

Raising European Productivity Growth Through ICT

BY BEN MILLER AND ROBERT D. ATKINSON | JUNE 2014

Raising productivity growth rates will be crucial for Europe to prosper, and a key factor in engineering such a turnaround will be supporting the widespread adoption of information and communication technologies by organizations.

Most commentary on Europe's economy focuses on its precarious financial system and anemic employment recovery since the Great Recession. But Europe faces a challenge of equal or even greater magnitude that has received far less attention: lagging productivity. After a long period during which Europe was closing the productivity gap with the United States, since 1995 that gap has widened steadily and shows no signs of narrowing. If Europe is going to catch back up, it must follow the same path that drove U.S. productivity growth: more ubiquitous adoption—as distinct from production—of information and communication technologies (ICTs) by all organizations (for-profit, nonprofit, and government) throughout the European economy.

Increasing productivity is the key way that countries can raise their per-capita income. It should not be surprising, then, that two decades of lackluster productivity growth have left many European companies uncompetitive, European incomes stagnant, and European government finances in turmoil. Only one EU-15 country, the relatively small Ireland, managed productivity growth rates that exceeded those of the United States in the two periods since 1995. Given the demographic challenges and increasing international competition that Europe faces in the coming decades, it is crucial that Europe find a way to reverse these growth trends.

The scholarly evidence strongly suggests that increased ICT adoption, and the transformative change it can bring to organizations, is a key piece of Europe's productivity puzzle. ICT is a general purpose technology (GPT) that has wide-ranging effects throughout an entire economy, reshaping entire systems of production and distribution.

Around two-thirds of U.S. total factor productivity growth between 1995 and 2004 was due to ICT, and ICT has contributed roughly one-third of growth since then. These gains are primarily due to the efficiencies of ICT capital, as well as associated complementarities and spillovers.

Compared to the United States, Europe has had far smaller productivity gains from ICT. Although the contribution of ICT varies between European countries—some countries have gained roughly as much from ICT as the United States while many others, including France and the Mediterranean countries, have benefitted significantly less—overall Europe trails significantly behind. This variation in outcomes between countries along with variation at the industry and firm levels makes clear, however, that those countries, industries, and firms that do invest in and use ICT reap significant benefits. This is as true for Europe as it is for the United States.

Europe's lack of productivity gains from ICT initially presented a puzzle, because in many ways Europe appeared to be equally well suited to gain from new technologies. Over time, however, the reasons for Europe's lack of gains appear to have been identified. The primary proximate cause is simply the lack of investment in ICT capital: European countries have lagged significantly behind the United States in ICT investment, both as percent of total investment and as a percent of GDP, since the 1990s. And this is true not just of the ICT-producing sector itself. ICT-using sectors, primarily the service sector, that have been large drivers of growth in the United States have been relatively untouched by ICT in Europe. Productivity in European private-sector services grew only one-third as fast as it did in the United States between 1995 and 2007, because the positive effects of ICT production did not spill over into use.

There are four primary reasons for Europe's failure to invest in and gain from ICT. First, regulation within product, labor, and land markets limits possible business models, raises the cost of ICT investment, and slows down market forces that can push firms to adopt more productive practices. For example, privacy regulations reduce the effectiveness of online advertising, the "right to be forgotten" legal provision can significantly raise the cost of doing business for a wide range of data providers, and restrictions on cloud provider locations and nationality can slow access and also increase costs. Labor regulations also limit firms from using ICT to reengineer production processes.

The second reason for Europe's failure to invest in ICT is European tax policy. EU consumption taxes on ICT products are high, which lowers consumer adoption and can therefore slow business adoption of consumer-facing ICT. Corporate tax policies may play a role as well, as depreciation rates for ICT capital investments are generally less generous than in the United States.

A third reason is the limited ability of European businesses to reach more efficient economies of scale. The continued fragmentation of European markets limits the potential size of demand for European products (particularly services), which in turn makes it harder to achieve economies of scale from ICT investments. Moreover, Europe's much higher proportion of small firms makes it hard for firms to surmount the high fixed costs of many

ICT investments. In the latter case, regulation has provided the significant bottleneck to firm growth, by favoring small firms at the expense of large ones.

A final important difference that explains why Europe has lagged behind the United States in adopting ICT is management styles. Research has shown that getting the full potential from ICT investments requires organizational redesign, and that U.S. firms are better at employing management techniques that can facilitate such transformation.

Although European productivity growth has slowed significantly, as it emerges from its extended crisis there are a number of steps that Europe can take to ensure that it takes full advantage of the productivity effects of ICT going forward. First, making productivity improvement the centerpiece of economic policy is crucial. While employment presents a formidable challenge in many European countries, sacrificing productivity for jobs—that is, deliberately creating or maintaining inefficiencies—is not the answer.

Second, and more specifically, Europe needs to focus on raising productivity in industries where productivity growth has been slow, such as retail and professional services, by encouraging the adoption of ICT. Europe should focus primarily on ICT-using sectors because ICT-producing sectors alone are unlikely to provide significant productivity increases to the economy without the adoption of ICT in other sectors. In addition, actions to encourage the ICT-producing sector may sometimes hurt ICT-using sectors, if protective tariffs or other actions to bias the market toward local ICT producers raise ICT prices for ICT-using industries.

Third, Europe can actively assist in the digital transformation of industries by creating the right conditions for ICT investment and adoption. The government can do this through its own procurement and adoption of ICT products, but it can also play a proactive role in addressing network externalities that exist in many sectors.

Fourth, tax and trade policy provide important levers that Europe can use to promote ICT investment. By minimizing taxes on ICT investments, policymakers encourage the productivity effects of ICT use. These tax incentives are particularly important because while ICT investment provides large benefits for the broader economy, the nature of these benefits makes them hard for any single firm to capture; therefore, firms tend to underinvest in ICT. Trade policy can play a role, particularly through an expanded Information Technology Agreement.

Fifth, European firms would be better able to take advantage of ICT if they could achieve larger economies of scale, particularly in ICT-using industries. Recent EU reports have shown that, due to national barriers to entry, the EU is far from a single market in many service industries. Additionally, the Transatlantic Trade and Investment Partnership (TTIP) would better facilitate access to U.S. markets.

Sixth, Europe should reduce preferences for small businesses. The high percentage of small firms in Europe, and in Mediterranean countries in particular, holds back productivity. Certain types of small firms are important, such as “gazelle” firms that start small and grow

quickly, but many other types of small firms are simply inefficient organizations that have been protected from competition.

Finally, Europe needs to be vigilant about “doing no harm.” At this stage the large benefits from innovation and the use of new technologies are largely driven by market forces, and digital regulation can significantly limit these benefits. Europe needs to find ways to address legitimate concerns around digital issues like privacy and security without damaging the ICT ecosystem.

This report examines EU and U.S. productivity trends, discusses why higher productivity is critical for the future of Europe, examines the relationship between ICT and productivity in the United States and Europe, and lays out in further detail the seven key policy principles for attaining EU digital prosperity.

EU AND U.S. PRODUCTIVITY TRENDS

For most of the post-war period, productivity was growing faster in Europe than in the United States. Yet, after 1995 the trend reversed. Indeed, as U.S. productivity growth accelerated in the late 1990s into the mid-2000s and then slowed down somewhat, European productivity growth was low in the decade after the mid-1990s and has been even lower since. U.S. labor productivity growth averaged 1.6 percent per year from 1980 to 1995, rose to 2.7 percent from 1995 through 2004, and then slowed to 1.2 percent between 2004 and 2013.¹ In contrast, productivity growth in the EU-15 has gone in the other direction, declining from an average of 2.8 percent growth per year before 1995, to 1.6 percent between 1995 and 2004, to an average of only 0.8 percent since then.² (Figure 1) As a result, the labor productivity gap in the EU-15 relative to the United States widened by 10 percentage points between 1995 and 2013, from 89 percent to just 79 percent of U.S. levels.³ (Figure 2) The gap between the EU-28 and the United States is even greater, at 74 percent of U.S. levels, because even though EU-13 productivity growth has been more robust than in the EU-15, productivity levels in the new EU countries are much lower.⁴

The labor productivity gap in the EU-15 relative to the United States widened by 10 percentage points between 1995 and 2013, from 89 percent to just 79 percent of U.S. levels.

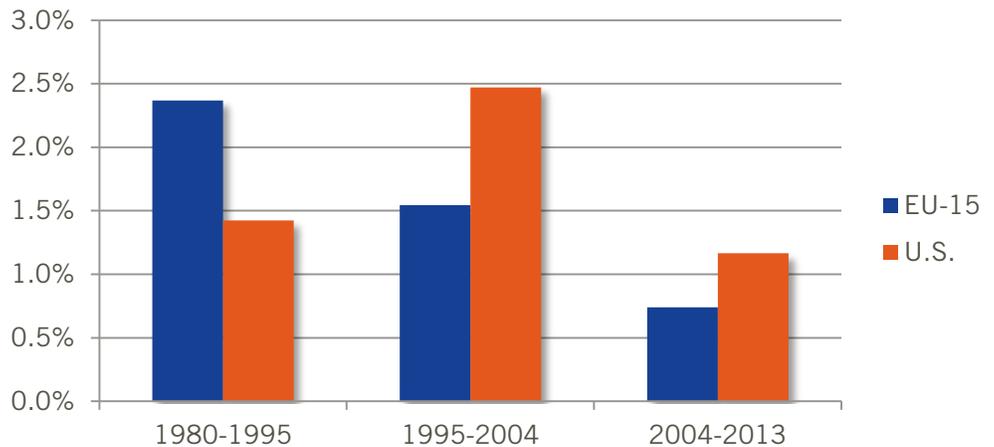


Figure 1: EU-15 and U.S. average annual labor productivity growth, 1980-2013⁵

The diverging productivity trends also reflect important industry-level differences. U.S. productivity growth since 1995 has been more broadly based: roughly half of U.S. industries accelerated their rate of growth after the early 1990s, compared to only 20 percent of EU industries.⁶ Much of the growth acceleration in the United States was driven by the service sector, especially wholesale and retail trade, banking, and other financial services.⁷

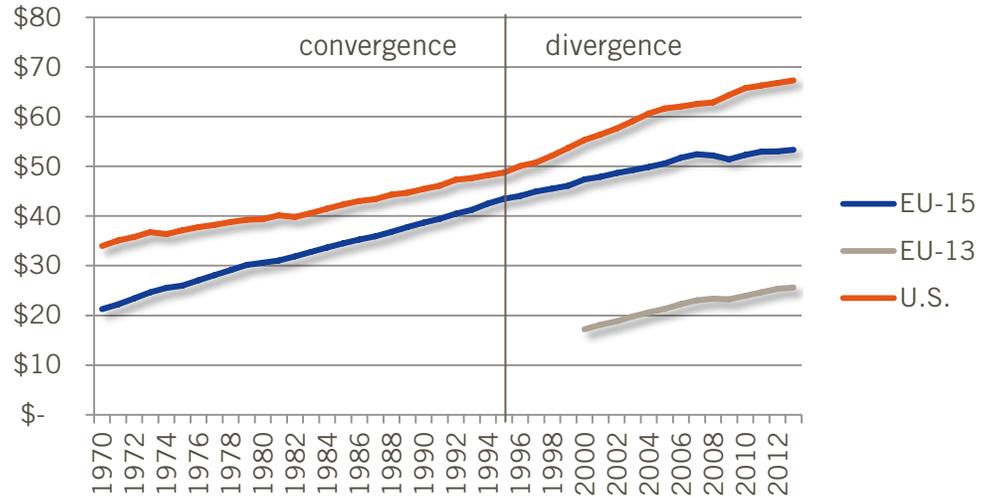


Figure 2: EU-15, EU-13, and U.S. labor productivity growth trends (GDP per hour worked)⁸

Within the EU the performance of individual nations has varied significantly, and trends leading up to and after 2004 have been mixed. Ireland is the sole EU-15 nation to converge with U.S. labor productivity over both the 1996-2004 period and the 2004-2013 period. (See Table 1) As a result, the Irish productivity gap with the U.S. economy shrank from 35 percent in 1995 to 17 percent in 2013.

