adjusted, many others require constant attendance despite the lower volume of visitors, leading to weaker labor productivity growth. After the financial crisis hit, for example, productivity growth fell from 0.7 percent in 2000–04 to minus 0.6 percent on average in the sector as value added contracted faster than jobs, for example, in France and the United States. Yet these shocks masked a longer-term robust demand momentum, fueled by both income and demographics, that has helped the industry to bounce back from the downturn, a trend we expect to continue.

Online transactions for airlines increased from **14%** in 2001 to **34%** in 2005

Innovations and operational improvement within the industry have also contributed to the sustained growth trend since 2000, starting with performance pressure during the post-9/11 demand decline. Airlines, for instance, reduced direct labor inputs substantially through the centralization of back-end resources, using technology to automate front-end processes such as check-in, along with an increasing trend of offshoring jobs related to IT services and administrative processes. This is reflected in the decline in labor share, from 35 percent of revenue in 2000 to 24 percent in 2014. Consolidation across airlines, particularly in the United States, led to restructuring and efficiency gains from greater economies of scale.[139] As another illustration, the number of retail travel agency outlets has decreased significantly since the early 2000s due to increased productivity and the rise of online channels.

The tourism sector has been in many ways a pioneer of digital transformations, starting with online air travel and hotel booking. Online transactions for airlines in the United States, for example, increased from 14 percent of all transactions in 2001 to 34 percent in 2005, dramatically reducing labor inputs needed for the same number of bookings.[140] Online aggregators such as Booking.com increased price transparency and provided customers with more choice and convenience, while the entry of low-cost airlines helped drive productivity gains by increasing competitive pressures. We have seen the rise of new business models, with Airbnb starting operations in 2008 and growing, but still makes up less than a 5 percent market share of demand for rooms.[141] While the speed of technological

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[139] Industry dynamics vary for airlines and hotels. The airline industry is relatively concentrated, with the top three US airlines, for example, having roughly 65 percent market share, based on data from the US Department of Transportation. Consolidation was driven by losses in the industry and an imperative for restructuring. Consolidation has also been occurring in the hotel industry, but it has been driven primarily by the large chains seeking to add more brands to their portfolios to serve a broad array of customer segments and to expand in new geographies. This part of the tourism industry remains relatively less concentrated, though, with the top three players in the United States having roughly 45 percent market share by revenue and 35 percent of inventory, based on data from Euromonitor International Travel (2018 edition).

[140] Based on data from Phocuswright, *US Online Travel Overview Sixteenth Edition*, 2017.

[141] “Airbnb and hotel performance: An analysis of proprietary data in 13 global markets,” *STR*, 2017.

adoption varies between subsectors of the tourism industry and types of players, the productivity of the industry overall has benefited from digitization.

Looking ahead, we find further productivity-growth potential as digitization continues across the tourism sector. Large opportunities to both improve internal operations and enhance the customer experience remain. There is room for greater labor cost savings with the introduction of technologies such as facial recognition at airports, predictive maintenance, and automation.[142] For example, online transaction volumes still remain at 40 percent for hotels in the United States, and 48 percent in Europe.[143] Better revenue optimization through targeted marketing of new custom products using big data to predict demand and set pricing to help fill capacity is just at the beginning.

We also expect increasing experimentation with online and shared-economy business models. In the hotel industry, digital players have entered as information providers, sales channels, tour operators, and providers of rooms. They can help personalize travel, increase customer choice, and add to supply. For example, Airbnb now has listings of more than 3 million units worldwide.[144] A variety of other digital players have entered this space. Websites like Booking.com and Expedia are growing at double-digit rates, with higher margins compared to traditional players. New entrants include Google Trips. Online players are helping to create price transparency in the industry and, with their mechanisms to highlight customer feedback and ratings, are increasing pressure on companies to improve the quality of their offerings. Finally, these business models are not only taking a higher share of consumer spending but are also contributing to increasing the overall size of the market, with more people willing to travel given increased transparency and lower prices.

Tourism should also benefit from ongoing demand growth that will continue momentum for productivity growth. External forecasts suggest that demand for tourism is expected to grow at 4.2 percent a year between 2014 and 2020, on par with historical growth rates.[145] Growing numbers of people are traveling worldwide, and the expansion and diversification of service offerings is boosting spending per traveler. Aging baby boomers across developed economies are the largest consumer group fueling global demand, contributing 20 percent of global consumption growth in the period to 2030.[146] As they retire, they have more time to travel. In addition, demand will be fueled by an appetite to travel from millennials and the growing middle class in emerging regions such as China. The industry also has the potential for value-added growth as an increasingly diverse population of tourists is an opportunity for companies to provide differentiated offerings to each customer segment. While the industry has had separate offerings for mass and luxury segments for a long time, better use of customer data enables companies to target and tailor offerings to increasingly small niche segments. Some examples of customized offerings already in the market range from active hiking and biking tours and food or medical tourism to tours designed for international visitors. Strong demand growth can help keep capacity utilization in the industry healthy and fuel new investment and innovations.

Yet we also identify headwinds that could hold back productivity growth in tourism. Some of the new business models described above push the boundaries of existing regulations and lead to regulatory uncertainty and possible direct restrictions on their operations. Potential visa and other policy restrictions for cross-border travel may limit the expansion of the number of travelers. And given the volatility of tourism demand, unforeseen events, such as rising terrorism, crime, or war, or simply another recession, could dampen demand growth.

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[142] Wage growth in the sector has remained moderate, putting limited pressure on companies to emphasize automation. However, going forward, if wages rise, we could see industries turning to automation much faster than expected.

[143] Based on data for 2016 from Phocuswright, *US Online Travel Overview Sixteenth Edition*, 2017, and Phocuswright, *European Online Travel Overview Twelfth Edition*, 2016.

[144] “Airbnb and hotel performance: An analysis of proprietary data in 13 global markets,” *STR*, 2017.

[145] Based on data from WTTC on travel and tourism consumption, and is a simple average of consumption growth in local currency units across France, Germany, Spain, Sweden, United Kingdom and the United States.

[146] For a detailed look at aging consumers’ spending and consumption patterns, see *Urban world: Global consumers to watch*, McKinsey Global Institute, April 2016.

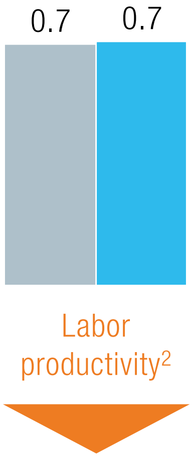
Tourism

▨ 2000–04 🟦 2010–14

The sector at a glance

Our analysis of the tourism sector includes the transportation of people, accommodation, food services, and arts, entertainment, and recreation[1]

Compound annual growth rate (%)

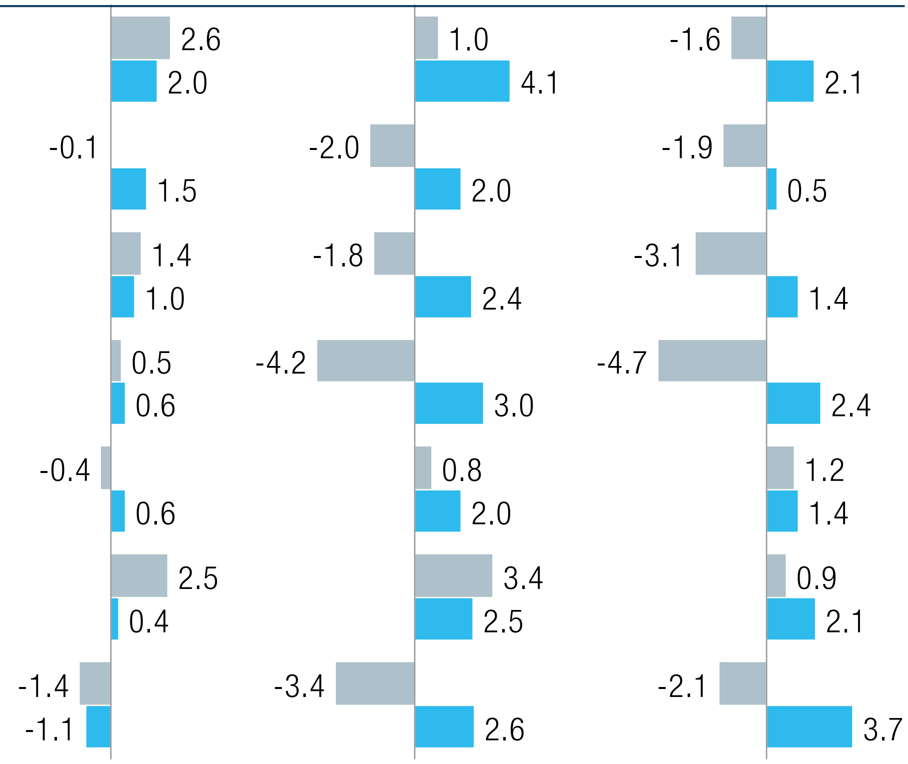


Online transactions for airlines increased from **14%** in 2001 to **34%** in 2005 and today stand at **56%**

Demand growth fell to **-0.7%** during the crisis but recovered to precrisis levels of roughly **4%** in 2010–14

Airbnb today has roughly **5%** of market share in accommodation

Productivity-growth trends



	2014 share (%) **of**		**Compound annual growth rate** (%)					
	Gross value added	Hours worked	Labor Productivity[3]		Value added		Employment[4]	
			2000–04	2010–14	2000–04	2010–14	2000–04	2010–14
United States	2.7	3.6	2.6	2.0	1.0	4.1	-1.6	2.1
Germany	3.9	7.0	-0.1	1.5	-2.0	2.0	-1.9	0.5
France	3.8	4.4	1.4	1.0	-1.8	2.4	-3.1	1.4
United Kingdom	3.3	4.5	0.5	0.6	-4.2	3.0	-4.7	2.4
Spain	5.1	4.6	-0.4	0.6	0.8	2.0	1.2	1.4
Sweden	2.3	3.3	2.5	0.4	3.4	2.5	0.9	2.1
Italy	4.4	5.3	-1.4	-1.1	-3.4	2.6	-2.1	3.7

1 Data for tourism sector as a whole obtained from WTTC; hence we did not need to aggregate tourism sub-sectors using EU KLEMS and BLS data.
2 Simple average across countries. Based on number of jobs vs. hours worked due to data availability.
3 Order based on fastest to slowest labor productivity growth, 2010–14.
4 Number of jobs used in lieu of hours worked due to data availability.
NOTE: Capital intensity and contribution to the productivity-growth decline not available for tourism.
SOURCE: Phocuswright; WTTC; McKinsey Global Institute analysis

Drivers of productivity growth over time

● Simple average productivity growth across countries (%)

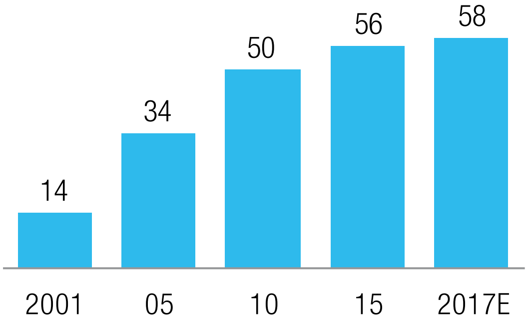
0.7

2000–04

Innovation and operational improvement, start of digital transformations, particularly from online channels, boosted productivity growth

- Demand shock in countries post-9/11 attack in United States; performance pressure drove restructuring, innovation, and operational improvements
- Firms starting to computerize business processes including online booking systems

US airlines online booking transactions
%



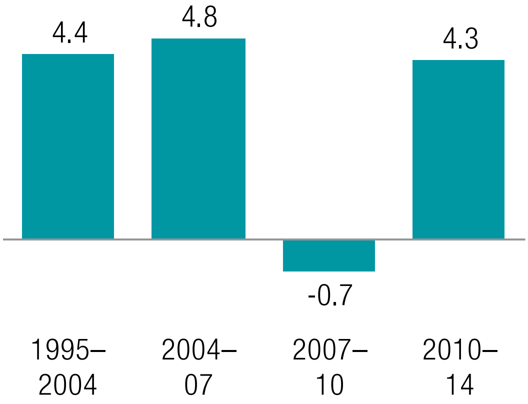
0.7

2010–14

Demand returned, digitization continued, and operational efficiency underpinned productivity

- Robust demand recovery postcrisis after a brief dip
- Continued focus on efficiency
  - Ongoing automation of tasks such as check-in
  - Increased outsourcing
  - Consolidation across all forms of travel and accommodation, especially in United States
- Continued focus on digitization with growing share of new business models like Airbnb

Travel and tourism consumption[1]
Compound annual growth rate (%)



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2015–25

Digital opportunities, new business models, and robust demand could boost productivity growth

- Digital opportunities (e.g., revenue optimization led by advanced analytics for higher capacity utilization, generating higher value added through customized products)
- Introduction of new business models across value chain, specifically among travel agents
- Increasing shift to capital-light models for parts of the sector
- Continuing growth in demand from emerging markets, retirees, and millennials

Changes across value chain (examples)

Suppliers
- Airbnb: Asset-light model gaining market share
- Ryanair: Car rental, room, holidays as well as travel

Intermediaries
- Google, Spotsetter: New players planning to integrate suppliers and act as pseudo-capacity provider and matcher

Customers
- Google Trips: Personalizing travel
- Secret Escapes: Offering new point of sale with more choice

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[1] Based on data in local currency units on travel and tourism consumption from WTTC in nominal terms. Simple average of growth across France, Germany, Spain, Sweden, United Kingdom, and United States.

SOURCE: Phocuswright; WTTC; McKinsey Global Institute analysis

WEAK PRODUCTIVITY GROWTH IN UTILITIES: A CASE OF DECLINING DEMAND FROM GREATER ENERGY EFFICIENCY AND CHANGES IN REGULATION

The utilities sector provides another case study in how demand—and regulation shaping that demand—impacts productivity growth, alongside technological disruption. The sector stands out as having the most consistent decline in productivity growth across countries, even negative levels in many cases, due to a sharp decrease in value-added growth accompanied by an increase in hours worked growth. The factors at play are the waning of a liberalization wave, declining demand from energy efficiency measures and other factors, and technological disruption from digital and renewables that will eventually boost productivity but come with a protracted transition.

1.7%

drop in electricity consumption per year in Europe between 2010 and 2014

During the 1990s and 2000s, a wave of deregulation occurred in the United States and Europe, opening utilities up for competition.[147] This included generation, where many suppliers could provide power to a grid, and resellers who could sell electricity to consumers. In the United States, deregulation began in the late 1990s to varying degrees by state. This meant that the value chain around the electricity distribution networks, still owned by a regulated monopoly, was rapidly transforming. The competition in generation and reselling also helped drive operational efficiency gains.[148] The electricity transmission and distribution networks were in turn encouraged to focus on operational efficiency gains through the use of performance-based ratings schemes, particularly in Europe, where revenues were dependent on achieving such gains. This also helped drive productivity improvements in the sector. For example, companies focused on operational efficiency gains like maximizing time for personnel in the field and reducing travel time with route optimization, bundling inspections, and so forth. However, some of these factors ended by the mid-2000s. For example, in the United Kingdom, the period from 2000 to 2005 saw regulators requiring efficiency improvements of 3 percent per year, but by 2010, there was no such requirement. Particularly in the United States, there is room to further liberalize the sector in generation and sales, boosting productivity growth; only 20 states allow some degree of competition in reselling choice, for example.

At the same time, the industry has faced a trend of declining demand for electricity since the mid-2000s, slowing productivity growth in a given grid network. Energy efficiency technologies such as LED lights and more efficient air conditioning systems, together with demand-side factors, drove down total consumption as well as consumption per capita of electricity across countries. In Europe, consumption fell by 1.7 percent per year between 2010 and 2014, compared with growth of 2.1 percent between 2000 and 2004, while in the United States, it fell to 0.1 percent after growth of 0.9 percent.[149] Government regulation has played a critical role in shaping consumer preferences and reducing demand for electricity. For example, Europe set energy and emission targets for 2020: a 20 percent reduction in greenhouse gases, a 20 percent increase in savings from energy efficiency, and 20 percent of energy consumption from renewables. While demand has declined in utilities, labor

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[147] Deregulation typically occurs in the electricity generation and retail/reselling subsectors of utilities, while transmission and distribution represents a regulated natural monopoly.

[148] On the retail side, there is debate about the final effect of deregulation on productivity, as multiple factors come to bear. Deregulation could result in multiple providers duplicating functions of customer service, marketing, billing, and so forth, which could drag down productivity growth. Meanwhile, retail choice allows new entrants to innovate in new value-added offerings beyond just the core energy commodity (for example, providing customers with dynamic price packages, and bundling electricity consumption with other services like security systems). To what extent the deregulated retail market increases value added and changes the amount of labor will ultimately determine productivity gains.

[149] Based on a simple average of growth in France, Germany, Spain, Sweden, and the United Kingdom for Europe. Based on data from Eurostat and EIA.

has not been correspondingly cut back because of two factors. First, many of the easier operational improvements and labor cuts had already taken place during earlier efficiency improvement efforts. Second, the transmission and distribution subsector, which makes up a significant portion of employment (as much as 60 percent, for example, in the United States), is mainly driven by the number of customers rather than by per capita demand.

Demand may continue to play a limiting role for productivity growth in the sector. McKinsey's Energy Insights, Power IQ models, and past MGI research suggest that electricity consumption in the United States and Western Europe could remain flat or grow slowly as energy efficiency improvements continue and generation for own use on the part of households (so-called distributed generation) picks up. Flattening consumption could limit the benefits of other productivity drivers unless labor and capacity are reduced accordingly. However, there is the potential for upside from electrification (for example due to the advent of electric vehicles), which could keep demand for utilities robust.

