Productivity and Economic Growth in Europe: A Comparative Industry Perspective

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Why did European productivity growth slow down while American growth accelerated since the 1990s? In this article we provide a detailed analysis of the sources of growth from a comparative industry perspective, based on our recent book *Economic Growth in Europe*. We argue that Europe's falling behind is the combined result of a severe productivity slowdown in traditional manufacturing and other goods production, and a concomitant failure to invest in and reap the benefits from Information and Communications Technology (ICT), in particular in market services. The analysis is based on an update of the EU KLEMS growth accounting database and introduces a new measure for patterns of growth.

Comment expliquer la concomitance depuis les années 1990 d'un ralentissement de la croissance en Europe et d'une accélération de la croissance américaine? Dans cette étude, nous nous sommes attachés à faire une analyse détaillée des sources de croissance en comparant les secteurs industriels et en nous appuyant sur notre dernier ouvrage *Economic Growth in Europe*. Nous soutenons que la perte de terrain de l'Europe est due aussi bien à un ralentissement brutal de la productivité dans les secteurs de la production de biens et de l'industrie manufacturière traditionnelle que de l'échec concomitant à investir dans le secteur des technologies de l'information et de la communication (TIC) et d'en récolter des bénéfices, plus particulièrement pour ce qui a trait aux services du marché. Nos recherches se fondent sur des données provenant de la base de données comptable sur la croissance «EU KLEMS» et proposent un nouvel indicateur pour mesurer le profil de croissance.

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THE BENEFITS OF THE MODERN KNOWLEDGE economy differ greatly between advanced economies. The EU–15, that is the 15 European Union countries that constituted the Union up to 2004, experienced a sharp slowdown in labour productivity growth (measured as GDP per hour of work) from an annual rate of 2.7 per cent during 1973–1995 to 1.5 per cent during 1995–2007. At the same time, labour productivity in the United States increased sharply from 1.3 per cent to 2.1 per cent between 1973–1995 and 1995–2007 respectively. While differences in the timing of business cycles in the United States and the European Union may have some effect on this comparison, they do not explain these divergent trend growth rates.

The slower labour productivity growth rates in Europe compared to the United States since 1995 reverse a long–term pattern of convergence. This article first reviews the productivity and economic growth of Europe since 1950, identifying three periods characterized by different drivers of productivity. In the period 1950–1973, European growth was characterized by a traditional catch–up pattern based on the imitation and adaptation of foreign technology, coupled with strong investment and supporting institutions. However, the traditional postwar convergence process came to an end by the mid-1970s (Crafts and Toniolo, 1996; Eichengreen, 2007). Then, in the period from 1973 to 1995, output and productivity growth in both Europe and the United States began to slow. However, while the gap in output (and average per capita income) growth rates narrowed between the two regions, Europe's productivity growth remained much faster than in the United States. During this time, Europe experienced a strong decline in labour force participation and a fall in average hours worked, which in turn triggered a substitution of capital for labour bringing capital–labour ratios in some major European economies to levels well above those of the United States by the mid-1990s. Since 1995, U.S. productivity growth accelerated until around 2004, after which it began to slow, whereas the rate of productivity growth in Europe fell throughout the period, with the exception of two brief positive spells during the peaks of the business cycle at the end of the 1990s and around 2006–2007. Finally, during the Great Recession in 2008-09, the productivity growth rates in Europe and the United States rapidly diverged, as the United States saw a pickup in productivity growth as the labour market shrunk well beyond that in the European Union. The EU saw a decline in productivity parallel to the contraction of the economy.

In the second section of this article, we focus on the European growth experience, especially in the period from 1995 to 2007, using a new and detailed database called the EU KLEMS Growth and Productivity Accounts.[2] The level of detail in this database allows a discussion of a number of developments during this period: changes in patterns of capital–labour substitution; the increasing importance of investment in information and communications technology; the use of more high–skilled labour; the different dynamics across sectors, like those producing information and communications technology, or manufacturing and services more generally; and the diversity of productivity experiences across the countries of Europe.

We show that the productivity slowdown in Europe since the mid–1990s is mainly attributable to the slower emergence of the knowledge economy compared to the United States. In the third section we consider various explanations

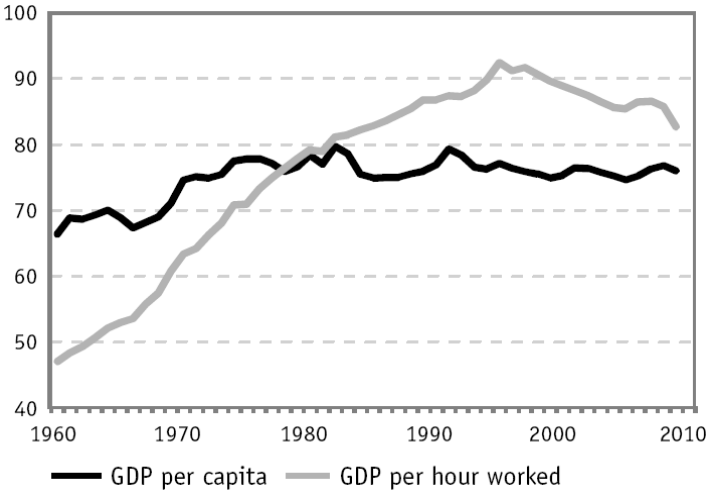
2 The November 2009 release of this industry-level database provides time series on output, inputs and productivity for more than 65 industries over the period 1970 to 2007. It covers not only data for 25 European Union countries, but also for the United States, Australia, Canada, Japan and South Korea. The data are publicly available at http://www.euklems.net/. For a summary overview of the methodology and construction of the EU KLEMS database, see O'Mahony and Timmer (2009) and Chapter 3 in Timmer *et al.* (2010).

for the slowdown which are not mutually exclusive: for example, lower growth contributions from investment in information and communication technology in Europe, the relatively small share of technology–producing industries in Europe, and slower multifactor productivity growth (which can be viewed as a proxy for advances in technology and innovation). Underlying these explanations are issues related to the functioning of European labour markets and the high level of product market regulation in Europe. This article emphasizes the key role of market service sectors in accounting for the productivity growth divergence between the two regions.

In the final section we look at some of the policy implications for Europe to strengthen its productivity growth performance. The slowing productivity growth and faltering emergence of the knowledge economy in Europe since the mid–1990s has led to an ambitious action program of the European Commission, called the 'Lisbon Agenda,' which was executed during the first decade of the 21st century. Its goal was to make Europe by 2010 'the most competitive and dynamic knowledge–based economy in the world.' This program was succeeded in 2010 by a new growth strategy, named 'Europe 2020,' which aimed to make Europe a smart, sustainable and inclusive economy. Both strategies have focused on the importance of employment growth and innovation, especially through ambitious targets for research and development, as well as environmentally friendly growth strategies. Both agendas have so far not led to a reversal in Europe's downward productivity trend.

Although we do not think there is one silver bullet to revive growth, we argue that the future for European productivity growth will strongly depend on the performance of its services sector. The nations of Europe also need to find their own ways of adjusting to the opportunities and dislocations of the new information and communications technologies. Thus, within the broader growth and competitiveness agenda, we emphasize greater labour mobility and flexibility of service product markets within and across countries as being especially important.

