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Economic growth in the US and the EU: A sectoral decomposition

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ABSTRACT

Drawing on the OECD's structural analysis (STAN) database, this paper contributes to the understanding of European economic growth through a decomposition into employment and productivity, across sectors, and across different time periods and countries. The US productivity surge from the mid-1990s continued for years after the bursting of the dot-com bubble. In the meantime, the EU-15's relative productivity stagnation continued. The sectoral perspective helps us better understand this divergence. While manufacturing remains disproportionately important for aggregate productivity growth, the market services sector, given its size, accounts for the bulk of differences across countries, also within the EU. Market services differ from manufacturing in terms of the nature of innovation and other drivers of growth. This calls for sector-specific analysis when designing growth policy in Europe.

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Economic growth in the US and the EU: a sectoral decomposition

1. Introduction

Europe has good reasons to be concerned about its long-term growth performance. Demographic trends point to an inexorable slowdown in the contribution of employment to growth in coming years and decades. This makes labour productivity (*i.e.* output per hour worked) the only plausible source of high and sustainable economic growth in coming decades. Unfortunately, Europe has so far largely failed to create the conditions needed to foster such economic dynamism.

Following an era of high labour productivity growth and income convergence *vis-à-vis* the US in the 1950s and 1960s, Europe experienced a slowdown in growth from the mid-1970s onwards. The causes for this slowdown are complex and not entirely well understood. The US suffered from a similar slowdown, which led observers at the time to interpret it as a largely exogenous phenomenon, impervious to economic policy. From the mid-1990s onwards however, the US economy has experienced an impressive rebound in terms of productivity growth, sustained well into the last decade, despite its already high level of productivity and incomes. When large portions of the European economy failed to replicate this economic rejuvenation, the growth-impeding features of its economic policies and institutions attracted growing attention from researchers, international institutions and policymakers. The most prominent examples include the EU's own "Lisbon Strategy", launched in 2000¹, and the unwavering promotion of more growth-friendly policies and institutions by international organisations such as the OECD.

The empirical literature has made important progress in understanding the drivers of productivity growth and the paper will refer to key milestones in the empirical literature where appropriate. The main focus of this paper is to present key facts and figures on the sectoral distribution of growth in value added, employment and productivity across countries, thereby shedding light on the nature of the growth gap between the EU and the US, as well as that between individual EU Member States.

The sectoral perspective of growth is illuminating. The fact that sectors are so fundamentally different has important implications for aggregate economic growth. Output growth in different industries is propelled to varying degrees by growth in employment and labour productivity. As a result, changes in an economy's sectoral composition have a direct bearing on the composition of aggregate economic growth. It directly follows from this structural diversity that the underlying drivers of growth differ markedly across sectors. Many researchers have thus come to conclude that growth is more effectively studied at an industry rather than economy-wide level.

Particular emphasis is put on the more recent period, comparing the past decade with the 1990s. Key questions addressed here include whether the relative out-performance of the US in the 1990s has been sustained; what is the relative importance of different sectors in propelling aggregate productivity growth and in accounting for the US/EU productivity growth gap; and which sectors account for most of the sluggishness in aggregate productivity growth in individual EU countries? Another key dimension addressed in the paper is the comparison of growth between the EU-15 and the new member states (NMS). Unlike many recent productivity studies, this paper does not assess productivity growth in complete isolation from employment trends, but instead acknowledges that the two are interdependent. Since the focus is on long-term growth trends, the exceptional period after 2008 is looked at separately.



Kristian Uppenberg

¹ Lisbon European Council, 23 and 24 March 2000.

The data source used is the OECD Structural Analysis (STAN) database. The main advantage of this database is that it is continuously updated. A drawback, however, is that data on hours worked are incomplete. In this paper, labour productivity is therefore calculated on the basis of total employment instead of hours worked. This introduces a distortion to our labour productivity proxy, incurred by changes in hours worked per employee. In level terms, this wedge is quite substantial. In growth terms, however (which is what we look at here), the wedge is sufficiently small – especially in recent years – not to pose a threat to our qualitative observations and conclusions.

The paper focuses exclusively on the sectoral distribution of value added, employment and labour productivity. It does not dig deeper into the underlying decomposition of productivity growth between capital deepening, labour quality and multifactor productivity. These issues are covered by other contributions to this volume of the EIB Papers.

2. The sectoral composition of advanced economies

Different industries often have unique structural characteristics, which affect how they grow.

The mechanisms that propel aggregate productivity growth are complex and the empirical investigation into this issue is a lively field of economic research, as other papers in this volume of the EIB Papers illustrate. One conclusion that has emerged from the growth literature is that the mechanics of productivity growth differ markedly across sectors. Different industries often have unique structural characteristics, relying to different degrees on economies of scale, on fixed and human capital, and on technological and non-technological innovation. They are also exposed differently to foreign and domestic competition, and to domestic regulation.

Before we look at growth at the sectoral level, an important *caveat* needs to be mentioned. The growth literature has shown that aggregate productivity growth is the predominant driver of incomes at the national level. Hence striving for high productivity growth at the national level becomes almost synonymous with boosting per-capita incomes. It could be tempting to take this relationship to hold also at the sectoral level and to conclude that countries should specialise in activities with high productivity growth. This is, however, a fallacy. The link between sectoral productivity growth and aggregate income and welfare is weakened by relative price movements and shifts in demand between product groups. To illustrate this point: If we assume that the production of flat-screen television sets is associated with very high productivity growth, would a country be better off specialising in producing these? Probably not, for two reasons. First, the consumption basket of the average household contains a wide range of goods and services, many of which are not tradeable, e.g. health care and education. Hence these would need to be produced locally, or consumer welfare would suffer from their absence. Second, relative price changes across different types of products and services insert a wedge between real growth and incomes. If productivity gains are offset by falling relative prices, then high productivity growth does not translate into high purchasing power in terms of the goods and services that the workers and capital owners of the flat screen industry can buy. The argument extends to international trade, as shrinking terms of trade can undermine the purchasing power of producers of high-productivity growth manufactures.

Before proceeding to look at the composition of growth across sectors, this section sets the stage by looking at the broad sectoral evolution of the EU and US economies. Observing the relative size of major sectors – as measured by employment – helps us understand their importance in the context of GDP growth. All other things being equal, large sectors contribute more to aggregate growth than small ones. Changes over time in the sectoral distribution of employment have accompanied the evolution of economic activity throughout history. This evolution is characterised first by a shift from the primary sectors (agriculture and mining) to manufacturing. At a later stage, the manufacturing

sector's share in aggregate employment gives way to an expansion of services. This evolution is propelled by two factors. The most important is that the income elasticity of demand differs across different types of products. As incomes rise, at first, a growing share of national income is devoted to manufactured goods and then to services. A second key factor behind these shifts is higher productivity growth in primary sectors and manufacturing, which reduces the resources devoted to them relative to services, where productivity growth has traditionally been lower.

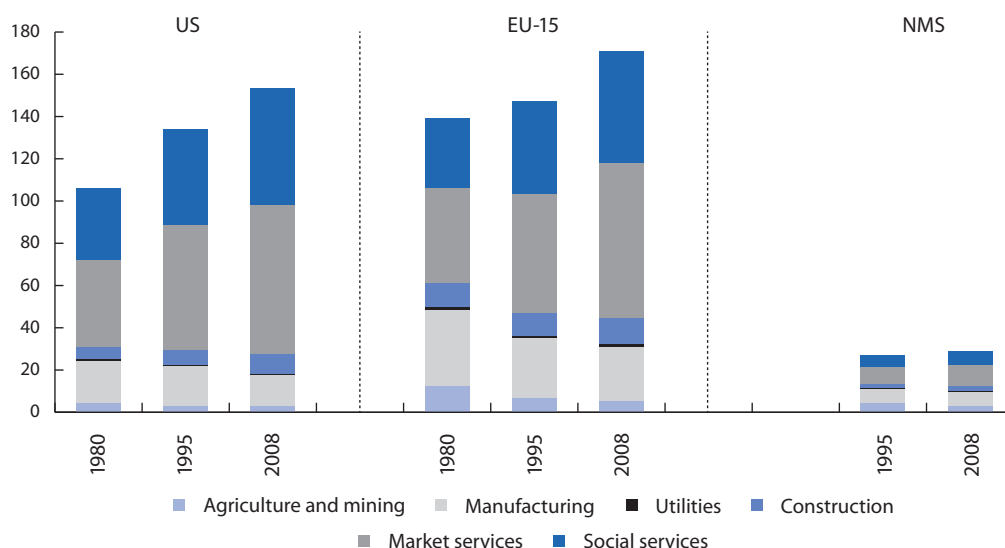
This evolution is illustrated in Figure 1, showing the expansion and distribution of employment across sectors. For simplicity, we have merged sectors into six broad sectors: Social services, market services, construction, manufacturing, utilities, and agriculture and mining.²

Both in the US and in the EU-15, expansion of service sector employment has more than offset contraction in other sectors, with positive employment growth for the economy as a whole. Over time, services have come to completely dominate employment. Social and market services together accounted for 82 percent of employment in the US in 2008, against 74 percent in the EU-15³ and 57 percent in the NMS.

Both in the US and the EU-15, expansion of service sector employment has more than offset employment contraction in other sectors.

The mirror reflection of the rising share of services is the ever-smaller employment share of manufacturing. At 10 percent in the US in 2007, the employment share of manufacturing was only half of what it was in 1980. In the EU-15 it fell from 26 percent to 15 percent in the same time span. The new member states are the notable exception with a still relatively large 23 percent manufacturing employment share. While the employment share of services – and especially of market services – has increased in the NMS, this has occurred more at the expense of primary sectors than of manufacturing.

Figure 1. Employment by sector (millions)



Source: OECD STAN Database

Notes: EU-15 includes Austria, Belgium, Finland, France, Germany, the Netherlands, Spain, Sweden and the UK. It excludes Ireland, Luxembourg, Portugal and Greece for data availability reasons. NMS includes Poland, the Czech Republic, Hungary, Slovakia, Slovenia and Estonia. It excludes Cyprus, Latvia, Lithuania and Malta for data availability reasons.

² See Annex 1 for a description of the OECD data and the way sectors have been merged.

³ The EU-15 is in this study represented by all EU-15 countries except for Ireland, Luxembourg, Portugal and Greece, which have been excluded for data availability reasons. The NMS are represented by Poland, the Czech Republic, Hungary, Slovakia, Slovenia and Estonia.

In line with the shift towards services in aggregate employment and output, global rankings of leading firms, such as the Fortune 500, now contain more service companies than in previous decades. A *caveat* is needed here, however. The distinction between manufacturing and service sectors is less clear-cut today than it was in the past. In some cases, traditional manufacturing firms have transformed themselves into predominantly service-providing companies. One prominent example is IBM, which now considers itself primarily a service business, although it still makes computers. The production of physical goods has become secondary to firms that instead focus on the provision of “business solutions”. This transformation of manufacturing firms into service providers is part of a shift in the comparative advantage of advanced economies. As China and other lower cost producers move up the value-added chain in manufacturing, straight goods production has fallen under intense cost pressure. Many manufactured goods, for instance consumer electronics, have become commoditised. High-income countries have lost competitiveness in such manufacturing. They have been able to stay competitive in part by shifting towards providing business solutions rather than just selling products, as the price elasticity of demand is lower for business solutions than for hardware. This shift has been accompanied by a shift towards subscription pricing. Rather than receiving a single payment for a piece of manufactured equipment, many manufacturers are now receiving a revenue stream for ongoing contracts, which include a non-negligible service component. The management literature refers to this as the “servitisation of products”. For a discussion, see for instance Vandermerwe and Rada (1988).