Like other sectors, utilities are in the middle of a digital transition that takes time and comes with transition costs. The digital utility of the future will innovate across the entire value chain, with many opportunities to reduce labor and increase productivity from things like big data–driven supply and demand matching, predictive maintenance, smart-grid infrastructure, and automation of billing and processing. Some estimates suggest that the use of smart meters and grids, digital productivity tools for employees, and automation of back-office process could boost profitability by as much as 20 to 30 percent.[150] GPS and traffic information could be added to conventional route planning, which could help increase productive hours by 15 percent. In addition, the digital utility will reinvent the user experience via mobile solutions and apps, and price-comparison websites, which will continue to increase transparency in the retail market. However, utility providers are still in the process of making these investments, and a learning curve continues to be associated with many of them. As with other digital disruptions, making the most of these technologies is not just about making the investment but about corresponding business process and organizational changes. For example, the productivity gains from smart meter technologies are not just from ease of meter readings and billings but come when the data can be used for analysis to identify which customers need help to avoid defaults on their bills, use of data for predictive maintenance and enabling better asset health, and helping utilities understand and manage patterns in demand.[151]

The shift to renewables will be a boon to labor productivity in the long run. The energy mix shift will continue due to targets for renewables set in Europe, the falling price of renewable energy, and legacy technologies that may become less attractive over time. Renewables still make up less than 10 percent of power generation in the United States and less than 20 percent in Europe, and as costs decline further they will be more competitive with fossil fuels.[152] The advent of electricity storage could also make renewables far more attractive compared with fossil fuels.[153]

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[150] *The digital utility: New opportunities and challenges*, McKinsey & Company, 2016.

[151] Ibid.

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

[153] Thus far, it has not been possible to store electricity economically. This means that the industry must maintain more generation capacity than will be used (reserve capacity) to ensure that demand does not exceed supply. This is particularly exacerbated in the case of the use of renewables, which have lower utilization than legacy plants because they often depend on weather conditions to produce energy.

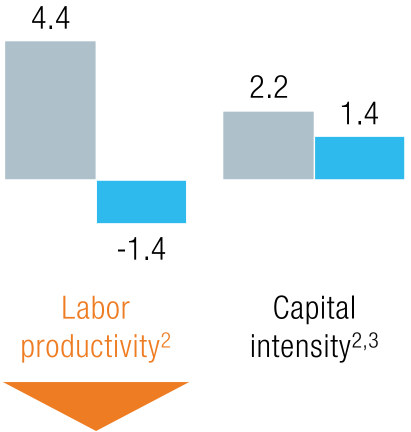
Utilities

■ 2000–04 ■ 2010–14

The sector at a glance

Our analysis of the utilities sector includes electric power generation, transmission, and distribution[1]

Compound annual growth rate (%)



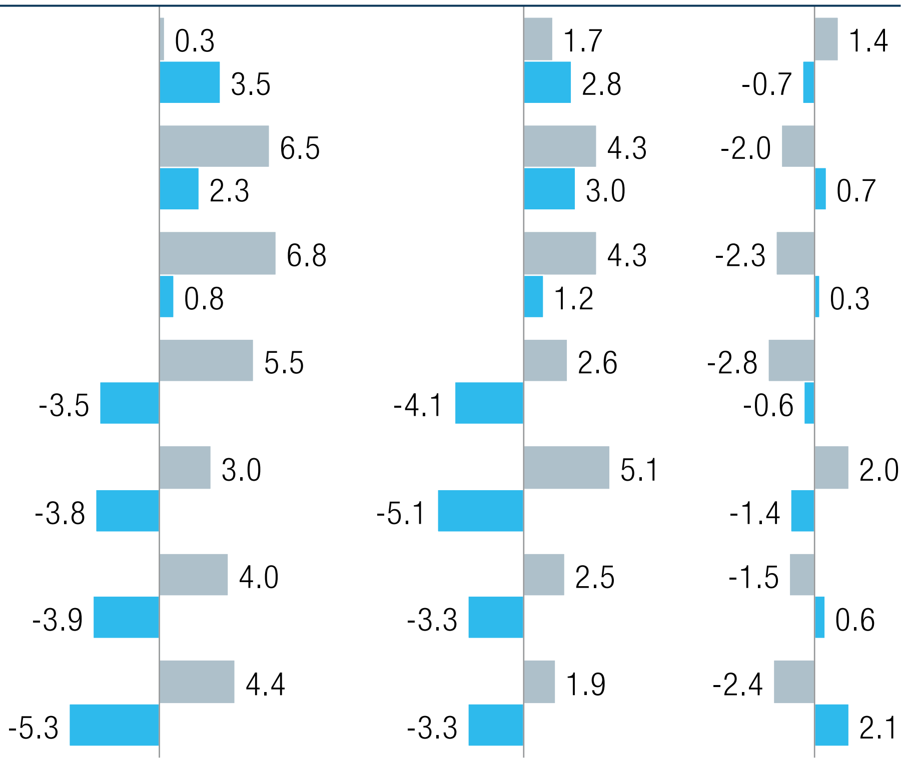
15% contribution to the productivity-growth slowdown across countries[4]

1.5–2.4% decline per year in hours worked during 2000–04, in the United States and some European countries, boosting productivity

~3.5 percentage-point fall in electricity demand growth in Europe between 2000–04 and 2010–14

Smart meters and grids, digital productivity tools for employees, and automation of back-office process could boost profitability[5] by as much as **20–30%**

Productivity-growth trends



	2014 share (%) **of**		**Compound annual growth rate** (%)					
	Gross value added	Hours worked	Labor productivity[6]		Value added		Hours worked	
			2000–04	2010–14	2000–04	2010–14	2000–04	2010–14
Sweden	2.5	0.7	0.3	3.5	1.7	2.8	1.4	-0.7
France	1.8	0.5	6.5	2.3	4.3	3.0	-2.0	0.7
United States	3.0	0.6	6.8	0.8	4.3	1.2	-2.3	0.3
Italy	1.8	0.4	5.5	-3.5	2.6	-4.1	-2.8	-0.6
Spain	2.5	0.3	3.0	-3.8	5.1	-5.1	2.0	-1.4
Germany	1.8	0.7	4.0	-3.9	2.5	-3.3	-1.5	0.6
United Kingdom	1.5	0.5	4.4	-5.3	1.9	-3.3	-2.4	2.1

1 Utilities defined as "Electricity, gas, steam and A/C supply" for European countries (ISIC code D) and "Utilities" for the United States (NAICS code 22). US data are for the private business sector only; Europe data are for the total economy.
2 Simple average across countries.
3 Growth of capital services per hour worked.
4 Includes simple average of countries where the industry contributed to a slowdown in productivity growth.
5 *The digital utility: New opportunities and challenges*, McKinsey & Company, 2016.
6 Order based on fastest to slowest labor productivity growth, 2010–14.
SOURCE: BLS Multifactor Productivity database (2016 release); EIA; Eurostat; McKinsey Global Institute analysis

Drivers of productivity growth over time

● Simple average productivity growth across countries (%)

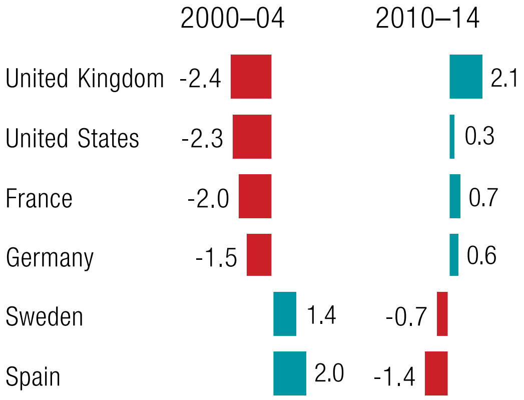
4.4

2000–04

Liberalization from the 1990s/2000s and operational efficiency gains boosted productivity growth

- Liberalization in electricity generation and retail increased competition and efficiency
- Performance-based rating schemes promoted operational efficiency in the regulated transmission and distribution sector

Hours worked (average annual growth, %)



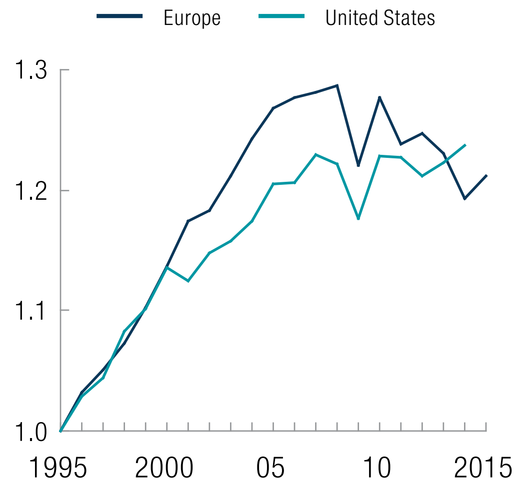
-1.4

2010–14

Waning of liberalization wave, weak demand, while digitization was still subscale, driving down productivity

- **Wave 1**: Waning of liberalization wave
- **Wave 2**: Energy efficiency efforts and the financial crisis eroded demand, while labor in transmission and distribution (60% of employment) could not be streamlined
- **Wave 3**
  - Smart meters and grids, digital productivity tools for employees, and automation of the back office could boost profitability, but investment remains subscale and requires learning
  - Solar and wind have higher labor productivity, but legacy plants cannot yet be decommissioned for capacity and stability reasons, resulting in transition costs

Energy consumption (MWh)[1]
Index: 1 = 1995



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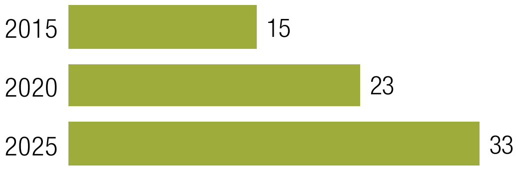
2015–25

Continuing weak demand yet digital opportunities remain

- Electricity consumption likely to remain weak as energy efficiency improvements continue and population growth slows, with some upside from electrification of vehicles
- Digitization/automation could enable better productivity across the sector
- Higher penetration of renewables production with higher labor productivity, yet also increased requirements on the grid

Share of renewables in total generation (%)[2]



1 Based on data from EIA and Eurostat. Europe is simple average of France, Germany, Spain, Sweden, and the United Kingdom.
2 Simple average of share across countries, considering France, Germany, Spain, the United Kingdom, and the United States.
SOURCE: BLS Multifactor Productivity database (2016 release); EIA; Eurostat; McKinsey Energy Insights, Global Energy Perspective; McKinsey Global Institute analysis

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5. CAPTURING THE PRODUCTIVITY POTENTIAL OF A DIGITAL AGE

As financial crisis aftereffects dissipate and the digital transformation of industries continues, we expect productivity growth to recover from current lows across sectors and countries. We are seeing an uptick today in economic variables like productivity and GDP growth in many countries. Our sector deep dives reveal significant potential to boost productivity growth from opportunities such as traditional operational efficiency gains as well as new avenues enabled by digital technologies. We estimate that productivity-boosting opportunities could amount to at least 2 percent per year productivity growth over the next ten years, with more than half of that coming from the latest wave of digital opportunities. However, there is no guarantee that the productivity-growth potential we identify will be realized. Two factors stand out that may keep productivity growth below potential. First, changing demographics, rising income inequality, decreasing labor share of income, and a decline in investment relative to earnings could create chronic drags on the demand for products and services. Second, the nature of digital technologies is reshaping industry structures and economics in a way that raises questions about incentives to invest and innovate, and could further amplify demand drags. As a result, traditional supply-side approaches alone to boost productivity growth may prove inadequate. Addressing bottlenecks in both demand and digital diffusion may be required to capture the productivity-growth potential of advanced economies.

60%
of the productivity potential comes from digital opportunities

In this chapter, we identify productivity-boosting opportunities across industries, including those emerging from the next wave of mobile, automation, and data analysis. We then discuss how demand drags and potential consequences of the emerging digital economy may prevent the full opportunities from being realized. Finally, we outline an approach to boosting productivity growth for stakeholders that includes a dual focus on promoting sustained demand and digital diffusion.

WE IDENTIFY A PRODUCTIVITY-GROWTH POTENTIAL OF AT LEAST 2 PERCENT FROM A RANGE OF DIGITAL AND NON-DIGITAL OPPORTUNITIES

Our sector deep dives reveal significant potential to boost productivity growth from a continuation of core opportunities such as operational efficiency gains and from new avenues enabled by digital technologies. We estimate that the productivity-boosting opportunities could lead to growth of at least 2 percent per year over the next ten years, with 60 percent coming from digital opportunities (Exhibit 23).[154] The opportunities we have identified range from those within companies—to boost efficiency, reduce costs, streamline labor requirements, and enhance innovation—to opportunities that are reshaping entire business models and industries and changing barriers to entry.[155] In addition, external factors such as regulation can positively influence industry behavior and company action that boosts productivity growth. Our findings strongly suggest that recent weak productivity growth is not caused by a lack of enhanced tools or techniques nor is it a predictor of the future.[156]

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[154] Based on an analysis of current and past MGI estimates. See *Global growth: Can productivity save the day in an aging world?* McKinsey Global Institute, January 2015; *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015; *Digital Europe: Pushing the frontier, capturing the benefits*, McKinsey Global Institute, June 2016; and *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017.

[155] See Chapter 4 for a detailed discussion of productivity-enhancing opportunities by sector.

[156] Research by others also shows that past productivity performance has been a poor predictor of future performance. See Erik Brynjolfsson, Daniel Rock, and Chad Syverson, *Artificial intelligence and the modern productivity paradox: A clash of expectations and statistics*, NBER working paper number 24001, November 2017.

Exhibit 23

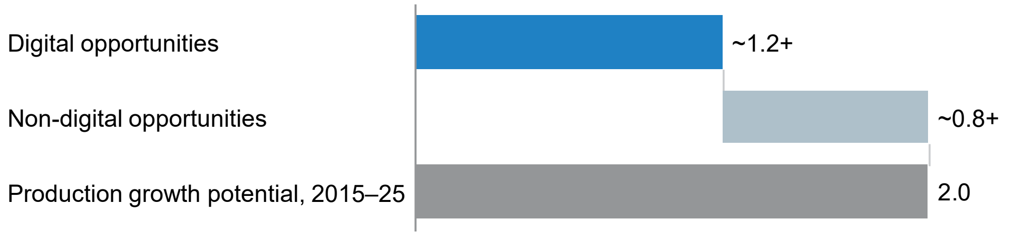
Significant productivity-boosting opportunities exist across sectors

Examples

Purely digital opportunities

Automotive	Finance	Retail	Tech	Tourism	Utilities
Operational efficiency improvements					
▪ Predictive maintenance ▪ Advanced robotics ▪ 3-D printing ▪ Electric vehicles ▪ Continued operational improvements and global platforms	▪ Compliance, back- and front-office automation ▪ Branch consolidation	▪ Goods handling with robotics/ drones ▪ Automated checkout ▪ In-store and warehouse operational improvements and inventory optimization ▪ Continuing store mix shift to more productive large formats and chain stores	▪ Predictive maintenance ▪ Testing with machine learning ▪ Continued benefits from zero marginal cost in software	▪ Predictive maintenance ▪ Automation ▪ Reservations apps ▪ Continued consolidation potential (e.g., hotels)	▪ Smart grids and meters ▪ Drones for inspection ▪ Route optimization and bundling inspections ▪ Energy storage
Enhancing value added					
▪ Autonomous driving ▪ Continued shift to premium cars	▪ Digital wallets ▪ Innovative payment methods	▪ Customer targeting/ bundling via data analytics	▪ Wearables technology ▪ Voice-activated assistants and aids	▪ Revenue and capacity management	▪ Energy management systems in homes/offices
Adoption of new business models					
▪ Infotainment and connected car	▪ Mobile and online banking ▪ Peer-to-peer lending ▪ Blockchain	▪ E-commerce	▪ App stores ▪ Cloud services	▪ Shared economy (e.g., Airbnb) ▪ Vertical aggregators (e.g., Google Trips)	▪ Customers feeding back into the grid ▪ Shift to more productive renewables
Reducing barriers to entry and improving price transparency					
▪ Online comparison websites				▪ Comparison websites and marketplaces (e.g., Trip-Advisor)	▪ Retail comparison websites

Productivity-growth potential, United States and Western Europe, 2015–25
Percentage points



NOTE: Our estimate for the productivity-growth potential builds on extensive past MGI research on sector opportunities for improving productivity through technologies that are already implemented today or have a clear path to deployment at scale by 2025. These include benefits from digitization (e.g., big data, Internet of Things, automation, AI) as well as nondigital opportunities such as mix shifts in products and channels, continued consolidation, etc. See *Global growth: Can productivity save the day in an aging world?* McKinsey Global Institute, January 2015; *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015; *Digital Europe: Pushing the frontier, capturing the benefits*, McKinsey Global Institute, June 2016*; A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017; and technical appendix for more details.

SOURCE: McKinsey Global Institute analysis

Across sectors, operational efficiency improvements through business process efficiency, automation, digitization, and scale benefits can boost productivity growth

Increasing operational efficiency will continue to be a core focus of companies as it helps reduce costs, and we see great potential across industries. In tourism, data analytics can help better manage price and demand fluctuations and increase capacity utilization. In utilities, lean initiatives will continue to improve operational efficiency by minimizing travel times to customer locations through route optimization and bundling inspections. Continued penetration of technologies like self check-in in hotels and airports, as well as the use of self-checkout in retail, can boost productivity growth. Many automation technologies are being enhanced with the use of data and machine learning to further raise efficiency. In auto and utilities, opportunities exist for predictive maintenance through machine learning software and the Internet of Things, with remote sensors on robots to identify the likelihood of failures. In finance, the automation of knowledge work could be significant for productivity, as about half of the activities like the operation of branch networks, call centers, and monthly paper statements typically represent between 40 and 60 percent of total costs in retail and commercial banking.[157]

> Many automation technologies are being enhanced with the use of data and machine learning to further raise efficiency.

In industries from retail to logistics, past MGI research has demonstrated how increasing scale can increase incentives to invest in productivity-improving tools and processes.[158] In our sector deep dives, we find further opportunities to gain economies of scale through consolidation. Productivity growth in the tourism sector, for example, could continue to benefit from partnerships in the vertical value chain (that is, across hotels or airlines, tour providers, and customer interfaces for travel bookings), which streamline back-end resource needs, increase capacity utilization, and provide greater customer convenience. Other sectors, like construction, are also still at the early stages of consolidation and could benefit from internationalization and platform development.[159]

Enhancing value-added content through digital is becoming a more important way to lift the "numerator" component of productivity

Digital add-on features already allow drivers to utilize software in cars to help with driving and parking, home and building owners to digitally manage climate control, and customers to track packages, but there is more to come as products are enhanced with software features. In the auto sector, digitization is creating large value-added opportunities through digital vehicle content (software is projected to account for 30 percent of car value by 2030 globally, up from 10 percent in 2016). Use of customer data is also enabling online retailers to target sales and increase basket sizes through bundled purchases. Digitalized processes can reduce minimum efficient scale and allow for increasing customization, enabling companies to cater to increasingly diverse and fragmented consumer preferences and shift the mix of products and services toward more productive segments. In the auto sector, we identify this shift as a continued increase in features, a shift to premium vehicles, and increased flexibility and ability of customers to customize car features. We calculate mix shift

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[157] *A brave new world for global banking: McKinsey global banking annual review 2016*, McKinsey & Company, January 2017.

