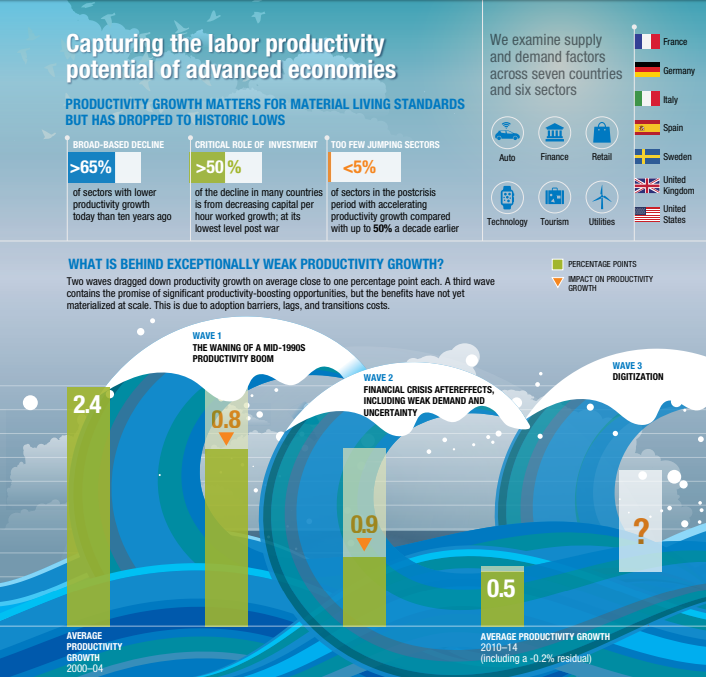
**- Solving the productivity puzzle: the role of demand and the promise of digitization** (**Productivity, Competitiveness & Growth - McKinsey Global Institute** - **February 2018**)

(New research uncovers how three waves collided to create historically low productivity growth but finds the potential for it to recover to 2 percent or more)

**In brief**

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.





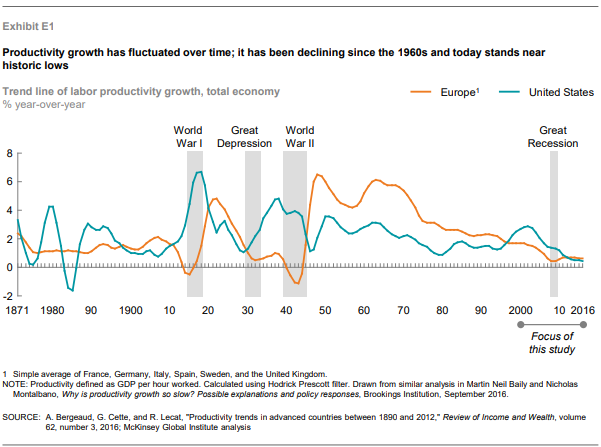
**Executive Summary**

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. 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.

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. 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.

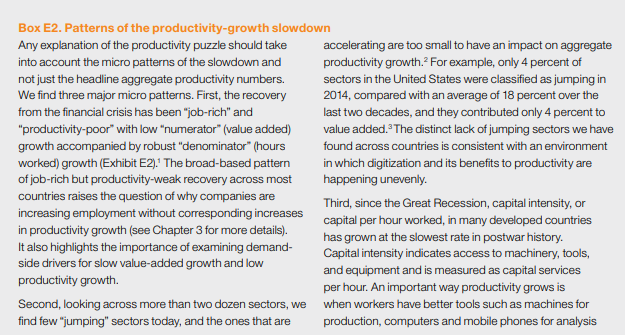
**Productivity growth remains near historic lows, following a job-rich, productivity-weak recovery**

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.

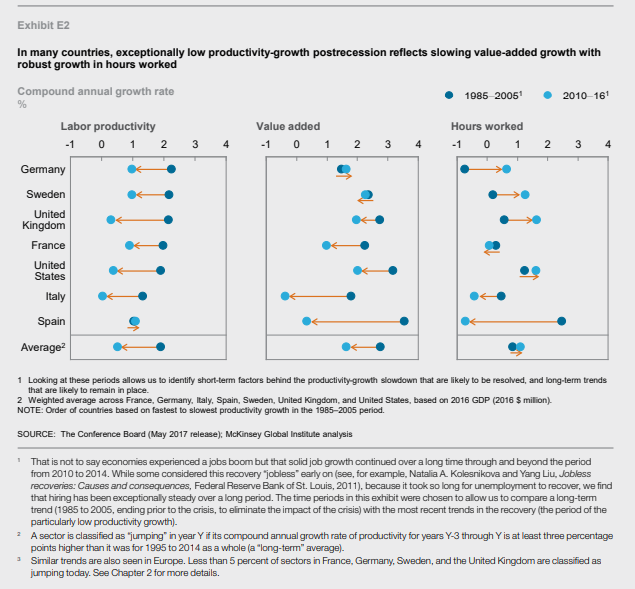


While we find many similar patterns of the productivity-growth slowdown across our sample of countries, there are also notable differences. Sweden and the United States experienced a strong productivity boom in the mid-1990s and early-2000s followed by the largest productivity-growth decline, and much 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.

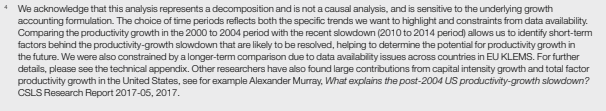
While many key economic variables such as GDP growth and investment as a share of GDP, as well as productivity growth, have started to pick up recently in the United States and Europe, productivity growth remains low relative to historical levels, with many countries in our sample seeing around 1 percent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











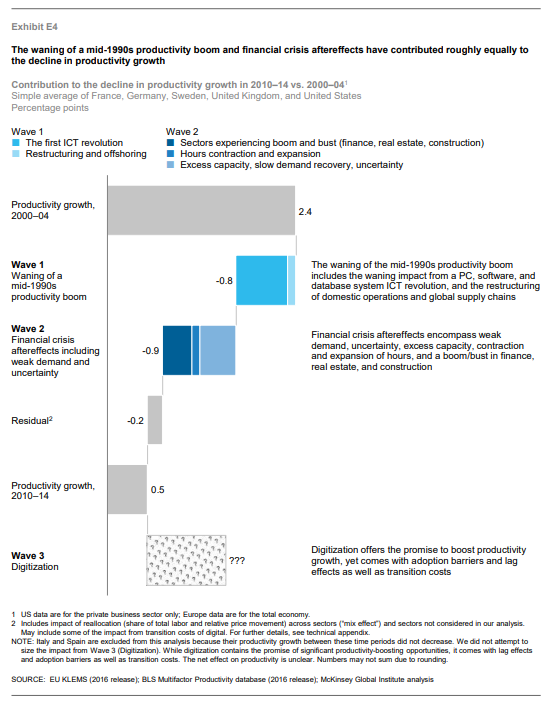
**The waning of a boom starting in the 1990s and financial crisis aftereffects have dragged down productivity growth to historic lows while digitization is under way**