Chart 1
Total Economy GDP per Hour Worked and GDP per Capita in EU–15, 1960–2009 (relative to the United States)
(EU as a per cent of U.S. level)



Source: The Conference Board Total Economy Database, January 2011, http://www.conference-board.org/ economics/database.cfm.

Notes: EU–15 refers to the 15 countries constituting the European Union before 2004 and include Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom. The EU expanded to include ten new member states mainly in Central and Eastern Europe in 2004 and another two in 2007; the new members are not included here. Relative levels are based on purchasing power parities for GDP for 2005 from the OECD.

European Productivity: 1950–2007

Europe's productivity growth performance relative to the United States since 1950 can be usefully divided into three periods: 1950–1973, 1973–1995, and 1995–2007. The comparative European experience in GDP per capita and in GDP per hour is illustrated in Chart 1. The measures are compared relative to the U.S. levels and are adjusted for differences in relative price levels using the GDP–based purchasing

Table 1
Average Annual Growth Rates of GDP, GDP per Capita, and GDP per Hour Worked, EU–15 and United States, 1950–2007
(per cent)

	GDP	GDP per capita	GDP per hour worked
1950-1973			
EU-15	4.9	4.2	4.9
United States	3.9	2.5	2.6
1973-1995			
EU-15	2.2	1.9	2.7
United States	2.9	1.8	1.3
1995-2007			
EU-15	2.4	2.0	1.5
United States	3.2	2.1	2.1

Source: Calculations based on The Conference Board Total Economy Database, January 2011, at http://www.conference-board.org/data/economydatabase/.

Notes: See Chart 1. The growth rates are presented as differences in the log of the levels of each variable instead of a percentage change in the actual level in order to facilitate aggregation to regional averages and a decomposition of growth sources.

power parities for 2005 from the OECD. We also added the latest years for which data are available, 2008 and 2009, on the basis of provisional national accounts estimates.

European Catch–Up: 1950–1973

During the first period, from 1950–73, rapid labour productivity growth in the European Union went together with catching–up in terms of per capita income levels with the United States. The reasons for this dual catching–up process during the 1950s and 1960s have been extensively discussed in the literature and can broadly be divided into two groups: technology imitation and new institutions (for example, Boltho, 1982; Crafts and Toniolo, 1996; Eichengreen, 2007).

Imitation of technology and incremental innovation allowed European countries to speed up both output and productivity growth quite rapidly following the Depression of the 1930s and the devastation of Europe's economies during World War II. Many European countries could draw upon their legacy as industrializing nations during the nineteenth and early twentieth century. Compared to other parts of the world, Europe after World War II already had a relatively well–educated population and a strong set of institutions for generating human capital and financial wealth, which allowed a rapid recovery of investment and absorption of new technologies developed elsewhere, notably in the United States.

This process was strengthened by the emergence of a new set of institutions in the area of wage bargaining (Eichengreen, 2007). Although there were important differences between countries, essentially these arrangements involved limiting wage demands in exchange for a rapid redeployment of profits for investment. Through this arrangement, a consensus was developed between workers and capitalists that benefited both productivity and per capita income. In addition, European capital markets favored the emergence of large 'national champion' companies while at the same time (notably in Germany) supporting a strong system of small– and medium–sized enterprises. In several northwest European countries, the education system tended to emphasize technical and vocational training. These characteristics of European institutions largely lasted until the end of the 1960s, after which labour markets became increasingly tight, leading to substantially higher wage demands.

The Productivity Slowdown: 1973–1995

The 'golden age' of post–World War II growth came to an end rather abruptly in the early 1970s, followed by a period of significantly slower growth lasting almost two decades on both continents (Maddison, 1987). Table 1 shows that while U.S. GDP growth slowed from

3.9 per cent on average per year in the period 1950–1973 to 2.9 per cent in the period 1973–1995, EU–15 growth slowed substantially more from 4.9 per cent in the period 1950–1973 to only 2.2 per cent in the period 1973–1995. However, average growth rates of per capita income between the United States and the EU–15 became quite similar at 1.8 per cent (for the EU) and 1.9 per cent (for the United States) between 1973 and 1995.[3]

Looking back at Chart 1, one striking observation is that while per capita income in Europe hovered between 70 to 80 per cent of the U.S. level between 1973 and 1995, the productivity gap between Europe and the United States continued to narrow. Indeed, average annual labour productivity growth in the EU–15 was still more than twice as fast as in the United States, at 2.7 per cent in the EU–15 against 1.3 per cent in the United States from 1973 to 1995. Thus, the labour productivity gap virtually closed from more than 30 percentage points in 1973 to only 7.6 percentage points in 1995, as shown in Table 2. In some European countries, including Belgium, France, Germany, and the Netherlands, GDP per hour worked was even higher than the U.S. level in 1995. In Europe, the combination of an unchanged gap in per capita income and a narrowing gap in labour productivity was related – by accounting identity – to a decline in labour force participation rates and a fall in working hours per person employed. Working hours per capita in the European Union countries declined from 11 per cent above the U.S. level in 1973 to 84 per cent of the U.S. level by 1995, as shown in Table 2.

A substantial literature has explored why Europe's labour market institutions have led to less work, in particular during the period 1973–1995. Blanchard (2004) stresses how the trade–off between preferences for leisure and work

Table 2
Levels of GDP per Capita, Hours Worked per Capita, GDP per Hour Worked and Capital Input per Hour Worked in EU–15 Relative to the United States, 1950, 1973, 1995 and 2007
(United States =100, per cent)

	1950	1973	1995	2007
GDP per capita	51.5	75.4	77.1	76.2
Hours worked per capita	126.2	110.9	83.5	88.1
GDP per hour worked	40.8	68.0	92.4	86.6
Capital input per hour worked*		75.3	103.6	103.0

Source: Calculations based on The Conference Board Total Economy Database, January 2011, at http://www.conference-board.org/data/economydatabase

Note: Output and capital levels are converted by GDP purchasing power parities for 2005.

* Measured as capital stock per hour worked.

developed differently in Europe and the United States. Prescott (2004) estimates that the role of income taxes can account for virtually all of the difference in labour participation rates across European countries. Nickell (1997) shows that in addition to high payroll taxes, other labour market issues, such as generous unemployment benefits, poor educational standards at the bottom, and high unionization with little coordination also play an important role in accounting for Europe's rise in unemployment since the mid-1970s. Europe's welfare state rapidly expanded in the 1970s, causing an increase in labour cost, a strong bias towards insiders in the labour market, and an increase in structural unemployment, in particular among youth and older workers.

One result of Europe's slowing growth in labour input was a rapid increase in capital intensity, as the rise in wages led to the substitution of capital for labour. Table 2 shows that Europe's capital stock per hour worked was at 75.3 per cent of the U.S. level in 1973, but had reached 103.6 per cent of the U.S. level by 1995. European countries with a higher capital stock per hour worked than the United

3 Further details on the growth slowdown during this period are provided by Crafts and Toniolo (1996), Baily and Kirkegaard (2004), and Eichengreen (2007).

States in 1995 include Austria, Belgium, Finland, France, Germany, and the Netherlands. As a result, the high labour productivity levels in the European Union by the mid-1990s should be interpreted with care.