[158] *Reaching higher productivity growth in France and Germany*, McKinsey Global Institute, October 2002.

[159] *Reinventing construction through a productivity revolution*, McKinsey Global Institute, February 2017.

to premium vehicles alone could add as much as 0.2 to 0.3 percentage point to productivity growth over the next ten years in this sector in the United States. In addition, regulation could also influence the nature and pace with which features are added in the United States. Regulation mandating advanced driving assistance systems in cars, for example, could boost value added with limited impact on hours. Utilities may also experience a mix shift toward more productive renewables, which make up roughly 5 to 25 percent of the sector today (depending on the country), to 20 to 45 percent in ten years. In Europe, the EU has established targets for renewables as a share of total energy consumption, which could help drive the mix shift toward more productive renewables technology.

The introduction of new business models has productivity-boosting potential

Across sectors, new digital competitors are disrupting traditional models and replacing them with more productive ways of doing business, creating competitive pressures on incumbents. Online retail, for example, is roughly twice as productive as offline retail.[160] In finance, online banking is becoming increasingly popular, with further potential especially in the United States. In North America, 56 percent of customers report wanting to purchase products like checking accounts on digital platforms, but only 13 percent are able to do so.[161] The shift to mobile banking in finance is creating a new generation of direct banks that do not have physical branch networks and can have much lower operating costs. Tourism was an early industry to see a rapid shift to online booking, and it continues to see the rise of new digital business models like Airbnb. Since its inception in 2008, Airbnb has increased its market share to roughly 5 percent.[162]

13%
the proportion of US customers who are able to purchase bank products online compared with
56%
who want to

Reducing barriers to entry and improving price transparency can improve productivity

We find examples of platform solutions that are reducing barriers to entry and enabling smaller niche players to be more competitive. For example, the use of platforms like eBay and Etsy provides easy entry for single-person businesses. Such platforms can also create price transparency and easy comparison, thus helping foster competition. Introduction of aggregators and booking portals in tourism has tremendously improved price transparency and allowed customers to easily compare options. This has also enabled smaller niche hotels to compete with larger hotel chains. Airbnb has further shifted the industry supply curve by dramatically reducing the cost and effort required for households to rent out available beds. In the utilities sector, comparison websites for electricity retailers have the potential to continue to increase transparency and competition.

BUT CHRONIC DRAGS ON DEMAND AMPLIFIED BY DIGITAL AND CHANGES IN COMPETITIVE DYNAMICS MAY NEED TO BE ADDRESSED

There is no guarantee that the productivity-growth potential we identify will be realized. This has always been the case with productivity opportunities, as it takes time and effort for business owners, managers, and workers to change established ways of doing things, and enabling change often requires competitive pressure, a healthy business environment, and access to infrastructure and talent. However, making the most of this wave of productivity opportunities may require tackling additional barriers to growth. There are concerns that the ongoing wave of digitization may change the dynamics of productivity growth in ways that require careful management. The nature of digital technologies could fundamentally reshape industry structure and economics, and amplify the drags on demand, for example, from changing demographics and rising income inequality.

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[160] Calculated based on a measure of revenue less of cost of goods sold divided by number of employees, using company financials. Based on data from S&P Capital IQ.

[161] McKinsey Retail Banking Survey 2016.

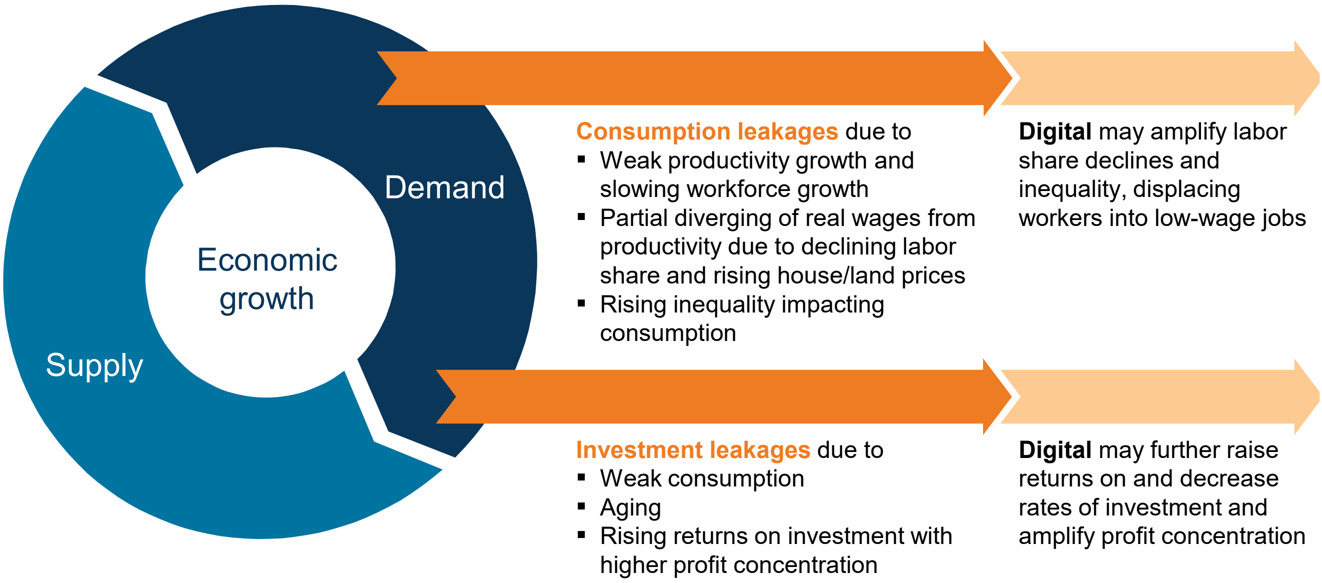
[162] "Airbnb and hotel performance: An analysis of proprietary data in 13 global markets," *STR*, 2017.

Persistent drags on demand for goods and services, amplified by digital adoption, may feed back into slower productivity growth

The impact of demand on productivity growth is often underappreciated. Yet we have found several ways weak demand hurt productivity growth in the aftermath of the financial crisis, including through lowering investment, reducing economies of scale, and shifting consumption to lower-value goods and services. Looking ahead, there is growing concern that drags on demand may be more structural in nature and that digitization may further amplify those drags. Several leakages may continue to hold back demand, capital deepening, and productivity, slowing down the virtuous cycle of growth and economic prosperity (Exhibit 24).

Exhibit 24

Long-term demand leakages could act as a drag on productivity growth and may be further amplified by digital



Consumption leakages due to
- Weak productivity growth and slowing workforce growth
- Partial diverging of real wages from productivity due to declining labor share and rising house/land prices
- Rising inequality impacting consumption

Digital may amplify labor share declines and inequality, displacing workers into low-wage jobs

Investment leakages due to
- Weak consumption
- Aging
- Rising returns on investment with higher profit concentration

Digital may further raise returns on and decrease rates of investment and amplify profit concentration

SOURCE: McKinsey Global Institute analysis

Persistent drags on household consumption may include diverging wage and productivity growth, growing inequality, and changing demographics

For some time now, wage growth in advanced economies has diverged from productivity growth (see Box 9, "What is behind the divergence of median real wages and productivity?"). This is firstly reflected in a declining share of income going to wages. Declining labor share of income can act as a drag on consumption and hence aggregate demand, as the propensity to consume from capital income is lower than from labor income.[163] Along with the decline in labor share of income, shifts in relative prices of production vs. consumption, especially the rising cost of housing and services such as education, have further widened the gap between productivity growth and the rise in employee purchasing power.[164] Finally, rising income inequality could be shifting income to those with a lower propensity to consume, placing a further drag on consumption.

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[163] Zita Tamasauskiene et al., "The impact of wage share on domestic demand in the European Union," *Eurasian Economic Review*, volume 7, issue 1, April 2017.

[164] In the United States, for instance, the share of income spent on housing has risen from 28 percent to 32 percent over the past 30 years as housing costs have grown faster than overall consumption. For more on how price changes impact consumption, see *Urban world: The global consumers to watch*, McKinsey Global Institute, April 2016.

Box 9. What is behind the divergence of median real wages and productivity?

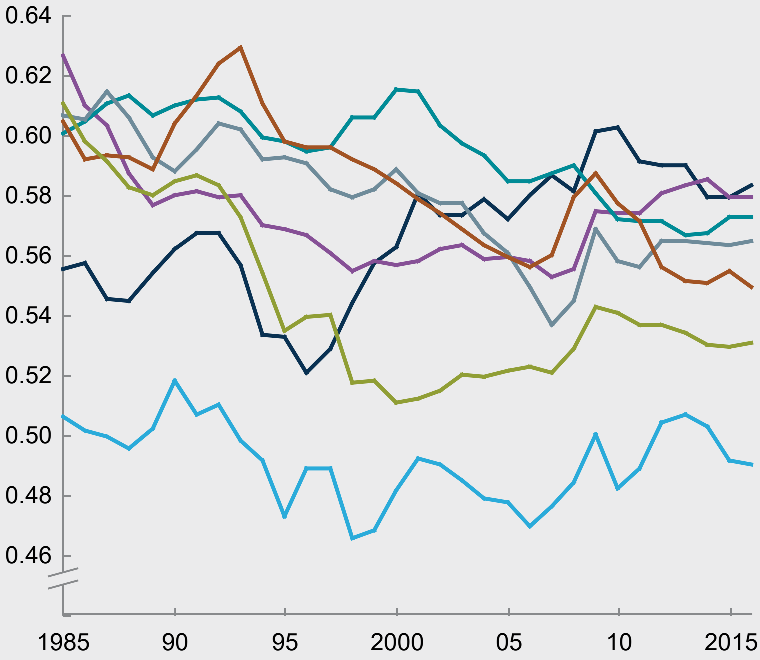
Across advanced economies, the share of national income paid to wage earners has declined since the 1980s. This means that the benefits of rising labor productivity have gone disproportionately to corporate profits rather than to raising incomes. The decline in wage share of GDP has not been uniform across countries. An exception is the United Kingdom, where wage share was below that of most peers in 1985 and has risen since then (Exhibit 25). Some sectors have contributed disproportionately to the change. For instance, in the United States, the manufacturing sector alone explains two-thirds of the overall 2.7 percent decline in wage share of value added since 1990.[1] Manufacturing helps explain 41 percent of the increase in capital share since the early 2000s in the United States, while primary industries contributed 36 percent to the increase in profit share and real estate 28 percent.[2]

Exhibit 25

The labor share of income has declined in many countries

Adjusted labor share of income[1]

%



Change in adjusted labor share

Percentage points

	1985 vs. 2016	2000 vs. 2016
United Kingdom	+2.8	+2.0
France	-4.7	+2.3
United States	-2.8	-4.3
Germany	-4.2	-2.4
Spain	-5.5	-3.5
Italy	-8.1	+2.0
Sweden	-1.6	+0.9

1 Adjusted wage share for total economy over GDP at market prices from AMECO. AMECO adjustment based on ratio of total compensation of employees to GDP multiplied by the ratio of total employment to the number of employees. This incorporates mixed income of self-employed households by assuming a similar wage rate as that of salaried households.

SOURCE: AMECO (November 2017 release); McKinsey Global Institute analysis

Many reasons for the decline have been discussed, particularly the impact of globalization, technological advances with declines in the relative cost of capital, a decline in bargaining-related labor market institutions such as unions, and a rising share of superstar firms or

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[1] *Making it in America: Revitalizing US manufacturing*, McKinsey Global Institute, November 2017. Wage share within manufacturing itself has declined, which explains roughly half of this contribution; the other half comes from the decline in manufacturing share in the economy, given that it started at a much higher wage share than the rest of the economy.

[2] Capital share defined as net operating surplus divided by gross value added.

establishments with lower labor share of income.[3] Research by the OECD has also found that the decline in labor share in advanced economies was primarily due to a decline in labor share within sectors, rather than a compositional shift between labor and capital-intensive sectors.[4]

We do not find a single explanation for the declining labor share. Manufacturing, an important contributor to the decline in the United States, has been at the center of many of the potential explanations. Automation, offshoring, and outsourcing many support activities have all contributed to shifts in capital-labor ratios and the skill mix of manufacturing workers. Return on investment and profitability increases in sectors like tech manufacturing and automotive have also contributed to rising capital shares as gross operating surplus of companies has increased. The declining rate of unionization and globalization in many manufacturing industries may have shifted bargaining power away from workers. The real estate bubble and the mining booms in the United States may also have contributed to a decline in labor share and an increase in capital share by shifting the economy toward sectors with high capital intensity.

An additional challenge is that while the nominal wage share of income has declined, the purchasing power of those wages has been eroded by changes in relative prices. The price deflator used to determine real productivity growth (GDP deflator, focused on production) has grown more slowly than the prices households pay for the goods and services they consume (consumer price index, or CPI, focused on consumption baskets).[5] A big contributor to the difference is the rise in housing costs that reflects payments between renters and landlords rather than annual production reflected in GDP.

Finally, while average real wage growth has been diverging from real productivity growth due to the factors described above, median real income growth for households has diverged even further due to rising income inequality. While the exact reasons for the rise in income inequality are unclear, one factor linked to the rise in inequality is the rise in business concentration and market power, which may then result in disproportionate benefits to the workers employed in these winning companies, as well as their shareholders.[6]

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[3] See, for example, *The labor share in G20 economies*, report prepared for the G20 Employment Working Group, Antalya, Turkey, February 26–27, 2015; “Understanding the downward trend in labor income shares,” in *Gaining momentum?* IMF World Economic Outlook, April 2017; Autor et al., *The fall of the labor share and the rise of the superstar firm*, NBER working paper number 23396, May 2017; Matthias Kehrig and Nicolas Vincent, *Growing productivity without growing wages: The micro-level anatomy of the aggregate labor share decline*, Economic Research Initiatives at Duke (ERID) working paper number 244, March 2017.

[4] *The labor share in G20 economies*, report prepared for the G20 Employment Working Group, Antalya, Turkey, February 26–27, 2015.

[5] Michael Brill et al., “Understanding the labor productivity and compensation gap,” *Beyond the Numbers*, volume 6, number 6, US Bureau of Labor Statistics, June 2017.

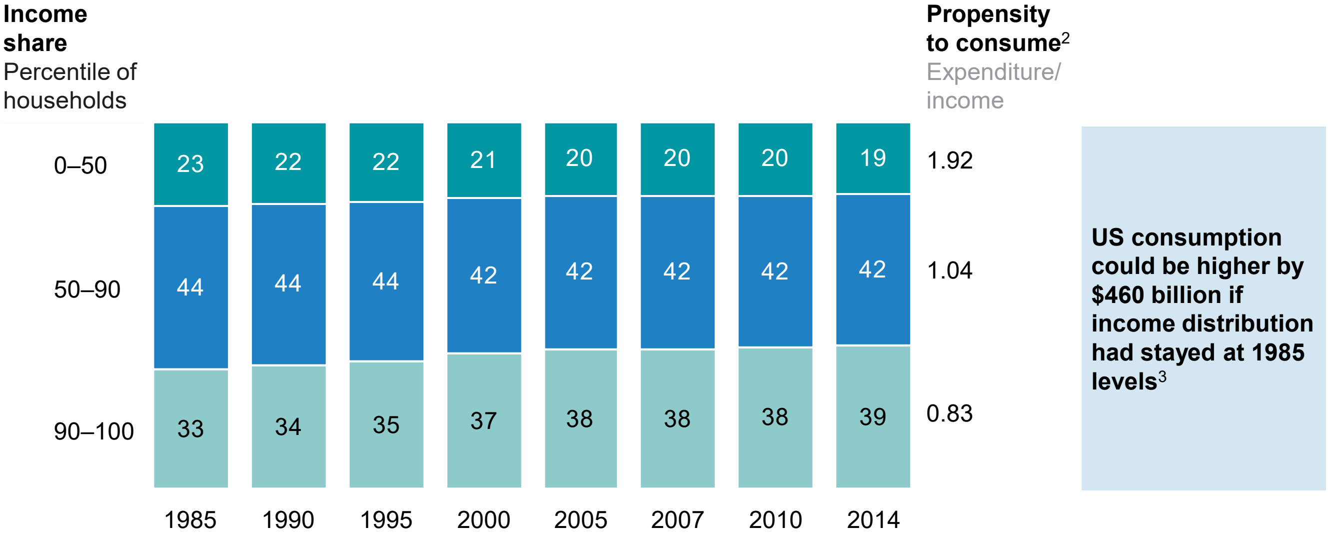
[6] See, for example, Jason Furman and Peter Orszag, *A firm-level perspective on the role of rents in the rise in inequality*, presentation at Columbia University, October 2015; and Jae Song et al., *Firming up inequality*, Centre for Economic Performance discussion paper number 1354, May 2015.

Income inequality has increased in both Western Europe and the United States, particularly in the pre-crisis period. Widening income inequality can reduce consumption and demand across a broad range of products by shifting incomes from lower-income households with a higher propensity to consume to higher-income households with a lower propensity to consume.[165] We estimate that rising income inequality since the mid-2000s, including the effects of declining labor share of income, has acted as a constant moderate drag on overall household spending in all countries in our sample. Spain and the United States have seen the largest impact. If income distribution had stayed at the level of the early 2000s, consumption in Spain and the United States would have been higher by roughly 1 percent of GDP each in 2014. For other countries, such as France, Sweden, and the United Kingdom, the income inequality effect since 2000 has been less pronounced. Using 1985 income distribution as the benchmark, consumption in the United States would be about 2.5 percent higher today, translating to roughly $460 billion (Exhibit 26). Income distribution also matters for the mix of goods and services consumed. This means that companies face the challenge of attracting customers at very different price points, which tends to fragment their markets, add complexity to their operations, and provide opportunities for new competitors to target specific income segments with tailored offerings.