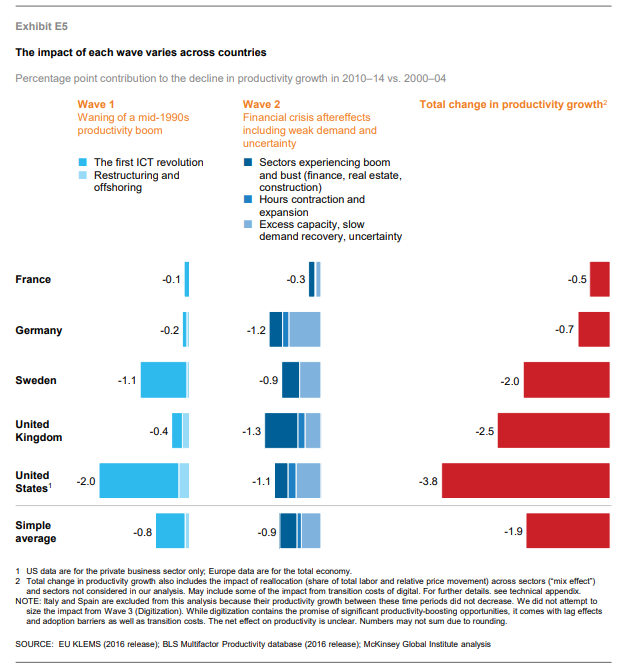
Two waves have dragged down productivity growth by 1,9 percentage points on average across countries since the mid-2000s: the waning of a boom that began in the 1990s with the first information and communications technology (ICT) revolution, and a subsequent phase of restructuring and offshoring, which 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.

**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. 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.





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. For example, the shift in demand toward smartphones requires managing sometimes dozens of sensors from fingerprint recognition and GPS to multiple cameras, 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.

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**

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. For example, in the United States, light-vehicle production fell by 47 percent between 2007 and 2009 (data from IHS Markit, 2017 for light-vehicle production), 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. 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. 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 auto sector in the United States, growth in hours worked surged after 2010, but total hours still remained below pre-crisis levels in 2015 (based on data from the BLS). Capacity utilization in the United States in light-vehicle production began a significant drop in 2007 and fell by 32 percentage points between 2007 and 2009. From 2009-10, US capacity utilization rates went up 20 percentage points, then 9 percentage points from 2010-11 (thus returning close to 2007 levels), and another 10 percentage points from 2011-12. Across the economy, 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.

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. 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. 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. 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. However, the good news is that the latest data from Europe and the United States indicate that economic growth is 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. 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 lagging in both. 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 points 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.

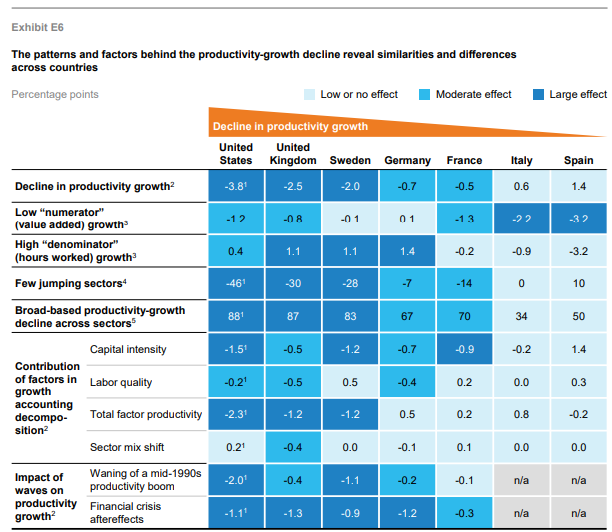
History shows that technological diffusion takes time and comes with barriers to adoption. An MGI review of the historical rate of adoption of 25 previous technologies over the past half century shows that the time from commercial availability to 90 percent adoption ranges from approximately eight to 28 years. 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. 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.

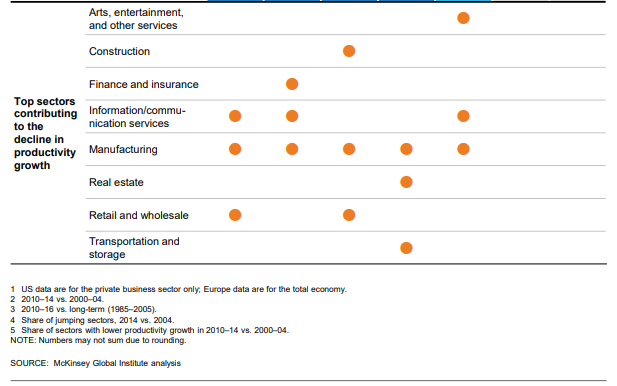
The challenge of adoption in the current digital wave may be even harder because of the broad range of uses of digital that not only help improve current processes but fundamentally transform business models and operations. For example, in retail, the first ICT revolution was focused on getting the right 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.

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. 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. Industry productivity benefits will then materialize mostly as incumbent businesses restructure or exit, and adoption costs are outweighed by benefits as digitization reaches scale.

**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.

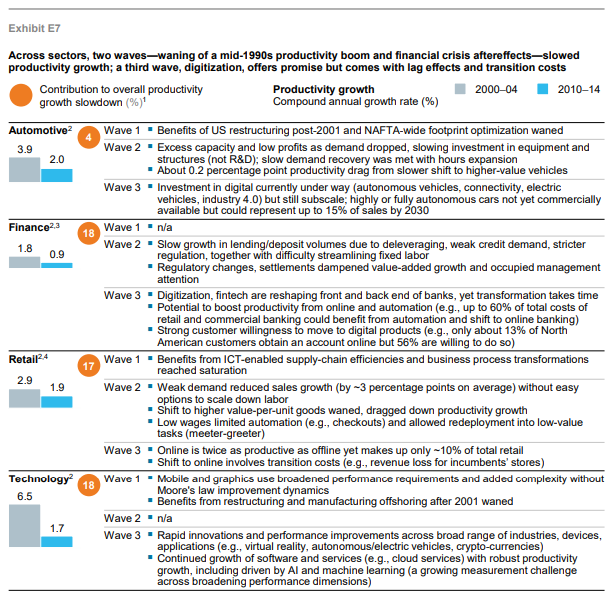


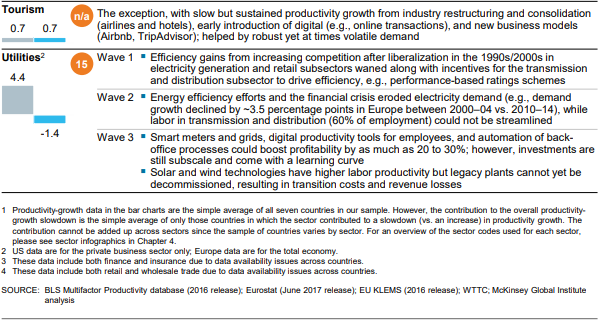


**A sector view highlights a 2 percent plus potential for the future**

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. 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.

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. 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. 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.