3. Growth in sectoral labour productivity and employment

3.1 Main concepts

Turning now to the issue of growth and its breakdown between employment and labour productivity, we need first to establish the main concepts. The standard definition of labour productivity (λ) is how much output (Y) is generated per unit of labour – in our case employment (L):

$$\lambda(t) = Y(t) / L(t) \tag{1}$$

This we easily turn inside out by expressing output as the product of employment and labour productivity:

$$Y(t) = L(t) \cdot \lambda(t) \tag{2}$$

Output growth is the sum of growth in employment and growth in labour productivity.

This expression simply shows that output is the result of the number of employees times the output that each employee generates on average. Taking logs and exploiting the fact that the difference in the log of a variable from one period to the next is a close approximation to the growth rate, we get

$$\hat{Y}(t) \approx \hat{L}(t) + \hat{\lambda}(t) \tag{3}$$

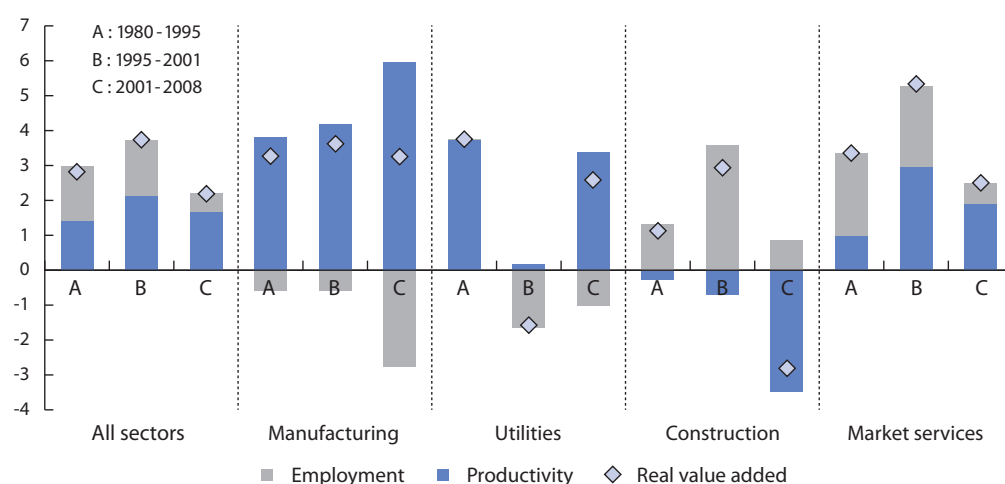
where a hat denotes the year-on-year rate of change in output, employment and labour productivity, respectively. This relationship also holds true at the sectoral level, with a minor semantic difference. Gross Domestic Product (GDP) is the sum of Value Added (VA) across all sectors. VA is thus the sector equivalent of GDP.

On this basis, the figures below show the decomposition of real VA growth between employment and labour productivity. Note that we have chosen not to cover primary sectors and social services in this paper, since these are not central in the context of innovation and aggregate productivity.

3.2 A sectoral decomposition of growth in the US and the EU-15

The US is a natural place to start in its role as a benchmark against which Europe's growth performance is typically measured. The sample is split into three time periods: 1980-1995; 1995-2001; and 2001-2008. The aim is to understand longer-term growth patterns, not short-term cyclical swings. This is achieved by avoiding cut-off years which are at extreme cyclical peaks or troughs, and by including a sufficient number of years in each sub-period. The 1995 break-point has been chosen in part because the mid-1990s is generally viewed as the time when US productivity was rejuvenated. Splitting the post-1995 period in two along the middle allows us to address the question of whether the US productivity boom of the late-1990s – the “New Economy” – has been sustained after the bursting of the dot-com bubble in 2001. As regards the EU, this split also allows for the crucial comparison of growth performance between the late-1990s and the 2000s.

Figure 2. Contribution to average annual real value-added growth in the US (percent)

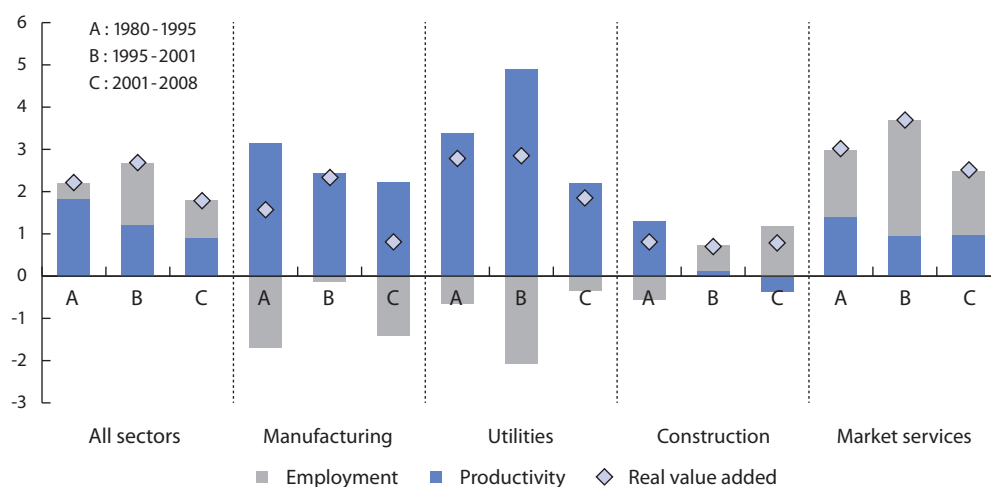


Source: OECD STAN Database

Figure 2 decomposes average growth in real value added into growth in employment and growth in labour productivity, for the economy as a whole and for selected key sectors. Three general observations can be made for the US on the basis of this figure. First, starting with the aggregate economy (“All sectors” is essentially the same as GDP), the US has largely managed to sustain its reinvigorated post-1995 productivity growth after 2001. Employment growth, on the other hand, slowed markedly in the last period. Second, on a sectoral level, the US has achieved a remarkable acceleration in manufacturing productivity growth after 2001. This has been accompanied by accelerated contraction in manufacturing employment, leaving value-added growth largely unchanged. This is consistent with a period of restructuring and streamlining in the wake of the bursting of the dot-com bubble and the ensuing squeeze in corporate profits (see Section 5 below). Third, relatively high productivity growth has also been sustained in market services, accompanied by continued, though sharply decelerated, expansion of employment. Given the large size of this sector, its contribution to aggregate growth has been substantial.

Unlike the EU-15, the US has largely sustained its high productivity growth after 2001, though accompanied by near-stagnant employment.

Figure 3. Contribution to average annual real value-added growth in the EU-15 (percent)



Source: OECD STAN Database

Note: See Figure 1.

The EU-15 economy has been characterised by a long-term decline in labour productivity growth in many sectors.

The EU-15 economy has been characterised by a long-term decline in labour productivity growth, from 1.8 percent per year in the first period, to 1.2 percent in the second, and 0.9 percent in the third period (Figure 3). Some of the aggregate productivity slowdown stems from slower productivity growth within sectors. But especially in the last period, a non-negligible part of the slowdown also stems from the continuing shift in employment from manufacturing (where productivity growth is higher) to market and social services (where it is substantially lower). Total EU-15 employment increased by 26 million between 1995 and 2008. The vast majority of these jobs were in sectors with average (market services) or sub-par (construction) productivity growth. In terms of remedies to this slowdown, substantially higher productivity growth in manufacturing would not be sufficient. The relatively small share of manufacturing in the EU economy means that raising its productivity growth rate by, for instance, 2 percentage points would only raise aggregate productivity growth by 0.3 percentage points (from 0.9 to 1.2 percent growth in the last period). In comparison, if labour productivity growth in market services rose by the same 2 percentage points, (from 1 to 3 percent in the last period), aggregate labour productivity growth would double (from 0.9 percent to 1.8 percent).

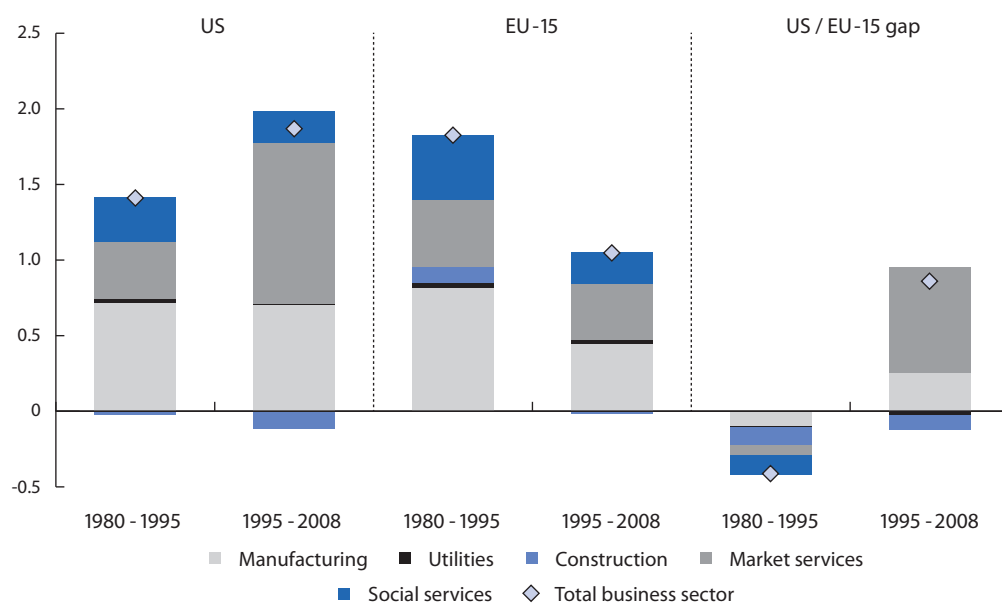
The other sectors shown here – utilities and construction – are relatively small and thus have a marginal impact on the aggregate economy. They are nevertheless of some qualitative interest. Utilities and the network industries included in this aggregate have been subject to far-reaching deregulation in many countries. The 1990s saw a wave of liberalisation and privatisation of utilities and network industries. This led to a period of restructuring visible as a surge in productivity growth and contracting employment. In the EU, this restructuring wave seemed to have reached its peak in the second half of the 1990s. As for construction, this sector has been relatively important for employment in the years before the crisis, in both the US and the EU, while productivity growth has been low or even negative. The pre-crisis building boom should not be extrapolated into the future.

The contribution that each sector makes to aggregate productivity growth can be approximated by the growth rate of each sector times its share in aggregate employment. This is shown for the US and the EU-15 in Figure 4. For simplicity we have merged the last two periods into one (1995-2008).

Several striking observations can be made from this figure. First, as regards the US, the manufacturing sector has made as substantial a contribution to aggregate productivity growth in the second period as in the first. This constancy between the two periods reflects an accelerated pace of productivity growth that has fully offset the fast-shrinking employment share of manufacturing in the economy. Second, the entire US acceleration in labour productivity growth since 1995 is accounted for by market services. This reflects both its growing size and the quickening of productivity growth in market services after 1995.

Market services account for the entire acceleration in US labour productivity growth after 1995.

Figure 4. Sectoral contributions to labour productivity growth (average annual growth rates, percent)



Source: OECD STAN Database
 Note: See Figure 1.

In the EU-15, in contrast, the contribution from manufacturing to aggregate productivity growth was halved between the two periods. In this case, the shrinking employment share of manufacturing was neither offset by faster productivity growth in the sector, nor was the diminished contribution from manufacturing offset by a larger contribution from services. The contribution from market services remained unchanged between the two periods, while that from social services was halved.