Exhibit 26

In the United States, rising income inequality among households has held back consumption

US share of disposable income[1]
% distribution across income deciles



US consumption could be higher by $460 billion if income distribution had stayed at 1985 levels[3]

1 Distribution of disposable income (post-tax disposable income and public spending).
2 Mean total expenditures over mean income after taxes for 1985. Based on data for households in percentile 0–40, 40–80, 80–100, given data availability.
3 Assumes average propensity to consume in each income segment stays at 1985 levels.
NOTE: Numbers may not sum due to rounding.

SOURCE: World Wealth & Income Database; US Bureau of Labor Statistics; McKinsey Global Institute analysis

Slowing population growth and aging in advanced economies are also reducing demand momentum. Not only is the consumer pool expanding more slowly, but as the population ages, demand tends to shift to industries such as health care and the public sector that have seen slower (measured) productivity growth.[166] One question this raises is how to measure productivity in services, particularly non-market services. (See Box 10, “How do we better

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[165] Özlem Onaran and Thomas Obst, *Wage-led growth in the EU15 member states: The effects of income distribution on growth, investment, trade balance, and inflation*, working paper number PKWP1602, Post-Keynesian Economics Study Group, January 2016.

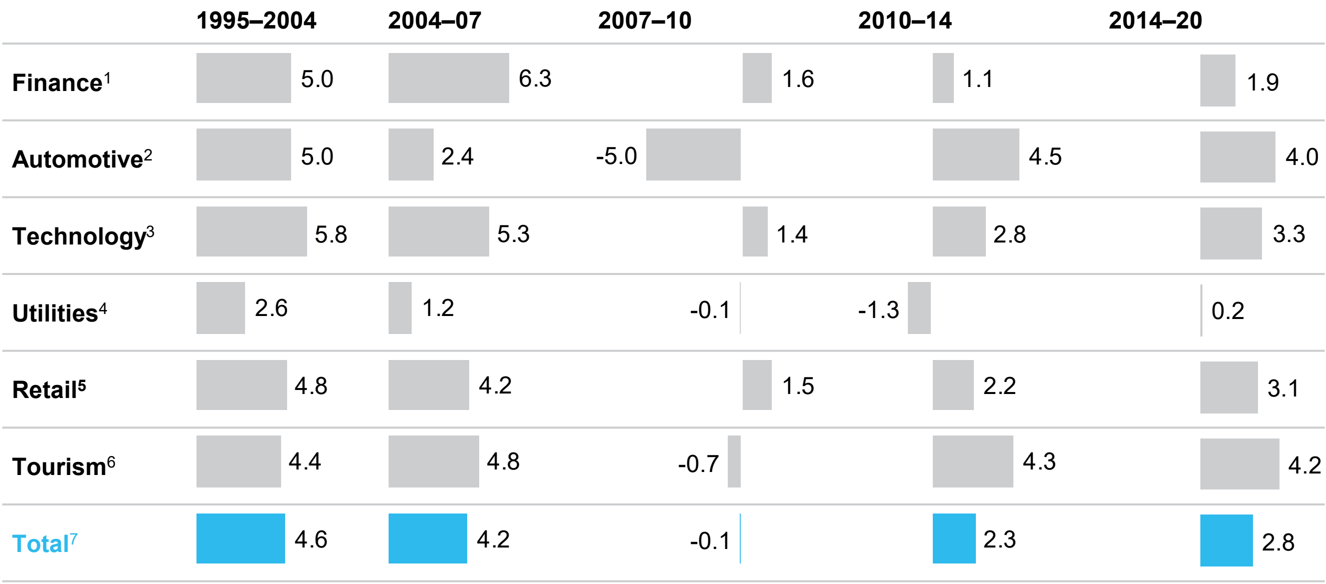
[166] See Chapter 2 for a discussion of the mix shift effect on productivity growth.

capture productivity in non-market services?") Looking across our sector deep dives, we have found declining trends that are likely to dampen demand, particularly in finance and utilities, while in automotive, tech, retail, and tourism, forecast demand remains below 1995–2004 levels in 2014–20 (Exhibit 27).

Exhibit 27

Demand growth has slowed across sectors, and that trend may continue

Demand, simple average across countries
Compound annual growth rate
%



1 Finance: 1995–2014 values based on gross/sectoral output from Eurostat and BLS, while 2014–20 values based on loans outstanding from McKinsey Panorama database.
2 Automotive: 1995–2015 values based on gross/sectoral output from Eurostat and BLS, while 2014–20 values estimated based on number of vehicles produced from IHS Markit and historical rates of growth of value per vehicle in 2000–14.
3 Technology: Based on total IT spending from IDC.
4 Utilities: Based on MWh electricity demand from EIA, Eurostat, McKinsey Power IQ, and McKinsey Energy Insights, Global Energy Perspective.
5 Retail: 1995–2014 values based on gross/sectoral output from Eurostat and BLS, while 2014–20 values based on retail value excluding sales tax from Euromonitor International, Retailing data (2018).
6 Tourism: Based on data on travel and tourism consumption from WTTC.
7 Total: Simple average across sectors.

NOTE: Considers France, Germany, Spain, Sweden, the United Kingdom, and the United States. Automotive and utilities exclude Sweden (an outlier in the former case; no future data available in the latter case). All values based on nominal local currency units except for utilities, which is based on MWh of energy production. Time periods selected to allow for a view of long-term historical growth (1995–2004), impact before, during, and after the financial crisis, as well as forward projections.

SOURCE: BLS Multifactor Productivity database (2016 release); Eurostat; EU KLEMS (2016 release); McKinsey Panorama; IHS Markit, 2017; IDC Historical Databook 2017; IDC Worldwide Black Book Standard Edition, 2017; EIA; Eurostat; McKinsey Power IQ; McKinsey Energy Insights, Global Energy Perspective; Euromonitor International, Retailing data (2018 edition); WTTC; McKinsey Global Institute analysis

Box 10. How do we better measure productivity in non-market services?

Accurately measuring productivity growth in services is important and has been a key consideration for economists for some time now.[1] Measurement issues are particularly rife in government and government-dominated services such as health, education, transportation, and public safety, with lack of timely and easily observable metrics for quality, and inherent challenges in defining output for public goods such as defense or the police force (including the lack of a "market price" to use as a starting price for measuring output). For lack of a better metric, many national income accounts rely on the "output = input" convention and define output as the sum of compensation to employees, the procurement cost of goods and services, and a charge for the consumption of fixed capital.

Government expenditures alone represent 34 percent of global GDP today and continue to rise. Therefore, it is increasingly important to develop better tools to assess the productivity changes in these sectors. Analysis by the McKinsey Center for Government suggests that one way to estimate productivity growth in government-dominated service sectors is by incorporating an explicit quality adjustment to output measures.[2] By applying a quality adjustment to an output metric, this approach can provide a rough proxy for the real value-added evolution in each sector over time.[3] For example, healthy life expectancy is a measure of the quality of services produced by the health-care sector, and reductions in tax evasion are a measure of quality improvements in tax administration.

Take the health sector as an example. For our sample of countries, measured productivity CAGR was 0.4 percent in 2000–04 and -0.2 percent in 2010-14.[4] In other words, productivity growth, as measured in national accounts, fell by 0.6 percentage point and would thus have contributed to the slowdown in measured productivity growth highlighted in this report. However, the proposed analysis adjusts gross output for quality improvements as described above.[5] With this approach, health sector productivity growth for this sample would have been -1.1 percent in 2000–04 and -0.6 percent in 2010–14, indicating an increase in productivity growth of 0.5 percentage point.[6] Hence, had national accounts included an estimate of quality adjusted outputs (as opposed to using the "output = input" convention for public services), the decline in productivity growth from 2000–04 to 2010–14 would have been somewhat less stark than estimated by conventional techniques.

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[1] Jack E. Triplett and Barry P. Bosworth, *Productivity in the U.S. services sector; New sources of economic growth*, Brookings Institution Press, September 2004; Robert Mitchell Stern, *Services in the international economy*, University of Michigan Press, 2001; Diane Coyle, *GDP: A brief but affectionate history*, Princeton University Press, 2014.

[2] See *Government productivity: Unlocking the $3.5 trillion opportunity*, McKinsey Center for Government, April 2017. This analysis looks at health, primary, secondary and tertiary education, road transport, public safety, and tax collection; these sectors account for about 30% of total government expenditure.

[3] This methodology is conceptually in line with how some statistical agencies, such as the Office for National Statistics in the United Kingdom, are developing and implementing measurement of public service productivity. See for example, *The ONS Productivity Handbook*, Office for National Statistics, February 2016.

[4] Based on a simple average across six countries—France, Germany, Italy, Spain, Sweden, and United Kingdom—for sector Q ("Health and social work") in the EU KLEMS sector classification.

[5] In this approach, quantity is measured using the total population served, which is a proxy for the annual quantity of services provided by the health-care sector in a given year. The productivity metric (in year X) is defined as: [(healthy life expectancy in year X)/(healthy life expectancy in year 2010)] * [total population in year X] / [labor hours in year X]

[6] A negative productivity growth rate implies that the sector is increasing the number of labor hours consumed faster than the increase in the number of citizens served, adjusted for quality. The McKinsey Center for Government's analysis shows that beyond a certain point, additional expenditure on health care tends not to deliver large improvements in healthy life expectancy. For more details, see Exhibit 14 in *Government productivity: Unlocking the $3.5 trillion opportunity*, McKinsey Center for Government, April 2017. Both labor hour inputs into the production of health services, and the quality adjusted outputs from health services, grew slower in the 2010-2014 period than in the 2000-2004 period. The relative increase in productivity growth rates from the first period to the second reflects the fact that the slowdown in growth of labor hour inputs (denominator) outweighed the slowdown in growth of citizens' healthy life expectancy (numerator).

Long-term pressure on investment may hurt demand as well as productivity growth

While rising inequality and slackening consumption growth put upward pressure on household savings, several factors are putting downward pressure on investment, another important component of demand (as well as a contributor to productivity). As investment follows demand and demand expectations, in a world of slowing sales growth expectations, businesses will invest less of their income, amplifying tensions in the savings-investment balance. At the same time, returns on investment have been rising, further lowering the need to invest relative to company earnings. Another concern relates to a mix shift to less capital-intense sectors of the economy, yet we have not found that to be a significant drag on investment rates. We found that sector mix shifts had a small negative effect on overall investment rates in most European countries. On the household investment side, demographics is an important contributor. Slowing population growth requires a slower rate of housing expansion, while aging households have fewer needs to accumulate additional household durables. Public investment has also seen a persistent decline. All countries in our sample experienced a longer-term decline of 0.5 to 1 percentage point in public investment between the 1980s and early 2000s, and the figure has been roughly flat or decreasing since then. The dual forces of declining consumption and rising savings, together with declining investment needs, are putting pressure on demand that gives rise to secular stagnation concerns, particularly as interest rates hover around the zero lower bound.[167]

Digitization may further amplify persistent demand drags

Digitization may further amplify these demand drags. First, based on an analysis of the United States, the tech industry itself has seen both a substantial decline in labor share of income and an increase in return on investment, contributing to lower propensity to consume and invest. Secondly, digital players and digitization across industries could contribute to a rise in business and profit concentration, a broader rise in returns on investment, and an increase in the wage premium to talent. These factors could contribute to rising income inequality, reduce the need and incentives to invest, and thus amplify the slackening of demand.

> All countries in our sample experienced a longer-term decline of 0.5 to 1 p.p. in public investment between the 1980s and early 2000s, and the figure has been roughly flat or decreasing since then.

An additional worry is that together with the slowing demand growth, the automation and digital revolution will end up being different from past technology waves in its impact on jobs and incomes. While technology has always replaced jobs, those lost have been replaced with new jobs created. Over 25 years, about 15 to 30 percent of net new jobs created in the United States were in occupations that did not exist, or barely existed, at the start of the period.[168] Recent MGI research on the future of work finds that automation could displace between 400 million and 800 million workers globally by 2030, depending on how rapidly

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[167] Work by the Bank of England also finds weaknesses in consumption and increases in desired savings, and suggests that these will result in low real interest rates for some time to come; see Lukasz Rachel and Thomas D. Smith, *Secular drivers of the global real interest rate*, Bank of England, staff working paper 571, December 2015.

[168] *Global growth: Can productivity save the day in an aging world?* McKinsey Global Institute, January 2015; *Jobs lost, jobs gained: Workforce transitions in a time of automation*, McKinsey Global Institute, November 2017.

the technologies are adopted in the workplace, but rising labor demand—including from a range of global trends and economic growth will create numerous new employment opportunities that would largely offset the jobs lost to automation. However, millions of workers—between 3 percent and 14 percent of the global workforce—may need to change occupational categories and acquire new skills, and the transition may increase pressure in advanced economies on wages for medium- and low- skill occupations, which in turn could exacerbate income inequality and potentially reduce consumption.[169] Our ability to create new jobs and provide workers with the skills to fill these positions will impact prospects for income growth and income inequality, and therefore demand and growth. The Commission on Technology, created by President Johnson in 1964, made a statement in a 1966 report that is as relevant today as ever: "The basic fact is that technology eliminates jobs, not work. It is the continuous obligation of economic policy to match increases in productive potential with increases in purchasing power and demand. Otherwise the potential created by technical progress runs to waste in idle capacity, unemployment, and deprivation."

Digitization may change industry structure and economics in ways that could constrain innovation and productivity growth

Digital technologies are changing business models, industry structure, and even industry economics in unprecedented ways. Significant players, with large economies of scale and very low or even zero marginal costs, could gain market power that allows them to extract rents and keep potential competitors out.

Economic history suggests that dramatic changes in industry structure can catalyze a productivity acceleration. For example, when the computer and mobile phone supplier industry shifted from integrated device manufacturers, such as IBM computers and Motorola phones, to separate semiconductor, software, and device manufacturers, competition intensified within each step of the value chain and led to higher-performing yet cheaper consumer electronics products. Yet the depth and the breadth of the changes occurring today are raising concern that this time may be different and that some of the characteristics of digital technologies may create longer-term barriers to productivity growth.

The rise of platforms with large network economies of scale raises concerns about rising market power, but the implications are uncertain

With large network effects and zero marginal costs, digital platforms are associated with the rise of market power. These digital platforms are often not limited by geographic boundaries but have the potential for global reach, creating potential for market power on a scale never seen before. While the economic cost associated with monopolies has been well established, digital platforms may exhibit unique characteristics that make the implications of that market power differ from many past monopolistic industries.

Consider cloud computing, for example. Cloud computing is an extremely capital-intensive industry with large fixed costs. Amazon Web Services and Microsoft Azure serve roughly 55 percent of the global market.[170] What makes them similar to traditional network industries such as railroads and electricity suppliers is the large fixed costs that limit entry, at the same time that their economies of scale dramatically reduce costs for other businesses using their services. For example, small and medium-sized companies can now access software services in finance, human resources, and customer relations without incurring the costs of investing in servers and hiring IT professionals to maintain these applications. Or consider the network effects from digital platforms such as Facebook and Google. Users of both platforms benefit from a growing user base, as social networks with more users allow for

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[169] *Jobs lost, jobs gained: Workforce transitions in a time of automation*, McKinsey Global Institute, November 2017.

[170] Calculated based on the IDC Semiannual Public Cloud Services Tracker - Final Historical, 2017H1; based on data for the first half of 2017 and for the Infrastructure-as-a-Service category.

more connections, and larger pools of search data generate better and more targeted results. Yet these services are free to users, who determine their success, as revenue from advertising relies on the number of users. Therefore, incentives remain for digital platforms to innovate and stay ahead of the competition to ensure that they satisfy users, even though they may have strong bargaining power with their advertisers.

Another new platform model not only produces benefits from network scale economies but also dramatically shifts industry supply curves by reducing the cost of entry for new and small players. Here too the economic effects may not be straightforward. Amazon and eBay have helped expand the supply of small manufacturers, artisans, and retailers by connecting them to a much broader customer base; niche hotels have been able to use TripAdvisor ratings and reviews by satisfied customers to market their services to often global, specialized segments; and TaskRabbit and Airbnb allow individuals to generate income from their skills and residences. While the platform players themselves perform a unique enabling function in the market, they also reduce the costs of entry and expand the number of suppliers in many markets. This notwithstanding, replicating those platforms' own best practices may prove challenging. Take the case of retail, where productivity growth in the late 1990s and early 2000s was driven by Tier 2 and 3 retailers replicating the best practices of frontier firms like Walmart. Today, it is less clear how easily Amazon's practices can be replicated by other retailers, given Amazon's large platform and low marginal cost of offering additional products on its platform.

Therefore, while digital technologies are resulting in the rise of platforms and networks, it is not clear that this will automatically lead to monopolistic behavior and reduce incentives to innovate. What is clear is that regulators and policy makers will need to understand the differences in the nature of such technologies from the network industries of the past, and develop the tools to identify non-competitive behavior that harms consumers.

Rising corporate concentration has not yet reduced incentives to innovate but could do so in the future

Beyond platform economies, rising corporate concentration may reduce competitive pressure and translate into weaker incentives to innovate and invest in raising productivity. Rising market power could also lead to increased power of large companies in the supply chain, allowing them to push the share of their preferred suppliers rather than the most competitive and productive ones. While the empirical evidence suggests that the link between concentration and either competitive intensity or productivity growth is not a strong one, this is another often cited concern about the digital economy.[171] In our sector deep dives, we found no evidence that rising business concentration has contributed to the recent productivity-growth slowdown (see Box 11, "Has increasing business concentration had an impact on productivity growth?"). However, this may change in the future if some industries see declining competitive intensity as a result of changes in industry structure or dynamics. Furthermore, rising corporate concentration may contribute to rising inequality. We find that profit concentration has been rising much faster than revenue concentration, suggesting that the demand impact through changes in the allocation of economic value may well be larger than the direct impact on competition.[172]

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[171] In MGI's 100-plus industry case studies around the world, we have found that competitive intensity matters for productivity growth, especially when regulation protects less productive local companies from world-class competition. However, we also found that Posco, South Korea's state-owned steel company, led the global industry in productivity. See also Jason Furman and Peter Orszag, *A firm-level perspective on the role of rents in the rise in inequality*, presentation at Columbia University, October 2015.

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

Box 11. Has increasing business concentration had an impact on productivity growth?