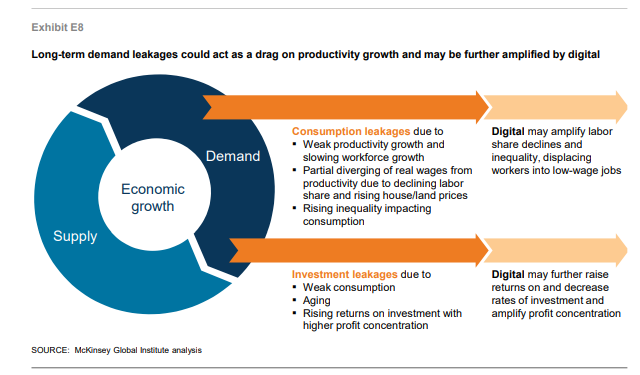


**Capturing the productivity potential of advanced economies may require a focus on promoting both demand and digital diffusion**

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. 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.



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. 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.

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. 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.

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**

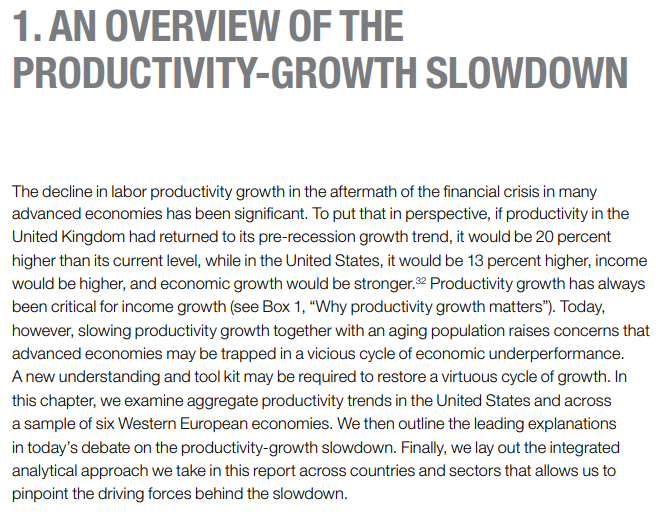
Unlocking the productivity potential of advanced economies may require a focus on promoting both demand and digital diffusion, in addition to interventions that help remove traditional supply-side constraints such as red tape. To incentivize broad-based change, companies need competitive pressure to 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.

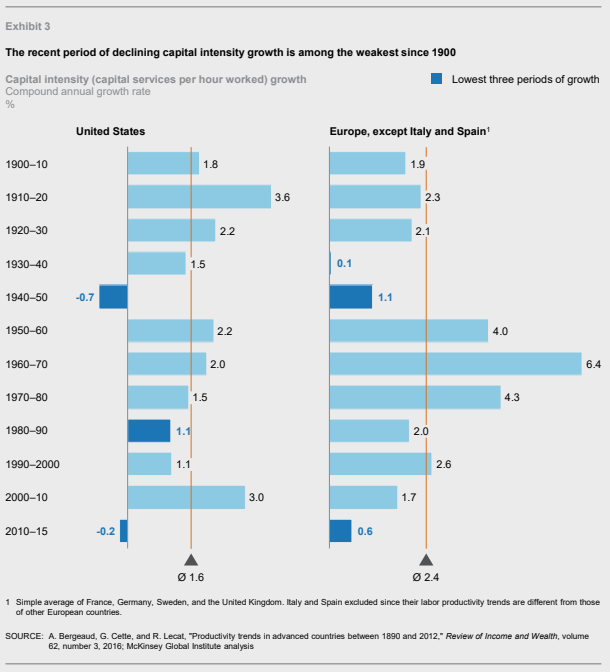
There are many opportunities today for policy makers to help boost productivity growth in advanced economies that focus on demand and digital diffusion. Demand may deserve attention to help boost productivity growth not only during the recovery from the financial crisis but also in terms of longer-term 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.

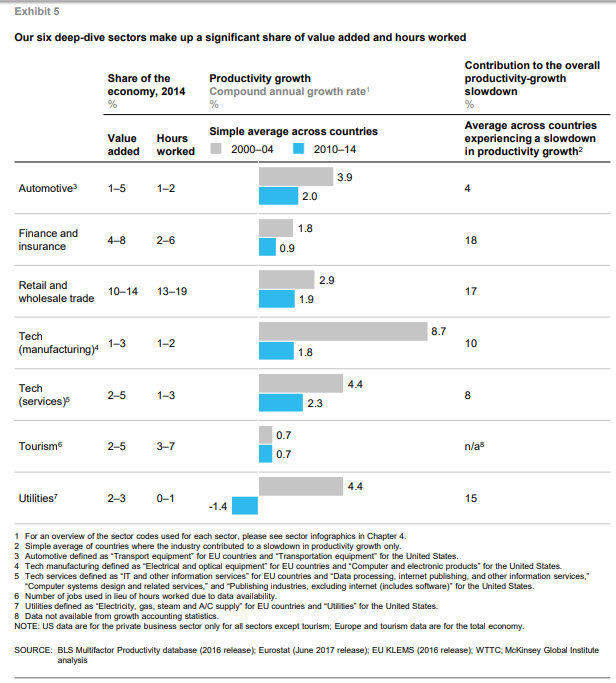
On digital, action is needed both to overcome adoption barriers of large incumbent business and to broaden the adoption of digital tools by all companies and citizens. Actions that can promote digital diffusion include: leading by example and digitizing the public sector; leveraging public procurement 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.

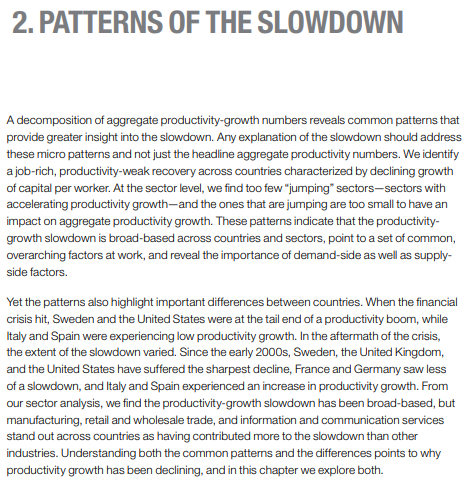
Other stakeholders have a role to play, too. How do companies, labor organizations, and even economists respond to the challenge of restarting productivity growth in a digital age? Companies will need to develop a productivity strategy that includes the digital transformation of their business model 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.