		2004-2013	
		Diverging	Converging
1995-2004	Converging	Finland Greece Sweden United Kingdom	Ireland
	Diverging	Belgium Denmark France Germany Italy Luxembourg Netherlands Portugal	Austria Spain

Table 1: EU-15 productivity growth relative to the United States¹⁰

Four countries—Finland, Greece, Sweden, and the United Kingdom—continued closing the productivity gap with the United States until 2004 but then fell behind. The United Kingdom and Greece fell the hardest, with the UK averaging only 0.4 percent growth and Greece experiencing negative productivity growth (something difficult to achieve).¹¹ In contrast, eight nations lost ground over both periods, including France, Germany, Italy, and the Netherlands. Italy was a particularly poor performer, with a decade of poor performance followed by completely flat productivity between 2004 and 2013. Two countries that diverged between 1995 and 2004 did manage to increase productivity faster than the United States after 2004: Austria and Spain. Spain, however, gained most of its productivity from a massive decline in hours worked. Figure 4 shows the convergence/divergence process in more detail for EU-15 countries.

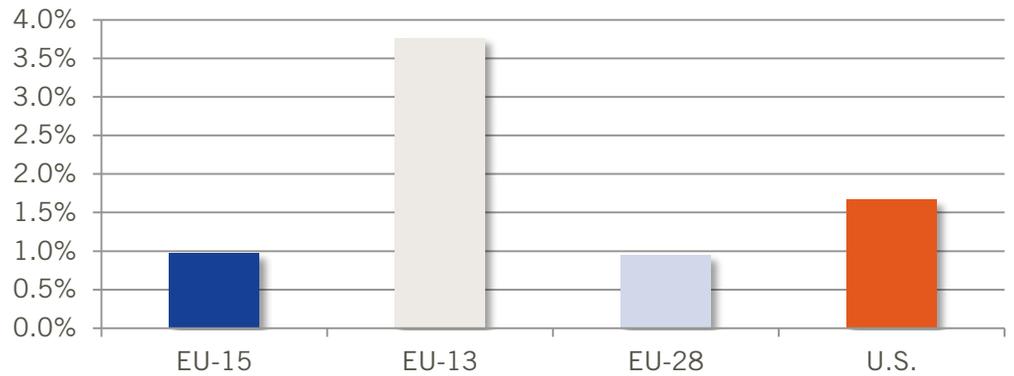


Figure 3: EU-15, EU-13, EU-28, and U.S. average annual labor productivity growth, 2000-2013¹²

Most EU-13 countries have had more robust productivity growth rates. As shown in Table 2, the large majority of these countries grew faster than the United States in both periods between 1995 and 2013. Only Cyprus and Malta lost ground in both periods. However, the EU-13 countries constitute less than 12 percent of EU GDP, and are only half as productive as EU-15 nations.¹³ Because GDP grew relatively quickly in these countries it in fact brought overall EU-28 productivity down slightly, as Figure 3 shows. Figure 5 illustrates the magnitude of convergence and divergence within the EU-13 as well as the relative sizes of the EU-13 economies.

		2004-2013	
		Diverging	Converging
1995-2004	Converging		Bulgaria Czech-Republic Hungary Lithuania Poland Romania Slovak-Republic
	Diverging	Cyprus Malta	

Table 2: EU-13 productivity growth relative to the United States¹⁵

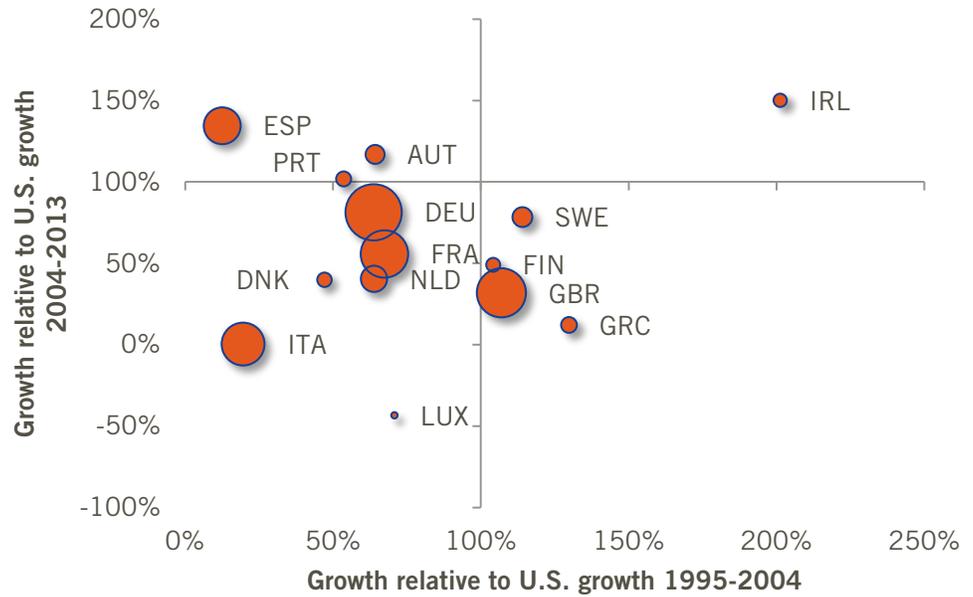


Figure 4: EU-15 productivity percent growth rate relative to U.S. (area of circle is relative size of country GDP)¹⁶

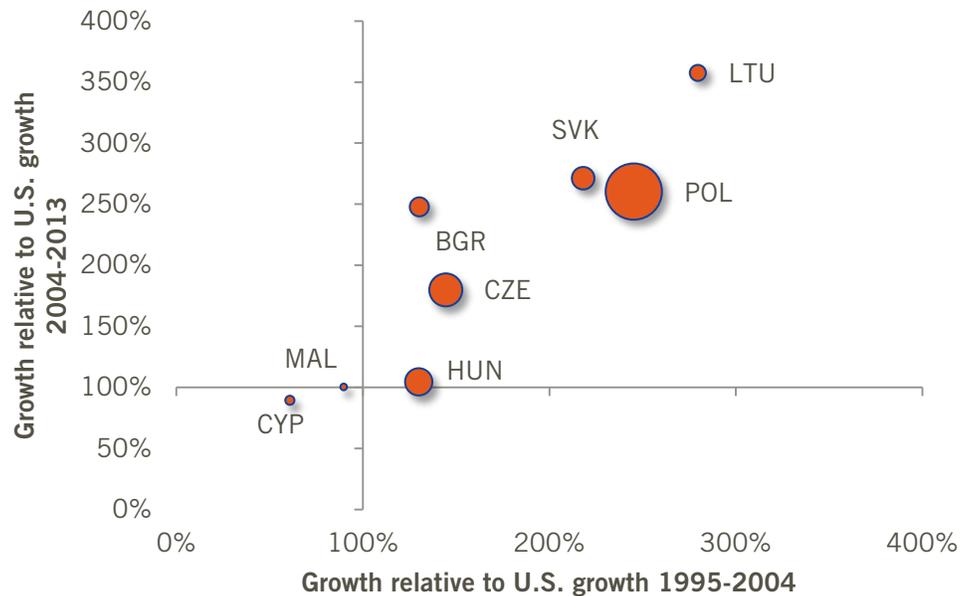


Figure 5: EU-13 productivity percent growth rate relative to U.S. (area of circle is relative size of country GDP)¹⁷

If the U.S. and EU-15 had swapped productivity growth rates from 1995 to 2013, EU GDP would be €2.2 trillion larger than the United States, instead of €1.6 trillion smaller.

WHY EUROPE NEEDS TO ACCELERATE PRODUCTIVITY GROWTH

Higher productivity is the sine qua non of economic growth.¹⁸ To see why, consider that if the EU-15 nations had maintained the productivity growth rate they enjoyed from 1980 to 1995 through to 2013, their annual GDP would be 16 percent larger today, over €1.6 trillion greater (up from its current €10.6 trillion).¹⁹ Likewise, if growth had not accelerated in the United States and had remained at the 1980-1995 rate, U.S. annual GDP would be 17 percent smaller today, or \$2.8 trillion lower (down from its current

\$16.7 trillion).²⁰ Or from a different perspective, if the U.S. and EU-15 had swapped productivity growth rates from 1995 to 2013, EU-15 GDP would be €2.2 trillion larger than the United States, instead of €1.6 trillion smaller.²¹

Boosting productivity is critical to the EU's future economic health, in part because the EU's labor force participation rate is lower than that of the United States. A greater share of Europeans retire before the age of 65 than in the United States: 65 percent of American workers ages 55-65 are employed, while only 55 percent of European workers are.²² Moreover, a greater share of the EU population is above age 65.²³ In 2013, 18.2 percent of the population of the EU-27 nations was 65 years and older, compared to 13.8 percent in the United States. By 2050 that gap will grow even larger, to 28.7 percent in the EU and 20.2 percent in the United States. With so many Europeans consuming and not producing, the only way for Europe to enjoy rising per-capita incomes (absent raising the retirement age) is to raise the rate of productivity growth.

To see how important productivity is to future prosperity, consider that if EU labor productivity were to grow over the next 25 years at its 1980-1995 average of 2.3 percent per year, real output per capita would increase by roughly 75 percent, significantly more than enough to pay for the increased retiree population while at the same time ensuring that after-tax worker incomes continue to rise. However, if Europe's current low productivity growth rate persists, real output per capita would grow just 22 percent—barely enough to cover increased retirement costs from increased retirees, and leaving no surplus for workers who would see no income growth.²⁴

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BOX 1: PRODUCTIVITY, INNOVATION AND COMPETITIVENESS

The terms productivity, innovation and competitiveness are often confused in the media and popular consciousness, but there are important distinctions between them.²⁵

Productivity—the most fundamental of the three concepts—is the ratio of output to input, where output is valued using the amount of goods or services and input is typically an hour of labor, a single worker, or a combination of workers and physical capital. Using hours of work or the amount of workers as the denominator yields labor productivity (the measure used in this report unless otherwise specified), while using the combination of workers, physical capital, and other inputs as the denominator yields total factor productivity (TFP; TFP is also called multi-factor productivity, or MFP, when using only workers and physical capital).

Productivity is the main determinant of national income per person, because over the long term a nation can consume only what it produces or is able to trade for. Nations can increase their productivity in two ways. If most industries, even low productivity ones, increase productivity, this is the “growth effect.” The “shift effect” occurs when an economy shifts resources from less productive industries (e.g., call centers) to more productive ones (e.g., software). The lion's share of productivity growth for almost all nations, especially larger ones, however, comes not from shifting the sectoral mix to higher-productivity industries, but from the growth effect: industries, even low-productivity ones, boosting their productivity.²⁶

On the level of individual industries, productivity gains can occur in three different ways: through all firms increasing their productivity by innovating or adopting new technologies; through less productive firms dying and being replaced by new, more productive firms; or by more productive firms gaining market share from less productive ones. In the past 20 years, firm-level research has shown that there are large, persistent productivity gaps between firms in the same industry, which means that there are large productivity gains to be made from moving toward best practice production techniques, such as using ICT.²⁷ In addition, ICT can boost productivity by making older, less productive business models obsolete in favor of newer ones (e.g., online book selling replacing “bricks and mortar” bookstores).