Economists draw a distinction between labour productivity, which can be measured by GDP per hour worked, and multifactor productivity, which relates to the level of output after accounting for labour as well as capital inputs. As we will argue in more detail below, even though Europe experienced relatively strong growth in labour productivity, the growth in multifactor productivity was much lower. This indicates that Europe's higher labour productivity growth during this period may not have been so much the result of catch–up, access to superior technology, or even faster innovation, but can be largely attributable to accumulated labour market rigidities.

Europe's Falling Behind: 1995–2007

Since the mid-1990s, the patterns of productivity growth in Europe and the United States changed dramatically. In the United States, average annual labour productivity growth accelerated from 1.3 per cent during the period 1973–95 to 2.1 per cent during 1995–2007. Comparing the same two time periods, annual labour productivity growth in the European Union declined from 2.7 to 1.5 per cent. By 2007, GDP per hour worked in the EU was 13 percentage points below the U.S. level, while capital intensity levels remained relatively high, above the U.S. levels, suggesting that the productivity adjustment was mainly made through a slowdown in multifactor productivity growth (Table 2).

The slowdown in labour productivity may be related to the rapid growth in labour input in many European countries. During the late 1980s and the 1990s, several European countries introduced labour market reforms and instigated active labour market interventions to bring long–term unemployed people back into the workforce and raise the participation rate. The slowdown in productivity growth and the stability in capital intensity in Europe realtive to the United States since 1995 suggest the possibility that just as limited employment growth accompanied higher labour productivity in Europe in the 1973–1995 period, perhaps that pattern reversed itself in the more recent time period (Gordon, 2004).

While in the short run labour productivity growth may decline due to the dampening of real wage growth and consequent reduction in the rate of substitution of capital for labour, it is unlikely that the elasticity of labour input with respect to productivity is large in the medium and long term. According to Blanchard (2004), the employment–productivity trade–off would only exist under the assumption of stagnant output growth, which is an unrealistic assumption for the medium and long run.

Indeed, despite slowing productivity growth, the European Union has not experienced a slowdown in GDP growth since 1995. A related argument is that increases in employment have raised the share of low–skilled workers in the workforce, causing labour productivity to decline. However, there are no signs of a significant decline in the growth of the skill level of the labour force, which would presumably arise if the underlying cause was a large rise in low–skilled labour in Europe. On the contrary, the average skill–level of the employed labour force continued to improve since the mid-1990s. Thus, the labour market is unlikely to be the main explanation for the slowdown in productivity growth.

When put into a comparative perspective, the productivity slowdown in Europe is all the more disappointing as U.S. productivity growth has

accelerated since the mid-1990s. The causes of the strong U.S. productivity resurgence have been extensively discussed (see, for example, Jorgenson, Ho, and Stiroh, 2008). In the mid-1990s, there was a burst of higher productivity in industries producing information and communications technology equipment, and a capital–deepening effect from investing in information and communications technology assets across the economy. In turn, these changes were driven by the rapid pace of innovation in information and communications technologies, fuelled by the precipitous and continuing fall in semiconductor prices. With some delay, arguably due to the necessary changes in production processes and organizational practices, there was also a multifactor productivity surge in industries using these new information and communications technologies—in particular in market services industries (Triplett and Bosworth, 2006).

In Europe, the advent of the knowledge economy has been slower since the mid-1990s. In the next section, we exploit the EU KLEMS database on industry–level growth accounts to develop a better view of how inputs and productivity have contributed to the change in the growth performance of European countries since 1995, in particular in comparison with the United States.

Table 3
Growth Rates of GDP, GDP per Capita, Total Hours Worked and GDP per Hour Worked, EU–15 and the United States, 2007-2009
(annual and average annual per cent change)

	GDP	GDP per capita	Total Hours Worked	GDP per hour worked
2007				
EU-15	2.8	2.3	1.6	1.1
United States	1.9	0.9	1.0	1.0
2008				
EU-15	0.3	-0.2	0.4	-0.1
United States	0.0	-0.9	-0.8	0.8
2009				
EU-15	-4.3	-4.6	-3.0	-1.3
United States	-2.6	-3.5	-5.0	2.5
2007-09				
EU-15	-2.0	-2.4	-1.3	-0.7
United States	-1.3	-2.2	-2.9	1.6

Source: Calculations based on The Conference Board Total Economy Database, January 2011, at http://www.conference-board.org/data/economydatabase.

Divergence During the Great Recession: 2007-2009

In 2008-09, advanced economies were hit by the deepest recession since the 1930s. In 2008, GDP growth in the EU-15 slowed to 0.3 per cent and then dramatically fell to -4.3 per cent in 2009. The United States experienced a standstill in GDP growth in 2008, but contracted less severely than the EU-15, at -2.6 per cent, in 2009 (Table 3). Traditionally productivity is pro-cyclical, which implies that during a downturn productivity growth slows or even declines as initially output growth slips more than the growth in employment. Businesses typically hold on to their staff (labour hoarding) and equipment at least for a while to see how the economy will develop before laying off people or scrapping machines. Adjustments are usually made through lowering capacity utilization and reducing working hours of staff.

This typical pattern of pro-cyclicality in productivity can be observed for Europe's performance during the recession. The EU-15 showed a slowdown in productivity growth of -0.7 per cent per year from 2007-2009. The United States, however, showed an atypical increase in productivity of 1.6 per cent per year over the same period (0.8 per cent in 2008 and 2.5 per cent in 2009). As the U.S. recessions of 1990-91 and 2001-02 also exhibited such counter-cyclicality going into the recession, various explanations have been put forward for the change in the relationship between output, productivity, and employment in the United States. These range from labour market-based explanations, pointing at

increased flexibility in hiring and firing, technology-based explanations pointing at the role of ICT in continuing productivity increases during recessions, and explanations related to financial market incentives and executive compensation. The latter may have stimulated short term gains in performance over long term concerns with regard to the sources of growth in U.S. companies.

While there may be no unique explanation for the continued productivity growth in the United States vis-à-vis the typical pro-cyclicality in the European Union during the recession, it should also be pointed out that Europe itself has not shown a unique pattern of productivity growth. For example, in Germany labour productivity growth declined by 2.4 per cent from 2007-2009, as government and businesses chose to use shorttime working schemes and other instruments to dampen the threat of large layoffs. Total hours worked in Germany therefore only fell by 1.4 per cent. In contrast, in Spain, large structural labour market problems led to massive layoffs of temporary and migrant employees in tourism, construction and agriculture, causing a drop in hours worked of 6.3 per cent between 2007 and 2009, but a productivity improvement of 3.3 per cent.

Clearly there is no silver bullet to deal with productivity issues during recessions, and ultimately the long-term strength of an economy's economic structure, as measured by its industry composition and sources of growth, determines its long term growth potential.

Growth Accounting for Europe and the United States

To assess the contribution of various inputs to GDP growth, we apply the neoclassical growth accounting framework pioneered by Solow (1957) and further developed by Jorgenson and associates (Jorgenson and Griliches, 1967; Jorgenson, Gollop, and Fraumeni, 1987). Using this framework, measures of output growth can be decomposed into the contributions of inputs and productivity within a consistent accounting framework. This approach allows researchers to assess the relative importance of labour, capital, and intermediate inputs to growth, and to derive measures of multifactor productivity growth.