In our sector deep dives, we find evidence of increased business concentration and consolidation but do not find that rising concentration has contributed to the decline in productivity growth.[1] We continue to find evidence of strong competitive pressure and innovation across industries. However, we caution that this may not be the case in the future if changes in industry structure reduce competitive intensity as well as incentives to innovate and improve operational performance. We note the following developments in our sectors:

Automotive. In a sector where concentration has always been high, incentives to innovate and improve productivity remain as strong as ever. Three examples help illustrate this. First, concentration among parts suppliers has been increasing. The number of global tier-one suppliers declined from 30,000 in 1988 to 2,800 in 2015, and the top 100 suppliers' share of global revenue grew from 36 percent in 2004 to 50 percent in 2014.[2] This has been a boon to productivity, as it enabled productivity improvement in the sector through the evolution of global value chains in the 1990s and global platforms in the 2000s. Second, global competitive intensity between the leading OEM players is high, reflecting shifting market shares within markets and over time, and we now have new players like Tesla in the mix. Third, the technology race to stay competitive is fierce, as new features, long-distance electric vehicles, and, soon, autonomous vehicles are sure to shift the winners and losers in the industry once more. The life of these companies depends on raising productivity by delivering attractive cars at good prices.

Finance. Across the countries we studied, we found no evidence that higher concentration would reduce productivity growth, and in fact, there is a fragmented tail in banking in many economies with relatively low productivity where further consolidation might be helpful. Take Sweden as an example. Sweden's finance sector is more concentrated than the industry in Germany and the United States, yet is also the most innovative and has the highest productivity growth in our sample of countries. This reflects the fact that Sweden is the most "cashless" of the economies and has the highest level of online banking.

Retail. The rising share of large-format retailers raised concentration in the 1990s, but at the same time led to a productivity acceleration that was substantial enough to show in the aggregate figures.[3] Now we are in the early stages of yet another technology-enabled transformation to more productive online retail, that is raising questions about winner take all dynamics in the sector. However, our findings suggest that both pure-play online retailers (such as Amazon until its Whole Foods purchase) and incumbent brick-and-mortar retailers are looking for a balance between in-store and online sales and seeking to determine their strategy for the future. At least in the medium term, the pace of change is such that whatever happens to concentration, all retailers are racing to find the Goldilocks mix for their business, and the push to innovate and compete remains strong.

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[1] We distinguish between the impact that rising concentration has on competitive pressure to innovate and improve the productivity of company operations from the rising corporate profit or revenue concentration. There is strong empirical evidence for the latter, with corporate profit concentration rising faster than revenue concentration. For further reading, see Jason Furman and Peter Orszag, *A firm-level perspective on the role of rents in the rise in inequality*, presentation at Columbia University, October 2015; Germán Gutiérrez and Thomas Philippon, *Declining competition and investment in the U.S.*, March 2017. These trends are contributing to rising inequality and may put downward pressure on consumption and investment, as discussed above. However, the direct impact of rising concentration on productivity can be and has been positive or negative, so it cannot be deduced from levels of concentration alone.

[2] *Performance and disruption: A perspective on the automotive supplier landscape and major technology trends*, McKinsey & Company, March 2016.

[3] *US productivity growth, 1995–2000*, McKinsey Global Institute, October 2001.

Tech. In the technology sector, including manufacturing, software, and services, concentration has always been high, as has turnover among leading companies. The share of top four companies by value added has declined from 44 to 38 percent between 2000 and 2016: Microsoft and IBM were among the top four in both years, while Apple and Alphabet replaced Intel and HP at the lead.[4] Despite high concentration, competition is intense as the rapid pace of technological change makes it challenging for firms to remain in the lead. This applies to companies at the productivity frontier as well.[5] By 2004, 66 percent of 1998 frontier firms had dropped out of the frontier; 52 percent of 2004 frontier firms dropped out by 2010, and 42 percent of 2010 frontier firms dropped out by 2014. In fact, only eight firms were in the frontier in 1998, 2004, 2010, and 2014.

Tourism. Ongoing consolidation in this sector is occurring across large-scale corporate hotels and airlines, with more rapid consolidation having taken place in the United States than in Europe. However, the industry looks very different across different segments. In hotels, despite significant M&A among the large corporate chains that has raised concentration, the industry still remains very fragmented, with the top three players in the United States, for example, having roughly 45 percent market share by revenue and 35 percent of inventory.[6] The advent of platforms like Airbnb has dramatically expanded capacity, while TripAdvisor and others have facilitated the entry of smaller, more niche players to compete with larger hotels. This remains an industry with multiple players, including new entrants, that fosters innovation to attract and retain customers. At the same time, the travel booking industry has been one of the most rapidly digitalized, as fragmented local travel agents have been replaced by online booking platforms and other intermediaries. Significant consolidation in the US airline industry has resulted in more productive businesses supported by ongoing restructuring.

Utilities. In the 1990s, liberalization of electricity generation and retail across Europe and in some states in the United States brought competition to the industry, while transmission and distribution remain as regulated natural monopolies. Today, new technologies—for example renewable energies, distributed generation, energy management via smart devices and regulators in the home, and innovation towards electricity storage—are all attracting specialized new entrants in niche sectors, increasing dynamism and driving innovation in the industry. Online platforms are allowing customers, for example, to compare and switch between utility retailers. In Germany, for example, 51 percent of customer switching now happens online, and a large share of this happens via price comparison websites rather than directly on the webpage of the supplier.[7]

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[4] The volatility in tech company rankings means that concentration trends vary depending on the number of companies included. For example, the top 12 firms make up 64 percent of value added today, compared with 69 percent of value added in 2000—a decline in concentration. Our analysis is based on data from S&P Capital IQ and has looked at publicly listed technology companies headquartered in the United States. We measured productivity for these companies by global revenue minus cost of goods sold per employee. This is not directly comparable to productivity measures from national accounts for three reasons. First, publicly traded companies are only a subsector of the overall industry, albeit a large subsector. Second, unlike the national data, these figures reflect global operations, not just national ones. And third, company data is not adjusted for quality, so it reflects nominal, not real, value added in the numerator.

[5] The productivity frontier is defined here as the top 50 firms by productivity level in each year of analysis. This analysis was robust to different specifications of the number of firms at the frontier.

[6] Based on data from Euromonitor International Travel (2018 edition).

[7] Kreutzer Consulting press release, www.kreutzer-consulting.com/pressmitteilung/55-aller-wechselvorgaenge-im-energiemarkt-finden-online-statt.html.

The growing customization of products and services enabled by digital technologies may obscure market price, with implications for the functioning of markets

Digitization may, counterintuitively, reduce price transparency as the customization of price, product features, and sales terms proliferates through the use and analysis of consumer data.[173] Digital companies are increasingly able to create "markets of one," tailoring their products, services, and prices to each individual customer and determining the most individuals would pay for each price and product. As a result, companies may be able to extract more of the consumer surplus than before, shifting money from consumers to digitally enabled companies. Customization is about a fundamental change in the marketplace. Individuals know the price they are paying but not what everyone else is paying, and the market price becomes opaque. Over time, how do consumers know if they are getting a fair price? Without a transparent market price, how will the free market function? These are some important aspects of the digital economy that need closer examination and study.

CAPTURING THE 2 PERCENT PRODUCTIVITY-GROWTH POTENTIAL MAY REQUIRE FOCUS ON PROMOTING DEMAND AND DIGITAL DIFFUSION

Weak productivity growth in many advanced economies today does not reflect a shortage of ideas or innovation. Once financial crisis aftereffects, including weak demand and uncertainty, recede and the benefits from digitization reach scale, we believe the opportunity exists to move closer to 2 percent annual productivity growth. However, capturing the productivity potential of advanced economies requires an approach by policy makers that moves beyond traditional supply-side drivers of productivity and focuses on unlocking both sustained demand growth and digital diffusion. To be sure, traditional productivity growth enablers remain as relevant as ever: removing market distortions and setting the right incentives, ensuring healthy domestic and international competition, smart regulation and cutting red tape, and the buildup of strong public and business ecosystems (also at cluster level) that provide sufficient access to talent, capital, infrastructure, and a robust legal framework.[174] Yet those approaches may not be enough. An additional focus of promoting digital diffusion while closely monitoring digital competitive dynamics and, in parallel, unlocking productive investment, income, and demand growth and supporting job transitions for displaced workers, seems essential.

Policy makers have many tools to support demand and digital diffusion

A focus on promoting sustained demand growth and digital diffusion could elevate productivity to a national policy priority.

Demand-promoting policies to consider—beyond the typical monetary and fiscal macroeconomic stability toolkit—include:

- **Focusing on productive investment as a fiscal priority.** As sovereign debt is already elevated, and the political environment makes government spending difficult, targeted government spending on productive investment is more important than ever. One example is productive infrastructure and educational investment. In our estimate, the gap between needed investment rates for 2017–35 vs. actual figures for 2010–15 amounts to 0.5 percent of GDP each for Germany, the United Kingdom, or the United States.[175] A change in public accounting standards that promotes public spending as investment

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[173] Anna Bernasek and D. T. Mongan, *All you can pay: How companies use our data to empty our wallets*, Nation Books, 2015.

[174] William Lewis, *The power of productivity: Wealth, poverty, and the threat to global stability*, University of Chicago Press, 2004; John B. Taylor, "Slow economic growth as a phase in a policy performance cycle," *Journal of Policy Modeling*, volume 38, issue 4, July–August 2016; Steven J. Davis, "Regulatory complexity and policy uncertainty: Headwinds of our own making," prepared for Hoover Institution conference on "Restoring Prosperity," Stanford University, February 9–10, 2017.

[175] *Bridging infrastructure gaps: Has the world made progress?* McKinsey Global Institute, October 2017.

rather than consumption, particularly in the context of the fiscal compact rules in Southern Europe, could be helpful.[176]

- **Growing the purchasing power of low-income consumers with the highest propensity to consume.** Another approach to promoting demand without amassing higher government debt is to facilitate a shift in purchasing power to those at the bottom of the income pyramid who are most likely to spend. This could be achieved through redistributive or pre-distributive policies such as greater investment in public education and health care. This may require increasing the tax intake, for instance on capital gains, or at the top end of the income spectrum.[177]

- **Supporting worker training and transition.** Public funding for job training programs is falling in many countries, for example from 0.08 percent of GDP in 1993 to 0.03 percent in 2015 in the United States, and from 0.57 to 0.2 percent in Germany. Scaling and reimagining job retraining and workforce skills development will be critical, as will improving labor market dynamism and mobility, and providing income and transition support to workers.[178] If workers displaced by technology end up in menial tasks, the benefits of that automation would disappear.

- **Unlocking private investment.** The type of demand-supporting policies outlined above will likely have the biggest effect on private investment. But there are further ways to unlock it. Businesses cite uncertainty as a key barrier to investing more. Policy makers would hence be well advised to limit wherever possible risks of regulatory changes (such as regarding energy efficiency, renewables, and climate change), financial risks (for example, continuing to strengthen the Eurozone framework and clearing up the overhang of debt in Southern Europe), or political risk (for instance, accelerating clarity on the Brexit negotiations or ramping up predictability of policies in the United States). One often underappreciated way to unlock private investment revolves around land market barriers and their effect on residential (and commercial) real estate. In particular, global cities like London, New York, Paris, and San Francisco suffer from substantial housing affordability and supply gaps—with a difference between market prices of acceptable units and what people can afford to pay in excess of 2 percent of city GDP.[179] Our research suggests that California, for instance, would need to build 3.5 million new homes over the next decade to satisfy pent up demand and meet the needs of a growing population. The primary culprits are barriers to bringing sufficient land forward to the market, including restrictive zoning, infrastructure gaps, and cumbersome permitting processes and building codes.[180]

Digital-promoting policies to consider include:

- **Leading by example on digitization.** Governments could set ambitious targets for the digitization of their own sector, leading by example while raising efficiency and improving citizen interaction and delivery of citizen services. Estonia is a case in point, going “all in” on government digitization since the early 2000s, including introduction of e-residency. Germany, for instance, has taken the first steps to address its low public-sector digitization levels by driving digital transformations at scale in the Federal Employment Agency and Federal Office for Migration and Refugees, and by implementing e-government services, including rolling out an electronic tax declaration system (known

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[176] *Bridging global infrastructure gaps*, McKinsey Global Institute, June 2016; *A window of opportunity for Europe*, McKinsey Global Institute, June 2015.

[177] *A window of opportunity for Europe*, McKinsey Global Institute, June 2015.

[178] *Jobs lost, jobs gained: Workforce transitions in a time of automation*, McKinsey Global Institute, November 2017.

[179] *A blueprint for addressing the global affordable housing challenge*, McKinsey Global Institute, October 2014.

[180] *A tool kit to close California’s housing gap: 3.5 million homes by 2025*, McKinsey Global Institute, October 2016.

by the acronym ELSTER) and electronic court files in the justice system with the aim of achieving a fully paperless court.[181] New Zealand is using advanced analytics and big data to track social-sector spending's impact on individuals, helping to identify which housing, health, and welfare programs have the greatest impact on citizen outcomes, so that government investment can become more effective over time. Governments can further set their own data free with open data policies.[182]

- **Leveraging public procurement and investment in R&D.** Governments could spur digital catch-up in lagging sectors like construction via public procurement rules, such as mandating the use of building information modeling in public works, as Singapore has done, and as Germany will require for federal transportation projects from 2020. Further opportunities include the targeting of public spending to accelerate digitization of education, health care, security, and defense. Similarly, governments could help fund research efforts to spur innovation, often in collaboration with universities, facilitating programs similar to those run by the US Defense Advanced Research Projects Agency and the National Institutes of Health.

- **Driving digital adoption by SMEs.** SMEs are, on average, far behind in digital adoption. Governments and SMEs can benefit from good practice exchange and interaction with large digital platforms, as well as access to enabling capabilities and supports. Also, there is scope for further consolidation of the SME landscape, for instance where regulation and state ownership are holding it back, as in some European countries in sectors such as retail banking, pharma retail, and medical services. Governments may consider identifying high potential SMEs, facilitating training programs, and encouraging network building.

- **Investing in hard and soft digital infrastructure and ecosystems.** Digitization requires efficient and ubiquitous broadband infrastructure. Some countries still need to catch up. For instance, in the first quarter of 2017, just 33 percent of German internet connections had average speeds above 15 Mbps, well behind leaders like South Korea (69 percent), Switzerland (56 percent), and Norway (54 percent).[183] But investment is also needed in soft infrastructure such as digital identities and micropayment systems for Internet of Things applications. A strong supportive ecosystem is necessary for the growth of hubs of digital innovation with a network of talent, funding, ideas, and supply chains. In China for instance, three tech giants—Baidu, Alibaba, and Tencent—provided 42 percent of all venture capital investment in 2016, a far more prominent role than Amazon, Facebook, Google, and Netflix, which together contributed only 5 percent of US venture capital investment in the same year.[184]

- **Doubling down on the education of digital specialists as well as consumers.** There is a large divergence in the availability of digital talent, which in turn is cited as one of the primary barriers for companies in their digitization efforts. For instance, in 2016, ICT specialists made up just 3.7 percent of the German workforce, compared with 6.6 percent in Finland and 6.3 percent in Sweden.[185] But as we have seen, the pace of consumer adoption is another significant driver of digitization, so it is also important to make sure the broader population, including older citizens, is digitally savvy.

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[181] *Driving German competitiveness in the digital age*, McKinsey Global Institute, July 2017.

[182] *Open data: Unlocking innovation and performance with liquid information*, McKinsey Global Institute, October 2013.

[183] *State of the Internet Report Q1 2017*, Akamai, February 2017.

[184] *Digital China: Powering the economy to global competitiveness*, McKinsey Global Institute, December 2017.

[185] *Employed ICT specialists as a percentage of total employment*, Eurostat, 2016.

- **Ensuring global connectivity.** MGI research has shown that digital flows are already more important for economic growth than traditional trade of goods and services.[186] It is imperative to stay plugged in to global flows, and to attract foreign investment in digital capabilities and make the most of globally operating platforms. In Europe, efforts to create a Digital Single Market with common legal and regulatory frameworks can enable digital companies to scale within and beyond individual countries and realize the potential of the single market. Enabling the free movement of data could be enshrined as a new European freedom, yet attention must also be paid to cybersecurity issues. Recent efforts to frame a model of talent mobility and data flows are a good example of supporting the goal of a Digital Single Market. Policy makers will need to make the case more clearly that digital technologies will be a force for greater prosperity, even as they maintain a high level of data protection and digital rights.

- **Clarifying regulations on digital and investing in cybersecurity.** The digital economy is putting new demands on regulators to understand the implications of technological changes on consumers, employees, and industries. Business models such as Uber and Airbnb do not fit neatly within existing industry regulatory frameworks, while the seamless cross-border flow of digital content passes by traditional border controls. Improving cybersecurity for citizens and businesses requires completely new tools and capabilities. Policy makers can help standardize areas such as IoT, can move forward on clarifying regulations such as for autonomous vehicles, and can spearhead investment in data privacy, data ownership, and cybersecurity. Furthermore, regulators and policy makers will need to understand the differences in the nature of digital platforms and networks from the network industries of the past, and develop the tools to identify non-competitive behavior that could harm consumers.

A productivity strategy for companies includes a plan for digitization and demand

Companies may need to think of their productivity strategy in terms of the digital transformation of their business model, as well as their entire sector and value chain. In addition, they may need to think about pricing and employee compensation to ensure that demand for products and services remains robust, and to ensure that their workers have the skills to make the most of new digital technologies. Companies may consider:

- **Building digital capabilities across the organization.** All industries are undergoing a digital transformation, yet companies are still learning how to make the most of such technologies. As we discussed in Chapter 3, the degree of transformation may make companies hesitant, but companies that adopt a wait-and-see approach may lose in the long term. Companies will need to identify their digital road map, link it with their broader strategy, make strategic investment, identify new organizational roles needed to make the most of digital technologies, and attract and retain the right talent.[187] Research by McKinsey finds that 90 percent of digital leaders have fully integrated digital into their strategic planning process.[188] Building digital capabilities will also require investment, for example to upgrade equipment to integrate IoT sensors or analytics systems to process data captured from this equipment.[189] A number of organizations have added a chief digital officer role to their executive teams, with responsibilities including oversight of comprehensive organizational change and helping integrate digital into all aspects of

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[186] *Global flows in a digital age: How trade, finance, people, and data connect the world economy*, McKinsey Global Institute, April 2014.

[187] Jacques Bughin, Laura LaBerge, and Anette Mellbye, "The case for digital reinvention," *McKinsey Quarterly*, February 2017; Jacques Bughin and Nicolas van Zeebroeck, "The right response to digital disruption," *MIT Sloan Management Review*, April 2017; Jacques Bughin and Tanguy Catlin, "What successful digital transformations have in common," *Harvard Business Review*, December 19, 2017.