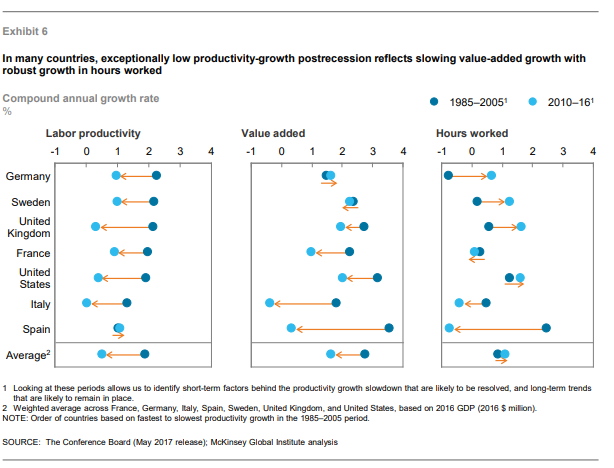
**While productivity growth in advanced economies has been slowing for decades, the sharp downturn following the financial crisis has raised alarms. We find that the most recent slowdown is the product of two waves, the waning of a 1990s productivity boom and financial crisis aftereffects, while a third 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.**

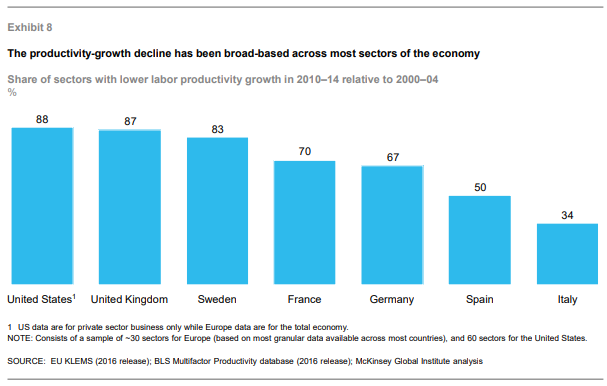


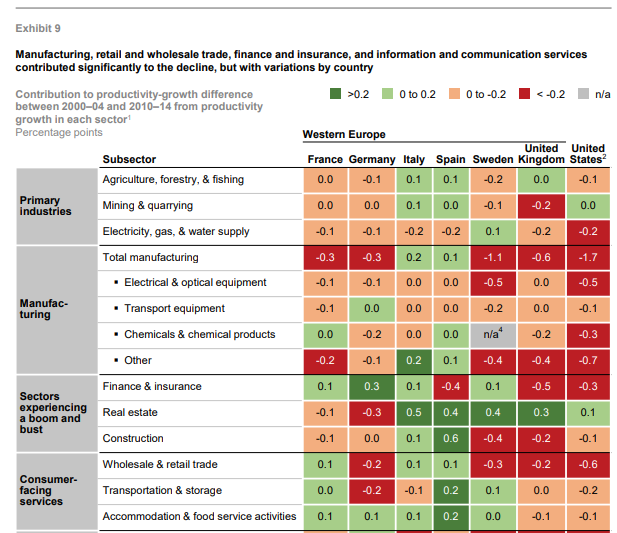