Innovation means developing a new or significantly improved product (a physical good or service), production process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations.²⁸ The distinction between “product” and “process” innovation is important because product innovation affects the product market (output, or the numerator in the productivity ratio) while process innovation affects the input side of productivity.

Competitiveness is a more complicated concept: it relates only to the economic health of a region’s or nation’s traded sectors whose output can be purchased by consumers outside the region or nation. But how do we define health? The true definition of competitiveness is the ability of a region to export more in value-added terms than it imports. This calculation includes accounting for “terms of trade” to reflect all government “discounts,” including an artificially low currency, suppressed wages in export sectors, artificially low taxes on traded sector firms, and direct subsidies to exports. It also controls for both tariff and non-tariff barriers to imports.

Under this definition, a nation may run a large trade surplus (one component of competitiveness), but if it does so by providing large “discounts” to its exporters or by restricting imports it would not be truly competitive, for such policies would reduce its terms of trade by requiring its residents to give up some of their income to foreign consumers and/or pay higher prices for foreign goods and services.²⁹

Policymakers, not just in Europe but around the world, tend to prioritize the three factors in the following order: competitiveness, innovation, and productivity. But for most nations and regions, especially large ones like Europe, productivity is the most important driver of economic well-being. The majority of jobs in Europe are in non-traded sectors where productivity gains go directly to European workers and consumers. Moreover, productivity gains in traded sectors help EU consumers and boost competitiveness.

ICT AND PRODUCTIVITY GROWTH

Productivity increases stem from a variety of factors, but the principal one is use of more and better “tools” by producers: in other words, the use of more and better machinery, equipment, and software. Indeed, new growth economics accounting suggests that the lion’s share of productivity stems from the use of more and better “tools.”³⁰

And in today's knowledge-based economy, the tools that are most ubiquitous and most effective in raising productivity are ICT-based. These digital tools are more than simply the Internet, although that itself drives growth.³¹ They include hardware, software applications, and telecommunications networks, and increasingly tools that incorporate all three components in them, such as computer-aided manufacturing systems and self-service kiosks.

These tools and can be used in the internal operations of organizations (business, government and nonprofit); transactions between organizations; and transactions between individuals, acting both as consumers and citizens, and organizations. Indeed, ICT has enabled the creation of a host of tools to create, manipulate, organize, transmit, store and act on information in digital form in new ways and through new organizational forms. And its impact is pervasive as it is being used in virtually every sector, from farming to manufacturing to services to government. In the United States, 48 percent of non-structures capital investment is in ICT, and the number would be even higher if all IT-enabled machines were classified as ICT.³²

ICT is a key driver of productivity. This is because ICT is what economists call a “general purpose technology” (GPT). GPTs have historically appeared at a rate of once every half century, and they represent systems of fundamentally new technologies that change virtually everything, including: what economies produce; how they produce it; how production is organized and managed; the location of productive activity; the skills required for productive activity; the infrastructure needed to enable and support it; and the laws and regulations needed to maintain or even allow it.³³ GPTs share a variety of similar characteristics. They typically start in relatively crude form for a single purpose or very few purposes; they increase in sophistication as they diffuse throughout the economy; they engender extensive spillovers in the forms of externalities and technological complementarities; and their evolution and diffusion span decades.³⁴ Moreover, GPTs undergo rapid price declines and performance improvements; become pervasive and an integral part of most industries, products, and functions; and enable downstream innovations in products, processes, business models, and business organization. By any of these measures, ICT ranks well against the most transformative technological breakthroughs in human history.³⁵

This is why ICT is such an important enabler of better tools to drive productivity. The evidence that ICT led to the U.S. productivity rebound in the 1990s, and has remained a key driver of growth since then, is well established. In a conclusive review of over 50 scholarly studies on ICT and productivity published between 1987 and 2002, Dedrick, Gurbaxani, and Kraemer found that “the productivity paradox as first formulated has been effectively refuted. At both the firm and the country level, greater investment in ICT is associated with greater productivity growth.”³⁶ In fact, nearly all scholarly studies since the mid-1990s through to 2014 have found positive and significant effects of ICT on productivity.³⁷ The beneficial effects of ICT on productivity have been found across different levels and sectors of economies, from firms to industries to entire economies, and in both goods- and services-producing industries.³⁸ Firm level studies have also shown that

“Firms with high levels of ICT are more likely to grow (in terms of employment) and less likely to [go out of business].”³⁹

The United States was the first country to show a large impact from ICT. Between 1995 and 2002, ICT was responsible for two-thirds of total factor productivity growth in the United States, and virtually all of the growth in labor productivity.⁴⁰ While productivity growth slowed in the mid-2000s, ICT continued to be a primary source of growth: IT-using and IT-producing industries were the only source of value-added growth between 2005 and 2010, as low-IT-using industries lost productivity over that time.⁴¹ Overall, recent studies have found that approximately one-third of U.S. growth over that period is attributable to the adoption of ICT by organizations.⁴²

Why has the use of ICT been the key driver of growth? A principal reason is that it has a greater impact on productivity and growth than non-ICT capital. Studies in the early 2000s found that investment in ICT capital increased productivity by three to eight times more than investment in non-ICT capital.⁴³ Likewise, Wilson finds that of all types of capital, only computers, communications equipment, and software are positively associated with multi-factor productivity.⁴⁴ Hitt and Tambe find that the spillovers from IT nearly double the impact of IT investments.⁴⁵ Rincon, Vecchi, and Venturini confirm the GPT nature of ICTs through an exhaustive industry-level study of both productivity benefits and spillovers.⁴⁶ These studies have been corroborated with research on the benefits of ICT in a richer variety of contexts, including developing countries and public sector organizations.⁴⁷

If productivity growth is to accelerate in the future, it will almost certainly be due to ICT-enabled developments now under way.

There are at least three possible reasons why ICT has stronger effects on productivity than other capital. First, in economies where ICT capital equipment innovations are new, they are able to pick off the “low hanging fruit” of relatively easy to improve efficiencies. Second, ICT doesn’t just automate tasks, it also has widespread complementary effects, including allowing companies to fundamentally reengineer processes. Third, IT has what economists call “network externalities,” which are the “spillovers” from adding additional users to a network. Simply put, increasing the user size of a network makes all current users better off. When these three factors are combined, ICT can have a big impact.

While it’s unclear as to the future of ICT development and its impact on productivity, it does appear that if productivity growth is to accelerate in the future it will almost certainly be due to ICT-enabled developments now underway, including cloud computing, “Internet of Things,” data analytics and big data, IT-powered robotics, intelligent agents, mobile commerce, improved self-serve kiosks, 3D printing, location awareness, and machine learning.

THE IMPACT OF ICT ON EUROPEAN PRODUCTIVITY

A principal reason the EU has had lower productivity growth than the United States since the emergence of the Internet age is that it has had lower productivity gains from ICT. OECD data show that from 1985 to 2010, ICT capital contributed 0.53 percentage points to the average annual GDP growth rate in the United States and 0.56 percentage points in the United Kingdom, but only 0.32 percentage points in France, 0.28 in Italy, and 0.27 in

Germany. (Figure 6) Similarly, a 2011 report from Coe-Rexecode finds that while ICT contributed 37 percent of U.S. GDP growth between 1995 and 2008, it contributed 32 percent in Germany and just 26 percent and 27 percent, respectively, in France and the United Kingdom.⁴⁸

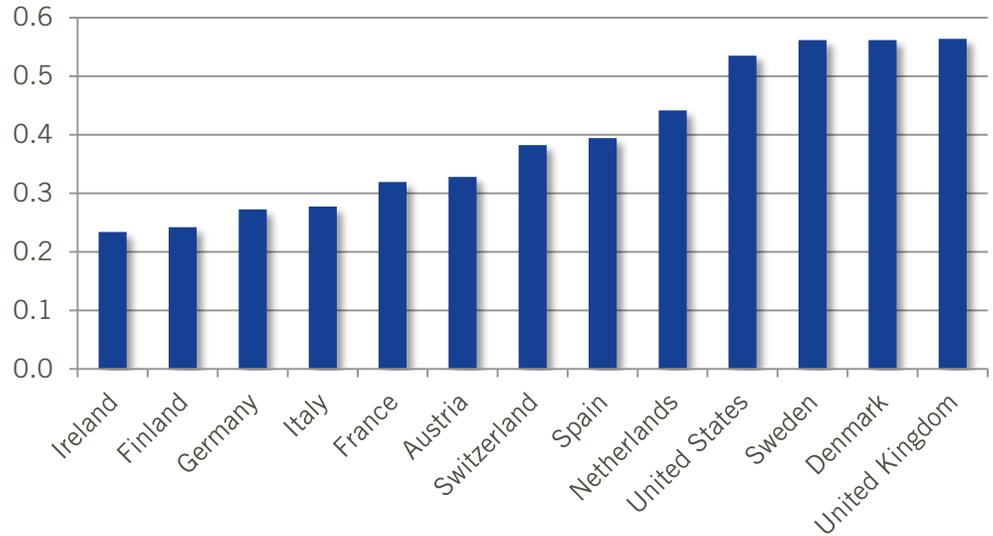


Figure 6: ICT contribution to average annual GDP growth rate, 1985-2010⁴⁹

Narrowing the focus to productivity growth, van Welsum, Overmeer, and van Ark found that ICT contributed 1.3 percentage points to the average annual growth rates of labor productivity in the United States between 1995 and 2007, but only 0.7 percentage points in the EU-15 (64 percent and 57 percent of total labor productivity growth, respectively).⁵⁰ Figure 7 shows contributions in both the total economy and private sectors for the EU-15 and the United States. An OECD report finds that the ICT contribution to value-added total factor productivity (TFP) growth from 1996 to 2007 was significantly higher in the United States than in EU countries.⁵¹ Disaggregated statistics, however, show that some EU countries have benefitted from ICT at a level comparable to the United States: Germany and the United Kingdom gained around 66 percent of their TFP from ICT, the United States 60 percent, but France and the Netherlands under 50 percent.⁵²

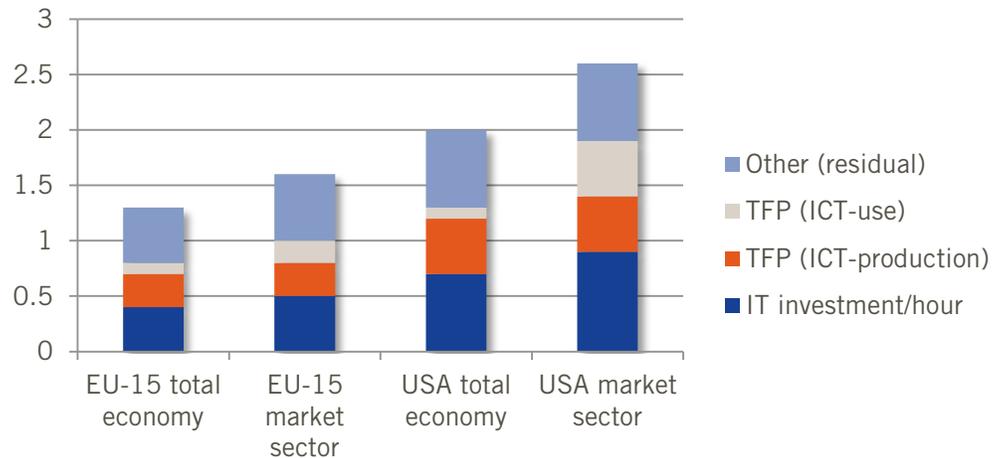


Figure 7: Components of labor productivity growth (average percentage points per annum), 1995-2007⁵³