Turning finally to the productivity growth gap between the US and the EU-15 (by simply taking the difference between US and EU growth rates in each period), it is noteworthy that the EU still had higher productivity growth than the US in the first period, visible as a negative US-EU growth gap before 1995. The gap was sharply inverted in the second period, with annual US productivity growth in 1995-2008 outrunning that of the EU-15 by nearly a full percentage point. Three-quarters of this second-period gap is accounted for by market services.

To conclude this section, there is widespread agreement in the literature that Europe will not be able to close its productivity growth gap with the US unless it achieves significantly higher labour productivity growth in market services (e.g. Guellec and Pilat 2008). Policies targeting productivity growth primarily via manufacturing may thus have only a limited aggregate effect.

4. Sector composition of growth: cross-country evidence

It is apparent from what we have already seen that sectors differ from each other with respect to the rate and composition of growth, also within countries. These inter-sectoral differences are partly the result of factors specific to each sector, for example: intensity in the use of capital and skilled labour in production; the scope for continuous product and process innovation; the degree of product standardisation; economies of scale; sector-specific regulation; and global demand growth. To the extent that these factors are sector- rather than country-specific, we would expect the growth profile of each sector to display some similarity across countries.

But then there are also factors influencing growth which are country specific, causing sector growth rates to vary across different economies. Such country-specific factors include growth in aggregate domestic demand and incomes, interest rates and exchange rates, and macroeconomic conditions more generally. Other country-specific factors include barriers to trade, domestic competition, regulation of labour and product markets, tax systems, together with financial and other conditions that influence labour supply, fixed and human capital formation, and innovation.

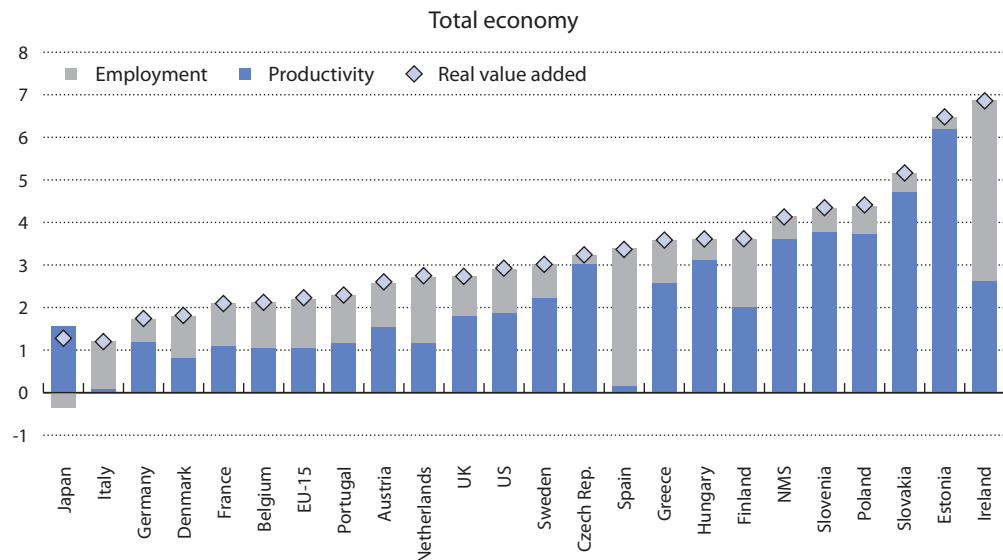
4.1 The composition of value-added growth by sector

The figures below illustrate that there are both similarities and differences in the growth of sectors across countries.

In most fast-growing OECD countries, labour productivity growth is the predominant source of output growth.

Starting with the aggregate economy (**All sectors**, Figure 5), one observation that stands out is that labour productivity growth is the predominant source of value-added growth in most high-growth countries for this period (1995-2008). There are a few notable exceptions. In Spain, productivity growth has been virtually non-existent during this period, offset by very high employment growth. Ireland has enjoyed the EU's highest economic growth rate on the back of a combination of solid productivity and even higher employment growth.

Figure 5. Contribution to average annual real value-added growth (1995-2008, percent)



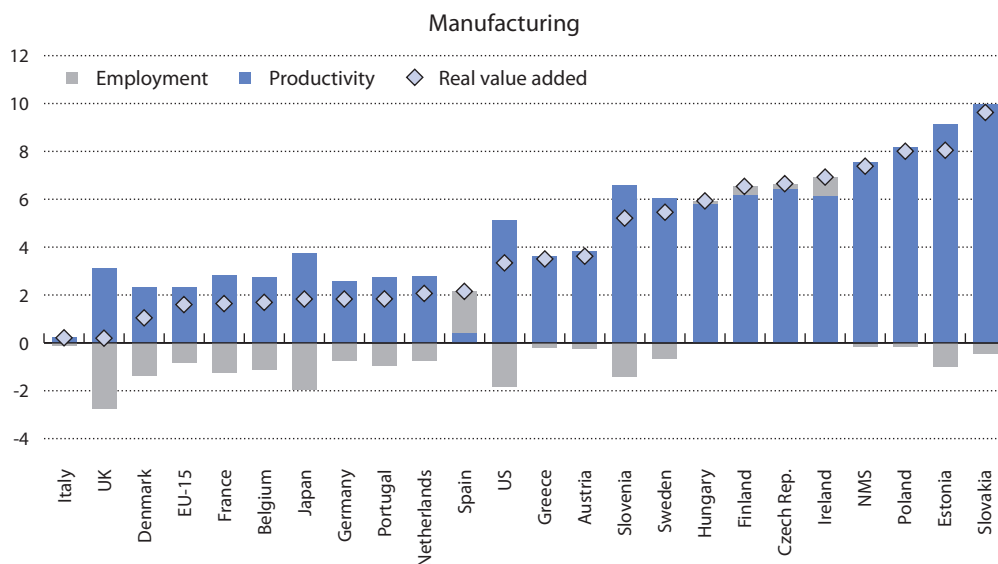
Source: OECD STAN Database

Note: See Figure 1.

Turning to individual sectors, one common pattern in **manufacturing** (Figure 6) is the combination of – oftentimes high – productivity growth and declining employment. For the period 1995-2008, employment growth was positive in only four EU countries: Spain, Finland, the Czech Republic,

and Ireland. Note, however, that there is a negative correlation between productivity growth and the rate of employment contraction. In other words, countries with the highest growth in manufacturing productivity tend to have positive or only slightly negative rates of employment growth.

Figure 6. Contribution to average annual real value-added growth (1995-2008, percent)

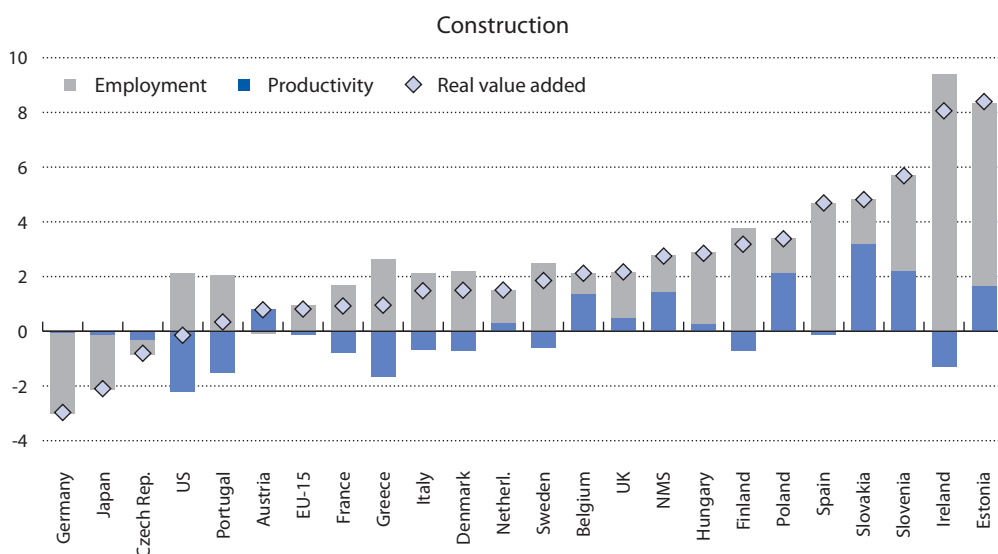


Source: OECD STAN Database
 Note: See Figure 1.

The **construction** sector (Figure 7) differs markedly from manufacturing in that growth has been largely employment-driven. Both the EU-15 and the US had negative productivity growth in construction during this period. However, year-by-year data show that this average stems from a steep decline in output towards the very end of the period. Reflecting very different market conditions across countries (including real estate bubbles in some cases), employment growth has been particularly diverse in this sector.

In both the US and the EU-15, the construction sector differs from manufacturing in that growth has been employment-driven, while productivity growth has been negative.

Figure 7. Contribution to average annual real value-added growth (1995-2008, percent)

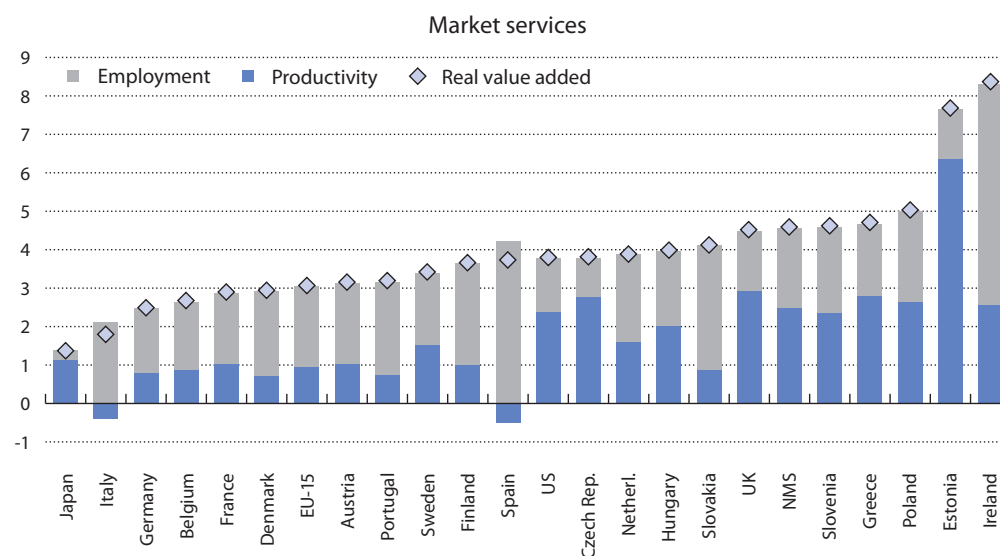


Source: OECD STAN Database
 Note: See Figure 1.

Unlike other sectors, output growth in market services is propelled by a combination of employment and productivity growth.

Market services represent a third type of growth pattern (Figure 8). It is the only sector where both employment growth and productivity growth have been consistently positive. While there is less dispersion across countries than in other sectors, it is possible to distinguish between two groups of countries on the basis of productivity growth. In the high-growth group we find, alongside the US, a small number of EU-15 countries: the Netherlands, the UK, Greece and Ireland. Among the NMS included here, only Slovakia did not enjoy high productivity growth. Because of the large size of this sector, different productivity growth rates in market services account for a very substantial two-thirds of cross-country differences in aggregate productivity growth in the EU.