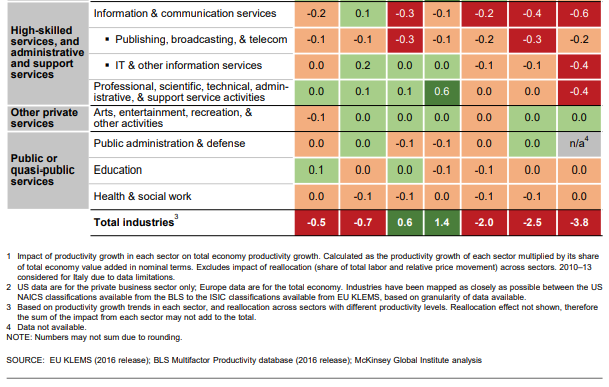


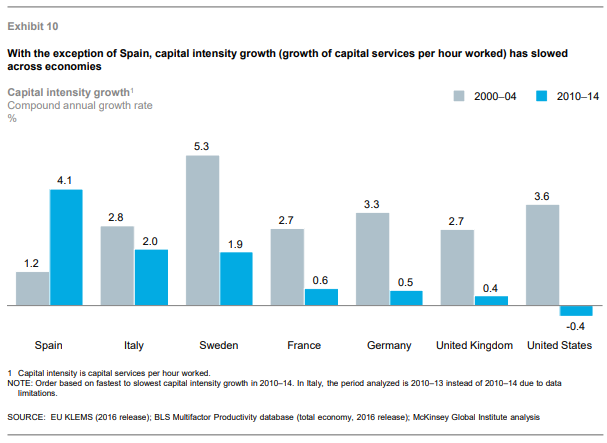


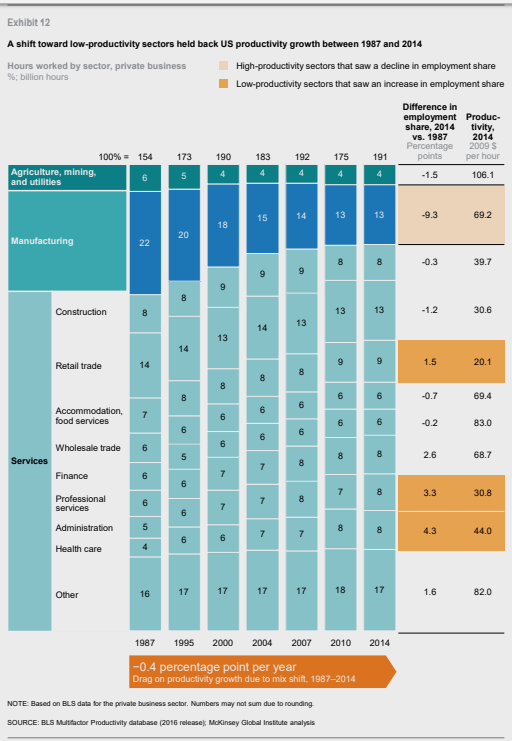




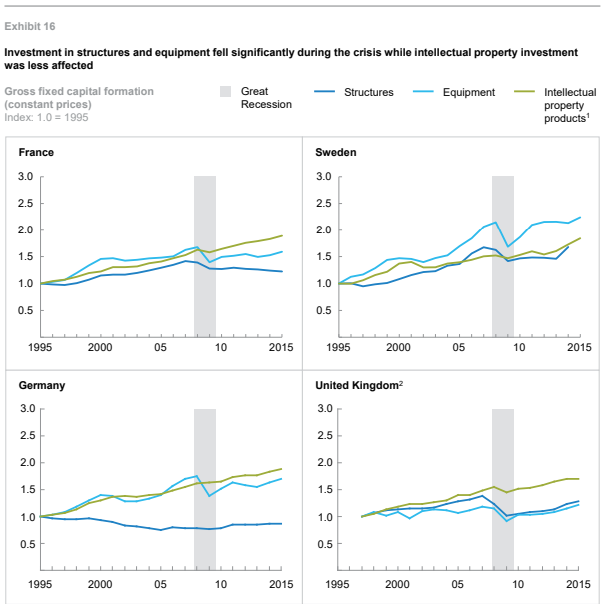


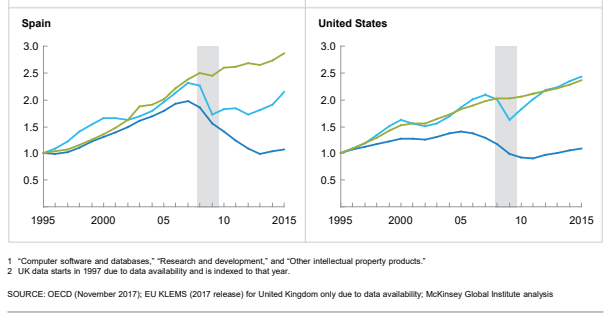


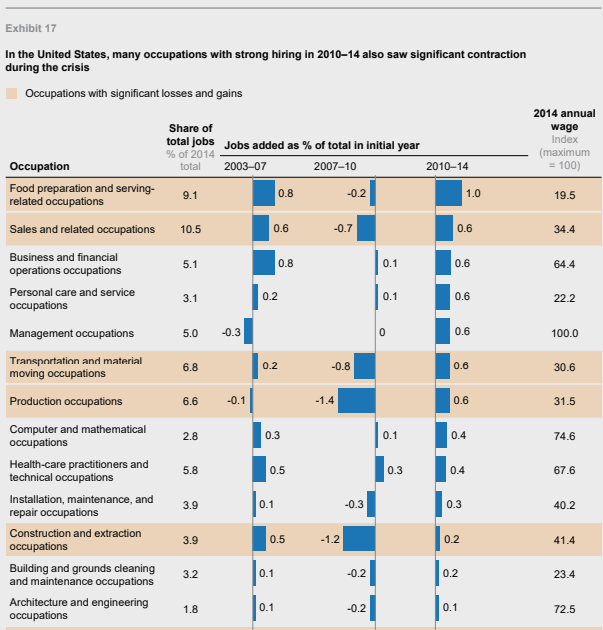


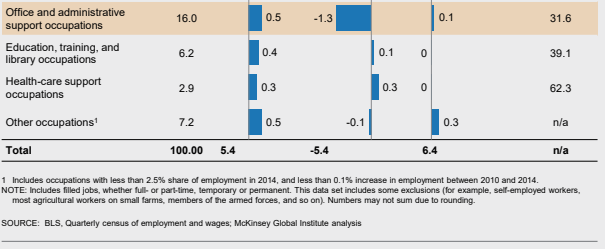


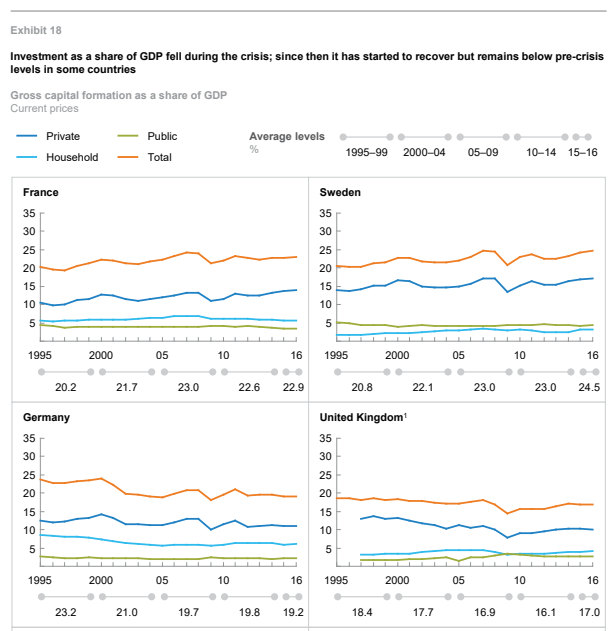


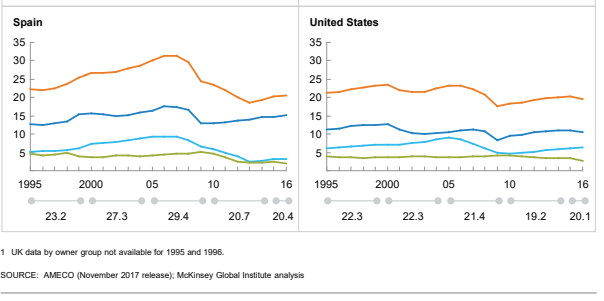


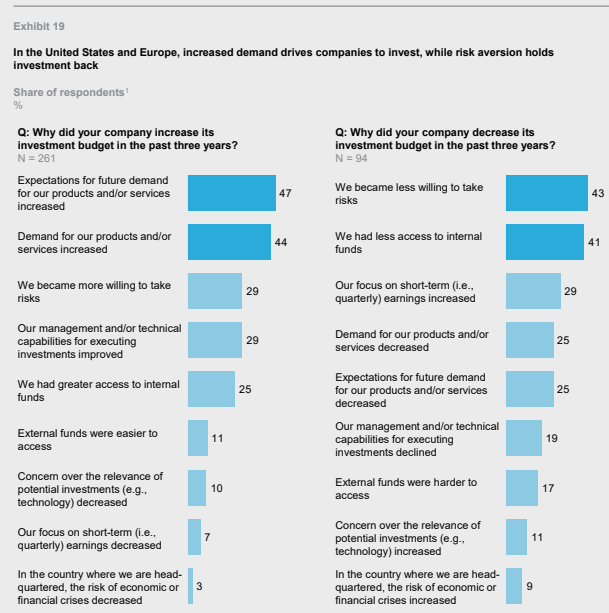


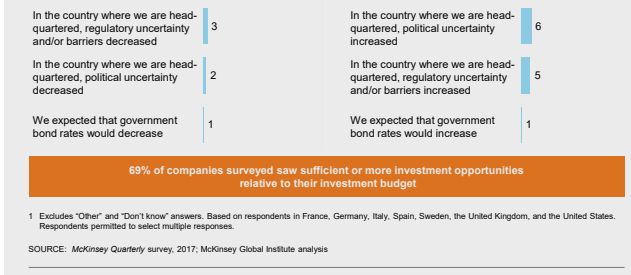


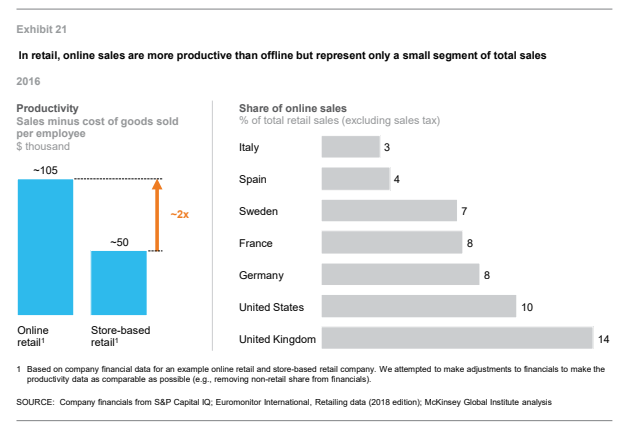