Even though the impacts of ICT EU-wide have not been as great as in the United States, we can still clearly see ICT benefits in Europe at the firm and industry levels. In the UK, several industry-level studies have found that ICT plays an important role in productivity growth. Corry et al. find that the contribution from the “knowledge economy,” which includes labor composition, ICT capital, and TFP, increased in the UK from 2 percentage points to 2.3 percentage points of overall growth after 1997.⁵⁴ Goodridge et al. find sectors that contributed most to value-added growth in the UK between 2000 and 2009 invested most heavily in ICT capital.⁵⁵ In Finland, Mairesse, Rouvinen, and Ylä-Anttila find that ICT contributed significantly to non-ICT-sector productivity growth between 1994 and 2007.⁵⁶

On a firm level, the benefits of Internet and computer use for productivity are also well established. A large number of studies in the late 1990s and early 2000s confirmed at a micro level that ICT has a positive effect on firm productivity in both the United States and Europe.⁵⁷ Varian et al., for example, find that firms in the UK, France, and Germany increased revenues 8.6 percent and decreased costs 2.6 percent through the use of Internet business systems; Johnston, Wade and McClean likewise find that e-business uptake increased revenues in small- and medium-sized enterprises by 9 percent.⁵⁸ In a large survey of German firms, Bertschek, Fryges, and Kaiser find that firms that engaged in business-to-business e-commerce significantly increased both multifactor and labor productivity.⁵⁹

But studies have continued to show the benefits of ICT after the initial years of the Internet boom as well. In a study of 1,955 European firms, Nurmilaakso finds that Internet access and standardized data exchange with trading partners contributed to significant increases in labor productivity.⁶⁰ Similarly, Koellinger finds that firms in the EU that implemented eight e-business practices were more than twice as likely to report that they had both increased productivity and expanded employment over the past year.⁶¹ Castiglione measures the impact of ICT investments in Italian manufacturing firms and finds that they had a positive and significant effect on firms’ efficiency, corroborating earlier work by Milana and Zeli.⁶² Iammarino and Jona-Lasinio find that Italian regions with significant ICT production have greater labor productivity and are the primary drivers

of national growth.⁶³ Also in Italian firms, Hall, Lotti, and Mairesse find that ICT investment is strongly associated with productivity.⁶⁴ In Spain, Romero and Rodríguez find that e-buying had significant impacts on firm performance over the 2000-2005 period.⁶⁵ Ruiz-Mercader, Meroño-Cerdan, and Sabater-Sánchez find that e-business solutions increased organizational performance by expanding industry learning and organizational efficiency.⁶⁶ In France, Chevalier, Lecat, and Oulton find that since 1992, firms near the technological frontier have increased productivity relative to other firms, attributing the speedup to ICT adoption and globalization.⁶⁷ Another study found that 29 percent of Danish small manufacturers surveyed indicated that their competitive position was strengthened a great deal by doing business online.⁶⁸ Studies examining Swedish firms found that access to broadband Internet is associated with increases in productivity of 3.6 percent for manufacturing and services firms and 62 percent for ICT firms.⁶⁹ Belgian firms that used technology from foreign sources were found to have significantly higher productivity growth.⁷⁰ These studies confirm that ICT investment goes hand in hand with firm productivity growth, and thus European productivity growth would have been even slower without investment in ICT.

ICT doesn't just increase firm productivity, it enables firms to be more competitive and innovative.

Moreover, ICT doesn't just increase firm productivity, it enables firms to be more competitive and innovative. For example, van Leeuwen and van der Wiel find that Dutch firms that invested more in ICT not only enjoyed faster productivity growth but also produced more innovations.⁷¹ According to a 2006 EU report, 32 percent of EU companies reported innovations, with ICT enabling half of the product innovations and 75 percent of the process innovations.⁷² Spiezia examines a range of OECD countries, including the UK, Italy, Spain, and the Netherlands, and finds that "ICTs act as an enabler of innovation, particularly for product and marketing innovation, in both manufacturing and services."⁷³ Garcia-Muniz and Vicente look at the EU as a whole and find that ICT helps technologies spread and businesses innovate because it facilitates business transactions and does not depend on other sectors to be successful.⁷⁴ Polder et al., looking at the Netherlands, investigate the sources of innovation in different sectors and find that ICT investment, broadband use, and e-commerce are all very important for innovation in the service sector, and that ICT investment and broadband use are less but still important drivers of innovation in manufacturing as well.⁷⁵

Box 2: Is Productivity Growth Over?

Recently, several prominent economists have argued that productivity growth in the United States is slowing down significantly for the foreseeable future. Robert Gordon at Northwestern University and Tyler Cowen at George Mason University put forth a number of arguments to support their claims, including smaller gains from such factors as education, fossil fuels, demographics, and other “low-hanging fruit.”¹ Many of these concerns, such as demographic shifts and slowing technological breakthroughs, apply equally well to Europe. However, this recent techno-pessimism errs in several ways. First and most importantly, it adopts a fundamentally fatalistic stance that misunderstands the

interplay between public policy and innovation. While innovation is a necessarily uncertain process, economics does in fact have a good deal to say about how it develops and how policies can play a role in creating it. Cowen and Gordon ascribe too much agency to broad historical forces and “fundamental” laws of economics, and not enough agency to policy.

Second, techno-pessimist accounts frequently conflate economic growth with productivity. The two are related but distinct, because growth can occur simply by adding more workers. While demographic shifts are important for the absolute size of the economy, they do not affect productivity or income per capita. Productivity is what matters for competitiveness and for per-capita income, so it is misleading to conflate a slowdown in GDP growth with a productivity slowdown.¹

Moreover, the techno-pessimists stand in stark contrast to other economists arguing that technological change will soon be progressing too quickly. Brynjolfsson and McAfee’s *Second Machine Age* both argue that technological progress is becoming problematic for exactly the other reason—because it is speeding up too quickly and purportedly leading to unemployment.¹ The main problems with this view are that productivity is clearly not speeding up, as shown above, and that productivity growth has been clearly shown to have no negative impact on either unemployment or workforce growth.¹

Reality, as usual, will probably sit somewhere comfortably between these two extreme views. It is unlikely that productivity growth will explode, but neither is it inevitable that growth will come to a halt. Healthy productivity growth is attainable with the right pro-productivity policies.

WHY HAS EUROPE NOT GAINED AS MUCH FROM ICT?

If ICT has such large productivity benefits at the firm, industry, and economy-wide levels, why has Europe failed to gain from ICT the way the United States has? This is a particularly important question because some European nations do lead in some ICT areas, like intelligent transportation systems, e-banking, digital authentication, and e-health.⁸⁰ There are a number of reasons why Europe has failed to take full advantage of ICT.

Amount of ICT Investment

Firms in Europe do not invest as much in ICT as firms in the United States. Higher levels of ICT investment drive higher productivity growth: in a recent survey of both micro and macro literature, Cardona et al. note that firm-level analyses provide “solid evidence that over the last two decades an increase of ICT investment by 10% translated into higher output growth of 0.5–0.6%” regardless of the country studied.⁸² Businesses in the United States have maintained a healthy lead in both ICT investment as a share of overall investment and ICT investment as a share of GDP.⁸³ (Figures 8 and 9) And that lead has grown, not shrunk, since 2000: the EU invested about 80 percent as much as the United States in ICT as a share of total capital investment in 2000, but by 2011 that number had declined to 57 percent.⁸⁴ This is true even though European countries invested more overall in fixed capital than the United States. (Figure 9) In other words, while Europe invests more overall, U.S. firms invest more in high-impact ICT.

“Over the last two decades an increase of ICT investment by 10 percent translated into higher output growth of 0.5–0.6 percent.”

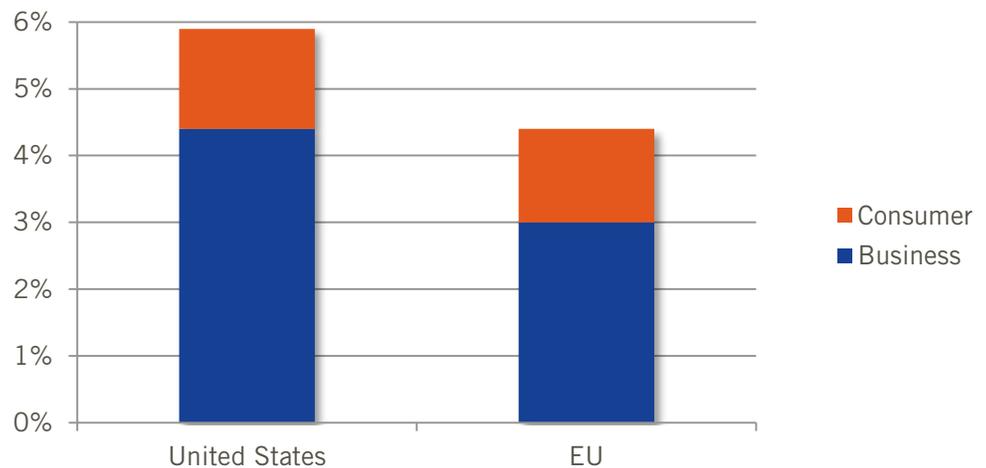


Figure 8: Business and consumer spending on ICT as a share of 2010 GDP⁸⁵

The numbers over time and across individual countries confirm the U.S. lead in ICT investment. ICT investment both as a percentage of GDP and as a percentage of total nonresidential investment peaked in the late 1990s for both the United States and the European Union. However, the United States has maintained much higher levels of investment in ICT as a share of fixed capital investment since the 1990s.⁸⁶ (Figure 10) Moreover, U.S. ICT investment is significantly higher as a percentage of overall investment than in any other large European nation other than the UK.⁸⁷ Continuously higher levels of ICT investment by the United States mean that it has built up a larger stock of ICT capital goods, even though these goods normally depreciate faster than other capital goods. From 1991 to 2007, ICT capital stock—the total accumulated ICT investment—tripled in Germany, Italy, and Spain, reaching 6 percent of total capital stock. In the United States (and the UK), however, it quintupled to 14 percent.⁸⁸

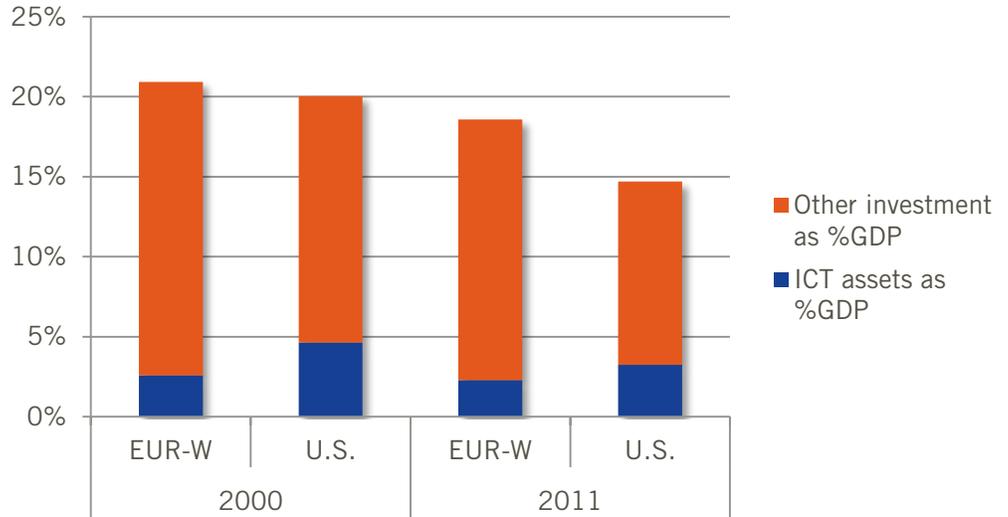


Figure 9: Gross fixed capital formation (investments) by type as a percentage of GDP (EUR-W is weighted average of major European countries)⁸⁹

From 1991 to 2007, ICT capital stock—the total accumulated ICT investment—tripled in Germany, Italy, and Spain, but quintupled in the United States.