Figure 8. Contribution to average annual real value-added growth (1995-2008, percent)



Source: OECD STAN Database
 Note: See Figure 1.

4.2 Sectoral growth in individual EU-15 countries

Valuable additional observations can be made from snapshots of growth in individual EU-15 countries. Below we therefore provide snapshots of growth on a country-by-country basis. An attempt has been made to group EU-15 countries together according to their sectoral growth patterns. This helps to identify broad growth patterns and may serve as a take-off point for more systematic investigations. We focus here on the two sectors that are the most important for aggregate growth: manufacturing and market services. A more detailed picture of growth, including also the utilities and construction sectors, is provided in the tables in Annex 2.

The EU country whose growth pattern resembles the US the most is the **UK** (Figure 9). Specifically, the UK has experienced similarly high growth in market services, in both employment and productivity. While the manufacturing sector has also achieved reasonably high productivity growth (above the EU-15 average), this has been matched by a steep contraction in employment, resulting in near-stagnant value added after 1995. Overall, the UK has been characterised by a faster-than-average shift in employment away from manufacturing towards market services.

France displays some similarities with the UK. In manufacturing, productivity gains have been largely offset by a decline in employment. In the case of France, the 1995-2008 average hides a noteworthy shift between 1995-2001 and 2001-2008. The first of these sub-periods saw very little contraction

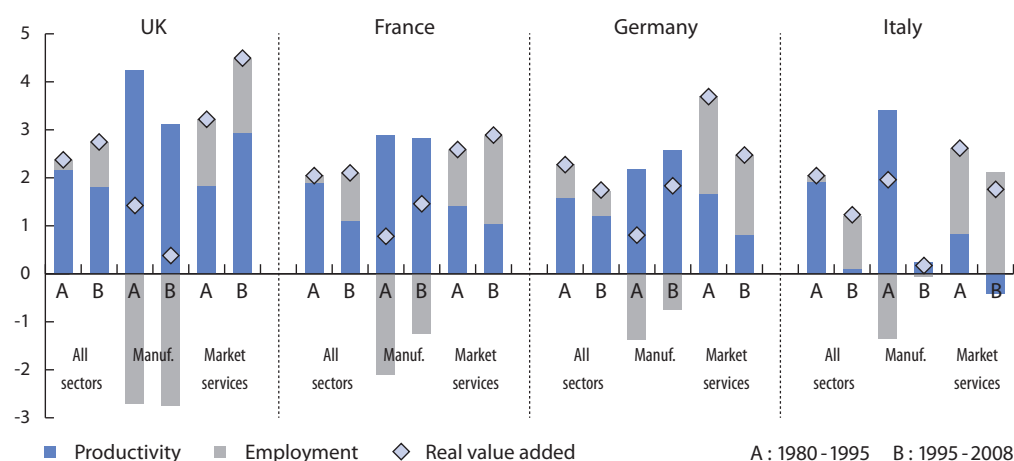
in employment and swift expansion in manufacturing value added. During the second sub-period, employment contracted and value-added growth stagnated (see Annex 2 for details). This suggests a faster pace of restructuring in recent years. In market services, employment expansion was particularly swift in the second half of the 1990s, before moderating in the second half of the 1995-2008 period. Productivity growth in this sector has, however, been substantially lower than in the UK.

Germany suffered from low growth in both output and employment in the years leading up to the financial crisis. Low growth environments tend to be accompanied by low productivity growth (with causality typically going in both directions). Producers struggle to keep their resources fully utilised, while weak growth undermines incentives for productivity-enhancing investments. In manufacturing, value added has expanded at a faster rate than in the UK and France, though still only half that of the US. Manufacturing productivity growth has been lower than in the UK, as has the rate of employment contraction. Similar to other countries, positive employment growth has, in Germany, been concentrated to market services, though it was slowing in the second half of the 1995-2008 period. An important source of Germany's rather moderate aggregate productivity growth after 1995 has been the very low rate of productivity growth in its market services, which stands in notable contrast to that in the US and the UK.

Italy stands out among the large EU-15 economies in its particularly weak growth performance since 1995, dominated by labour productivity for the economy as a whole grinding to a halt. The absence of labour productivity growth in manufacturing is particularly striking in an international context. This has been mirrored by an equally unique absence of decline in manufacturing employment. With negative productivity growth in market services during this period, Italy's weak productivity performance has been remarkably broad-based on a sectoral level.

Germany has enjoyed high manufacturing growth after 1995, while in other large EU countries growth has been propelled relatively more by market services.

Figure 9. Contribution to average annual real value-added growth (percent)

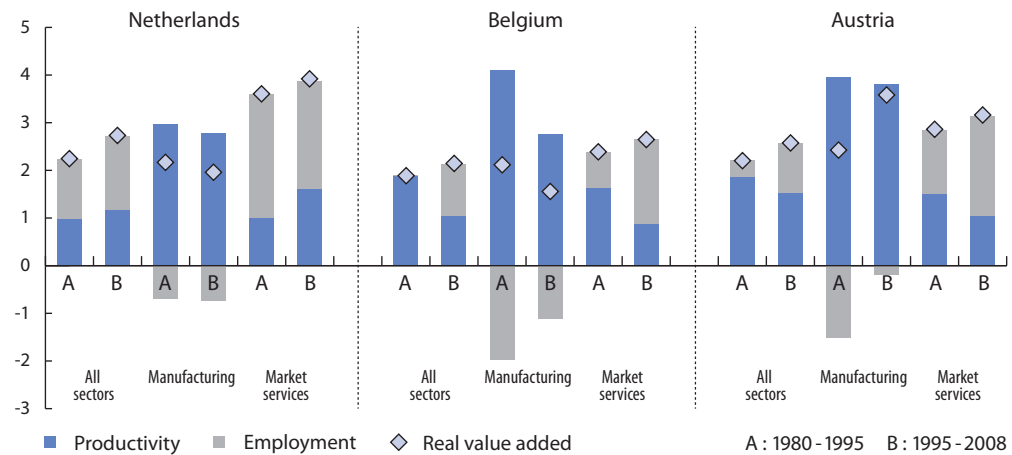


Source: OECD STAN Database

Turning now to three smaller continental EU economies (Figure 10), growth in **the Netherlands** resembles that in the UK and France. Relatively strong growth has been propelled by a combination of employment and productivity. Manufacturing value added has continued to expand, combining above-EU-15-average productivity growth with declining employment. In the market services sector, relatively solid productivity gains have been combined with strong growth in employment. Similar to the UK, the Netherlands has thus experienced a relatively swift transition towards an increasingly service-based economy.

Growth in **Austria** and **Belgium** has been broadly similar to that in the Netherlands, but there are a few notable differences. Aggregate growth has been relatively strong in Austria but less so in Belgium. Growth has typically relied, to a somewhat lesser extent than in the UK or the Netherlands, on productivity gains in the market services sector, while employment gains in this sector have been substantial after 1995.

Figure 10. Contribution to average annual real value-added growth (percent)

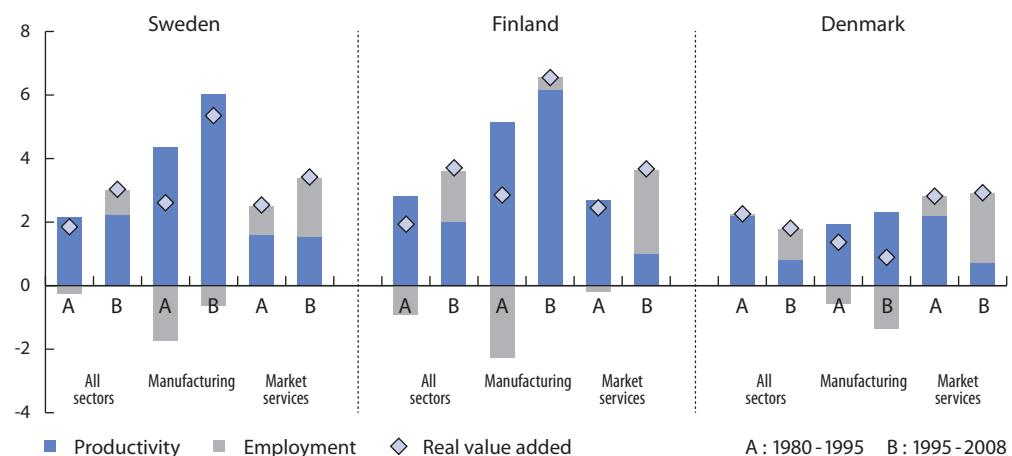


Source: OECD STAN Database

Sweden and Finland are characterised by exceptionally high growth in manufacturing output and productivity.

Growth in the two largest Nordic EU countries, **Sweden** and **Finland** has been more similar to that in Belgium and Austria than to the Netherlands. Aggregate growth in productivity and value added has been relatively high, though propelled to a much greater extent than elsewhere by the manufacturing sector. It has also relied less on productivity gains in the market services sector (although in Sweden there was an acceleration in market services productivity growth after 2001 – see Annex 2). Growth in market services has primarily centred on employment. The large role of manufacturing in economic growth and productivity growth in Sweden and Finland is somewhat unique to these countries. Given the small size and open character of these economies, it is unlikely that similar manufacturing-based growth could be implemented in the larger EU economies.

Figure 11. Contribution to average annual real value-added growth (percent)



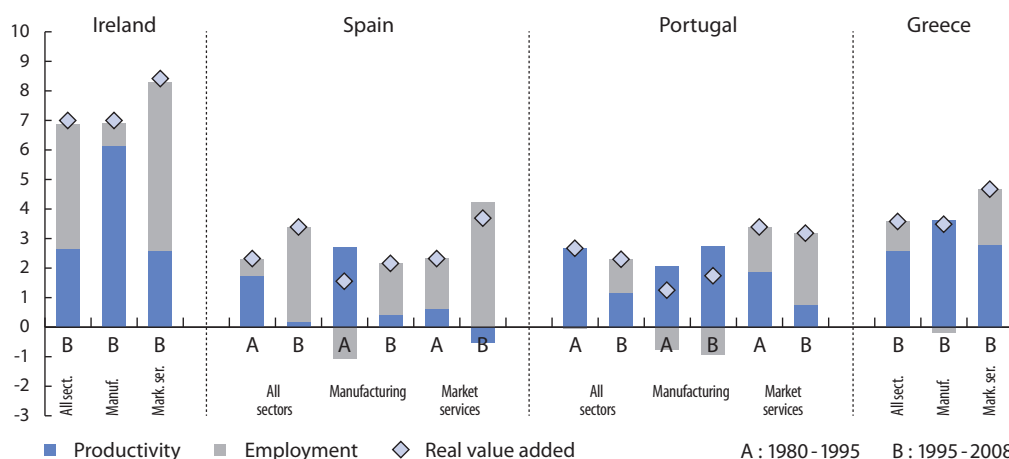
Source: OECD STAN Database

While similar in terms of its size and openness, **Denmark** differs from the aforementioned two groups of small countries in several ways. First, aggregate economic growth has been relatively weak in recent years (and weaker in the second half of the 1995-2008 period than in the first). Aggregate productivity growth has also been low, driven by a sharp slowdown in market services productivity growth after 1995. The manufacturing sector has been able to sustain its productivity growth, but manufacturing output growth has fallen as the pace of employment decline has quickened, especially after 2001 (see Annex 2).

The last group of EU-15 countries consists of Ireland, Spain, Portugal and Greece (Figure 12). These were once referred to as the “EU cohesion countries” in the context of EU financial support, which aimed at facilitating their speedy economic convergence towards the rest of the EU. This group of countries, however, defies easy generalisations as to their economic growth. Aggregate value-added growth has been relatively high up to the financial crisis (with the exception of Portugal, where growth fizzled already a decade ago).