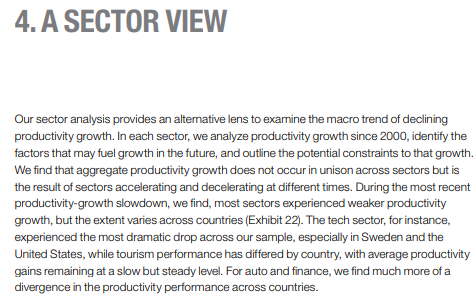


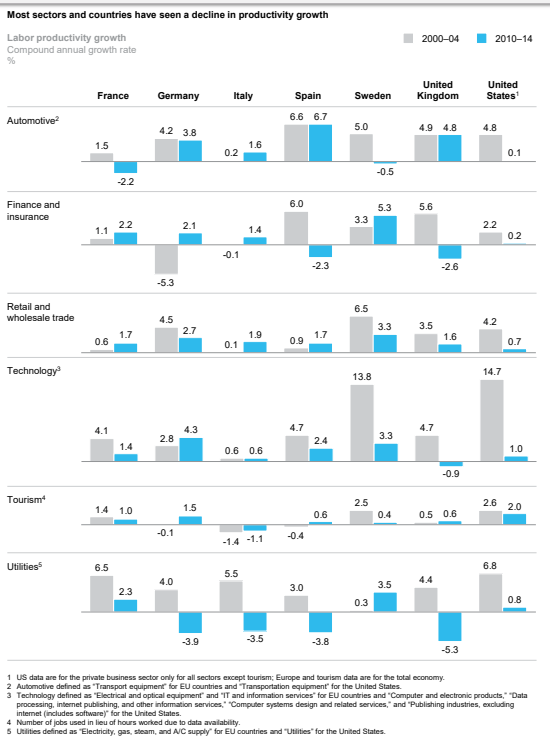


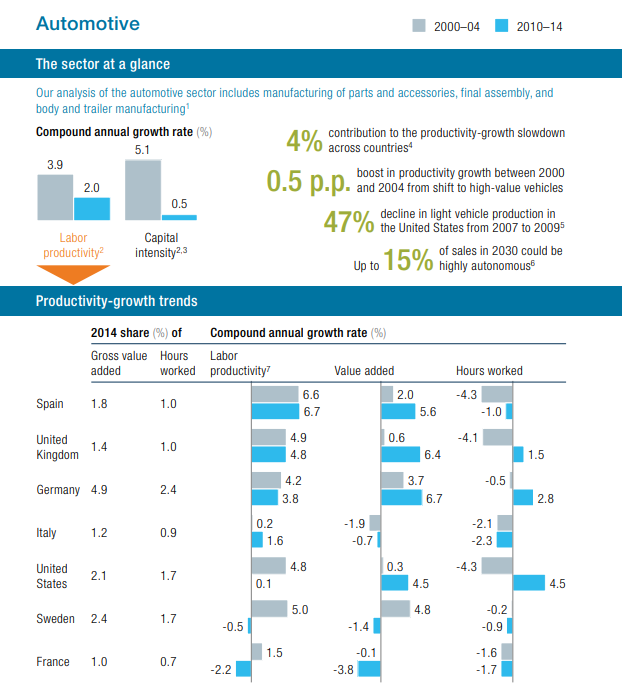




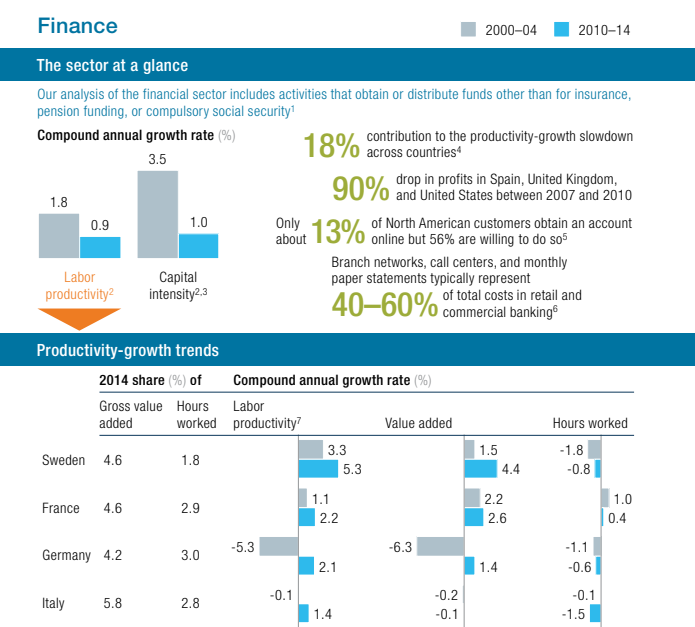






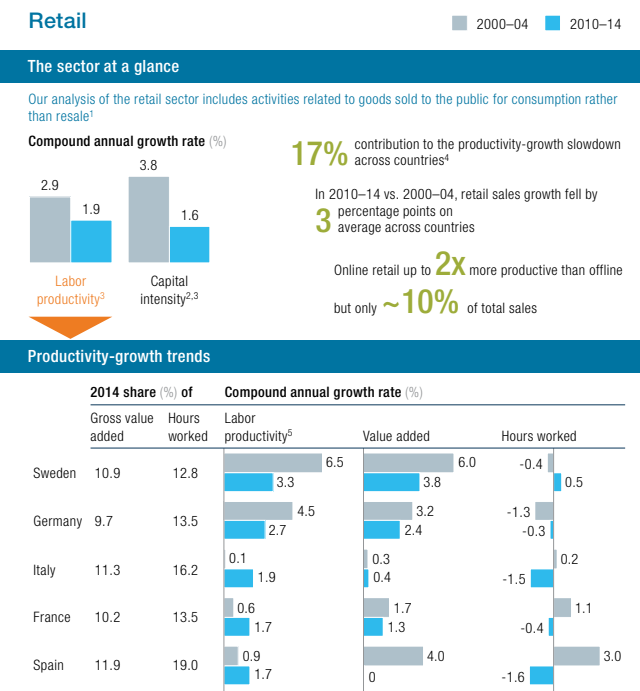


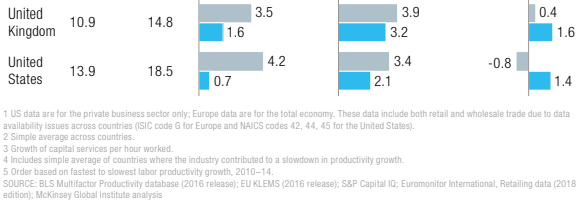


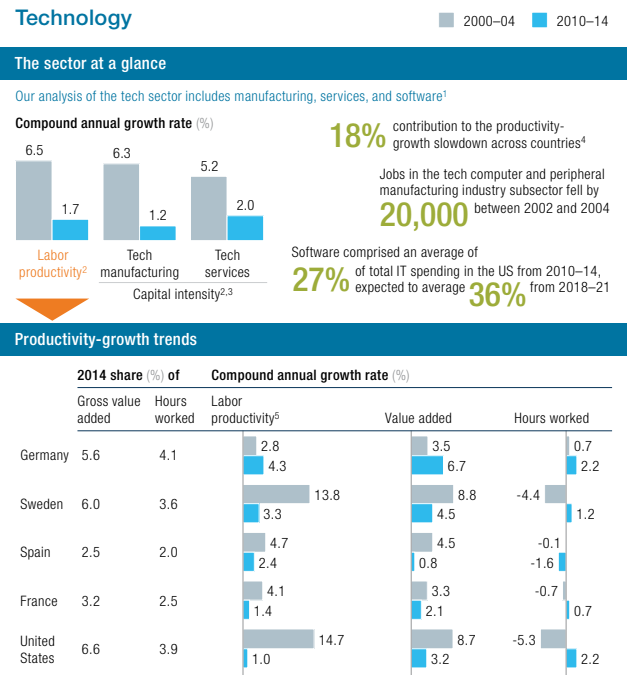


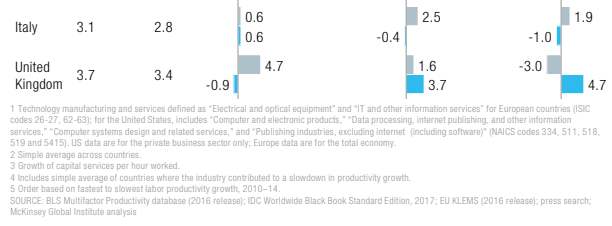


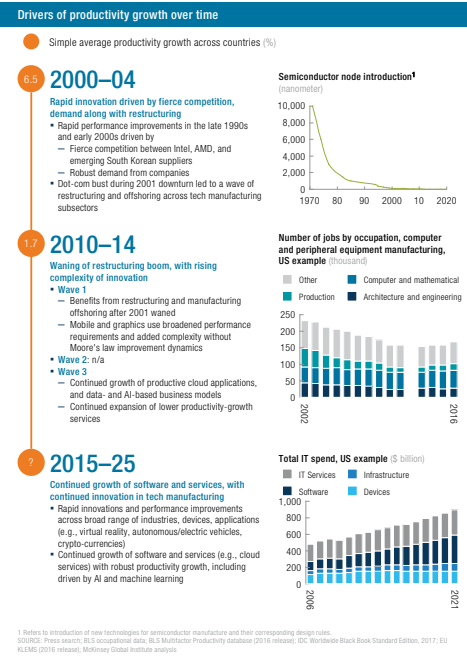
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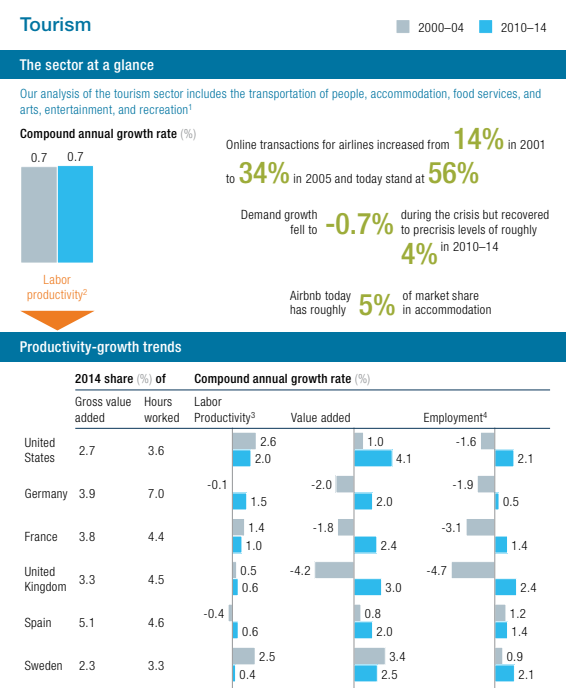