[188] *Six building blocks for creating a high-performing digital enterprise*, McKinsey & Company, September 2015.

[189] *Making it in America*, McKinsey Global Institute, November 2017.

a business.[190] Many companies have also set up incubators or centers of excellence during early stages of a digital transformation to cultivate capabilities. Regardless of how a company embraces the digital transformation, the adage "what gets measured gets managed" still holds true. The most successful digital companies are zealous about metrics that focus on the customer journey, such as measuring share of sales in offline or online channels in retail, for example.[191]

- **Preparing for increased competition.** Traditional geographic and industry boundaries matter less and less in a digital age. Our sector deep dives reveal examples of new digital entrants across sectors, who are often smaller players without the legacy costs and constraints of industry incumbents, and who have the advantage of being "born digital." Incumbents need constant vigilance to spot the new technologies, startups, and disruptions in their industries. The digital officer role described above is one way that companies are doing this.

- **Redefining customer experiences.** Data analytics can help deliver a streamlined yet personalized user experience that is seamless across multiple channels. Most companies are still experimenting with new avenues for engaging with customers, and trying to understand what to do with the volume of data at their disposal. Redefining the customer experience will require companies to build sophisticated analytics engines that consolidate all of a company's touch points with customers, create frictionless customer experiences between online and offline channels, and build an organization that is willing to experiment and pilot new designs.[192] Companies also need to understand how shifting demographics impact their organization's footprint and should factor in the growing importance of services into thinking of all consumer-facing businesses.[193]

- **Supporting their workforce, including through training programs.** In addition, they may need to think about pricing and employee compensation in order to ensure that their collective demand for products and services remains robust. While there is ongoing discussion about how large the so-called "skills gap" is, it is clear that sectors like manufacturing are increasingly adding jobs in areas like software engineering, engineering design, and logistics, and as working alongside machines increases, more jobs are likely to require some form of digital or technical training. Policy makers and education providers, including vocational and technical schools, will need to play a role. But employers will also have a part to play. One specific idea might be to develop "universal learning rights"—a system where employers provide tokens to employees for annual lifelong learning, which can be used on in-house training or traded in a marketplace for external training provision.[194] Apprentice programs in companies, or in partnership with governments, industry groups, and unions, may be one approach. Such programs could accompany national certifications, which could also help make skills portable across companies and provide workers the opportunity to change jobs.

- **Forming new alliances.** New partnerships could allow companies with different capabilities to combine technologies in novel ways. For example, auto manufacturers are teaming up with software companies to develop connected and autonomous vehicles. Companies may also need to collaborate with competitors and industry groups to set common standards for interoperability. For example, deploying IoT in complex settings

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[190] Tuck Richards, Kate Smaje, and Vik Sohoni, "Transformer-in-chief: The new chief digital officer," McKinsey.com Insights & Publications, September 2015.

[191] *Six building blocks for creating a high-performing digital enterprise*, McKinsey & Company, September 2015.

[192] *Digitizing the consumer decision journey*, McKinsey & Company, June 2014.

[193] *Urban world: The global consumers to watch*, McKinsey Global Institute, April 2016.

[194] *New concepts for Europe*, World Economic Forum in collaboration with McKinsey & Company, January 2018.

such as urban environments, the health-care system, and broader manufacturing value chains will require integration across multiple systems and vendors.[195]

Other stakeholders—including economists, non-government institutions, and individuals—also have roles to play

Apart from policy makers and companies, other stakeholders can help promote productivity growth. In particular:

- **Economists have a role to play in developing both new ways to measure productivity and models that assess the impact of technology on markets and prices.** Digital will only become more prevalent, making it harder to accurately measure productivity growth unless we can capture more of the digital economy. Many open questions related to measurement of the digital economy remain, including how best to capture quality changes, and new goods from digital, business and industry model changes.[196] A new way of measuring productivity growth in a digital age may be required as well as better models to assess the impact of digital on the transparency of prices and the functioning of markets, diffusion of digital best practices across firms and sectors, and the potential transition costs associated with digital transformations. As discussed earlier, digitization can drive productivity, but can also amplify challenges to demand growth and labor market dislocations; more research will therefore be needed to understand the net effect of digitization, time lags before productivity benefits are seen, and best strategies to minimize transition costs. In addition, the impact of demand on productivity growth is often underappreciated, and the link between the two and implications for policy makers warrant further research.

- **Non-governmental institutions, including not-for-profit organizations and unions, also have a role to play.** They can help foster a broader societal dialogue about automation, the need for productivity growth, and the shifts under way in labor markets. They can collaborate with policy makers and companies to support workers, including through training programs and enabling workforce transitions. Labor organizations should have a keen interest to help drive productivity as a prerequisite for rising real wages. They should also find ways to help engage in dialogue about worker transition in times of digitization and automation, embracing change but helping to find and develop new roles and skills.

- **Individual citizens must also seek to actively embrace the digital transformation and deal with its impact on them as workers, entrepreneurs, consumers, and citizens.**[197] As workers, they may need to develop a mindset focused on lifelong learning and become more proficient at adapting their skills to the changing workplace environment. Developing agility, resilience, and flexibility will be important at a time when the nature of work could change.[198] Digital technologies can reduce barriers to entry and allow entrepreneurs and small business owners to connect with global suppliers and customers, as well as allowing workers to access the gig economy. The digital economy has created a vast array of consumer surplus, but most consumers have yet to fully take advantage of newly available tools in areas like personal finance, health, and education. Consumers will also need to become aware of issues pertaining to data security and the sharing of personal data, and take steps to safeguard their personal information.

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[195] *The internet of Things: Mapping the value beyond the hype*, McKinsey Global Institute, June 2015.

[196] Diane Coyle, *Do-it-yourself digital: The production boundary and the productivity puzzle*, ESCoE discussion paper number 2017-01, June 2017. See also Roger R. Betancourt, *Distribution services and the digital economy: Implications for GDP measurement, productivity and household welfare*, Department of Economics, University of Maryland, working paper Version 3.0, September 2017; Rumana Bukht and Richard Heeks, *Defining, conceptualising and measuring the digital economy*, The University of Manchester working paper, 2017.

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

[198] *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017.

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Traditional approaches to productivity growth have focused on fixing supply constraints, but that may prove inadequate as slowing population growth and rising inequality depress demand and a new digital age turns industry structure and economics on their head. Digitization represents the key to unlocking productivity growth as well as the potential to hold it back. New tools may be necessary, but the digital economy also requires careful study and understanding. Unlocking the productivity potential of advanced economies while mitigating negative effects from demand leakages and promoting sustained demand growth and digitization is the best way to promote shared prosperity for decades to come.

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TECHNICAL APPENDIX

This appendix has the following sections:

1. Sources for GDP, hours, and productivity estimates

2. Selecting time periods for our analyses

3. Methodology for growth accounting decomposition and sizing the mix effect

4. Methodology for sizing the impact of the three waves on productivity growth

5. Methodology for estimating future potential for productivity growth

1. SOURCES FOR GDP, HOURS, AND PRODUCTIVITY ESTIMATES

Throughout our analysis, we have relied on a variety of sources for data on labor productivity, value added, capital intensity, and hours worked. No single source provides consistent cross-country data over the past decades and also covers data at the sector level. The main sources and the reasons we chose them are outlined below.

- To set current productivity performance in a historical context, we relied on Cette et al. to create productivity growth and capital intensity time series going back to the late 19th century.[199] To our knowledge, they are the only available sources for the data dating back that far.

- For cross-country comparisons of productivity since 1950, we used data from The Conference Board Total Economy Database (May 2017 release) for labor productivity, value added, and hours. We relied on this data to decompose labor productivity growth into the “numerator” vs. “denominator” effect, as well as for GDP series going back to 1950. For GDP data prior to 1950, we complemented this data with the Maddison Project Database (2018 release).[200]

- For cross-country industry analyses, we used data from EU KLEMS (May 2016 release) and BLS (May 2016 release). These are the sources used to decompose labor productivity into underlying factors of production (labor quality, capital intensity, and total factor productivity) and mix effect, as well as to size the impact of three waves, among other analysis involving sector-level data.[201] The constraint of the EU KLEMS data set is that we were unable to get data before 2000 for every country in our sample. Please note that for the BLS data for the United States, we have aggregated sector data to arrive at a total economy aggregate productivity-growth number that is consistent with the sector data. We have done this using a Tornqvist aggregation technique.

Given the inherent challenges of measuring productivity growth at the industry and national levels, these sources often differ slightly in their results. For example, between 2000 and 2014, United States productivity growth was 1.6 percent per year according to both the

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[199] Antonin Bergeaud, Gilbert Cette, and Rémy Lecat, “Productivity trends in advanced countries between 1890 and 2012,” *Review of Income and Wealth*, volume 62, issue 3, September 2016.

[200] See Maddison Project Database, version 2018; Jutta Bolt et al., *Rebasing “Maddison”: New income comparisons and the shape of long-run economic development*, Maddison Project working paper 10, 2018.

[201] Detailed definition of these terms and the methodology used is provided later in the technical appendix.

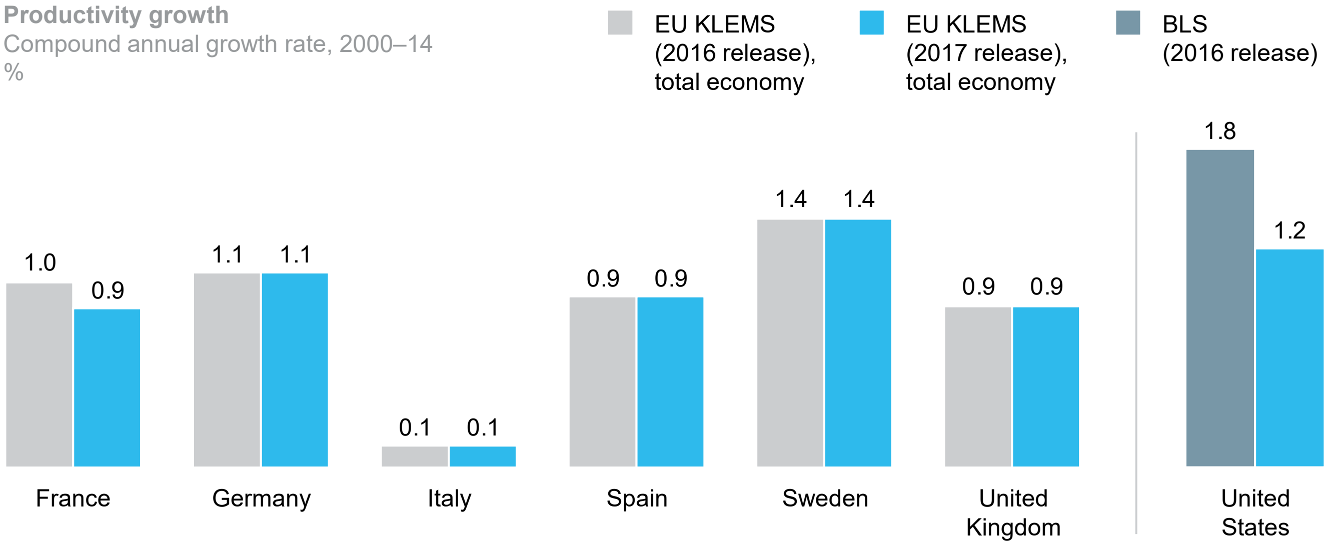
Cette et al. database and the Conference Board Total Economy dataset, while growth was 1.8 percent per year according to the BLS Multifactor Productivity database. In the United Kingdom in that time period, data from the Cette et al. and Conference Board databases showed growth of 1.0 percent per year, while EU KLEMS showed growth of 0.9 percent per year. One reason for the difference between data from the BLS and other sources of US data is that the BLS includes data only for the private business sector, while the other sources look at the total economy (i.e., including government and non-profit institutions). To ensure that our findings are robust to the choice of specific sources, we compared results from the same analyses using different data when multiple data sources were available. For example, we cross-referenced the growth accounting decomposition estimates using KLEMS and BLS data against The Conference Board Total Economy Database for growth accounting and total factor productivity, and found similar trends. One notable exception was the case of Sweden, where the results for TFP and labor quality were substantially different. We have therefore reported an average across three sources (EU KLEMS, The Conference Board, and Penn World Tables) to calculate TFP and calculate labor quality as the residual.

The 2017 release of EU KLEMS occurred too late for us to incorporate the data into this report. We have, though, triangulated our results against those and found them to be in broad agreement. The data matched across European countries, with the exception of France, which were slightly different between releases (Exhibit A1). This release also contained data for the United States, which we compared against the BLS. We found the BLS numbers slightly higher than the KLEMS figures, which is likely explained by the fact that the US data are for the private sector only.

For details of mapping the EU KLEMS and BLS data to each of the sectors covered in our deep dives, please refer to the sector infographics in Chapter 4. We used EU KLEMS and BLS data to understand sector trends across all sectors with the exception of tourism, where we relied on data from WTTC. We used the latter source as it is otherwise difficult to isolate the tourism sector from the sector categories in the EU KLEMS and BLS data. This is also the reason why tourism has been left out of the growth accounting analysis presented here (however, because this sector also did not experience a productivity-growth slowdown in most countries, this is not a problematic omission).

Exhibit A1

Comparison of labor productivity-growth data across sources



SOURCE: EU KLEMS (2016 release); BLS Multifactor Productivity database (2016 release); EU KLEMS (2017 release); McKinsey Global Institute analysis

2. SELECTING TIME PERIODS FOR OUR ANALYSES

The core focus of our work is to shed light on the future prospects of productivity growth, and we use a number of different historical periods in order to uncover the forces at work in today's productivity performance. The choice of periods reflects both the specific trends we want to highlight and constraints from data availability. The choice of specific periods unavoidably impacts the specific growth estimates, so we want to be explicit about the guiding principles used in our choice of periods:

- We have used the most recent data possible. In some instances, such as the EU KLEMS (2016 release) and BLS Multifactor Productivity (2016 release) data at the industry level, data were available only through 2014, for example, while in other cases, such as The Conference Board Total Economy Database, we had access to data through 2016.
- We use the post-2010 years as the reference period for current slow productivity growth. This removes the immediate impact of the financial crisis of 2008–09, and despite including the double-dip recession in Europe, it has been a relatively stable macroeconomic environment.
- To size the impact of the factors of production, mix effect, and three waves, we compared productivity growth in 2000–04 with the recent slowdown (2010–14). We chose these periods for the following reasons:
  - Looking closely at the recent slowdown allows us to identify short-term factors behind the productivity-growth slowdown that are likely to be resolved, allowing us to determine the potential for productivity growth in the future.
  - Much of the debate in the United States has focused on the role played by the waning of the ICT boom, which boosted productivity growth in the mid-1990s and early 2000s. Selecting these periods allows us to isolate the impact of that boom.
- We were also constrained by data availability from EU KLEMS, where data for many countries was only available for the years 2000 and on. This prevented us from doing a long-term analysis at a sectoral level.
- Across our analyses, we are aware that choosing specific years involves some degree of arbitrariness. After assessing the pros and cons of multiple periods, we determined that analyzing the period following the crisis allowed us to isolate different factors at the sector level across many different countries more easily. We also conducted robustness tests for how much these years impact our results.
- To analyze the productivity-weak, job-rich recovery, we compared a 1985–2005 trend with a 2010–16 trend. These periods were chosen to allow us to compare a long-term trend (1985–2005, prior to the crisis, to eliminate the impact of the crisis) with the most recent trends in the recovery (the period of particularly low productivity growth). This option was not available for our industry-level analyses because consistent data are not available for all of our countries before 2000.

3. METHODOLOGY FOR GROWTH ACCOUNTING DECOMPOSITION AND SIZING THE MIX EFFECT

Consistent with growth accounting frameworks and analyses used in the literature to calculate productivity growth contributions from different sectors, we decompose aggregate economy-wide labor productivity into four underlying factors, namely the role played by:

- **Labor quality.** Labor quality measures the impact of shifts in various demographic factors like education on the productivity of workers. Growth in labor services is calculated as the growth rate of each demographic group, weighted by its share of total wages. Labor quality growth is the difference between growth in labor services and growth in hours worked.[202]

- **Capital intensity.** This is capital services per hour worked, a measure of the average "tool kit" available to workers. Capital services is a measure of the equipment, tools, and other capital used in the production process.

- **Total factor productivity.** Total factor productivity (TFP), often used as a proxy for technological progress, reflects the output of goods and services produced from inputs including labor, capital, energy, materials, and purchased services. It is calculated as a residual, after the impact of other factors of production has been taken into account. TFP is calculated either as the residual of value added, after the effects of capital and labor quality have been accounted for, or as the residual of gross output, after the effects of capital, labor quality, and the intermediate inputs of energy, materials, and purchased services have been accounted for.

- **Mix shift across sectors.** This measures the impact of reallocation of labor and relative price movements across sectors with different productivity levels and productivity growth.

We rely on data from EU KLEMS (2016 release) and the Bureau of Labor Statistics Multifactor Productivity database (2016 release) for this analysis. Please note that the BLS MFP database reports data only for the private business sector and not the total economy. This means that data for our European and US samples may not be exactly comparable, and US results are not available for the government or non-profit sector. Also please note that the BLS does not directly provide data on value added, but reports data only on sectoral outputs and intermediate inputs (which are components of value added). We have used the data on sectoral output and intermediate input provided by the BLS to compute value added.[203] The level of granularity of sectors available in EU KLEMS and BLS, and the corresponding industry codes, also varied. For example, EU KLEMS typically reported data for about 30 granular sectors, while BLS did the same for 60 sectors. For comparison purposes, we made the best possible attempt to match sectors across the two sources.

For details of the analytical formulation used, please refer to Box A1, "Analytical formulation used to decompose labor productivity growth."

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[202] For additional details, see *Measuring productivity—OECD manual: Measurement of aggregate and industry-level productivity growth*, OECD, 2001, and EU KLEMS methodological materials.

[203] *Measuring productivity—OECD manual: Measurement of aggregate and industry-level productivity growth*, OECD, 2001.