The output contribution of an input is measured by the growth rate of the input, weighted by that input's income shares. Under neoclassical assumptions, the income shares reflect the output elasticity of each input, and assuming constant returns to scale, they sum to one. The portion of output growth not attributable to inputs is the multifactor productivity residual. Multifactor productivity indicates the efficiency with which inputs are being used in the production process, and includes disembodied technological change, along with changes in returns to scale and in mark–ups. Multifactor productivity, as a residual measure, also includes measurement errors and the effects from unmeasured output and inputs, such as research and development and other intangible investments, including organizational improvements (Corrado, Hulten and Sichel, 2009; van Ark *et al.*, 2009).

Our growth decompositions are based on the November 2009 release of the EU KLEMS database. This database provides harmonised measures of economic growth, productivity, employment creation, and capital formation at a detailed industry level for European Union member states, Japan, and the United States from 1980 to 2007. In particular, this database contains unique industry–level measures of the skill distribution of the work force and a detailed asset decomposition of investment in physical capital. Labour input reflects changes in hours worked, but also changes in labour composition in terms of age, gender, and educational qualifications over time. Physical capital is decomposed into six asset categories. Three of the asset categories are related to information and com-

Table 4

Contributions to Real Output Growth in the Market Economy, European Union and the United States, 1980–2007

(annual average growth rates, in percentage points)

		European Union*		United States**	
		1980-1995	1995-2007	1980-1995	1995-2007
1	Growth rate of market economy output	2.1	2.5	3.3	3.5
2	Hours worked	-0.5	0.8	1.3	0.9
3	Labour productivity	2.5	1.6	2.0	2.6
	Contributions from				
4	Labour composition	0.3	0.2	0.2	0.3
5	Capital services per hour	1.2	0.9	1.0	1.2
6	ICT capital per hour	0.4	0.5	0.7	0.9
7	Non-ICT capital per hour	0.8	0.4	0.3	0.3
8	Multifactor productivity	1.1	0.6	0.7	1.2
	Contribution of the knowledge economy to labour productivity (4)+(6)+(8)	1.8	1.3	1.7	2.4

Source: EU KLEMS database, November 2009; see O'Mahony and Timmer (2009).

Notes: * excludes 5 member states of EU-15: Greece, Ireland, Luxembourg, Portugal and Sweden; Data for European Union refers to ten countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, the Netherlands, Spain, and the United Kingdom.

** based on USA old standard industrial classification.

'ICT' is information and communications technology.

munications capital—including information technology hardware, communication equipment, and software—and three are related to capital that does not involve information and communications technology—machinery and equipment, transport equipment, and nonresidential structures. Residential capital, which does not contribute in any direct way to productivity gains, is excluded from the analysis.

The EU KLEMS database makes it possible for the first time to compare and analyze the role of high–skilled labour and information and communications technology capital for productivity growth at an industry level between countries. Our focus here is on the market economy, which means that we exclude health and education services, as well as public administration and defense. This exclusion implies a faster acceleration of output growth in both the European Union and the United States since 1995 than for the total economy reported in the previous section, but the difference in pace of acceleration between the two regions does not change. Also, in the remainder of this discussion, the European Union only includes 10 countries, excluding Greece, Ireland, Luxembourg, Portugal, and Sweden from our original 15, because no industry–level accounts back to 1980 were available for these five countries.

Table 4 provides a summary of the contributions to growth of factor inputs and multifactor productivity to labour productivity growth in the market economy in the ten European Union countries and in the United States for the periods 1980–1995 and 1995–2007. When comparing the period before and after 1995, the annual growth rate of output in the European Union accelerates, and the growth differential relative to the United States drops from 1.2 percentage points (2.1 per cent in Europe versus 3.3 per cent in the United States) to 1.0 percentage point (2.5 per cent in Europe versus 3.5 per cent in the United States). As described in the previous section, hours worked in the European

Union grew rapidly after 1995, to some extent making up for the shortfall in the earlier period. In contrast, the growth in hours worked slowed down substantially in the United States–in particular after 2000–even though the average growth rate in hours was comparable to that of the European Union between 1995–2007. As a result, labour productivity growth in the U.S. market economy increased significantly (0.6 percentage points) compared to a large slowdown in Europe after 1995 (0.9 percentage points).

Table 4 shows that changes in labour composition contributed 0.2–0.3 percentage points to labour productivity growth both in the European Union and the United States during this entire time period. Even though this contribution is small, its positive sign implies that the process of transformation of the labour force to higher skills has proceeded at roughly equal rates in Europe and the United States, thus confirming the observation above that Europe has not raised its share of low–skill workers. Instead, the upward trend in the skill content of the workforce shows that newcomers on the labour market have had on average more schooling than the existing labour force.

Concerning the total contribution of capital deepening to labour productivity growth, measured by capital services per hour, Table 4 shows somewhat larger differences between the European Union and the United States compared to labour composition. This contribution declined in Europe while rising in the United States. between the two time periods. The specific contribution of information and communications technology per working hour in Europe has been lower than in the United States, and since 1995, it accelerated more slowly (Timmer and van Ark, 2005). This slower uptake in deepening of information and communications technology capital is in part related to the overall decline in the rate of growth of capital–labour ratios across Europe since the mid-1990s, as European employment grew rapidly.

The largest difference between the European Union and the United States shown in Table 4 is in the contribution of multifactor productivity growth. Whereas multifactor productivity growth in the United States accelerated by half a percentage point from 0.7 per cent from 1980–1995 to 1.2 per cent from 1995–2007, it fell by the same degree from 1.1 to 0.6 per cent between these two periods in the European Union. As a residual measure, multifactor productivity has multiple interpretations, but in some way it does reflect the overall efficiency of the production process. Its reduced growth rate is therefore a major source of concern across Europe.

It should be stressed that the multifactor productivity growth differential between the EU and the United States was especially strong between 1995 and 2004. The differences became significantly smaller after 2004 when Europe saw an acceleration in multifactor productivity growth in the market economy from 0.4 per cent (from 1995–2004) to 1.2 per cent (from 2004–2007) due to a cyclical peak, whereas U.S. multifactor productivity growth slowed from 1.4 per cent to 0.4 per cent between the two periods.