The sectoral drivers of economic growth differ across countries. **Ireland's** sectoral growth patterns have shifted over the course of the last few years. On average for the 1995-2008 period, value-added growth has been evenly distributed between manufacturing and market services. If one splits this period down the middle, however, there has been a non-negligible slowdown in growth after 2001 mainly in the manufacturing sector. Along with construction, market services have accounted for a larger share of growth during these later years. Positive employment growth in manufacturing in the second half of the 1990s also turned negative in the years after 2001 (see Annex 2 for details).

Figure 12. Contribution to average annual real value-added growth (percent)



Aggregate productivity growth has been particularly low in Spain and Portugal.

Source: OECD STAN Database

Note: Period B refers to 1995-2007 for Ireland and to 1995-2006 for Portugal.

In **Spain**, growth has been even more centred on construction (see Annex 2) and market services, though only in terms of employment, not productivity. A wave of high employment-driven output growth occurred in manufacturing in the-1990s, but fizzled after 2001. Productivity growth has been consistently feeble in manufacturing after 1995, and negative in market services.

Portugal shares with Spain a sectorally near universal underperformance in terms of productivity growth. This is particularly the case in market services. The main difference between the two is that

Spain massively expanded its employment, whereas Portugal did not. In Portugal, as we saw earlier for Germany and Italy, weak growth in productivity and value added have accompanied each other in the past decade.

Greece, finally, appeared to be performing strongly in the years leading up to the financial crisis. Three-quarters of its output growth in the past decade took the form of labour productivity. Growth has also been broad-based, including high productivity growth in both manufacturing and market services. In retrospect, Greece serves as a good example of the inherent difficulty of distinguishing between transitory and permanent growth, also with respect to productivity.

4.3 Sectoral growth in the new member states

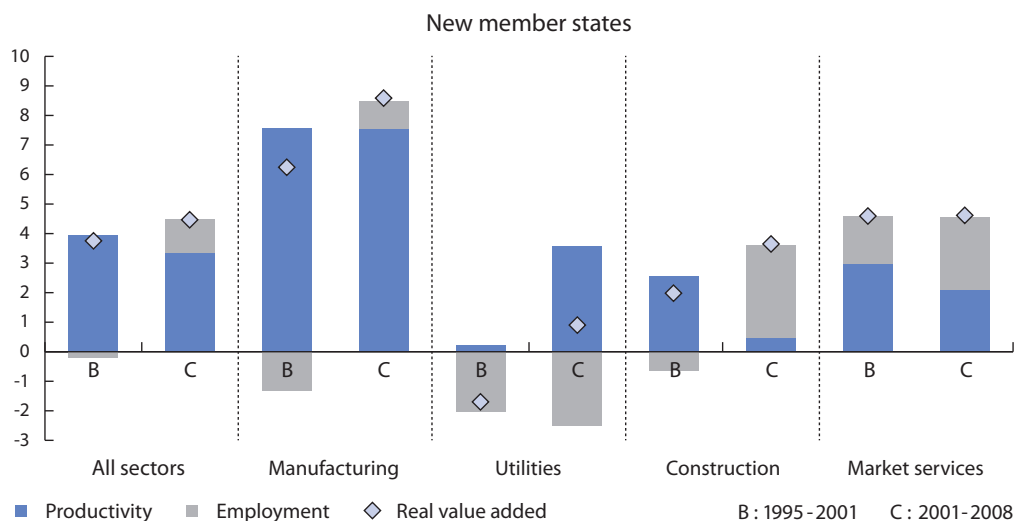
The new member states remain different from most EU-15 countries, having retained an economic structure less characterised by deindustrialisation.

There are several reasons why the new member states (NMS) are preferably assessed separately from the EU-15. The NMS remain different from the bulk of EU-15 countries in some key respects. Their economic structure is still relatively less characterised by the full onslaught of “deindustrialisation”. As we showed earlier, in Figures 1 and 2, the share of manufacturing in aggregate employment in the NMS is notably larger than in the EU-15, and its rate of decline is also slower. There is also a case for arguing that the process of productivity growth in the NMS still differs fundamentally from that in the US and many EU-15 countries. The NMS have retained some distance from the global productivity frontier, which means that productivity growth may to a greater extent be propelled by convergence and the adoption of best practice, for instance through foreign direct investment (FDI), rather than by home-grown innovation. Finally, treating the NMS separately is necessary in order to look at EU growth in a longer-term perspective. For the NMS, OECD data on employment and value added are only available from the mid-1990s onwards. This sub-section therefore concentrates on the two time periods 1995-2001 and 2001-2008.

The OECD STAN data set contains six countries from this region: Poland, Hungary, the Czech Republic, Slovakia, Slovenia and Estonia. A GDP-weighted growth average of this group is shown in Figure 13 below. Several observations can be made from this snapshot. Since 1995, the NMS have consistently had higher value-added growth than the EU-15. The bulk of this expansion stems from productivity rather than employment, although the latter did pick up in the last period. Also noteworthy is that high growth in productivity has been sustained across the two sub-periods. In stark contrast to the EU-15, the manufacturing sector has been a powerhouse for the region. Manufacturing value added has expanded at a rate 10 times higher than in the EU-15 in the period after 2001. This is suggestive of the NMS increasingly being turned into the “manufacturing hub” of the EU-27. Productivity growth in manufacturing has been particularly impressive, averaging around 7.5 percent in both periods. While employment has played a lesser role in the growth of manufacturing, it did not contract after 2001.

In addition to manufacturing, the NMS have also enjoyed a strong expansion in market services, on the basis of both productivity gains and employment. Productivity growth in this sector (as in manufacturing) may in part reflect continued efficiency gains from adopting best practice and addressing past structural impediments. Having entered the transition process with substantial inefficiencies in place, for a while at least, such productivity gains may have been more easily achieved than in the EU-15. At the same time, there has been great scope for expanding the size of this underdeveloped sector. In the NMS, as in the US and in the EU-15, market services have thus accounted for the bulk of new jobs created. As this process continues, the NMS should, over time, adopt an economic structure that is increasingly similar to that of the EU-15.

Figure 13. Contribution to average annual real value-added growth (percent)

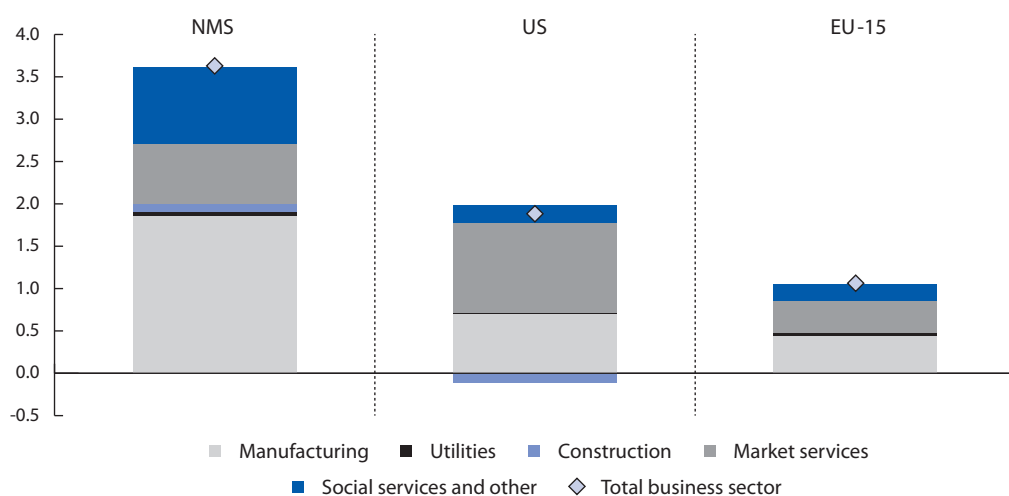


Source: OECD STAN Database
Note: See Figure 1.

A different way to illustrate sectoral productivity is to calculate each sector's contribution to aggregate productivity growth, using employment weights (as was done in Figure 4 above). As shown in Figure 14, in this respect the NMS differ from both the US and the EU-15. The NMS have experienced substantially higher aggregate productivity growth from 1995 to 2008 than either the US or the EU-15. Manufacturing accounts for a larger share (51 percent) of aggregate productivity growth than in either the EU (43 percent) or in the US (37 percent). This is the combined result of the NMS' higher manufacturing employment shares and higher productivity growth in manufacturing than in other sectors. The mirror reflection of this is that the relative importance of market services is smaller in the NMS (19 percent of total productivity growth) than in the EU-15 (35 percent) and the US (57 percent). This comparison across the three economic regions illustrates the importance of economic structure, in addition to sectoral productivity, for aggregate growth.

The new member states have had substantially higher productivity growth than either the US or the EU-15, with manufacturing playing a bigger role.

Figure 14. Sectoral contribution to average annual growth in labour productivity (1995-2008, percent)



Source: OECD STAN Database

We now turn to the individual countries. Inevitably, the GDP-weighted average for the NMS is heavily influenced by **Poland**, which accounts for 50 percent of the NMS-6 GDP at purchasing power parity. Poland's strong growth performance in recent years clearly influences the regional average, even though the NMS group also contains several other strong performers (Figure 15). Poland already achieved high growth in value added and productivity in the 1990s and has managed to sustain this in the past decade. Manufacturing growth has been consistently strong, reinforced in the second period by employment gains on top of high productivity growth. In contrast, productivity growth in market services has slowed down in the second period, with the sector's growth profile shifting towards employment.

The Czech Republic and Slovakia experienced relatively weak growth in the 1990s. Towards the end of the decade, however, an accelerated liberalisation process and massive FDI inflows facilitated a rapid economic transformation. This has paid off in the form of higher productivity growth in the period after 2001 and consequently a decent growth performance for the 1995-2008 period as a whole (for a split into sub-periods, see Annex 2). While employment gains have been concentrated in market services, productivity growth in this sector has been mixed – strong and rising in the Czech Republic but subdued in Slovakia.

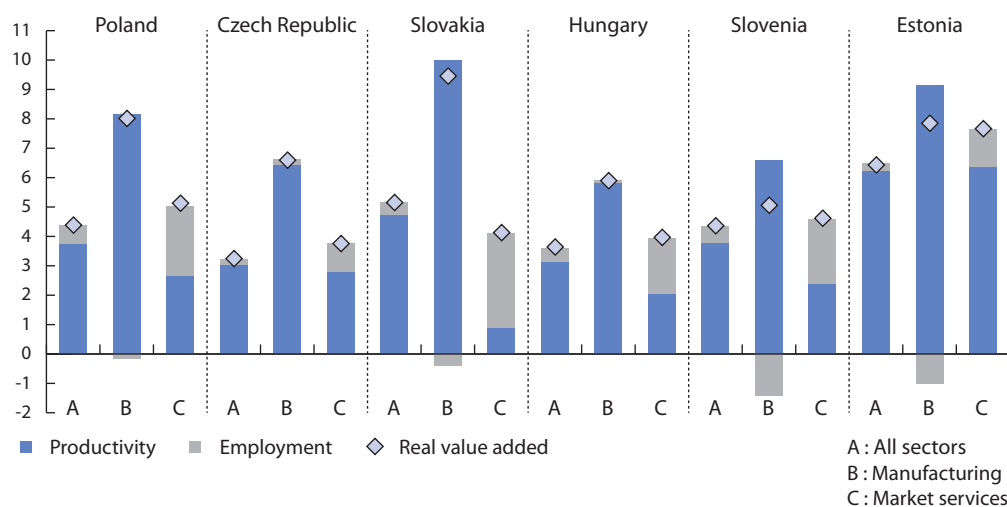
Hungary displays one of the region's weaker growth performances. While not shown in Figure 15, this is particularly visible in the absence of employment gains in the 2000s (see Annex 2). Still, some improvement is visible with respect to productivity growth during this later period, not least in the market services sector.