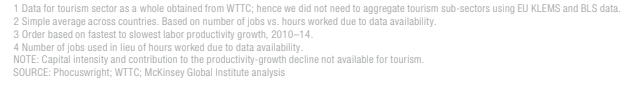


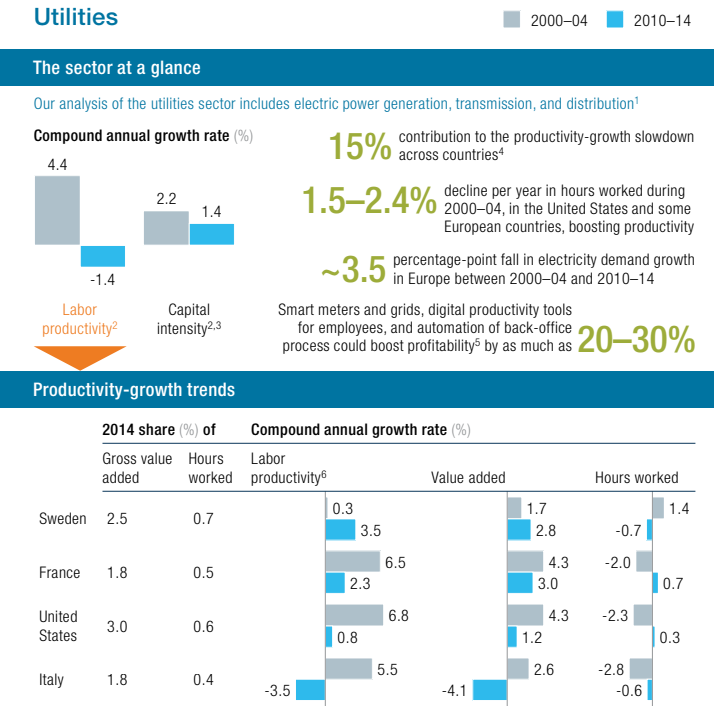


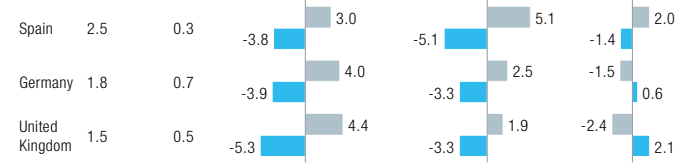






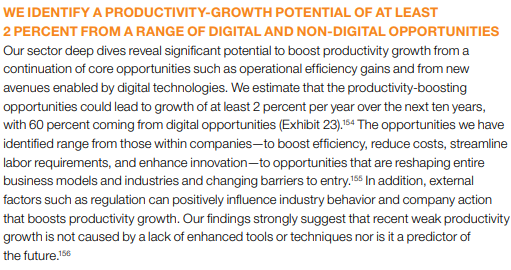


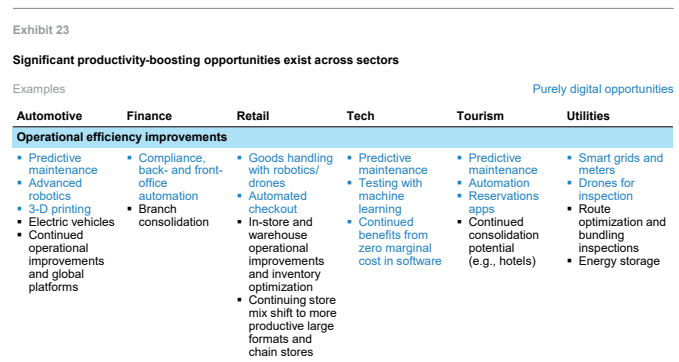


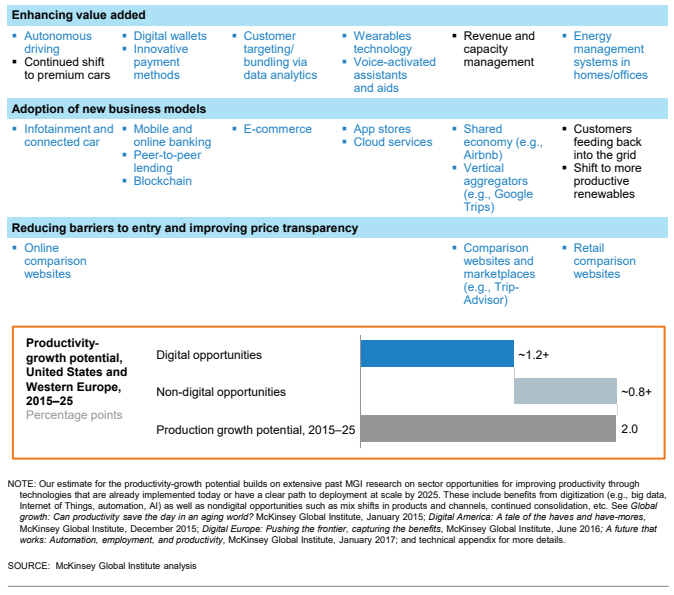


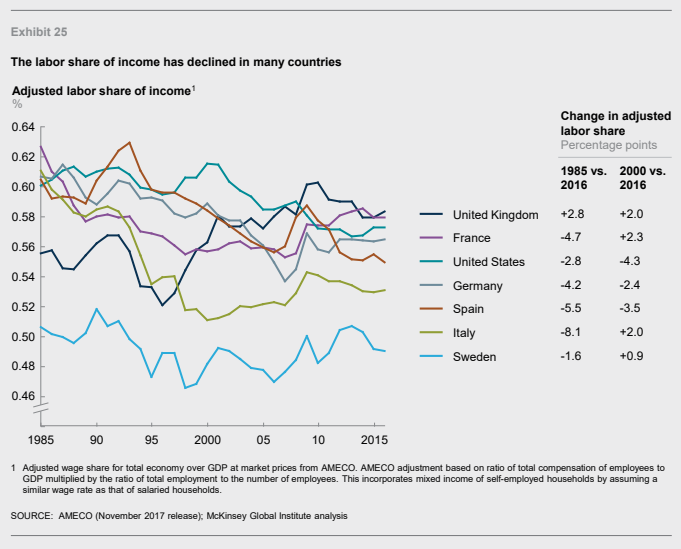


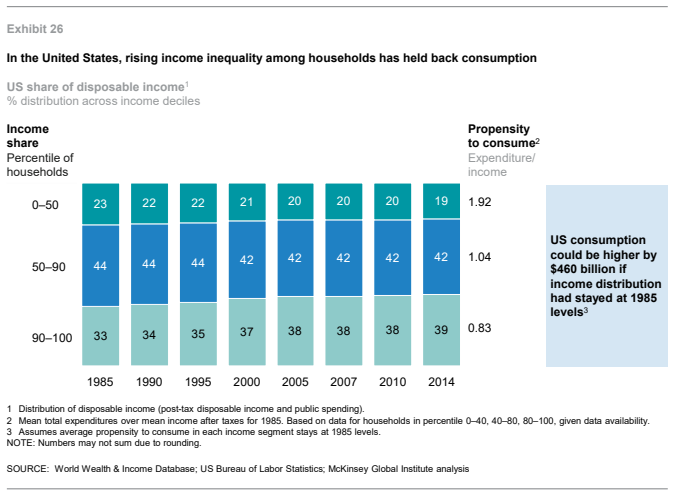


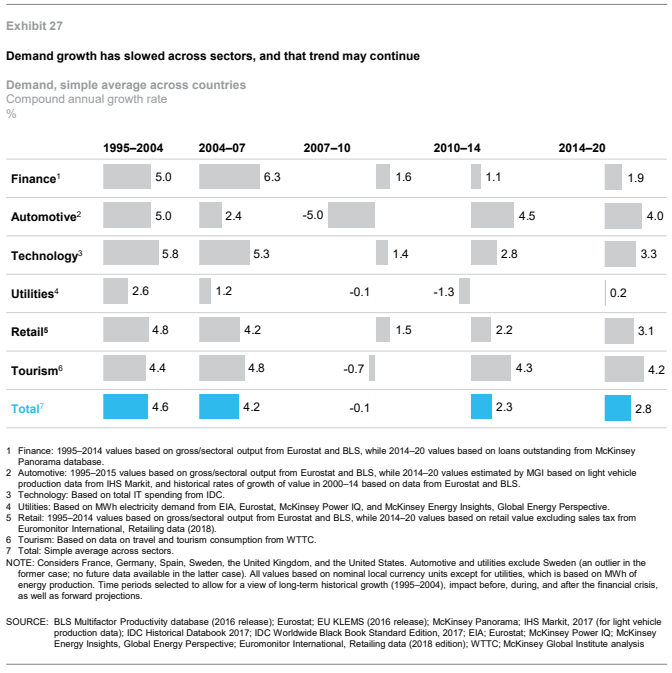


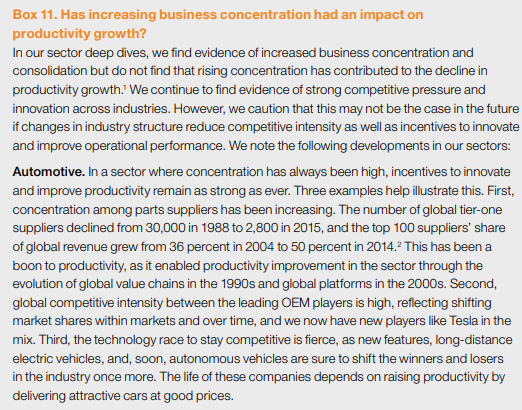


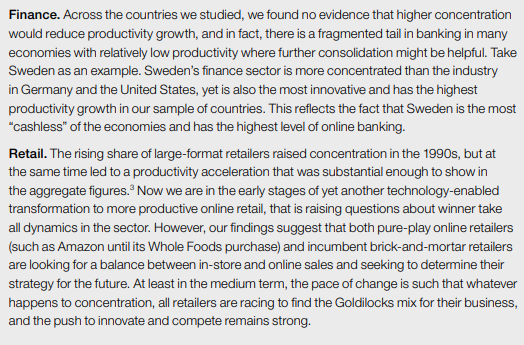


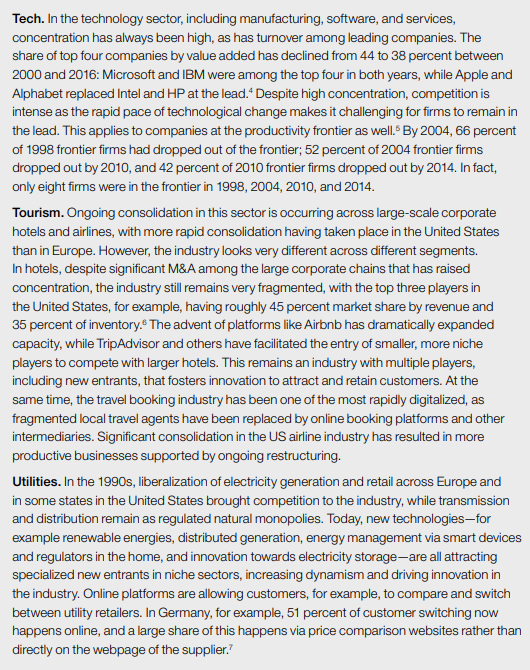












**The growing customization of products and services enabled by digital technologies may obscure market price, with implications for the functioning of markets**

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. 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. 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.

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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.**