Box A1. Analytical formulation used to decompose labor productivity growth

Our analysis first decomposes aggregate total economy labor productivity growth into a "within" and a "mix" effect. The within effect captures the impact of labor productivity growth within each sector, by weighting sector labor productivity growth by its share of nominal GDP. The mix effect captures the impact of reallocation of labor and relative price movements across sectors of different productivity levels, and different productivity growth. The formula we have used relies on the generalized exact additive decomposition (GEAD) technique.[1] The key characteristic of this formulation is that it does not require real aggregate output to equal the sum of real sectoral output, but relies only on the (always true) additivity of nominal output. It can therefore be used with superlative indexes such as Tornqvist or Fisher indexes to calculate real GDP and productivity.

In this formulation, labor productivity growth between time periods t-1 and t, Gt is given by

$$G_t = \sum_i \left[\frac{Y^i_{t-1}}{Y_{t-1}} G^i_t + \frac{Z^i_{t-1}}{Z_{t-1}} \left(\rho^i_t l^i_t - \rho^i_{t-1} l^i_{t-1} \right) + \frac{Z^i_{t-1}}{Z_{t-1}} \left(\rho^i_t l^i_t - \rho^i_{t-1} l^i_{t-1} \right) G^i_t \right] \qquad (1)$$

where

i refers to a sector

G is productivity growth

Z is real labor productivity level

Y is nominal GDP

ρi is the ratio between prices in sector i and economy-wide prices

l is the ratio of sector labor to total economy labor (employment or hours worked)

The first term in the above equation refers to the "within" effect, while the second two terms refer to the "mix" effect.[2]

We have then built on the standard growth accounting framework developed by Robert Solow. In the standard growth accounting framework,

$$Z^i_{t-1} = A^i \left(K^i \right)^{\alpha} \left(LQ^i \right)^{1-\alpha} \qquad (2)$$

where

A is total factor productivity

K is capital intensity

LQ is labor quality

α is the capital share of income

Differentiating equation (2) over time yields:

$$G^i_t = \dot{A}^i_t + (\alpha)\dot{K}^i_t + (1-\alpha)\dot{LQ}^i_t \qquad (3)$$

where the "dot" refers to growth

Putting equations (1) and (3) together allows us to further decompose the "within" effect of each sector. The contribution of each sector's TFP, capital intensity, and TFP growth is the respective growth rates weighted by the share of GDP of the sector, as described by the first term in equation (1). This analysis is equivalent to multiplying the factors of production for individual sectors by their Domar weights.[3] In our analysis, we conduct the above calculation year over year, and then aggregate over time to get the compound annual growth rate across any given time period.

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[1] For a detailed derivation of the GEAD formula, see Ricardo de Avillez, "Sectoral contributions to labour productivity growth in Canada: Does the choice of decomposition formula matter?" *International Productivity Monitor*, number 24, fall 2012, and Jianmin Tang and Weimin Wang, "Sources of aggregate labor productivity growth in Canada and the United States," *Canadian Journal of Economics*, volume 37, number 2, May 2004.

[2] Note that in the GEAD formulation, the mix term includes the effect of both a change in labor shares and changes in relative price. Some authors have attempted to further break down these terms into alternate formulations to isolate these two effects. See, for example, W. Erwin Diewert, *On the Tang and Wang decomposition of labour productivity growth into sectoral effects*, discussion paper number 08-06, Department of Economics, University of British Columbia, April 2008. Others have attempted alternate formulations, see for example Marshall Reinsdorf, "Measuring industry contributions to labour productivity change: A new formula in a chained fisher index framework," *International Productivity Monitor*, issue 28, spring 2015. In our work here, we choose to use the GEAD formulation because it allows for an exactly additive decomposition and is also relatively widely used in the labor-productivity literature, while acknowledging the challenges in the formulation highlighted in the above research. For our analysis, we use the "within" effect to understand growth dynamics and contributions of individual sectors, and only use the "mix" effect at a total economy level, rather than attributing it to individual sectors.

[3] Ibid.

4. METHODOLOGY FOR SIZING THE IMPACT OF THE THREE WAVES ON PRODUCTIVITY GROWTH

To calculate the impact of the three waves, we relied on our extensive sector analyses across countries and time periods. We started by determined which sectors were influenced by each wave; whether the impact was felt through value added or through hours worked; and during which periods the impact was felt; and we estimated the contribution of each sector based on a growth accounting framework (Exhibit A2).

Exhibit A2

Methodology for sizing impact of Wave 1 and Wave 2

● Included in calculation

				Difference in productivity contribution	
				2004–07 vs. 2000–04	2010–14 vs. 2004–07
Wave 1 Waning of a mid-1990s productivity boom	The first ICT revolution	▪ Retail and wholesale ▪ ICT services ▪ ICT manufacturing ▪ Professional services (United States only)	▪ Hours ▪ Capital services ▪ Total factor productivity ▪ Labor quality	●	● (excluding retail)
	Restructuring and offshoring	▪ Total manufacturing (except ICT) ▪ Utilities	▪ Hours	●	
Wave 2 Financial crisis aftereffects including weak demand and uncertainty	Sectors experiencing boom and bust (finance, real estate, construction)	▪ Finance and insurance ▪ Real estate ▪ Construction	▪ Hours ▪ Capital services ▪ Total factor productivity ▪ Labor quality	●	●
	Hours contraction and expansion	▪ Total manufacturing (except ICT) ▪ Retail and wholesale	▪ Hours		●
	Excess capacity, slow demand recovery, uncertainty	▪ Total manufacturing (except ICT) ▪ Utilities ▪ Retail and wholesale	▪ Capital services ▪ Total factor productivity ▪ Labor quality		● (hours also included for utilities)
Other sectors		▪ Agriculture ▪ Mining ▪ Transportation and storage ▪ Accommodation and food services ▪ Arts and entertainment ▪ Professional services (except United States) ▪ Public sector ▪ Education ▪ Health care	▪ Hours ▪ Capital services ▪ Total factor productivity ▪ Labor quality		

SOURCE: McKinsey Global Institute analysis

To conduct this sizing, we mapped the productivity growth trends in individual sectors to the waves our research identified. The sectors were chosen based on our knowledge of the underlying productivity drivers from our deep dives (see Chapters 3 and 4 for more details) and past MGI work.[204] In some instances we included the impact of other sectors such as construction, real estate, and professional and business services, as well as manufacturing more broadly (our deep dives covered only two manufacturing subsectors, tech and auto manufacturing). In these instances, we based our choice on including such sectors based on past MGI research about the underlying productivity drivers in these sectors.[205] Some sectors were included in different waves; retail, for example, shows up as both Wave 1 and Wave 2. This is because multiple factors have influenced the sectors. Retail productivity-growth declined after 2000–04 because companies in the sector captured benefits of the first ICT boom (the Wave 1 effect). Then the financial crisis hit retail, slowing demand and impacting the nature of goods purchased by consumers (the Wave 2 effect).

Wave 1: Waning of mid-1990s / early 2000s productivity boom

- **First ICT revolution.** Includes the impact of the waning of the productivity boom from the first ICT revolution of the mid-1990s and early 2000s. The sectors we consider as being impacted by this wave include tech (both manufacturing and services) and retail. For the United States, we also consider professional and business services.

- **Restructuring and offshoring.** Includes the impact of the waning of the restructuring and offshoring wave that boosted growth in the early 2000s. The sectors we consider as being impacted by this wave include manufacturing (except for ICT manufacturing, which is considered part of the first ICT revolution) and utilities.

Wave 2: Financial crisis aftereffects

- **Boom-bust sectors.** Includes the impact of the decline in labor productivity growth of sectors seeing a large boom and subsequent bust in demand pre- and postcrisis. The sectors we consider as being impacted by this wave include finance, real estate, and construction.

- **Hours contraction and expansion.** Includes the impact on labor productivity growth of hours contraction during the crisis with strong rebound as demand slowly returned. The sectors we consider as being impacted by this wave include manufacturing (except for ICT manufacturing, which is considered part of the first ICT revolution) and retail.

- **Excess capacity, slow demand recovery, uncertainty.** This includes various factors that drove a decline in labor productivity growth as excess capacity; economic, political, and regulatory uncertainty; and risk aversion impacted investment. This also includes the impact of a change in demand composition and magnitude impacting productivity (for example, due to economies of scale); however, we have not explicitly isolated the size of this effect. The sectors we consider as being impacted by this wave include manufacturing (except for ICT manufacturing, which is considered part of the first ICT revolution), retail, and utilities.

Wave 3: Digitization and Solow Paradox redux

We did not attempt to size the impact from this wave. While digitization contains the promise of significant productivity-boosting opportunities, it comes with lag effects and adoption barriers as well as transition costs. The near-term effect on productivity is unclear. Today we find that companies are allocating substantial time and resources to

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[204] See, for example, *How IT enables productivity growth: The US experience across three sectors in the 1990s*, McKinsey Global Institute, November 2002; *US productivity growth, 1995–2000*, McKinsey Global Institute, October 2001; and *Global growth: Can productivity save the day in an aging world?* McKinsey Global Institute, January 2015.

[205] See, for example, *Reinventing construction through a productivity revolution*, McKinsey Global Institute, February 2017.

changes and innovations that do not yet have a direct and immediate impact on output and productivity growth.

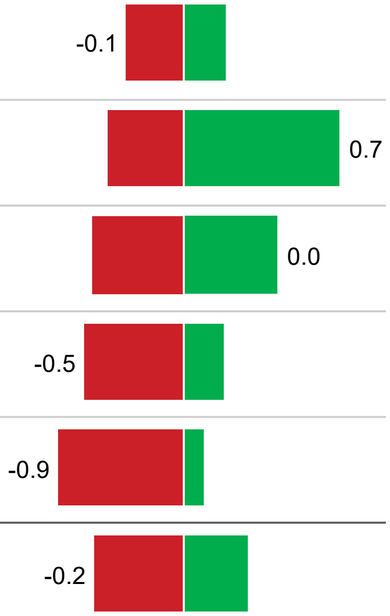
Note, in some instances, we used broader sector definitions for the analysis (for example, using data on retail and wholesale trade rather than just retail); this was done based on data availability from EU KLEMS and BLS. We focused our analyses on the sectors that had the biggest impact on the slowdown in most countries and also represented diverse sectors of the economy (See Chapter 2 and Chapter 4 for a discussion on this). After including the effects described above, we were also left with an unaccounted or "residual" component. This was because there were some sectors and effects that our analysis did not cover. The residual may also include some of the impact from transition costs in digital. Many of these acted as a boost to productivity growth, while others acted as a drag (Exhibits A3 and A4); however, the residuals are not large enough across countries to impact the aggregate story. In addition, it should be pointed out that the size of the total residual (sum of boost and drag) varies across countries. This is a reflection of the fact that productivity growth in nations does not move in unison, and reflects underlying sector-level dynamics.

Exhibit A3

Methodology for sizing impact of Wave 1 and Wave 2: Overview of residual term

Major sectors responsible for residual, percentage point contribution in 2010–14 vs. 2000–04

	🟥 Drag on growth	🟩 Boost to growth	Total residual
France	▪ Utilities[1] ▪ Arts and entertainment ▪ Telecommunications	▪ Education ▪ Accommodation and food services ▪ Finance and insurance	-0.1
Germany	▪ Transportation and storage ▪ Agriculture ▪ Utilities	▪ Manufacturing (except ICT)[1] ▪ Finance and insurance ▪ IT and other information services	0.7
Sweden	▪ Agriculture ▪ Telecommunications ▪ Education	▪ Real estate ▪ Manufacturing (except ICT)[1] ▪ Finance and insurance	0.0
United Kingdom	▪ Telecommunications ▪ Mining[1] ▪ Manufacturing (except ICT)[1]	▪ Real estate ▪ Arts and entertainment	-0.5
United States[2]	▪ Manufacturing (except ICT)[1] ▪ Utilities[1] ▪ Transportation and storage	▪ Arts and entertainment ▪ Real estate	-0.9
Total residual			-0.2



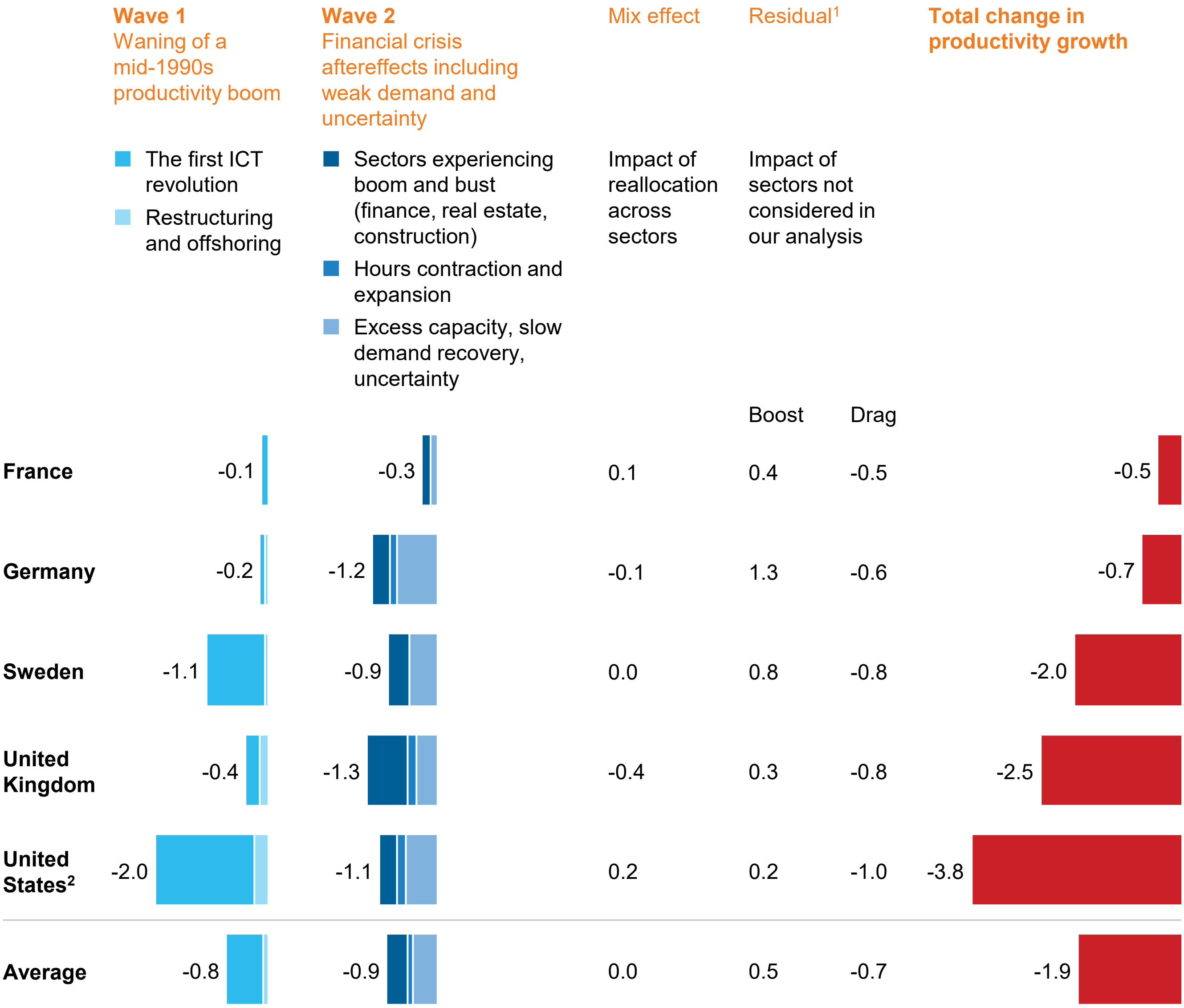
1 Includes impact on productivity growth in the 2004–07 vs. 2000–04 period for capital services, total factor productivity, and labor quality.
2 US data are for the private business sector only; Europe data are for the total economy.
NOTE: Italy and Spain are excluded from this analysis because their productivity growth between these time periods did not decrease.

SOURCE: EU KLEMS (2016 release); BLS Multifactor Productivity database (2016 release); McKinsey Global Institute analysis

Exhibit A4

The impact of each wave varies across countries

Percentage point contribution to the decline in productivity growth in 2010–14 vs. 2000–04



	Wave 1	Wave 2	Mix effect	Residual[1] Boost	Residual[1] Drag	Total change in productivity growth
France	-0.1	-0.3	0.1	0.4	-0.5	-0.5
Germany	-0.2	-1.2	-0.1	1.3	-0.6	-0.7
Sweden	-1.1	-0.9	0.0	0.8	-0.8	-2.0
United Kingdom	-0.4	-1.3	-0.4	0.3	-0.8	-2.5
United States[2]	-2.0	-1.1	0.2	0.2	-1.0	-3.8
Average	-0.8	-0.9	0.0	0.5	-0.7	-1.9

1 Includes the impact of sectors not considered in our analysis. May include some of the impact from transition costs of digital.
2 US data are for the private business sector only; Europe data are for the total economy.
NOTE: Italy and Spain are excluded from this analysis because their productivity growth between these time periods did not decrease. Numbers may not sum due to rounding.

SOURCE: EU KLEMS (2016 release); BLS Multifactor Productivity database (2016 release); McKinsey Global Institute analysis

5. METHODOLOGY FOR ESTIMATING FUTURE POTENTIAL FOR PRODUCTIVITY GROWTH

Our estimate for the productivity-growth potential builds on extensive past MGI research on sector opportunities for improving productivity through technologies that are already implemented today or have a clear path to deployment at scale by 2025. These include benefits from digitization as well as non-digital opportunities.