High productivity growth in the NMS is sectorally broad-based.

Slovenia is broadly similar to Poland in the combination of high productivity-driven growth in manufacturing, and an about equal split of market services growth into employment and productivity.

Estonia, finally, has achieved sustained high growth. In the 1990s, growth was largely productivity-driven. It was augmented by the expansion of employment in the second half of the 1995-2008 period, notably in construction and market services.

Figure 15. Contribution to average annual real value-added growth (1995-2008, percent)



Source: OECD STAN Database

The data presented in Section 4 lend themselves to a few key observations that will inform the analysis going forward. First, the composition of value-added growth between employment and labour productivity is extremely diverse across sectors, in particular between manufacturing and market services. This makes the sectoral perspective indispensable in the study of economic growth. Second, despite continued economic convergence between the NMS and the EU-15, these two country groupings still differ from each other in some important respects. Most notably, while output growth in EU-15 manufacturing has been grinding to a near-halt, with contraction in employment, the NMS have enjoyed very high output growth and employment gains. Third, the market services sector by its sheer size accounts for the bulk of cross-country differences in aggregate productivity growth. Even if the extraordinary productivity boost in US manufacturing in recent years has been impressive, this sector is inevitably becoming too small to drive the bulk of aggregate productivity growth in any advanced economy.

The next two sections zoom in on the two most important sectors in the context of the US/EU productivity gap: manufacturing and market services.

5. Productivity growth in US manufacturing: What's behind the surge?

Despite its relatively small and still-shrinking share in total employment, the manufacturing sector has sustained a non-negligible share of aggregate US productivity growth. As shown earlier, US manufacturing has managed to stage an impressive productivity surge after 2001; one that has been conspicuously absent in the EU-15. Manufacturing accounts for around one-third of the US/EU productivity growth gap since 1995, substantially larger than its share in either economy.

US manufacturing has staged an impressive productivity surge after 2001, largely absent in the EU-15.

A first step towards understanding the underlying mechanics of high productivity growth in the US is to further break this sector down into industry groupings. We have chosen to divide manufacturing into four sub-groups, each of which is large enough to have an impact:

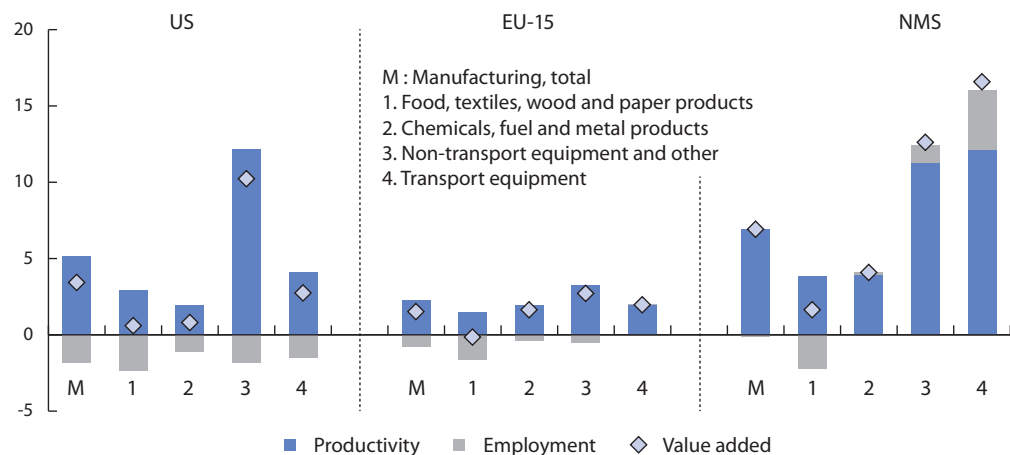
1. Sector 1: Food, textiles, wood and paper products;
2. Sector 2: Chemicals, fuel and metal products;
3. Sector 3: Non-transport equipment and other;
4. Sector 4: Transport equipment.

In both the US and the EU-15, the distribution of employment across these four sub-sectors is roughly as follows: around 30 percent each in Sectors 1-3 and 10 percent in Sector 4. In the NMS, however, the sectoral distribution is somewhat different: Sector 1 accounts for 44 percent of manufacturing employment, Sector 2 for 27 percent, Sector 3 for 23 percent and Sector 4 for only 6 percent.

The first two groups can be described as more traditional industries, where the degree of technical sophistication and innovation is typically lower. In the three economic regions shown here, both value-added growth and productivity growth are lower in Sectors 1 and 2 than in Sectors 3 and 4. Also, at least in Sector 1, the rate of contraction in employment is higher (Figure 16).

Sector 3 is the one with the highest rate of productivity growth in both the US and the EU-15. A major component of this sector is production of information and communication technology (ICT) equipment, which accounts for a non-negligible share of its expansion. Also, this sub-sector has by far the largest US/EU productivity growth gap. Sector 4, finally, is the most dynamic only in the NMS, where it has evolved very differently compared with both the EU-15 and the US.

Figure 16. Contribution to average annual real value-added growth: Manufacturing (1995-2008, percent)



Source: OECD STAN Database

Notes: For EU-15, see Figure 1. NMS includes Hungary, Czech Republic, Slovakia, Slovenia and Estonia. Poland is not included here for data availability reasons.

Figure 17 provides an estimate of the contribution of each sub-sector to aggregate manufacturing productivity growth for the period 1995-2008. What is clear from this figure is that the bulk of the US productivity lead is the result of its exceptionally high productivity growth in Sector 3: non-transport equipment and other. There are, however, substantial differences between the two sub-periods shown. While the large contribution of Sector 3 to US productivity growth has been sustained, a notable increase in the contribution of Sector 1 occurred during 2001-2008. In that period, Sector 1 accounted for roughly one-quarter of the US/EU-15 productivity gap. This sector's growing contribution to productivity growth has in part been propelled by manpower reductions, whereas value added has been stagnant.

Turning to the NMS, finally, the sectoral distribution of manufacturing productivity growth has been notably more broad-based than in the US, even as the aggregate rate of productivity growth has been comparable. This points to continuing efficiency gains throughout the manufacturing sector.

So what are the likely reasons for the strong productivity performance of US manufacturing, and what are the lessons for Europe? To answer these questions, we will draw on a few key observations made in the empirical literature.

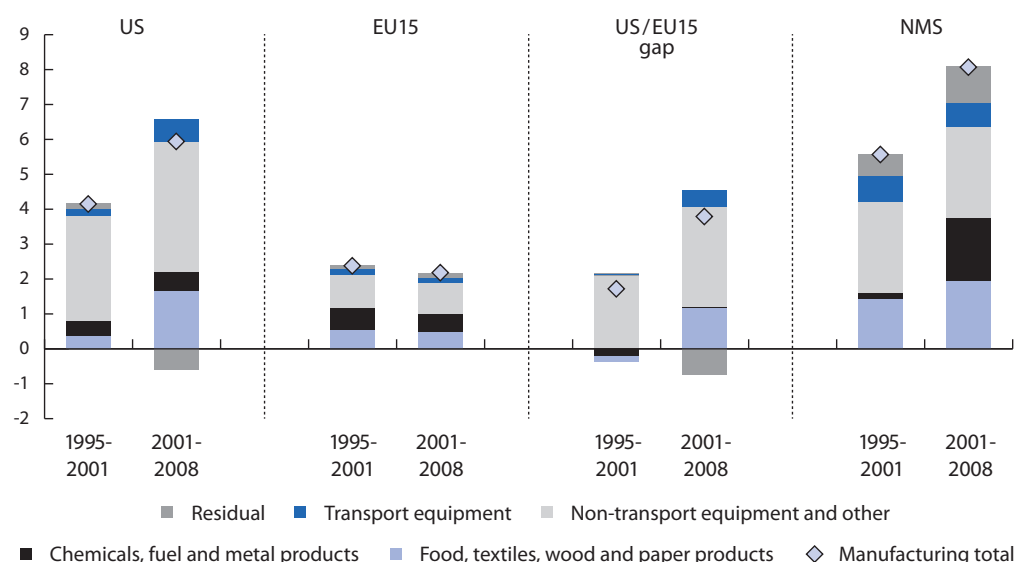
The production of ICT equipment has played an important role in high productivity growth in US manufacturing.

As regards the high rate of productivity growth in US manufacturing since 1995, the production of ICT equipment has been shown to have played a particularly important role. Several studies, including Jorgenson *et al.* (2005, 2008) and Oliner *et al.* (2007), demonstrate that a large portion of the contribution from ICT to aggregate productivity growth stems from ICT-producing industries as opposed to ICT-using industries, especially in the 1990s. The absence of a substantial ICT element in European manufacturing is therefore a central element in the US/EU productivity growth gap in manufacturing overall.

While the ICT-producing sector has clearly been very important, the data presented above show that relatively high productivity growth is visible also in other areas of US manufacturing. Much of these gains can be linked to a combination of ICT investment and productivity-enhancing business practices. Investing in ICT in isolation does not yield the desired effects. Brynjolfsson and Saunders (2010) point specifically to incentive systems, training, and decentralised decision making as important complements to technology in propelling the US productivity lead. Productivity gains from

improved business practices often take time to materialise, however. This may explain partly why high US productivity growth has been sustained for several years after the ICT boom ended in 2001.

Figure 17. Sub-sectoral contributions to labour productivity growth in manufacturing (percent)



Source: OECD STAN Database

Notes: For EU-15, see Figure 1. NMS includes Hungary, Czech Republic, Slovakia, Slovenia and Estonia. Poland is not included here for data availability reasons. Sub-sector productivity growth rates are weighted by 1995 employment shares.

But there is more to the story than this. Firms need the incentive as well as the opportunity to push through with the organisational changes that foster productivity gains. One pertinent observation made by Gordon (2003, 2010) is that competition and a squeeze on profitability seems to have provided the ultimate trigger for an accelerated shake-up of the US business sector. In this respect, the 2000s differ markedly from the 1990s. During the height of the 1990s dot-com bubble, firms invested heavily in new technology and hardware, but reductions in employment were limited. It was only after the dot-com bubble burst in 2001 that the cuts in payrolls gained momentum. Gordon observed that US firms experienced a period of unusually strong downward pressure on profits after 2001, partly linked to the severe underperformance of corporate pension plans when stock prices tumbled. This triggered aggressive cost-cutting in the business sector in the years that followed. After Gordon first introduced his “savage cost-cutting hypothesis” in 2003, Oliner *et al.* (2007) suggested that this could be tested on cross-section industry data. In support of Gordon’s hypothesis, they find that those industries that had experienced the largest declines in profits between 1997 and 2002 also exhibited the largest declines in employment and the largest increases in productivity.

The empirical literature points to a wide range of factors that contribute to high productivity in US manufacturing and beyond, including the level of investment in technology and new knowledge, access to skilled labour, and the relative ease with which finance and other resources are reallocated to high-growth activities, and especially risky ones. All these elements contribute to both continuously pushing out the technological frontier, and ensuring that manufacturing activity focuses on producing high value-added, innovative, products that can compete in world markets. But as this section has shown, US manufacturing productivity is also under intense pressure to contain costs to stay competitive. A continuous stream of process and organisational innovations – which include offshoring – is thus instrumental in ensuring that manufacturing value added grows alongside a rapidly shrinking manufacturing workforce.