When looking at these growth accounts from the perspective of the emerging knowledge economy, one might focus on the summed contributions of three factors: direct effects from investments in information and communication technology; changes in labour composition mostly driven by greater demand for skilled workers; and multifactor productivity growth, which—as indicated above—might include the impact of intangible investments such as organizational changes related to the use of information technology. Table 4 shows that the combined contribution of these three factors to labour productivity growth declined by 0.5 percentage points in Europe between the two time

Table 5

Contributions to Real Output Growth in the Market Economy, EU Economies and the United States, 1995–2007

(annual average growth rates, in percentage points)

	Growth rate of output	Output contribution from		Labour productivity contributions from				Labour productivity contribution of the knowledge economy
		Hours worked	Labour productivity	Labour composition	ICT capital per hour	Non-ICT capital per hour	MFP growth	
	1 = 2+3	2	3=4+5+6+7	4	5	6	7	4+5+7
Austria	2.8	0.6	2.2	0.1	0.5	0.0	1.5	2.2
Belgium	2.5	0.8	1.7	0.2	0.9	0.4	0.1	1.3
Denmark	2.3	1.3	1.0	0.1	1.0	0.1	-0.1	0.9
Finland	4.6	1.3	3.3	0.1	0.5	-0.1	2.8	3.5
France	2.5	0.5	2.0	0.3	0.3	0.4	0.9	1.6
Germany	1.4	-0.3	1.7	0.0	0.5	0.5	0.7	1.2
Italy*	1.5	1.1	0.4	0.1	0.2	0.4	-0.4	0.0
Netherlands	3.1	1.0	2.1	0.4	0.5	0.0	1.1	2.0
Spain	3.7	3.0	0.6	0.4	0.4	0.5	-0.6	0.1
United Kingdom	3.2	0.6	2.6	0.4	0.8	0.4	1.0	2.2
European Union**	2.5	0.8	1.6	0.2	0.5	0.4	0.6	1.3
United States***	3.5	0.9	2.6	0.3	0.9	0.3	1.2	2.4
standard deviation****	0.9	0.8	0.9	0.1	0.3	0.2	1.0	1.0

Source: Calculations based on EU KLEMS database, November 2009; O'Mahony and Timmer (2009).

Notes: 'ICT' is information and communications technology. 'MFP' is multifactor productivity.

* Data for Italy exclude agriculture and private households.

** Data for the European Union exclude 5 member states of EU-15: Greece, Ireland, Luxembourg, Portugal. Numbers may not sum exactly due to rounding.

*** based on old U.S. standard industrial classification

**** Standard deviation for EU countries and the United States.

periods, from 1.8 percentage points from 1980–1995 to 1.3 percentage points from 1995–2007. In contrast, in the U.S. economy the contribution of these three knowledge economy components increased from 1.7 percentage points from 1980–1995 to 2.4 percentage points from 1995–2007.

There is a large variation in labour productivity growth across European countries. Similar to the rows in Table 4, the first column of Table 5 shows the growth rate of output for 10 European countries over the 1995–2007 time period. The second and third columns divide that growth in output into changes in hours worked and changes in output per hour, or labour productivity. Columns 4–7 divide up the growth in labour productivity into the contributions from four factors: changes in labour composition; investments in information and communication technology capital; investments in other types of physical capital; and multifactor productivity.

One key observation to be drawn from this table is that the main difference in labour productivity growth between individual European economies and the United States is to be found in multifactor productivity, not in differences in the intensity of growth of the production factors. Indeed the bottom row shows that the standard deviation for multifactor productivity growth across the set of countries is by far the largest, with multifactor productivity growth ranging from -0.6 per cent in Spain to 2.8 per cent in Finland. By way of illustration, the difference in the contribution of capital deepening in information and communications technologies between a high investor like the United States and a low investor like Italy explains 0.7 percentage points out of a labour productivity

growth difference of 2.2 percentage points between those two countries during 1995–2007. The remaining 1.5 percentage point difference is (more than) accounted for by the differences in multifactor productivity growth. Differences in multifactor productivity growth also seem to have driven the divergence in labour productivity growth between European countries. In Belgium, multifactor productivity growth has been close to zero per cent per year, and in Denmark, Italy, and Spain, it is even negative. Only Finland significantly exceeded the U.S. growth rate of multifactor growth in the market economy (2.8 per cent versus 1.2 per cent).

How should we explain the large differences in multifactor productivity growth across countries? In the next section, a breakdown of the aggregate market economy measures by industry allows us to focus attention on the performance of the market services sector.

Structural Change and Sectoral Productivity Growth

During the postwar period Europe has experienced a large shift of production and employment from manufacturing and other goods–producing industries (such as agriculture and mining) towards services. Market services include a wide variety of activities, ranging from trade and transportation services, to financial and business services, and also hotels, restaurants, and personal services. Over the period 1980–2007, the share of labour input going to manufacturing has typically declined by one–third or more in most countries. Market services now account for almost half of the market economy employment in all countries. The share of total labour hours going to market services is not much lower in Europe than in the United States. While there are differences across European countries, even in Germany, a country in which manufacturing traditionally plays an important role, the number of hours worked in market services is now more than 2.5 times larger than in manufacturing. [4]

The growing importance of market services is the result of a number of interacting forces (Schettkatt and Yocarini, 2006). Higher per capita income leads to higher demand for services. There is also an increasing marketization of traditional household production activities, including meal preparation, cleaning, and care assistance. Finally, many manufacturing firms are outsourcing aspects of business services, trade, and transport activities. Whatever the underlying causes of the shift from manufacturing to services, it has important implications for productivity growth. Traditionally, manufacturing activities have been regarded as the locus of innovation and technological change, and thus the central source of productivity growth. For example, more productive manufacturing was the key to post–World War II productivity growth in Europe through a combination of economies of scale, capital intensification, and incremental innovation. More recently, rapid technological change in computer and semiconductor manufacturing seemingly reinforces the predominance of innovation in the manufacturing sector. In contrast, the increasing weight of services in output was thought to slow aggregate productivity growth. Baumol (1967) called this the 'cost disease of the service sector.' The diagnosis of the disease argues that productivity improvements in services are less likely than in goods–producing industries because most services are inherently labour–intensive, making it difficult to substitute capital for labour in service industries. Although Baumol originally mainly referred to services activities like education, health, and public services, it was widely believed to hold for many other services sectors

4 See Jorgenson and Timmer (2011) for an in-depth comparison of structural change in Europe, Japan and the United States.

Table 6

Major Sector Contributions to Labour Productivity Growth in the Market Economy, EU Economies and the United States, 1995–2007

(annual average growth rates, in percentage points)

	Market Economy 1=2+3+4+5	Contributions from			
		ICT production	Goods production	Market services	Reallocation*
		2	3	4	5
Austria	2.2	0.3	1.7	0.2	-0.1
Belgium	1.7	0.3	0.9	0.6	-0.1
Denmark	1.0	0.3	0.4	0.4	-0.1
Finland	3.3	1.7	1.3	0.5	-0.1
France	2.0	0.4	0.8	0.7	0.0
Germany	1.7	0.5	0.9	0.4	0.0
Italy	0.4	0.2	0.2	0.0	-0.1
Netherlands	2.1	0.4	0.6	1.2	-0.2
Spain	0.6	0.1	0.2	0.3	-0.1
United Kingdom	2.6	0.5	0.7	1.6	-0.2
European Union**	1.6	0.4	0.7	0.6	-0.2
United States***	2.6	0.8	0.3	1.8	-0.2

Source: Calculations based on EU KLEMS database, November 2009; O'Mahony and Timmer (2009).

Notes: The reallocation effect in the last column refers to labour productivity effects of reallocations of labour between sectors. The European Union aggregate refers to the ten countries in the table. Information and communications technology production includes manufacturing of electrical machinery and post and telecommunications services. Goods production includes agriculture, mining, manufacturing (excluding electrical machinery), construction, and utilities. Market services include distribution services; financial and business services, excluding real estate; and personal services. Numbers may not sum exactly due to rounding.

* Data for Italy exclude agriculture and private households.