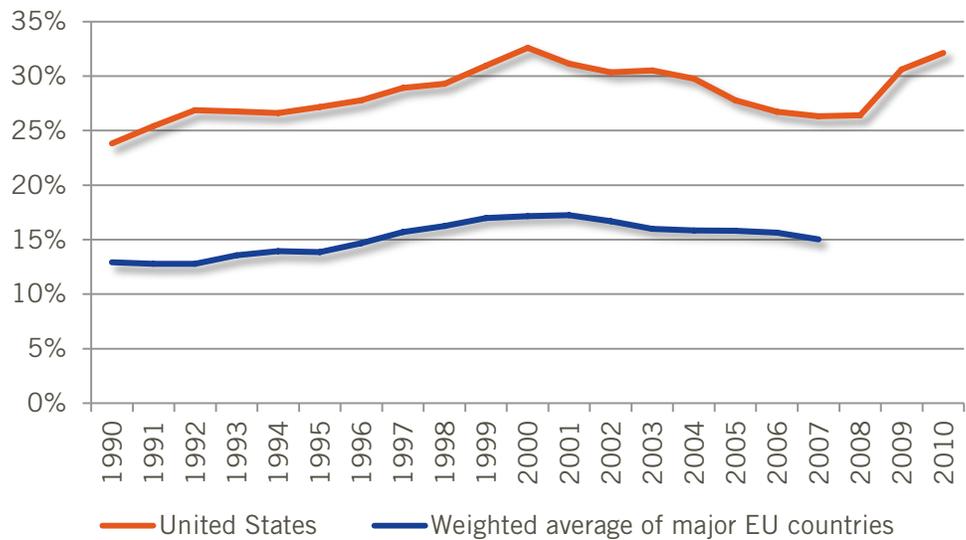


Figure 10: Shares of ICT investment as percent of nonresidential investment⁹³

Economists see U.S. ICT investment as a key reason the United States has maintained its place at the “technological frontier” as one of the most productive countries.⁹⁴ The effectiveness of greater ICT capital investment in the United States suggests that additional ICT investment in Europe is likely to have significant benefits as well. Strauss and Samkharadze argue that “US productivity has outgrown the EU-15 mainly because of stronger ICT capital deepening and faster progress in productive efficiency.”⁹⁵

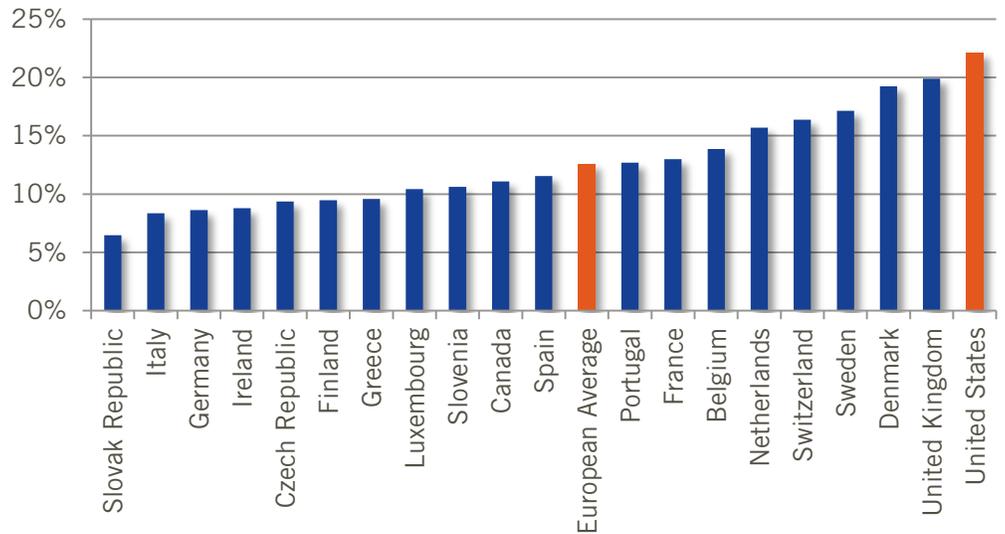


Figure 11: ICT assets as percentage gross fixed capital formation, 2011⁹⁶

ICT investment shows up in survey data on ICT use as well. The 2013 and 2014 World Economic Forum’s Networked Readiness Index survey shows that the EU-15 and EU-13 trail behind the United States in ICT adoption, business-to-business Internet use, business-to-consumer Internet use, and staff ICT training.⁹⁷ (See Figure 12)

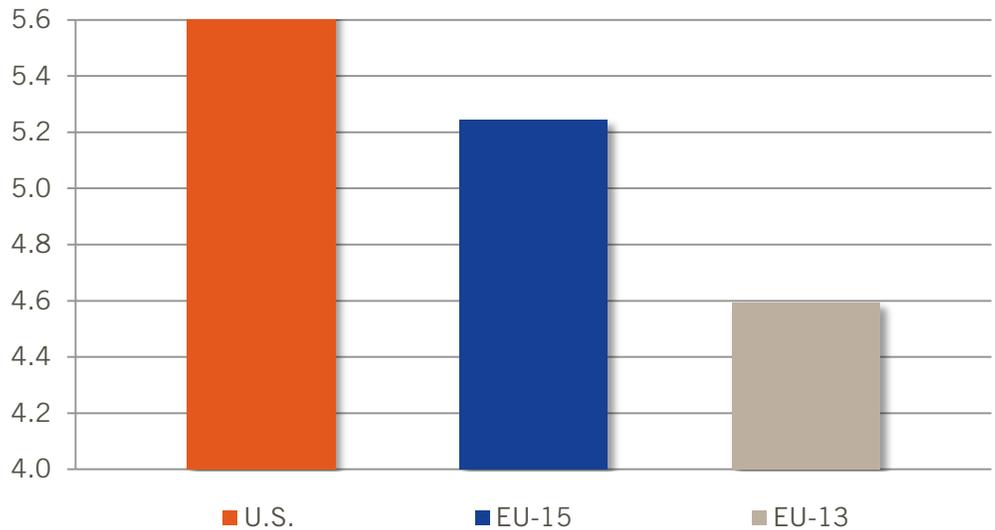


Figure 12: Average of 4 indicators of ICT use (1-7, where is 7 highest use; averaged over 2013 and 2014)⁹⁸

Limited Impacts in the Services Sector

Drilling down into the lack of investment, another reason Europe has not experienced the same macro-economic impacts from ICT as the United States is that it has not been able to use ICT to drive service sector productivity as well as the United States. U.S. service sector productivity has grown much faster than service sector productivity in most major EU countries. (Figure 13) Timmer, O’Mahony, and van Ark estimate that from 1995 to 2007,

One product market regulation that appears to have a negative effect on ICT-enabled productivity is privacy regulation.

EU private service sector productivity grew only one-third as fast as in the United States, primarily due to greater deployment and usage of ICT in the United States in service sectors.⁹⁹ Uppenberg finds that because services are such a large part of the European (and U.S.) economy, “substantially higher productivity growth in manufacturing would not be sufficient” to remedy the productivity slowdown.¹⁰⁰ Mas argues that it is “the services and not the manufacturing industries that make the difference between the US and the EU... while in the US TFP improvements in the ICT producers sectors spilled over to the other sectors of the economy (especially the ICT intensive users), in the EU-15 its positive effects were restricted to only the ICT producers sectors.”¹⁰¹

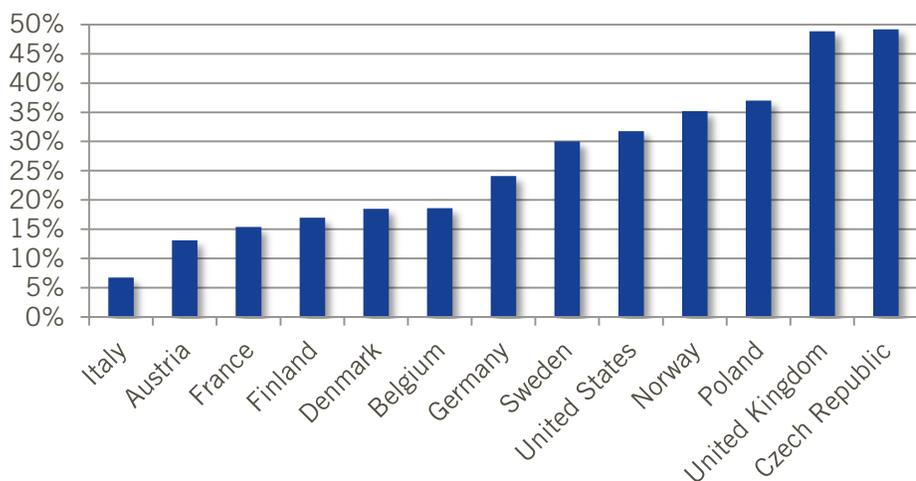


Figure 13: Total labor productivity growth in services from 1999-2009¹⁰²

Regulation and ICT Adoption

Simply knowing that firms in Europe have invested less in ICT than firms in the United States does not tell us why they have done so. Several interrelated reasons appear to be at play, one of which is the level of regulation in product markets, labor markets, and land markets.¹⁰³ Van Reenen et al. find that both product market and labor market regulations “may be significant determinants of cross-country differences in the impact of ICT,” because “high levels of labour and product market regulation are associated with a lower productivity impact of ICT.”¹⁰⁴ Overall, Van Reenen et al. find that product market regulations act as a productivity drag on ICT, lowering its impact by 16 percent for each dollar invested.¹⁰⁵ The fact that companies in Europe can get less “bang for their buck” from their ICT investment means not only that productivity is lower, but also that fewer projects meet investment hurdles and firms in Europe end up investing less than firms in the United States.

One product market regulation that appears to have a negative effect on ICT-enabled productivity is privacy regulation. Goldfarb and Tucker show that EU privacy regulation reduced the effectiveness of online advertising, reducing the revenue for websites that rely on ad-based business models.¹⁰⁶ This appears to be one reason the EU lags behind the United States in Internet companies. Campbell et al. examine the impact of privacy regulations in specific markets, finding that regulation may keep out new firms, some of which may become more productive than incumbents.¹⁰⁷

Privacy regulations not only limit business models, they also increase the cost of doing business for firms, presumably decreasing their ability to invest. For example, the recent EU decision on the “right to be forgotten,” which requires search engines to delete certain links based on individual requests, is likely to raise compliance costs significantly. A report by the European Centre for International Political Economy for the U.S. Chamber of Commerce estimates that a right to be forgotten, if implemented, could decrease EU GDP by -1.5 percent to -3.9 percent by reducing the productivity and competitiveness of EU ICT companies.¹⁰⁸ Christensen et al. show that these regulations are particularly costly for small- and medium-sized enterprises, costing them between €3,000 and €7,200 per year, or 16 percent to 40 percent of IT budgets.¹⁰⁹ Other examples of costly regulations that limit the effectiveness of IT investment include the new law requiring websites to obtain “explicit consent” before placing web cookies, and the requirement that companies provide external human involvement as needed in any automatic, IT-enabled process that produces significant or legal effects.¹¹⁰ The former policy is both overly ambiguous and burdensome, particularly to smaller websites, while the latter is likely to delay progress in the emerging area of big data analytics.

Given that so much of the ICT system is moving to the cloud, requiring a “European Cloud” is likely to have a significant negative impact on European productivity.