In addition to the role of ICT, aggressive cost-cutting in the wake of the bursting dot-com bubble in 2001 also boosted productivity gains in the years that followed.

6. The role of market services in the US/EU productivity gap

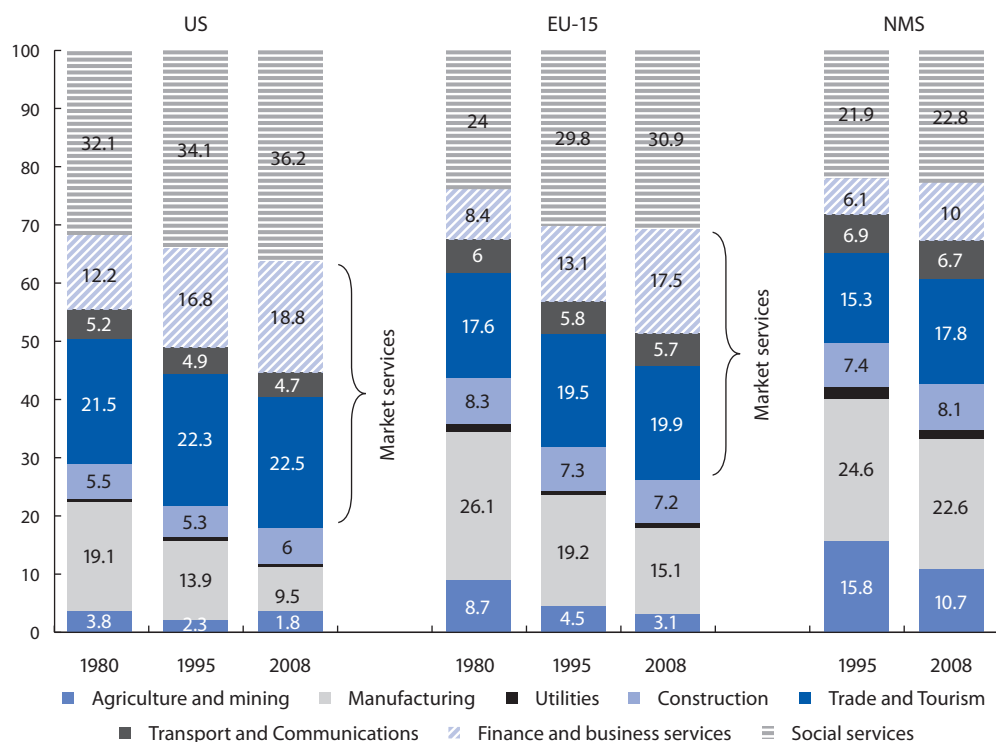
Because of the prominent role of market services in economic growth, a deeper understanding of this segment of the economy is needed. As a first step, a further breakdown of market services into three sub-sectors is contained in the OECD STAN dataset:

1. Wholesale and retail trade, restaurants and hotels (*Trade and tourism*)
2. Transport, storage and communications (*Transport and communications*)
3. Finance, insurance, real estate and business services (*Finance and business services*).

In terms of employment shares, Trade and tourism and Finance and business services are the largest segments of market services in the US and the EU-15.

On the basis of this breakdown, Figure 18 shows the composition of employment across sectors in the US, the EU-15 and the NMS. In terms of employment shares, the two sub-sectors *Trade and tourism* and *Finance and business services* are the largest, each accounting for around one-fifth of aggregate employment in the US and the EU-15. *Finance and business services* has been the fastest-growing sub-sector in both the US and the EU-15. In the EU-15, it has doubled its employment share since 1980. Also in the NMS, the employment share of *Finance and business services* has expanded on the back of high growth, although from a lower starting point. It therefore still accounted for only 10 percent of aggregate employment in 2008.

Figure 18. Employment shares by sector (percent)

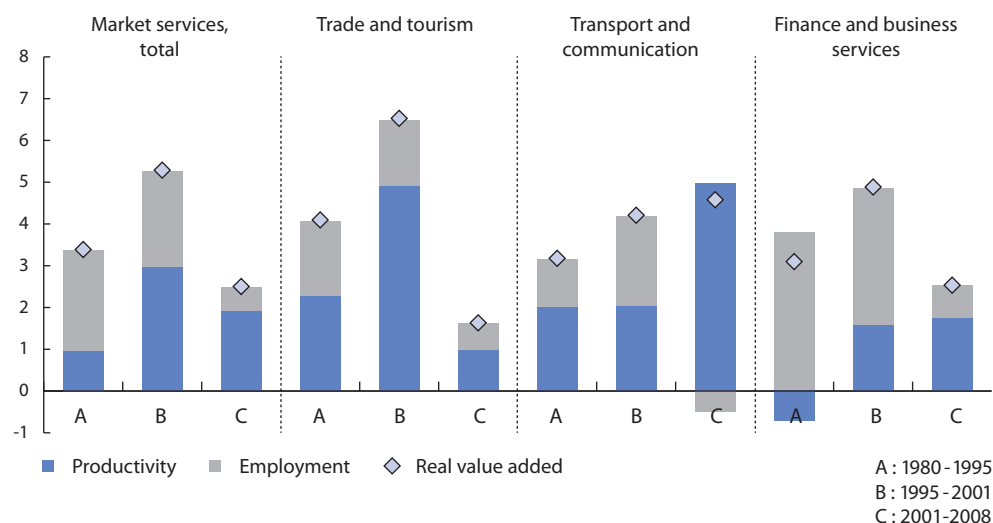


Source: OECD STAN Database

Note: See Figure 1.

As we have seen earlier, market services accounted for the bulk of the US productivity acceleration after 1995. The decomposition of the market services sector into its three main components sheds additional light on this insight. As seen in Figure 19 below, after 1995 the US experienced a sharp acceleration in productivity growth both in *Trade and tourism* and in *Finance and business services*. *Finance and business services* had been characterised by negative productivity growth in the 15 years up to 1995. There have also been shifts in the composition of growth over the last two periods. While productivity growth slowed dramatically in *Trade and tourism* in the final period, it held up well in *Finance and business services* and accelerated sharply in *Transport and communications*.

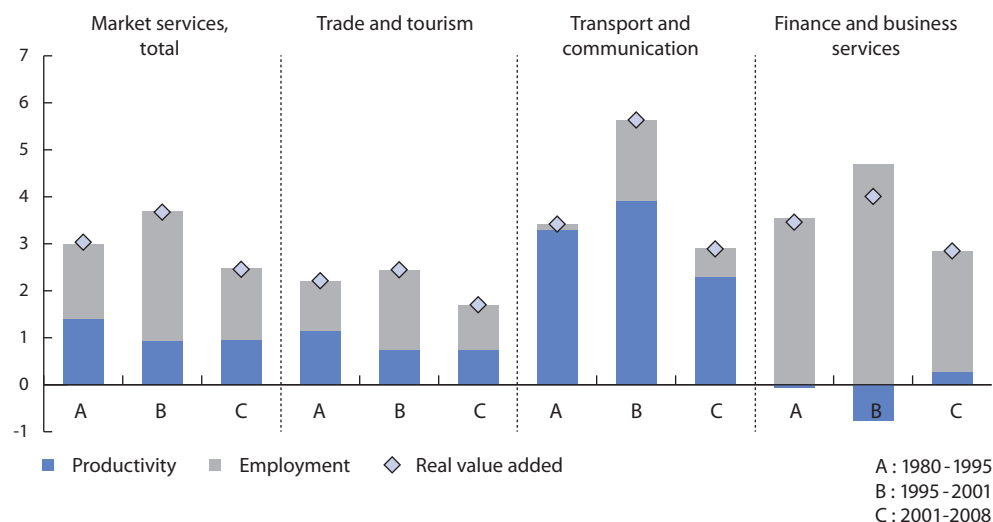
Figure 19. Contribution to average annual real value-added growth in market services (percent): US



Source: OECD STAN Database

Figure 20 shows the corresponding sources of value added growth for the EU-15. Comparing the US with the EU-15 reveals some similarities that point to sector-specific rather than economy-wide drivers of growth. The decomposition of market services also allows for a better understanding of the exact origins of the US/EU-15 productivity growth gap.

Figure 20. Contribution to average annual real value-added growth in market services (percent): EU-15



Source: OECD STAN Database

Note: EU-15 excludes Ireland, Luxembourg, Portugal, Greece and Sweden.

First, the US has, over the past three decades, substantially outpaced the EU-15 in terms of productivity growth in *Trade and tourism*, which is dominated by retail and wholesale trade. Sluggish productivity growth in this sub-sector is a well-known Achilles' heel for the EU-15. Reflecting its large size in the economy, *Trade and tourism* accounts for three quarters of the overall US/EU-15 productivity growth gap in market services (Figure 21) and around half of the gap for the economy as a whole, as regards the post-1995 period.

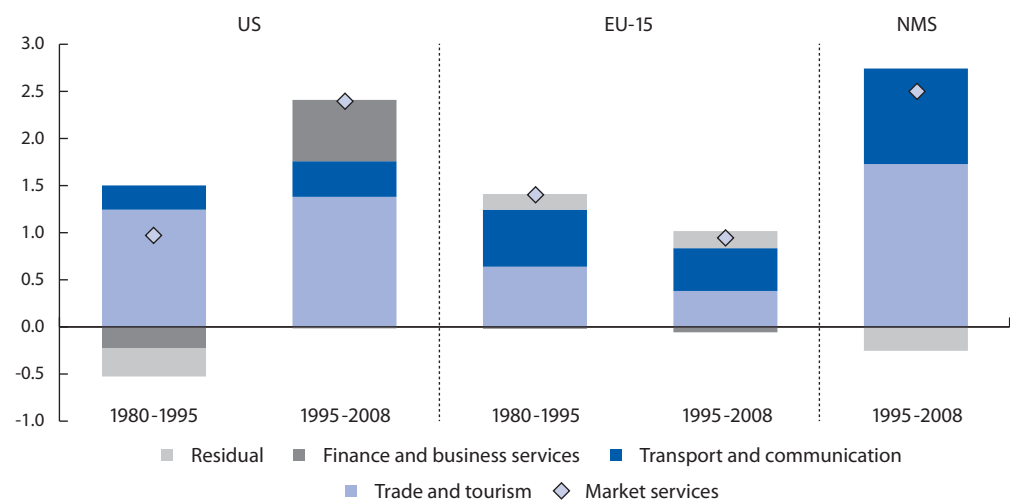
The US has consistently outpaced EU-15 productivity growth in Trade and tourism, which includes retail and wholesale trade.

Second, in *Transport and communications*, the EU-15 has historically outpaced the US in terms of productivity growth, with a reversal of leadership only in the last decade. This sub-sector is substantially more capital intensive than other areas of market services. As it is the smallest of the three sub-sectors, its contribution to the US/EU-15 productivity growth gap is relatively small.

Finance and business services account for most of the acceleration in US productivity growth in market services after 1995.

The third sub-sector, *Finance and business services*, was curiously similar in the US and the EU-15 before 1995, with its combination of high employment growth and negative productivity growth. After 1995, productivity growth took off in the US, even as high employment growth continued. As is apparent from Figure 21, this sub-sector accounts for most of the acceleration in US productivity growth in market services after 1995. In terms of productivity, no such improvement occurred in the EU-15. Instead, *Finance and business services* have continued to generate the bulk of EU-15's new jobs, expanding its share in the economy. Between 1980 and 1995, the employment share of business services in total market services rose in both the US (from 32 percent to 39 percent) and the EU-15 (from 26 percent to 34 percent).