** Data for the European Union exclude 5 member states of EU-15: Greece, Ireland, Luxembourg, Portugal. Numbers may not sum exactly due to rounding.

*** based on old U.S. standard industrial classification

as well. This hypothesis has subsequently been disputed in the literature (for example, Triplett and Bosworth, 2006) and, as the following discussion will show, is not supported by the evidence from the EU KLEMS data.

To evaluate the effect of structural changes on productivity growth, we need to look at the contributions of individual sectors on the aggregate economy. Table 6 shows labour productivity growth for the market economy split into contributions from labour productivity growth in the information and communications technology production sector (including production of electrical machinery and telecommunication services), goods production (including agriculture, mining, manufacturing other than electrical machinery, utilities, and construction), and the market services sector (including trade, hotels and restaurants, transport services, financial and business services, and social and personal services), each weighted by its share in value added, along with an adjustment in the final column for the reallocation of hours between industries with different productivity.

Table 6 shows that slow productivity growth in market services is not a universal truth, even among advanced countries with large service sectors. First, productivity growth in market services has been much faster in the United States than in Europe. At an average annual labour productivity growth rate of 1.2 per cent, market services contributed only 0.6 percentage points to labour productivity growth in Europe from 1995–2007. In contrast, labour productiv-

Table 7
Major Sector Contributions to Labour Productivity Growth in Market Services, EU Economies and the United States, 1980–2005
(average annual percentage points)

	European Union		United States	
	1980-1995	1995-2005	1980-1995	1995-2005
Market services labour productivity	1.4	1.0	1.5	3.0
Distribution services contribution	1.1	0.7	1.2	1.5
factor intensity growth	0.4	0.5	0.4	0.5
multifactor productivity growth	0.7	0.2	0.8	1.0
Financial services contribution	0.2	0.4	0.2	0.5
factor intensity growth	0.3	0.2	0.7	0.5
multifactor productivity growth	0.0	0.1	-0.6	0.1
Business services contribution	0.0	-0.1	-0.1	0.7
factor intensity growth	0.4	0.4	0.2	0.8
multifactor productivity growth	-0.4	-0.5	-0.3	0.0
Personal services contribution	-0.1	-0.1	0.2	0.2
factor intensity growth	0.1	0.1	0.1	0.1
multifactor productivity growth	-0.2	-0.1	0.1	0.1
Contribution from labour reallocation	0.1	0.0	0.0	0.0

Source: Calculations based on EU KLEMS database, March 2008; see O'Mahony and Timmer, 2009). *Notes*: European Union aggregate refers to 10 countries. Factor intensity relates to the total contribution from changes in labour composition and in capital deepening of information and communications technology (ICT) and non–information and communications technology (non–ICT) assets. The reallocation effect refers to the impact of changes in the distribution of labour input between industries on labour productivity growth in market services. Numbers may not add up due to rounding.

ity in market services increased at 3.0 per cent in the United States, contributing 1.8 percentage points to U.S. productivity growth. Second, within Europe two countries–the Netherlands and the United Kingdom–also showed rapid productivity growth in market services. Market services in the United Kingdom contributed almost as much to aggregate labour productivity growth as in the United States, mainly due to strong performance in trade and business services industries.[5] In contrast, Italy and Spain show almost zero contributions from market services to aggregate labour productivity growth. Previous studies on the growth differential between Europe and the United States also stressed the differentiating role of market services (O'Mahony and van Ark, 2003; Losch, 2006; Inklaar, Timmer, and van Ark, 2008).

The importance of market services for the productivity growth gap between Europe and the United States dwarfs the differences for other major sectors. Even though the United States has a somewhat bigger share in information and communications technology–producing sectors, the productivity growth rates in these sectors are not dramatically different. As a result, the effect on the aggregate growth differential is only 0.4 percentage points (0.8 per cent in the United States compared to 0.4 per cent in Europe). Goods production seems to be somewhat more important for aggregate productivity growth in Europe than in the United States. The contribution from labour productivity growth in goods production in Europe is about the same as that of market services, despite the former's relative size of only one–third of market services value added. For example, in France and Germany, manufacturing industries like machinery and car manufacturing are still important sources of productivity growth. In Spain and Italy, lackluster productivity performance is not only due to slow growth in market services, but also in manufacturing, as traditional labour–intensive sectors have faced a particularly tough challenge from increasing low–wage competition from eastern Europe and China.

A more in-depth focus on these industries reveals that cross-Atlantic growth differences were especially large in distributive trade and in business services. This is shown in Table 7 where we focus on the contribution of four major groups of market services industries,

5 Incidentally, market services also appear to exhibit rapid productivity growth in other Anglo–Saxon economies, such as Australia and Canada (Inklaar, Timmer, and van Ark, 2007).

namely distributive trade (including retail and wholesale trade and transport services), financial services, business services and personal services (including community and social services). In Europe, the distribution sector contributed 0.7 percentage points to labour productivity growth in aggregate market services during 1995-2005, compared to 1.5 percentage points in the United States. In business services a similar gap existed as this sector had a negative contribution in Europe while it contributed 0.7 percentage points in the United States. Interestingly in the light of the global financial crisis in 2007-08, the measured contribution from the finance sector to aggregate labour productivity growth was not disproportionate, adding about 0.5 percentage points in both the EU and US. The contribution of personal services was negligible as productivity growth in this sector was close to zero in both regions, echoing Baumol's cost-disease hypothesis.

Drilling more deeply into the data, it turns out that for distribution services and business services, multifactor productivity and not factor intensity was the key to the productivity growth differential between Europe and the United States. Differences in 'factor intensity', which include the total contribution from changes in labour composition and deepening of all types of capital, appear very small. The fuelling of U.S. multifactor productivity growth from trade, finance, and business services is confirmed in studies by Jorgenson, Ho, and Stiroh (2005) and Triplett and Bosworth (2006).

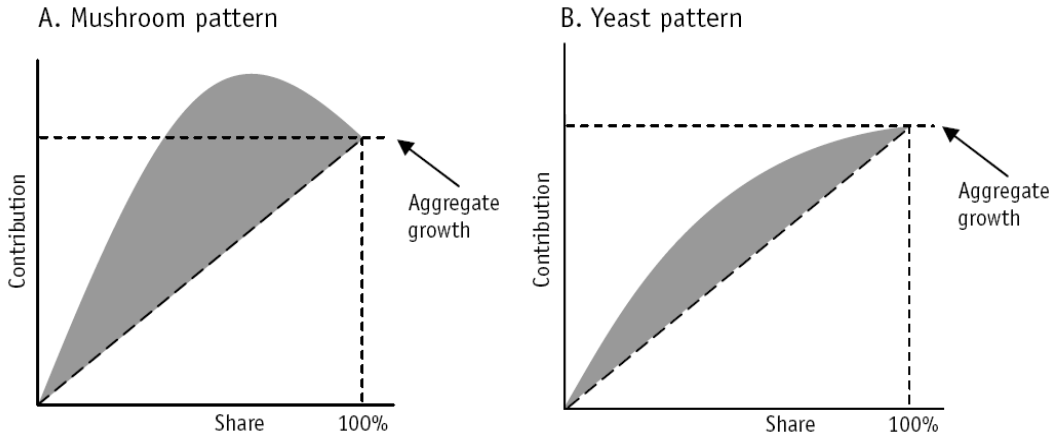
Recently the release of a comprehensive revision of GDP by industry data for the United States by the Bureau of Economic Analysis has led to significant changes in the productivity estimates for the United States, especially in the services sector. This raises the question of whether the productivity advantage for services will still be observed in the latest data. A comparison of the data suggests that the revision of the labour productivity growth rates for market services is small for the past decade, that is, from 2.8 per cent pre-revision to 2.6 per cent post-revision from 1998-2007 (EU KLEMS, November 2009 release; BEA, 2010).