Regulations don’t just increase costs—poorly-designed or unresponsive regulations can prevent or delay the adoption of new technologies, such as 4G/LTE mobile broadband networks. The European Union has been hampered by regulatory mandates that specified the technologies that carriers could use in their allotted spectrum, and LTE was not initially allowed by these mandates; a similar problem occurred with the European 3G rollout. Moreover, the United States was the first nation to take advantage of the “digital dividend” from the digital TV transition. In contrast, the process of allocating new spectrum for LTE and modifying regulations to permit LTE use on previous allocations is still underway in Europe. As a result, consumers and businesses in Europe can rely on a less robust mobile communications infrastructure.

Labor market regulations have a large negative impact on ICT investment and the benefits firms can obtain from it. Van Reenen et al. find that labor market regulations reduce productivity gains from ICT by approximately 45 percent.¹¹¹ The authors attribute one-third of this effect to how labor market regulations can slow down the entry and exit of firms: stricter regulations can protect and preserve less productive, less technologically advanced firms.¹¹² Labor market regulations also reduce the flexibility of managers, preventing them from reorganizing production in more efficient ways.¹¹³ Why buy IT to reorganize production and cut costs when regulations make it difficult to reduce the workforce? Antonelli similarly finds that rigid labor markets make firms less likely to adopt new technologies.¹¹⁴ They also appear to reduce productivity gains through outsourcing and offshoring—business practices heavily reliant on ICTs. Europe was slower to offshore and outsource production in the 2000s, and while it caught up to the United States in total outsourcing spending after the Great Recession, U.S. firms remain far ahead of European firms in terms of outsourcing and offshoring core business functions.¹¹⁵ Again, such rules reduce the return on investment from ICT purchases, leading firms in Europe to invest less than firms in the United States.

Land use regulation is a third area of regulation that leads to reduced ICT benefits, particularly in the retail sector. A number of studies in the United Kingdom, as well as in mainland Europe, have found that regulations regarding the use of land can prevent retail stores from attaining economies of scale, and ICT has been the main enabler of increasing retail scale.¹¹⁶ Cheshire et al., for example, find that rules preventing larger retail stores in the UK may have held back productivity in that sector by as much as 25 percent.¹¹⁷

Tariffs and Taxes

Companies make decisions about capital investment on the basis of return on investment. If the return is low due to factors like product market regulations, labor market regulations, or land use regulations, the number of projects that will exceed the firm’s hurdle rate will be smaller. But it’s also true that policies that raise prices for capital goods will lead to fewer projects exceeding their hurdle rates. Conversely, policies that reduce the after-tax cost of capital goods will increase the number of investable projects. Regulation can increase prices—as rules regarding a “European Cloud” will do. But taxes and tariffs also raise the cost of ICT products.

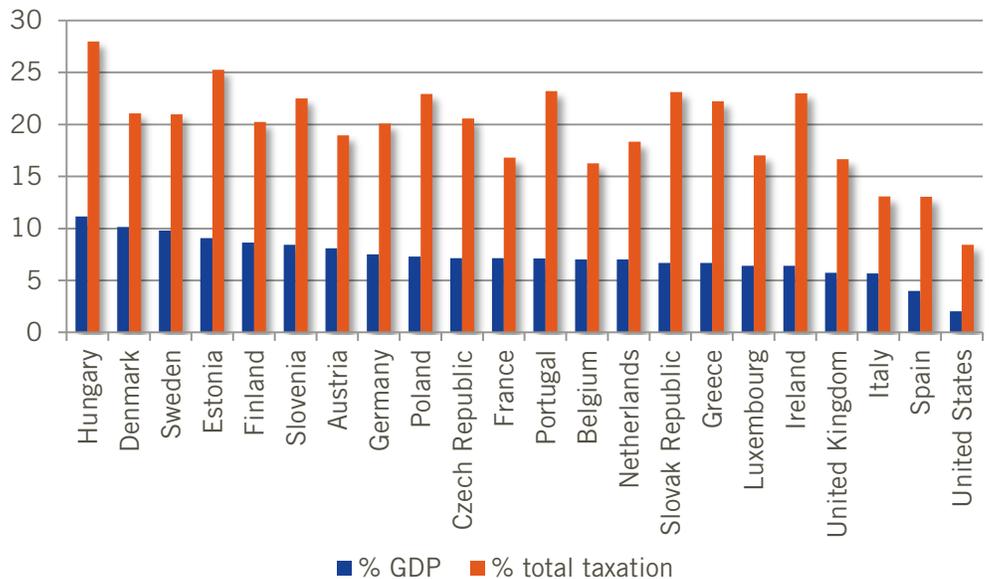


Figure 14: Taxes on general consumption in the United States and European Union, 2009¹²¹

Because the EU signed onto the 1997 Information Technology Agreement (ITA), an international agreement to reduce ICT barriers, its tariffs on ICT imports are low.¹²² However, in addition to tariffs, high taxes add costs for businesses and consumers. Europe has significantly higher consumption taxes than the United States. Rates for the Value Added Tax are set to be harmonized across Europe at around 20 percent, although they appear to be a bit lower than that in practice, averaging between 10 percent and 16 percent in different countries for a basket of goods.¹²³ This is compared to an average of 5.8 percent for the same basket of goods in the United States. Consumption taxes in Europe make up a much larger proportion of both overall taxation and GDP, despite Europe’s higher tax

overall. (Figure 14) These taxes have a clear impact on prices: a recent cross-country study found that for Apple's iPad, on average 14 percent of the purchase price went to taxes, but in European countries the percent going to taxes ranged between 16 percent and 19 percent.¹²⁴ These taxes are sometimes justified as “luxury” taxes, but in fact most ICT goods are not luxury goods, but rather “prosumer” capital goods that spur productivity.

Higher taxes on ICT products do not raise ICT costs for businesses in Europe, since under the EU VAT system businesses can recover tax expenses for business inputs, including investment. However, higher taxes on ICT consumption do discourage ICT use by consumers, making it more difficult for businesses to use ICT to adopt customer-facing productivity increases.

Europe's high consumption taxes may only affect business investment decisions indirectly, but corporate tax policies play a more direct role. Recently several European countries have proposed data mining and data collection taxes, directed specifically at large internet companies such as Google and Facebook.¹²⁵ Higher taxes on ICT-producing companies may raise the price of ICT goods and services for everyone else. Moreover, the existing proposals are poorly designed and could easily penalize or deter startups: the French tax on data collection would tax companies based on the number of users they collect data on, apparently with no regard to the actual market value of the data.

Another important channel through which tax policies influence investment is depreciation rates—the rates at which corporations can write off capital investments for tax purposes.¹²⁶ Accelerated depreciation decreases tax revenues in the United States by 6.6 percent, and thus comprises a substantial incentive to invest in new equipment, including ICT equipment.¹²⁷ However, depreciation rates in different countries vary widely between types of ICT. Compared to most European countries, for example, the United States allows faster depreciation for ICT assets like computing equipment (1-2 years), but its rate for communication equipment is much closer to average (1-4 years depending on depreciation method).¹²⁸ A number of fast-growing EU-13 countries like Lithuania and Slovenia have increased the speed at which companies can depreciate ICT investments.¹²⁹ Over time, these rate differences could have significant effects on ICT investment and thus accumulated ICT capital stock. Unfortunately this is not a well-developed body of research and further work is necessary to determine whether ICT capital depreciation rates have a significant effect on investment.

Scale Economies

Two additional reasons European firms lag in their investment in ICT capital are related to scale. The first scale problem is with firm size. The United States has a higher percentage of workers employed by large firms than all European countries. (Figure 15) In particular, Italy, Greece, and other Mediterranean countries stand out as having an unusually high proportion of their employment in small firms.

Firm size matters for the EU because larger firms are more likely to invest in ICT. This is because larger firms face fewer resource constraints and can more easily enjoy scale benefits of IT. For example, it can cost the same to develop an ERP (enterprise resource planning)

system for a mid-size firm as a large one, but the large one can amortize those costs over a larger revenue base. In short, as Hitt, Wu, and Zhou have shown in their paper examining IT adoption by firms, ICT investments have high returns to scale because of their low marginal costs but higher fixed costs.¹³⁰ To be sure, the increased provision of software through cloud-based services may change that somewhat, but scale benefits are not likely to disappear, if for no other reason than most enterprise IT needs some customization which raises fixed costs.

European policies favoring small firms and exempting them from the regulatory and tax burdens faced by larger firms only serves to keep European ICT adoption lower and resultant productivity lower than otherwise would be the case.

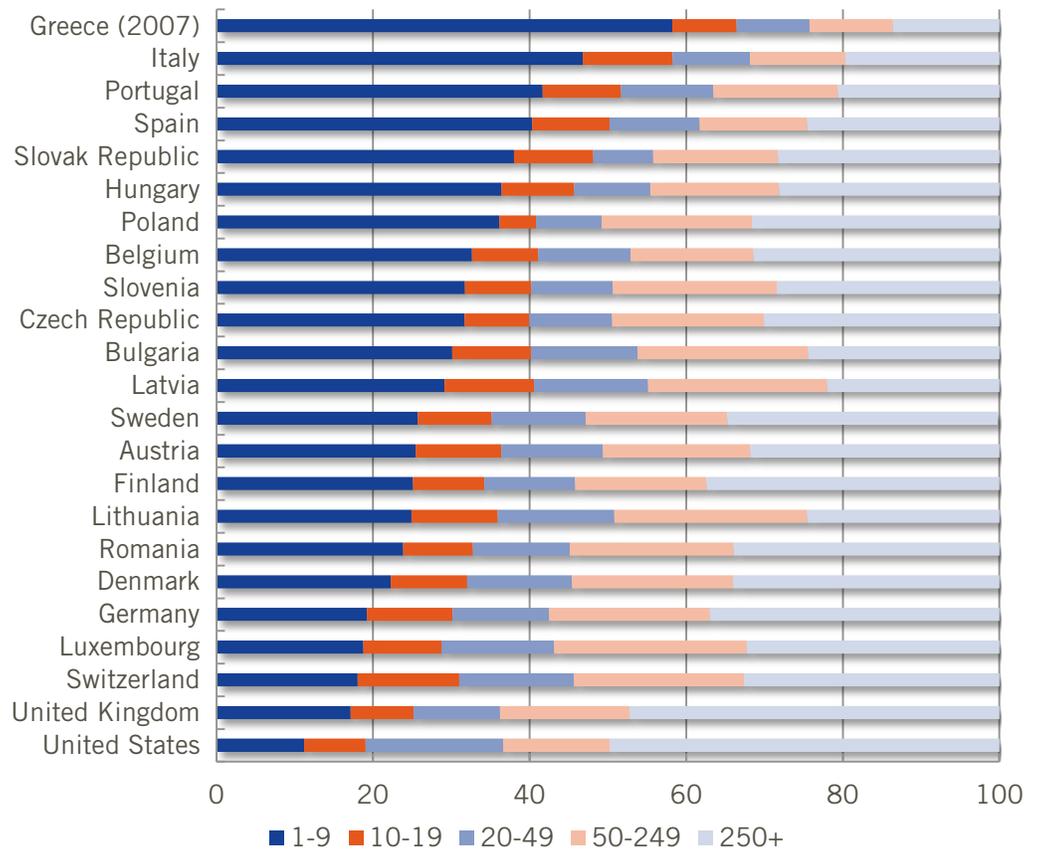


Figure 15: Percentage of total workforce employed at enterprises by size, 2010¹³¹

Regulation that favors small firms has been a significant bottleneck for ICT investment in many European nations.¹³³ The firm-size problem ties into the regulatory issues above, particularly because labor market regulation can limit the number of employees a firm chooses to have.¹³⁴ France, for example, has a number of laws that apply only to businesses with 50 or more employees, and this provides an incentive for firms to stay under the 50-worker threshold.¹³⁵ Land use regulations, as also described above, can also constrain both firm size, by preventing the entry of more efficient franchise-style firms, and establishment size, by preventing larger service industry locations. In general, European policies favoring small firms and exempting them from the regulatory and tax burdens faced by larger firms only serves to keep European ICT adoption lower and resultant productivity lower than otherwise would be the case.