- **Digital.** There are a variety of opportunities to boost productivity growth through digital channels. These include via automation, big data, Internet of Things, and AI. MGI's past research on automation suggests that productivity growth could be as much as 0.8 to 1.4 percent higher per year over the next 50 years through the use of automation technologies for our sample of seven countries.[206] Over the next ten years, this analysis finds that productivity growth from automation could be as high as 3.2 percent per year for our sample of countries. This analysis is based on estimating the technical potential for automation of the component activities for each occupation, that relies on databases published by institutions such as the World Bank and the US Bureau of Labor Statistics to break down about 800 occupations into more than 2,000 activities. Automation timelines are then overlaid onto this based on technical feasibility, economic feasibility, and other factors. This results in various scenarios for adoption. For the estimate of productivity growth, it is assumed that people displaced by automation will find other employment at the 2014 level of productivity. Another estimate of the potential for automation that relies on a general equilibrium model for a subset of European "digital frontrunner" countries (and includes an assessment of new job creation as a result of creating and using automation technologies, and second order effects from the improved productivity) also found that automation could boost GDP per capita growth by 1 to 3 percent per year between 2016 and 2030.[207] In a midpoint scenario, the research finds that automation could boost productivity growth by 1.2 percent a year, in that time frame. Triangulating across these estimates, a moderate assumption would suggest that automation could boost productivity growth by approximately 0.7 percent per year or more through 2025. Another analysis by MGI research has also identified opportunities for a variety of digital technologies relying on the Internet of Things, online talent platforms, and investments in data analytics to impact productivity growth, for example from the use of predictive maintenance techniques to reduce downtimes and expenditure on maintenance, real-time monitoring and control of production lines, better logistics routing through path optimization and prioritization, improved energy efficiency through intelligent building systems, etc.[208] The use of such digital technologies, some of which also result in increased automation, could boost productivity growth in the United States across the total economy by 0.5 to 0.7 percent per year over the next ten years.[209] An estimate for Europe finds that digitizing laggard firms and sectors could boost European GDP growth by 0.7 to 1 percent per year over the next decade, with a corresponding productivity growth impact of 0.5 to 0.9 percent per year.[210] Assuming a moderate impact on productivity growth of approximately 0.7 percent per year from these digital technologies, along with our earlier estimate from automation of ~0.7+ percent per year and an overlap between these two estimates of 0.2 percent per year, we find that various digital technologies could together add ~1.2+ percent per year under moderate assumptions.

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[206] *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017.

[207] *Digitally-enabled automation and artificial intelligence: Shaping the future of work in Europe's digital front-runners*, McKinsey & Company, April 2017.

[208] See *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015; *Digital Europe: Pushing the frontier, capturing the benefits*, McKinsey Global Institute, June 2016.

[209] Calculated by applying the upside from digital technologies to the total economy's GDP.

[210] *Digital Europe: Pushing the frontier, capturing the benefits*, McKinsey Global Institute, June 2016.

- **Non-digital.** There remain substantial opportunities to raise productivity using more traditional non-digital methods. These range from adopting more efficient operational practices to shifting workers to more productive establishments; better matching staffing levels to customer demand in many service industries; consolidation in fragmented industries like construction; to further shifting of in-store retail sales from less productive single owner stores to more productive larger formats. To size the potential for the non-digital opportunities, we complemented our sector analyses with past MGI sector work, most importantly our Global Growth report that looked in detail at opportunities in other sectors such as agriculture and health care.[211] In health care as well as many government activities, the opportunities for adopting better process or people management processes is especially large as many practices that are standardly adopted in private businesses are yet to be applied to these sectors. The report identified opportunities for sectors and firms to "catch-up" to the frontier of productivity growth in developed economies of 1.1 percent. Assuming that non-digital opportunities represent 70 percent of the non-frontier productivity growth opportunities identified in the Global Growth report, this translates to ~0.8 percent annual labor productivity-growth potential.[212] The order of magnitude is also corroborated by the 0.9 percentage point decline from weak demand and investment that can be reversed as we leave the crisis further behind and work on the longer-term demand drags. Hence, we assume non-digital opportunities could boost productivity growth by at least 0.8 percent per year.

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

[212] We recognize that as both economic and social activities are becoming increasingly digital, the purely non-digital opportunities are declining as digital tools are used to facilitate much broader sets of business activities.

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BIBLIOGRAPHY

A

Acemoglu, Daron, and Pascual Restrepo, "Secular stagnation? The effect of aging on economic growth in the age of automation," *American Economic Review*, volume 107, number 5, May 2017.

Acemoglu, Daron, 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.

Adler, Gustavo, Romain A. Duval, Davide Furceri, Sinem Kiliç Çelik, Ksenia Koloskova, and Marcos Poplawski-Ribeiro, *Gone with the headwinds: Global productivity*, IMF staff discussion note number 17/04, April 2017.

Aghion, Philippe, Antonin Bergeaud, Timo Boppart, Peter J. Klenow, and Huiyu Li, *Missing growth from creative destruction*, Federal Reserve Bank of San Francisco, working paper number 2017-04, November 2017.

Ahmad, Nadim, Jennifer Ribarsky, and Marshall Reinsdorf, *Can potential mismeasurement of the digital economy explain the post-crisis slowdown in GDP and productivity growth?* OECD Statistics Working Papers, number 2017/09, July 2017.

Aiyar, Shekhar, and Christian H. Ebeke, *The impact of workforce aging on European productivity*, IMF working paper number 16/238, December 2016.

Andrews, Dan, Chiara Criscuolo, and Peter N. Gal, *The best versus the rest: The global productivity slowdown, divergence across firms and the role of public policy*, OECD Productivity Working Papers, number 05, November 2016.

Andrews, Dan, Chiara Criscuolo, and Peter N. Gal, *Frontier firms, technology diffusion and public policy: Micro evidence from OECD countries*, OECD Productivity Working Papers, number 02, November 2015.

Andrews, Dan, Chiara Criscuolo, and Peter N. Gal, *The global productivity slowdown, technology divergence and public policy: A firm level perspective*, OECD, July 2016.

Anzoategui, Diego, Diego Comin, Mark Gertler, and Joseba Martinez, *Endogenous technology adoption and R&D as sources of business cycle persistence*, NBER working paper number 22005, February 2016, revised March 2017.

Autor, David, David Dorn, Lawrence F. Katz, Christina Patterson, and John Van Reenen, *The fall of the labor share and the rise of the superstar firm*, NBER working paper number 23396, May 2017.

B

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

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

Baker, Scott R., Nicholas Bloom, and Steven J. Davis, "Measuring economic policy uncertainty," *The Quarterly Journal of Economics*, volume 131, issue 4, November 2016.

Barrero, Jose Maria, Nicholas Bloom, and Ian Wright, *Short and long run uncertainty*, NBER working paper number 23676, August 2017.

Benmelech, Efraim, Adam Guren, and Brian T. Melzer, *Making the house a home: The stimulative effect of home purchases on consumption and investment*, NBER working paper number 23570, July 2017.

Bergeaud, Antonin, Gilbert Cette, and Rémy Lecat, "Productivity trends in advanced countries between 1890 and 2012," *Review of Income and Wealth*, volume 62, issue 3, September 2016.

Bernasek, Anna, and D. T. Mongan, *All you can pay: How companies use our data to empty our wallets*, Nation Books, 2015.

Besley, Timothy, Isabelle Roland, and John Van Reenen, *Credit market frictions and the productivity slowdown*, preliminary draft paper, August 2016.

Bessen, James, "Technology adoption costs and productivity growth: The transition to information technology," *Review of Economic Dynamics*, volume 5, issue 2, April 2002.

Betancourt, Roger R., *Distribution services and the digital economy: Implications for GDP measurement, productivity and household welfare*, Department of Economics, University of Maryland, working paper version 3.0, September 2017.

Biggs, Michael, and Thomas Mayer, *Bring credit back into the monetary policy framework!* Political Economy of Financial Markets policy brief, August 2013.

Blanchard, Olivier, Guido Lorenzoni, and Jean Paul L'Huillier, *Short-run effects of lower productivity growth: A twist on the secular stagnation hypothesis*, policy brief number 17-6, Peterson Institute for International Economics, February 2017.

Bloom, Nicholas, Charles Jones, John van Reenen, and Michael Webb, *Are ideas getting harder to find?* NBER working paper number 23782, September 2017.

Borio, Claudio, Enisse Kharroubi, Christian Upper, and Fabrizio Zampolli, *Labour reallocation and productivity dynamics: Financial causes, real consequences*, BIS working paper number 534, Bank for International Settlements, January 2016.

Börsch-Supan, Axel, and Matthias Weiss, "Productivity and age: Evidence from work teams at the assembly line," *The Journal of the Economics of Ageing*, volume 7, April 2016.

Brill, Michael, Corey Holman, Chris Morris, Ronjoy Raichoudhary, and Noah Yosif, "Understanding the labor productivity and compensation gap," *Beyond the Numbers*, volume 6, number 6, US Bureau of Labor Statistics, June 2017.

Brynjolfsson, Erik, and Lorin M. Hitt, "Beyond computation: Information technology, organizational transformation and business performance," *Journal of Economic Perspectives*, volume 14, number 4, fall 2000.

Brynjolfsson, Erik, and Andrew McAfee, *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*, Norton, 2014.

Brynjolfsson, Erik, Daniel Rock, and Chad Syverson, *Artificial intelligence and the modern productivity paradox: A clash of expectations and statistics*, NBER working paper number 24001, November 2017.

Bukht, Rumana, and Richard Heeks, *Defining, conceptualising and measuring the digital economy*, The University of Manchester working paper, 2017.

Bughin, Jacques, and Nicolas van Zeebroeck, *Getting digital "bucks": How the interplay of disruption and types of strategic responses shapes digital investment payoffs and solves the Solow paradox*, working paper, December 2017.

Bughin, Jacques, and Nicolas van Zeebroeck, "The right response to digital disruption," *MIT Sloan Management Review*, April 2017.

Bughin, Jacques, and Tanguy Catlin, “What successful digital transformations have in common,” *Harvard Business Review*, December 19, 2017.

Byrne, David M., and Carol Corrado, *ICT prices and ICT services: What do they tell us about productivity and technology?* Economics program working paper series, May 2016.

Byrne, David M., 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.

Byrne, David M., Stephen D. Oliner, and Daniel E. Sichel, *Is the information technology revolution over?* Finance and economics discussion series, Federal Reserve Board, March 2013.

Byrne, David, Stephen Oliner, and Daniel Sichel, *Prices of high-tech products, mismeasurement, and pace of innovation*, NBER working paper number 23369, April 2017.

C

Castellani, Davide, Mariacristina Piva, Torben Schubert, and Marco Vivarelli, *R&D and productivity in the US and the EU: Sectoral specificities and differences in the crisis*, Henley Business School discussion paper number JHD-2016-03, May 2016.

Cette, Gilbert, John Fernald, and Benoit Mojon, “The pre-Great Recession slowdown in productivity,” *European Economic Review*, volume 88, issue C, 2016.

Cincera, Michele, and Reinhilde Veugelers, *Differences in the rates of return to R&D for European and US young leading R&D firms*, KU Leuven, Faculty of Economics and Business, December 2013.

Comin, Diego, and Bart Hobijn, “An exploration of technology diffusion,” *American Economic Review*, volume 100, number 5, December 2010.

Coyle, Diana, *Do-it-yourself digital: The production boundary and the productivity puzzle*, ESCoE discussion paper number 2017-01, June 2017.

D

Dabla-Norris, Era, Si Guo, Vikram Haksar, Minsuk Kim, Kalpana Kochhar, Kevin Wiseman, and Aleksandra Zdzienicka, *The new normal: A sector-level perspective on productivity trends in advanced economies*, IMF staff discussion note, March 2015.

David, Paul, *Computer and dynamo: The modern productivity paradox in a not-too distant mirror*, The Warwick Economics Research Paper Series, 1989.

Davis, Steven J., “Regulatory complexity and policy uncertainty: Headwinds of our own making,” prepared for Hoover Institution conference on “Restoring Prosperity,” Stanford University, February 9–10, 2017.

de Avillez, Ricardo, “Sectoral contributions to labour productivity growth in Canada: Does the choice of decomposition formula matter?” International Productivity Monitor, number 24, fall 2012.

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

Diewert, W. Erwin, *On the Tang and Wang decomposition of labour productivity growth into sectoral effects*, discussion paper number 08-06, Department of Economics, University of British Columbia, April 2008.

E

Eichengreen, Barry, *Hall of mirrors: The Great Depression, the Great Recession, and the uses—and misuses—of history*, Oxford University Press, 2015.

Eichengreen, Barry, “Secular stagnation: The long view,” *American Economic Review*, volume 105, number 5, May 2015.

Erber, Georg, Ulrich Fritsche, and Patrick Christian Harms, “The global productivity slowdown: Diagnosis, causes and remedies,” *Intereconomics*, volume 52, number 1, January/February 2017.

F

Federal Reserve Bank of San Francisco, *The Pre-Great Recession slowdown in productivity*, working paper number 2016-08, April 2016.

Feldstein, Martin, “Remarks at the Brookings Institution conference on productivity,” September 2016.

Fernald, John G., *Productivity and potential output before, during, and after the Great Recession*, Federal Reserve Bank of San Francisco, working paper, June 2014.

Fernald, John, and Bing Wang, “The recent rise and fall of rapid productivity growth,” *FRBSF Economic Letter*, Federal Reserve Bank of San Francisco, February 2015.

Furman, Jason, and Peter Orszag, *A firm-level perspective on the role of rents in the rise in inequality*, presentation at Columbia University, October 16, 2015.

G

Gopinath, Gita, Sebnem Kalemli-Ozcan, Loukas Karabarbounis, and Carolina Villegas-Sanchez, *Capital allocation and productivity in Southern Europe*, NBER working paper number 21453, August 2015, revised March 2017.

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

Gordon, Robert J., “Secular stagnation: A supply-side view,” *American Economic Review*, volume 105, number 5, May 2015.

Grullon, Gustavo, Yelena Larkin, and Roni Michaely, *Are US industries becoming more concentrated?* October 2016.

H

Hall, Bronwyn H., Christian Helmers, and Georg Von Graevenitz, *Technology entry in the presence of patent thickets*, Institute for Fiscal Studies working paper, January 2016.

Haltiwanger, John, “Job creation and firm dynamics in the United States,” *Innovation Policy and the Economy*, volume 12, number 1, January 2012.

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

I

IMF World Economic Outlook, *Gaining momentum?* April 2017.

IMF World Economic Outlook, *Subdued demand: Symptoms and remedies*, October 2016.

IMF World Economic Outlook, *Uneven growth: Short- and long-term factors*, April 2015.

J

Jorgenson, Dale W., Mun S. Ho, and Kevin J. Stiroh, "A retrospective look at the US productivity growth resurgence," *Journal of Economic Perspectives*, volume 22, number 1, winter 2008.

Jovanovic, Boyan, and Peter L. Rousseau, "General purpose technologies," in *Handbook of Economic Growth*, volume 1B, Philippe Aghion and Steven Durlauf, eds., Elsevier, 2005.

K

Kehrig, Matthias, and Nicolas Vincent, *Growing productivity without growing wages: The micro-level anatomy of the aggregate labor share decline*, Economic Research Initiatives at Duke (ERID) working paper number 244, March 2017.

Kirkegaard, Jacob Funk, *Making labor market reforms work for everyone: Lessons from Germany*, Peterson Institute for International Economics, policy brief number 14-1, January 2014.

Kolesnikova, Natalia A., and Yang Liu, *Jobless recoveries: Causes and consequences*, Federal Reserve Bank of St. Louis, 2011.

L

Landesmann, Michael A., and Robert Stehrer, "Technology diffusion, international competition and effective demand," *Revue d'economie industrielle*, number 105, 2004.

M

Malhotra, Vikram, and James Manyika, "Five misconceptions about productivity," McKinsey & Company, March 2011.

McGowan, Müge Adalet, Dan Andrews, and Valentine Millot, *The walking dead? Zombie firms and productivity performance in OECD countries*, OECD Economics Department Working Papers, number 1372, January 2017.

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

McKinsey Global Institute, *Big data: The next frontier for innovation, competition, and productivity*, May 2011.

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

McKinsey Global Institute, *A future that works: Automation, employment, and productivity*, January 2017.

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

McKinsey Global Institute, *How IT enables productivity growth: The US experience across three sectors in the 1990s*, November 2002.

McKinsey Global Institute, *The impact of internet technologies: Search*, July 2011.

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

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

McKinsey Global Institute, *Secular stagnation and low investment: Breaking the vicious cycle*, April 2016.

McKinsey Global Institute, *A tale of two Mexicos: Growth and prosperity in a two-speed economy*, March 2014.

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

Murray, Alexander, *What explains the post-2004 US productivity-growth slowdown?* CSLS Research Report 2017–05, 2017.

N

Neumark, David, *Employment effect of minimum wages*, IZA World of Labor, May 2014.

O

Ohanian, Lee E., *Accounting for the Great Recession*, Federal Reserve Bank of Minneapolis, 2011.

Onaran, Özlem, and Thomas Obst, *Wage-led growth in the EU15 member states: The effects of income distribution on growth, investment, trade balance, and inflation*, working paper number PKWP1602, Post-Keynesian Economics Study Group, January 2016.

S

Schanzenbach, Diane Whitmore, Ryan Nunn, Lauren Bauer, and Audrey Breitwieser, *The closing of the jobs gap: A decade of recession and recovery*, The Hamilton Project at the Brookings Institution, August 2017.

Song, Jae, David J. Price, Fatih Guvenen, and Nicholas Bloom, *Firming up inequality*, Centre for Economic Performance discussion paper number 1354, May 2015.

Summers, Lawrence H., “The age of secular stagnation: What it is and what to do about it,” *Foreign Affairs*, February 15, 2016.

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

T

Tamasauskiene, Zita, Janina Seputiene, Rasa Balvociute, and Daiva Berzinskiene-Juozainiene, “The impact of wage share on domestic demand in the European Union,” *Eurasian Economic Review*, volume 7, issue 1, April 2017.

Tang, Jianmin, and Weimin Wang, “Sources of aggregate labour productivity growth in Canada and the United States,” *Canadian Journal of Economics*, volume 37, number 2, May 2004.

Taylor, John B., “Slow economic growth as a phase in a policy performance cycle,” *Journal of Policy Modeling*, volume 38, issue 4, July-August 2016.

Teulings, Coen, and Richard Baldwin, “Secular stagnation: Facts, causes, and cures,” *Vox*, September 2014.

Timmer, Marcel P., Robert Inklaar, Mary O’Mahony, and Bart van Ark, “Productivity and economic growth in Europe: A comparative industry perspective,” *International Productivity Monitor*, number 21, spring 2011.

V

Van Ark, Bart, and Kirsten Jäger, *Recent trends in Europe’s output and productivity growth performance at the sector level, 2002–2015*, working paper.

Vanderzeil, Sebastian, Emma Currier, and Michael Shavel, *Retail automation: Stranded workers? Opportunities and risks for labor and automation*, Investor Responsibility Research Center, May 2017.

Varian, Hal, "Intelligent technology," *Finance & Development*, September 2016.

Veugelers, Reinhilde, et al., "The impact of Horizon 2020 on innovation in Europe," *Intereconomics*, volume 50, number 1, January/February 2015.

Y

Danny Yagan, *Employment hysteresis from the Great Recession*, NBER working paper number 23844, September 2017.

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