Patterns of Growth: Yeast versus Mushrooms

With the availability of more industry-level data, an increasingly detailed picture of the patterns and sources of growth has become feasible. At the same time, there is a need to find insightful ways to summarize the wealth of industry detail. The most straightforward approach is to aggregate industries into larger groups and analyse the performance of these groups as a whole. However, by doing this we run the risk of possibly missing sizeable within-group heterogeneity. Alternatively, one can provide graphs with detailed industry data. But these graphs do not provide a clear interpretation of the overall growth process. So to complement our discussion we use in this section the Harberger diagram as a way to characterise the growth pattern of all industries (Harberger, 1998). Specifically, we use these diagrams and a number of summary statistics to characterise how widespread (yeast) or localised (mushroom) capital deepening and productivity growth is.

These Harberger diagrams can be used to shed light on some of the hypotheses about productivity growth in the United States and other countries that have circulated in recent years. At various points, it has been suggested that the acceleration of US labour productivity growth and/or the difference with other countries can be traced mostly to ICT production, the strong performance of a small number of ICT-using industries or a broad set of services industries. Harberger diagrams provide an intuitive and standardised way to determine how widespread growth and changes in growth are within an

Chart 2
Examples of Harberger Diagrams



economy. They can also be used to determine how evenly new technology spreads across an economy. For instance,we use Harberger diagrams to analyse whether ICT capital is growing at similar or very different rates across industries.

The Harberger diagram provides a convenient graphical summary of the industry pattern of growth. The diagram shows the cumulative contribution of the industries to aggregate growth on the *y*-axis and the cumulative share of these industries on the *x*-axis. It is based on a data set of industries and their contributions to aggregate growth calculated as outlined in Timmer *et al.* (2010, Chapter 5). The industries are first ranked by growth rate to ensure a concave diagram, so the fastest growing industries are to be found near the origin. The resulting pattern can have a more yeasty or mushroom character, depending on the number of industries contributing positively to aggregate growth and the distribution of growth rates. Growth is yeasty when it is broad-based and takes place in many industries or firms. Mushroom growth indicates a pattern in which only a limited number of industries contribute positively to aggregate growth.[6]

For illustration purposes, Chart 2 shows two examples of Harberger diagrams. For easy comparison, the sum of the industry contributions is the same for both diagrams, implying equal aggregate growth. Diagram A is an example of mushroom-type growth. Not all industries have positive growth, as the downward sloping part of the diagram implies some industries have negative growth. The second diagram is an example of more yeasty, balanced growth. It is closer to the straight diagonal line, so the growth rates of the industries are relatively close to each other and in addition, all industries have positive growth.

Diagrams such as these can be useful to quickly identify how important certain industries are in achieving growth. To compare diagrams of different shapes and with different levels of aggregate growth, Inklaar and Timmer (2007) devised summary statistics of the Harberger diagram. Chart 2 illustrates that the general shape of the diagram can be summarized by three statistics:

6 The analogy with yeast and mushrooms comes from the fact that yeast causes bread to expand slowly and evenly, while mushrooms are scattered and pop up almost overnight, in a fashion that is not easy to predict (Harberger, 1998).

Table 8
Patterns of Market Economy Multifactor Productivity Growth, EU Economies and the United States, 1980-2005

	Aggregate MFP growth (average annual rate of change)		% of industries with positive MFP growth		Relative area under Harberger	
	1980-1995	1995-2005	1980-1995	1995-2005	1980-1995	1995-2005
Austria	1.3	1.1	81	74	0.41	0.53
Belgium	0.7	0.0	63	39	0.61	0.99
Denmark	1.1	0.1	73	53	0.54	0.93
Finland	1.4	2.6	73	91	0.43	0.39
France	1.3	0.8	68	56	0.55	0.58
Germany	0.8	0.3	73	59	0.50	0.81
Italy	0.8	-0.7	65	29	0.62	0.56
Netherlands	0.4	1.0	64	63	0.75	0.53
Spain	0.6	-0.9	63	23	0.71	0.49
Sweden	1.7	1.6	68	59	0.64	0.51
United Kingdom	1.6	0.9	74	78	0.40	0.44
European Union	1.0	0.4	73	59	0.47	0.69
United States	0.7	1.3	61	73	0.63	0.48

Source: Calculations based on EU KLEMS Database, March 2008.

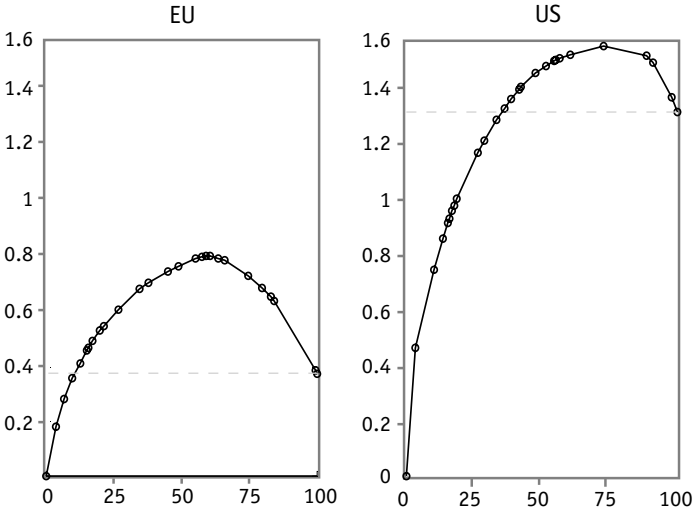
- Aggregate growth, which is the sum of industry contributions,
- the cumulative share of industries with positive contributions, as an indicator of the pervasiveness of growth[7] and
- the curvature as measured by the area between the diagram and the diagonal line (the shaded areas in Chart 2) divided by the total area beneath the diagram. This relative area measure lies between zero and one; it is zero when all industries have equal growth and when industry growth rates start to diverge, the relative area increases to a maximum of one.[8]

In Table 8 we report aggregate multifactor productivity growth, the share of industries with positive multifactor productivity growth and the relative area underneath the Harberger diagram for European countries and the United States before and after 1995. The column with aggregate multifactor productivity growth shows a familiar picture of a decline in multifactor productivity growth in most European countries and an increase in the United States. What is novel is that in almost all cases the decline in aggregate multifactor productivity growth coincides with an increase in the number of industries showing declines in multifactor productivity growth. To illustrate: before 1995, almost three quarters of the industries in Europe had positive multifactor productivity growth while after 1995 this share had dropped below 60 per cent. Furthermore, the relative area statistic increased from 0.47 to 0.69, implying that growth had become more concentrated among a few industries, i.e. had become more mushroom-like. Multifactor productivity growth in the United States is marked by the reverse pat-

7 Harberger (1998) stresses the importance of the share of industries that together make up aggregate growth. In other words, he focuses on the crossing of the aggregate growth line in Chart 2. We feel that a split between industries with positive growth and with negative growth is a more natural distinction.