Europe's second challenge regarding scale is the issue of market size. While the EU economy is larger than that of the United States, in practice it is much less integrated. Therefore, the market for a firm's products or services is more limited, often to only the nation it is based in.¹³⁶ Because the United States effectively has a much larger market, there are larger potential returns to ICT investments for U.S. firms, again because of the high fixed costs relative to marginal costs in many ICT capital investments. Moreover, larger markets mean more competition, which in turn spurs firms to invest more in order to innovate and cut costs. This is why Van Reenen et al. suggest promoting product market competition, more integrated European markets, and openness to trade as potential ways to increase ICT-based productivity.¹³⁷

Management Differences

While regulations and taxes affect the return on ICT investments, in any given environment firms still have investment choices. These choices are in part dependent on management practices which vary not only between firms but between nations. Management practices are another reason that European firms appear to have gained less from ICT than firms in the United States: EU firms have been less willing or able to reengineer business processes around the use of ICT. Such restructuring is a crucial step in getting full productivity benefits from ICT. For example, laser scanners not only boost checkout clerk productivity, they also allow retailers to reengineer their entire supply chain. Bresnahan, Brynjolfsson, and Hitt find that firms that embrace "new economy" management practices (e.g., decentralized decision-making) and at the same time invest significantly in ICT, outperform other firms.¹³⁸ As they note, "Firms do not simply plug in computers or telecommunications equipment and achieve service quality or efficiency gains. Instead they go through a process of organizational redesign and make substantial changes to their service or output mix."¹³⁹ Polling of business executives around the world confirms this analysis, as 97 percent believe technology alone would not raise productivity in their firm to the highest level achievable unless it was accompanied by organizational changes.¹⁴⁰ In a similar vein, Abramovsky and Griffith find that ICT facilitates outsourcing, and a firm's outsourcing potential depends largely on the ability of a firm to reorganize itself around its core competencies.¹⁴¹ These organizational effects of ICT end up facilitating more significant productivity gains than firms would achieve simply by optimizing individual processes.

This theory has been strongly supported by recent evidence by Bloom, Sadun, and Van Reenen, who examine differences in management techniques between U.S. and European firms both operating in Europe.¹⁴² U.S. firms are considerably more likely to employ management practices that enable organizational changes that harness the benefits of ICT, and the authors attribute nearly half of the U.S.-EU productivity differential over 1995-2005 to this "organizational capital." Furthermore, they find that "IT-using intensive" industries such as retail and wholesale had the greatest productivity benefits from better management practices. Previous work by Bloom and Van Reenen also found that American management quality was better overall than European management across a range of management quality indicators.¹⁴³ These indicators of management quality show up in sourcing decisions as well: outsourcing by U.S. firms is more likely to be driven by transformative strategies like reengineering processes, gaining access to new technology, and

developing new analytical capabilities, whereas in Europe the primary concern is straightforward cost cutting.¹⁴⁴ Such differences are obviously harder to influence through public policy than factors like regulation and taxes, but governments can do some things such as improving labor regulations or corporate governance laws.

What About the ICT-Producing Sector?

Since the late 1990s when the U.S. lead in ICT became apparent, Europe has tried to play catch-up, but not so much by figuring out how to boost adoption as by trying to build a stronger ICT-producing sector. Despite these efforts, it has yet to succeed on a Europe-wide scale. In 2009 the United States got nearly 10 percent of business value added from the ICT-producing sector, while Europe got only 5.6 percent.¹⁴⁵ While a number of European countries (such as Ireland, Sweden, and the UK) have larger ICT-producing sectors in terms of value added than the United States, other major European countries, including France and Germany, have smaller ICT sectors, and on average Europe gains less of its GDP from its production of ICT.¹⁴⁶

EU firms have been less willing or able to reengineer business processes around the use of ICT.

But as noted above, the large gains are to be realized not so much from production of ICT—which will be much more difficult for Europe to achieve in the presence of strong U.S. and Asian competitors—as in its adoption. Despite this fact, the European Commission and many individual European governments have placed more attention on building IT companies than on spurring IT use.¹⁴⁷ See for example this statement adopted in 2012: “The European Commission tabled on 26 June 2012 its strategy to boost the industrial production of KETs [key enabling technologies]-based products, e.g. innovative products and applications of the future. The strategy aims to keep pace with the EU’s main international competitors, restore growth in Europe and create jobs in industry, at the same time addressing today’s burning societal challenges.”¹⁴⁸ Along similar lines, many European countries have recently focused on building their own domestic data centers, rather than ensuring that European ICT users have access to the cheapest and highest quality cloud data providers.

This focus on the ICT-producing sector appears to be misplaced. Rohman finds that the beneficial effects of the ICT sector for the broader European economy declined after the year 2000.¹⁴⁹ Other recent evidence has shown that most of the productivity gains from ICT are due to ICT-using sectors. (Figure 16) To a large degree, this is because ICT-using sectors, like market and non-market services, make up a much larger part of developed-country economies than ICT-producing sectors, so productivity gains in those sectors have a much larger effect on the whole economy.¹⁵⁰

There are many possible reasons why policymakers prioritize ICT industry growth over ICT usage. One is simply a misunderstanding of the true sources of ICT-related growth. With the great success of some of the world ICT leaders, such as Apple, Google, Intel, and Samsung, it seems logical to try to replicate that success. A second reason appears to be an aversion to ICT adoption-based growth because of the fear that it will lead to disruption and perhaps job loss in individual enterprises. Emblematic are comments from French Industry Minister Arnaud Montebourg, who recently stated that when it comes to innovation that can destroy existing companies, “well, we have to go slowly.”¹⁵¹ Certainly, job disruption is painful and it is understandable for policymakers to try to prevent it, but it still leads to efforts to get a cloud data center in rural France, instead of helping French

companies embrace the cloud and engage in disruptive productivity growth. The reality is that “going slowly” means “growing slowly.”

This explains the overriding focus in Europe on job creation and the concern that productivity growth will conflict with job growth. For example, European officials look to the green economy for jobs, even though it will likely mean higher energy costs and lower productivity. Many in fact view that productivity as the enemy of job growth, even though this view has been thoroughly discredited both by history and economics.¹⁵²

Policymakers will have to make widespread adoption of ICT a policy priority across the entire EU economy.

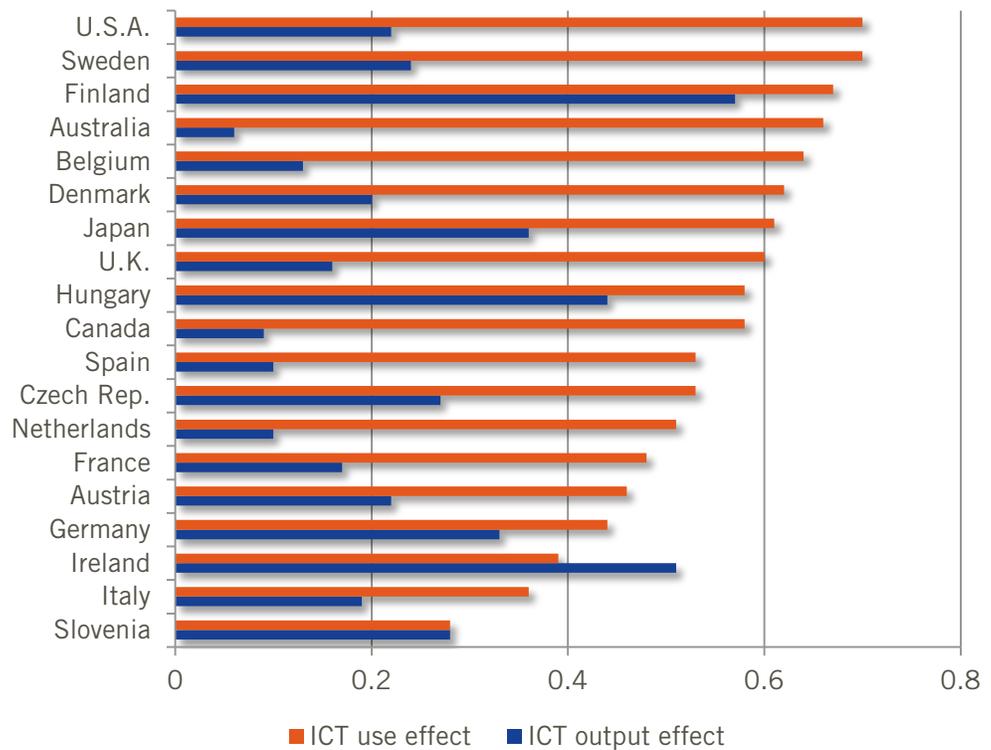


Figure 16: ICT use effect and ICT output effect on GDP (2000 to latest year, percentage points per annum)¹⁵³

WHAT DOES EUROPE NEED TO DO?

As Europe emerges from the economic crisis, it faces continued challenges but also opportunities. With its financial system stabilized, Europe’s central economic challenge over the next quarter century will be to raise productivity growth rates. Faster productivity growth will ensure that Europe’s production will be able to support a growing share of the population not in the labor force, that its firms will maintain global competitiveness, and that its governments will have the ability to raise needed revenues without imposing even higher tax rates. Its central opportunity will be to take advantage of the ICT engine to shift to a higher productivity path. To do this, though, policymakers will have to make widespread adoption of ICT a policy priority across the entire EU economy. While it is beyond the scope of this report to lay out a detailed ICT policy blueprint for Europe, there are at least seven key principles policymakers should follow if the EU and EU nations are to fully benefit from ICT.

Focus on Raising Productivity

Many European officials see increasing jobs, even if it means reducing productivity, as the top priority.¹⁵⁶ As long as European policymakers continue to place job creation above productivity it will be difficult to close the productivity gap with the United States. To be clear, in the aftermath of the Great Recession and the relatively anemic job growth in Europe (and the United States), job creation is important. But productivity growth is just as important, and will become even relatively more important as the years go on. Moreover, as the scholarly literature shows, there is no negative relationship between higher productivity and job growth.¹⁵⁷

Focus on Across-the-Board Productivity Growth, Particularly Through Greater Use of ICT

EU economic policymakers face the key choice of whether to focus their strategies on targeting a few key technology sectors—in part through trade policy (e.g., higher tariffs on imports) and regulations (e.g., the push for the “European cloud”)—or on spurring widespread ICT adoption. The choice should be clear: even in the United States the ICT sector itself employs a small percentage of the workforce that is not growing. Moreover, for most countries most of the productivity gains from ICT have originated in other sectors.