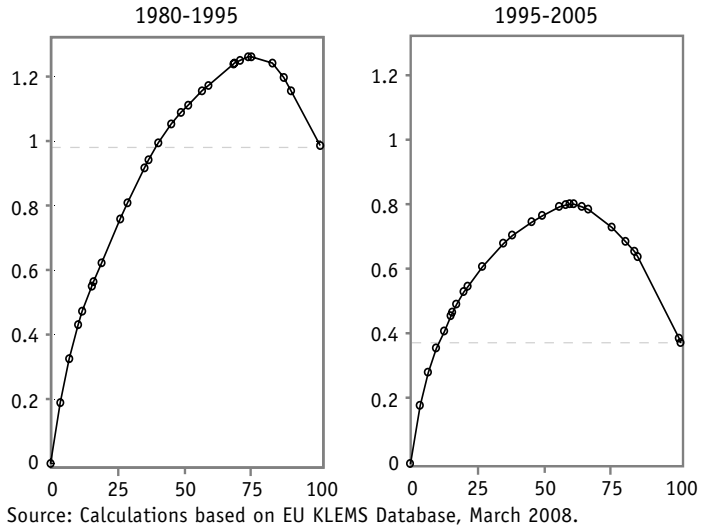
8 In practice, the diagrams are not smooth as in Chart 2, as we have a discrete number of industries. Instead, they consist of piecewise linear plots. This means that the area underneath the diagram can be calculated as the sum of triangles and squares.

Chart 3
Harberger Diagrams of Market Economy Multifactor Productivity Growth in Europe and United States, 1995-2005
(per cent)



Source: Calculations based on EU KLEMS Database, March 2008.

Chart 4
Harberger Diagrams of Market Economy Multifactor Productivity Growth in Europe, 1980-1995 and 1995-2005
(per cent)



Source: Calculations based on EU KLEMS Database, March 2008.

tern: increasing aggregate growth, a larger share of industries with positive multifactor productivity growth and a more yeast-like pattern as evidenced by the decline in relative area. However, this is not a uniform relationship. For instance, in Spain multifactor productivity growth declined (and even became negative), but the relative area declined as well, implying a broad-based decline. Multifactor productivity growth in Belgium after 1995 also stands out: while aggregate growth is zero, almost 40 per cent of industries had positive multifactor productivity growth. This is also an illustration of extremely mushroom-like growth as the relative area is 1.

Chart 3 shows the multifactor productivity Harberger diagrams for the period 1995-2005 for Europe and the United States. European growth is characterised by a mix of industries contributing positively and negatively to aggregate growth. In the United States, the multifactor productivity growth process is clearly more yeast-like with only a few industries showing negative growth and the positive contributions adding up to almost 1.6 per cent. These diagrams therefore suggest that the growth gap between Europe and the United States is broad-based: numerous industries show positive growth in the United States and negative growth in Europe. The alternative would have been a more mushroom-like pattern, for instance if the growth gap could have been fully attributed to a larger contribution from a limited set of industries like ICT production and retail trade.

Chart 4 shows the pattern of the European multifactor productivity slowdown after 1995 in Harberger diagrams for both periods. A common factor in both periods is the large negative contribution from business services (the rightmost industry in the diagram in both periods). However, for the 1980-1995 period, the contribution was smaller since the average value added share of business services was only 10 per cent rather than the 15 per cent for 1995-2005. In addition, the 1995-2005 period shows considerably more industries with multifactor productivity declines. These declines show up in some

manufacturing industries but also in construction and motor vehicle trade. In contrast, in some industries growth held up well, such as in ICT manufacturing, telecommunication services and utilities. The result of this is a more mushroom-like multifactor productivity growth process.

The Future of European Productivity Growth

Since the mid-1990s, the European Union has experienced a slowdown in productivity growth, at a time when productivity growth in the United States accelerated significantly. The resurgence of productivity growth in the United States appears to have been a combination of high levels of investment in rapidly progressing information and communications technology in the second half of the 1990s, followed by rapid productivity growth in the market services sector of the economy in the first half of the 2000s. Conversely, the productivity slowdown in European countries is largely the result of slower multifactor productivity growth in market services, particularly in trade, finance, and business services.

European economies therefore face major challenges if they are to increase economic performance and living standards through productivity growth. One negative factor is the projected slowdown in labour growth during the 2010–2020 period, which is the result of the rapid ageing of the population and limited attraction for skilled immigration. This calls for an even larger emphasis on productivity, meaning that Europe needs to find mechanisms to exploit innovations to achieve greater multifactor productivity growth, especially in services. Unfortunately, the traditional catch–up and convergence model of the 1950s and 1960s may not help Europe get back on track. Because Europe had reached the productivity frontier by the mid-1990s, it now may require a new model of innovation and technological change to make better use of a country's own innovative capabilities (Acemoglu, Aghion, and Zilibotti, 2006). Arguably innovations in services are more difficult to imitate than 'hard' technologies based in manufacturing. The greater emphasis on human resources, organizational change, and other intangible investments are strongly specific to individual firms. Moreover, the firm receives most of the benefits of such changes, which reduces the legitimization for government support such as research and development and innovation subsidies to support 'technology' transfer in services. Service activities also tend to be less standardized and more customized than manufacturing production; they depend strongly on the interaction with the consumer and are therefore more embedded in national and cultural institutions. In this situation, the spillover of technologies across firms and nations becomes much more difficult. Recent work by Bloom and Van Reenen (2007) links corporate management practices to productivity. They find significant cross–country differences in corporate management practice, with U.S. firms being better managed than European firms on average, as well as significant within–country differences as firm distributions have a long tail of badly managed firms. In other words, a simple 'copying' of practices from other countries—or even from other firms within the same country—is not the most likely way for European service companies to attain greater productivity growth.

Second, a more flexible approach towards labour, product, and capital markets in Europe would allow resources to flow to their most productive uses. Crafts (2006) discusses the increasing evidence that restrictive product market regulations, in particular those limiting new entry, hinder technology transfer and have a negative impact on productivity, although most studies relate only to manufacturing industries.

The diversity in productivity growth across European countries shows that some countries have been addressing these issues relatively successfully, while others have not. Even though most European countries have begun to make changes to institutional arrangements that increase flexibility and competitiveness in labour and product markets, such changes vary greatly across countries. The changes that have occurred depend, for example, on the size and maturity of the industry, the industry concentration, the nature of the education system, the availability of capital for startups, the sophistication of the consumer, and the characteristics of the legislative framework. More research is needed to understand the determinants of the differences in country experiences regarding innovation and regulations, in particular in services industries.

Finally, many service industries in Europe could benefit from a truly single market across Europe, in which competition can be strengthened and scale advantages may be realized. Of course, the European 'single market' program has since the 1980s aimed at removing the barriers to free movement of capital, labour, and goods, but the effect on the services industry is generally seen as limited. The present drive in Europe towards a greater openness of service product markets across the European Union, may hold the potential to increase productivity growth across Europe in the coming decade.

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