This means that Europe’s attempts to “create its own Silicon Valleys,” even if they were to be successful—which is by no means assured—is not the right path. While hi-tech clusters can provide important value, the United States has shown that there is much more potential productivity to be unlocked through “across-the-board” growth enabled by the use of ICT in non-ICT industries. For most nations, and certainly the EU as a whole, productivity growth across the board, rather than a shift to higher value-added ICT sectors, will account for the majority of per-capita income growth.¹⁵⁸

This does not mean that nations and the EU as a whole cannot pursue both strategies. However, they may come into conflict in some cases, as when a particular policy supports one of these goals but conflicts with the other. A case in point was the decision by the European Commission to reclassify some IT imports so that they were no longer covered by the WTO’s Information Technology Agreement that was supposed to eliminate tariffs on IT products. In particular, the European Taxation and Customs Union wanted to interpret the 2004 revisions to the Harmonized Tariff Schedule (HTS) by the World Customs Organization in a way that enabled EU member states to apply tariffs as high as 14 percent on digital cameras, multi-function printers, set-top boxes, and liquid crystal display (LCD) computer monitors.¹⁵⁹ The intent was to boost the production of these high-value products in Europe, but the impact would have also been to limit ICT adoption. Fortunately, a World Trade Organization panel ruled in 2010 that the European Union’s imposition of duties on these products violated the ITA, rejecting the European Union’s claim that added functionality since the agreement was reached in 1996 meant that some products were now consumer goods rather than information technology goods.¹⁶⁰

In cases like this, the key question facing European policymakers is whether there is more value in expanding their IT industry or in applying IT to other sectors of the economy, and

whether promotion of the former through higher tariffs or other restrictions (like on cross-border data flows) will be detrimental to the latter.

Yet, even if raising tariffs might lead to some offsetting production of the good or service in Europe, raising tariffs on ICT is particularly problematic because it makes ICT more expensive and reduces ICT investment by firms and other organizations. As noted above, this is already a key problem in most European nations, which has less investment in ICT than does the United States. There is compelling evidence that tariffs on IT products will result in less ICT use in Europe. Estimates for the price elasticity of demand for IT products find that for every 1-percent drop in price in IT products, there is a corresponding 1-percent increase in demand.¹⁶¹ Because tariffs raise the price of IT products, it would be expected that they would reduce demand—and this is exactly what research has found. For example, a study of tariffs on IT products in India found that they reduced domestic IT investment.¹⁶² In a cross-national study of countries in the Asia-Pacific region, Kraemer and Dedrick show clearly the benefits of IT use, and the high costs of policies, including tariffs on ICT products, which would depress demand for ICT.¹⁶³ As Kraemer notes, “One of the best ways to promote IT use is to not create barriers to use. Any government policy that makes computers more expensive will discourage use and reduce the possible benefits of IT. Simply lowering tariffs and taxes, eliminating other trade barriers, and encouraging competition in distribution channels will help promote use as much as any specific efforts to encourage use.”¹⁶⁴

It’s not enough to make productivity growth in a few sectors an overriding priority: any economy seeking success needs to prioritize “across-the-board” productivity growth strategies, rather than efforts to raise productivity by modestly expanding output in high-productivity sectors like ICT. But as noted above, this strategy comes with some levels of disruption. It’s easy politically to support the breaking of ground for a semi-conductor factory. It’s a lot harder to support a change in laws that would lead organizations to restructure work through ICT that might lead to some layoffs. Yet it is only by pursuing the latter path that Europe can meet its economic challenges of the next quarter century.

Actively Encourage Digital Innovation and Transformation of Economic Sectors

The private sector will drive much of digital transformation, but government can and should play a supportive role. Economists have long argued that businesses under-invest in research, which is the rationale for governments instituting research grants and R&D tax incentives. Economists have also documented significant market failures around IT investment, including network externalities and “chicken-or-egg” issues that slow digital transformation absent smart and supportive public policies.¹⁶⁵ Health care is a leading example. Success for any individual health organization that embraces a digital business model depends on other health organizations, and also patients, embracing the digital model. Such chicken-or-egg and network externality issues exist in a host of industries, including transportation, real estate, government, and education, as well as in a host of technology industry areas such as high-speed broadband telecommunications, smart cards, radio frequency identification devices (RFID), geographic information systems, mobile commerce, and the Internet of Things. In these cases, EU governments should use a wide

array of policy levers, including tax, regulatory, and procurement policies, to spur greater ICT innovation and transformation.

Moreover, government officials at all levels can and should lead by example by leveraging their own ICT efforts to achieve more effective and productive public sector management and administration. Among other things, this means government should not only actively promote e-government but should also look to how ICT can be used help solve a wide array of pressing public challenges. In this regard ICT can now be a key public policy tool, alongside tax, procurement and regulation.¹⁶⁶

Use Tax and Trade Policy to Spur ICT Investment

It is only through investment in ICT that ICT innovation is diffused throughout the economy. For this reason, public policies should focus on spurring additional investment by organizations in the latest-generation ICT. Policymakers should minimize, if not eliminate, taxes on ICT investments, including broadband telecommunications, Internet usage, and data. They should allow companies to more rapidly depreciate ICT investments for tax purposes, including allowing firms to expense them in the first year.

Some economists might question such policies, arguing that such tax incentives should only go to investments in areas like R&D where companies seldom capture all the benefits. However, there is evidence that because ICT transforms organizations and leads to innovations within other organizations, it operates in the same way as research, with high spillovers that may be taken advantage of by other organizations.¹⁶⁷ In such an environment, the socially optimal amount of investment will lag behind actual investment. As such, it makes sense for the tax code to spur additional ICT investment, or at least to avoid having the tax code penalize ICT investment.

At the same time, the EU should continue to embrace the ITA agreement in order to ensure low prices for European ICT users. The ITA has played a critical role in the spread of ICT products, helping to increase global ICT exports from \$1.2 trillion in 1997 to over \$5 trillion today.¹⁶⁸ Without the ITA, prices would rise for ICT-using industries, investment in ICT goods would decline, and productivity growth would slow.¹⁶⁹

Create Larger Markets for EU Firms

ICTs benefit from economies of scale. This means the larger the market, the easier it can be for an organization to recoup its ICT investments. The EU has been advancing frameworks for better intra-EU digital compatibility and access through the Digital Agenda for Europe's Single Digital Market initiative, started in 2010. For example, it is working to rationalize the value-added tax for online sales and simplifying rules for the licensing and distribution of content.¹⁷⁰

These are steps in the right direction, but Europe needs to go further. Since most the productivity gains from ICT are not from ICT industries but more traditional industries that adopt the use of ICT, it is important to encourage market integration in the latter industries as well. The 2014 European Commission report on Single Market Integration finds that a number of countries, including Germany, France, Austria, and Belgium, stand in need of reforms to more fully open their service sectors with the rest of Europe.¹⁷¹ In

Policies that lead to smaller firm size in an economy hurt productivity and income growth.

particular, many professional services have national or sub-national barriers to entry based on ensuring quality of service. While these barriers may serve important safety or quality goals, they may also function as barriers to competition and are not always worth their costs in public welfare.

Finally, the Transatlantic Trade and Investment Partnership (TTIP) would significantly expand markets for many European firms by reducing non-tariff barriers in the United States and increasing the ability of European companies to invest there. A recent report from Sweden estimates that European exports to the United States could increase by 20 percent to 40 percent under the TTIP.¹⁷² These larger markets would increase the return on investment on more ICT projects for firms in the EU.

Reduce Preferences for Small Businesses

Europe, to an even greater degree than the United States, overemphasizes the role of small firms in the economy in rhetoric and in policy.¹⁷³ For many policymakers, small firms have come to represent everything good in the economy. Yet, on average large firms are more productive, pay higher wages, injure their workers less, are more innovative, and export more.¹⁷⁴ This is not to say that small firms do not add value. Indeed, new firms that grow quickly do create a significant share of net new jobs. But the large majority of small firms stay small, particularly in Europe where firm size is much more stable than in the United States.¹⁷⁵

Policies that lead to smaller firm size hurt productivity and income growth. The European countries with the highest productivity tend to have far fewer small firms: Germany, Switzerland, and the UK have the smallest proportion of workers in small firms and have some of the highest labor productivity rates.¹⁷⁶ On the other hand, Greece has very low productivity, and has the highest percentage of small firms in Europe (two-thirds of Greek firms have under 20 workers).¹⁷⁷ Larger firms are usually more productive, in part because they can take greater advantage of economies of scale when they invest in capital stock, including ICT.¹⁷⁸

Preferences for small businesses can take two forms: active policies to provide special benefits to small business; and discriminatory policies that place tax and regulatory burdens only on large businesses. The former policies, unless carefully targeted to potential high-growth “gazelle firms,” simply keep the share of the economy produced by small businesses larger than it otherwise would be.¹⁷⁹ The latter policies not only slow the growth of larger firms, they can slow the growth of smaller firms that don’t want to lose their special entitlements for being small if they get bigger than the threshold.¹⁸⁰ France’s “anti-Amazon” law that prohibits discounts on books, including free shipping, is one example, because it raises prices for books from more efficient e-commerce channels, limiting productivity growth in this sector.¹⁸¹

Do No Harm

Putting spurring ICT adoption at the center of economic policy means not just supporting it, but just as importantly avoiding harm. Notwithstanding the progress that ICT enables, all too often well-intentioned policymakers are willing to consider laws and regulations that could slow digital transformation. One of the areas currently most at risk is digital trade,

European firms should have free access to the best in breed and best value IT goods and services, regardless of where they are produced.

due to emerging “data nationalism”—the idea that data must be stored domestically in order to keep it secure. Data nationalism is a “false promise” because it is unlikely to deliver the expected benefits of privacy and security, and it also holds significant potential to slow down ICT-related growth.¹⁸² Unfortunately, data nationalist policies are already a reality in some countries: both the Norwegian and Danish Data Protection Authorities have issued rulings to prevent the use of cloud computing services by municipalities when servers are not located domestically (although the Norwegian decision was rescinded).¹⁸³ There has been talk as well by European leaders of building a “European network” for communication so that data never physically crosses the Atlantic.¹⁸⁴ By definition, the result of these kinds of policies will be to raise the costs of ICT services for firms in these nations, reducing their ICT adoption and productivity. European firms should have free access to the best in breed and best value IT goods and services, regardless of where they are produced.

The issue of privacy regulations is similar. The responsible use of data can lead to productivity gains and innovation. However, overly stringent privacy rules limit the ability of enterprises to obtain these gains.¹⁸⁵ For example, less effective advertising reduces available revenue for websites and can cripple the growth of useful services.

Another example is the “right to be forgotten” rule implemented by the European Union.¹⁸⁶ The rule allows citizens to request that any information about them held by search engines be removed.¹⁸⁷ Such a rule might sound good in theory, but in practice it could prove quite difficult for compliance and enforcement. The rule could be “impossible to implement,” according to the European Network and Information Security Agency, rendering the attempt not only damaging to commerce but wasteful as well.¹⁸⁸ And as noted above, damage to the EU GDP could be large: between 1.5 percent and 3.9 percent of the GDP.¹⁸⁹

On a more local scale, city regulations have been keeping the ride-coordination service Uber from making inroads in Europe.¹⁹⁰ European cities need to find solutions that harness the benefits of technology and avoid rules that lock themselves into less productive producers.

CONCLUSION

In conclusion, Europe has the potential to raise productivity significantly if it fully embraces the use of ICT. Some progress has been made: the Digital Agenda for Europe takes many steps in the right direction, like moving toward the Digital Single Market and encouraging the use of ICT in a variety of public sectors.¹⁹¹ But the European economic crisis has kept Euro-area investment on the decline while preoccupying policymakers with other issues. Meanwhile, productivity rates continue to lag behind U.S. rates in the majority of EU countries. This is thanks to public policies and business practices in the United States that are more conducive to ICT use: better management, higher levels of ICT investment (particularly in ICT-using sectors), lower taxes on ICT products, and larger economies of scale at both the firm and market levels. Instead of seeing ICT adoption as a worldwide competition for the next new Silicon Valley, Europe needs to focus on where ICT can make the most difference: ICT use. This is a path the United

States has already taken and proven successful, and Europe would prosper by following its lead.

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