Figure 21. Sub-sectoral contributions to average annual labour productivity growth in market services (percent)



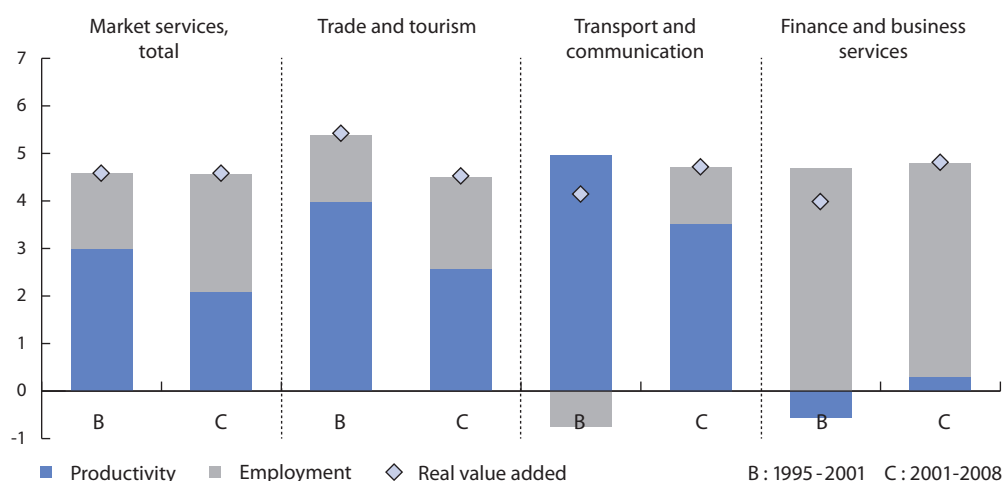
Source: OECD STAN Database
 Notes: EU-15 excludes Ireland, Luxembourg, Greece, Portugal and Sweden. For NMS, see Figure 1. Sub-sector productivity growth rates are weighted by 1995 employment shares.

On balance, while the US has staged a remarkable and broad-based acceleration in market services productivity growth after 1995, the EU-15 has for the most part gone in the opposite direction. It is pertinent to note here that the US/EU-15 productivity growth gap in market services would still largely remain intact if the financial sector was excluded. Although the financial bubble of the pre-crisis years likely inflated financial sector value added, the bulk of the growth gap lies with *Trade and tourism*.

Turning finally to the NMS (Figure 22), the broad pattern displays similarities to the EU-15 that, again, are suggestive of industry-specific elements. *Finance and business services* are, as in the EU-15, characterised by substantial expansion of employment, while productivity has been stagnant. Consistent with the region's greater scope for convergence-driven efficiency gains, productivity growth has otherwise been higher than in the EU-15. It has also been broadly sustained over the two sub-periods.

Due to its large share in market services employment (just over 50 percent in 2008), *Trade and tourism* is the dominant component of productivity growth in the NMS' market services, followed by transport and communication (see Figure 21). As in the EU-15, but in notable contrast to the US, productivity growth in *Finance and business services* has been close to zero in the NMS.

Figure 22. Contribution to average annual real value-added growth in market services (percent): New member states



Source: OECD STAN Database
 Note: See Figure 1.

7. Determinants of productivity growth in market services

One of the main observations emerging from the data presented in this paper is that the EU-15 has not succeeded in accelerating productivity growth in market services since the 1990s. The sectoral decomposition in Section 4 pointed, however, to substantial differences across individual EU Member States. While several countries have experienced sharp declines in the rate of productivity growth, others have seen improvement. Indeed, in half of the EU-15 countries, productivity growth in market services has either risen since the 1990s or been sustained at an already high level. This diversity is indicative of substantial structural differences across EU countries.

A number of EU member states have seen improved productivity growth in market services after 1995 while others have not.

Up to this point, this paper has not explored the underlying drivers of productivity growth. In order to obtain a deeper understanding of the diversity across EU-15 countries, this section draws on the existing empirical literature. The focus here is on the drivers of productivity growth in market services. As we will see, many high-growth countries share a mix of factors known to promote productivity growth, while those trailing behind typically do not.

7.1 Investment and innovation in market services

In services as in other sectors, output per hour worked (productivity) can be expanded through several channels. First, it can result from equipping each worker with more and better equipment. Second, it may stem from having more skilled workers, which are able to operate more sophisticated equipment or engage more generally in higher value-added activities. Third, it may stem from efficiency gains that increase output for any combination of factors of production. The efficiency in combining inputs to produce output is known as multifactor productivity (MFP). MFP growth reflects increases in knowledge, increased use of economies of scale and other efficiency gains that allow for more output from a given combination of inputs.

A natural first step to uncovering the drivers of productivity growth is to empirically separate these different components on the basis of a neo-classical production function. This process is called growth accounting. The simplest version of the neo-classical production function describes output as a function of labour and capital inputs. These inputs are characterised by diminishing marginal returns, which means that increasing one of them while keeping the other constant leads to smaller and smaller incremental increases in output. By assuming reasonable output elasticities of capital and labour – proportional to their shares in aggregate income – the growth contribution of each factor can be easily estimated on the basis of their own growth rates. The “residual”, *i.e.* the part of output growth that is not accounted for by growth in labour and capital, is then defined as MFP. Historically, this residual has made large contributions to output growth.

Directing our attention to market services, the growth accounting approach has proven useful also at sectoral level. It points to differences across sectors in both the size and the composition of fixed, human and intangible capital investment, as well as the role of the MFP residual. In short, the nature of productivity growth differs across sectors in part because they use different types of inputs. Investment in tangible fixed capital is on average not smaller in market services than in manufacturing, but this average is heavily influenced by the high level of investment in *Transport and communications*. In all other sub-sectors of market services, fixed investment is substantially lower than in manufacturing (Uppenberg and Strauss 2010). Also, the composition of fixed investment in market services is different from that in manufacturing. Investment in market services is dominated by buildings, ICT equipment and transport equipment. In manufacturing, around two-thirds of fixed investment consists of non-ICT equipment (*e.g.* machines).

While differences in fixed capital formation play a part, a substantial portion of the differences in labour productivity growth cannot be explained by fixed capital per worker.

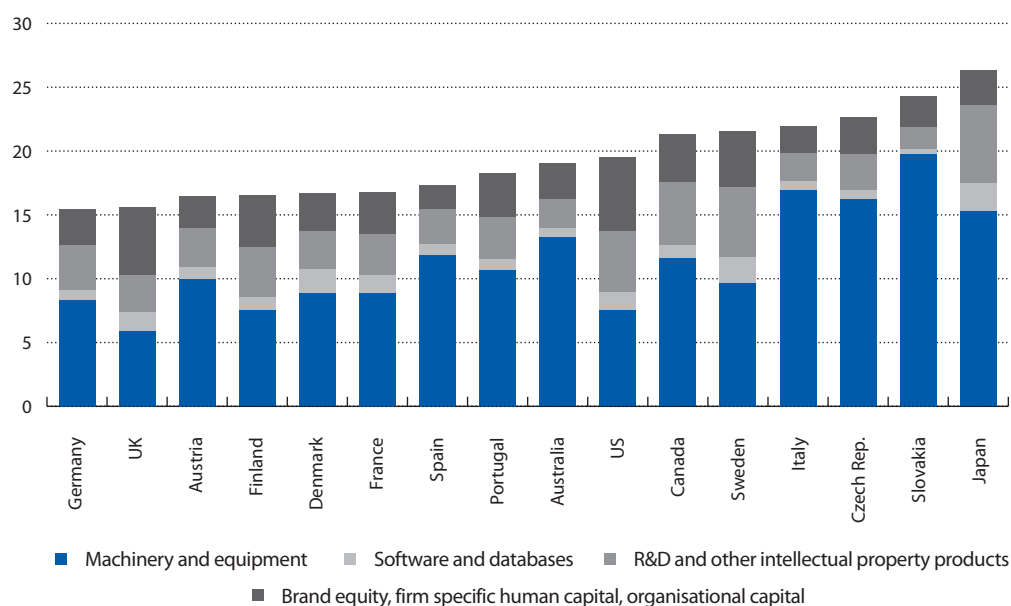
While differences in fixed capital formation play a part, a substantial portion of the difference in labour productivity growth across countries cannot be explained by capital deepening (*i.e.* by the rate of growth in capital available to each worker). This means that better understanding of these growth differences can only be obtained by explaining differences in the rate of growth of the MFP residual. Inklaar *et al.* (2008), for instance, find that while ICT and skilled labour are key to high labour productivity growth in market services, the bulk of the difference across countries stems not from these inputs, but from unexplained efficiency gains, as measured by the MFP residual. Also, the authors’ attempts at uncovering the drivers of MFP growth differences as externalities from ICT investment, the use of skilled labour or entry barriers yield limited results. The decisive role of MFP thus points to a relatively complex innovative process, where many different elements combine to generate productivity gains.

The large role of the unexplained MFP residual in productivity growth has inspired several different responses from empirical researchers. One way of shrinking the MFP residual has been to refine the measurement of traditional inputs by breaking down the labour force into different skill and age groups and the capital stock into various types of ICT and non-ICT capital. The MFP residual shrinks further through the creation of a broader definition of productive capital that includes more intangibles such as R&D capital, firm-specific skills and organisational knowledge. The work of Corrado, Hulten and Sichel (CHS, 2005, 2009) has been seminal in this respect. Key assumptions behind this work are that knowledge is a form of productive capital, that it is accumulated through investment and that it depreciates gradually over time, similar to conventional fixed capital. CHS split intangible investment into three groups:

- Computerised information (software and databases);
- Scientific and creative property (R&D, mineral exploration, copyright and license costs, other product development, design, and other research expenses);
- Economic competencies (brand equity, firm-specific human capital and organisational structure).

CHS find the level of investment in intangible capital to be substantial. Total annual investment in intangible assets by US businesses averaged around 12 percent of GDP in the 1990s, a similar order of magnitude as investment in tangible assets. Other researchers have since applied the CHS methodology to other countries, including many in the EU.⁴ Figure 23 shows estimates for intangible investment in a number of advanced countries, alongside investment in machinery and equipment.

Figure 23. Investment in intangible assets, machinery and equipment (percent of GDP, 2006 or latest available)



Source: OECD (2010)

Closer scrutiny of these investment data shows that the countries with high productivity growth are not always those with the highest overall investment rates. What is striking, however, is that this group of countries (notably the US, UK, Canada, Finland, Sweden and Australia) tend to have a larger share of intangibles in total fixed investment.

Countries with high productivity growth tend to have a larger share of intangibles in total fixed investment.

While the figure above provides a macroeconomic perspective on intangible investment, some sectoral evidence is also emerging. Sectoral data, for instance, show that investment in R&D is heavily concentrated in manufacturing, suggesting that intangible investment in market services is typically less about innovative products than about brand equity, upskilling of staff and organisational innovation. Indeed, it is an inherent characteristic of services that the final product is difficult to distinguish from the organisation that provides it, or from the manner in which it is provided.

One recent study that has made progress in providing a sectoral breakdown of intangible investment is Haskel and Pesole (2011). They find that the distribution of intangible investment between manufacturing and market services differs substantially from country to country. Specifically, in the UK only one-quarter of total intangible investment is conducted in manufacturing, against half or even more in Germany and Sweden. Combining this result with the levels in the figure above,

⁴ For estimates of intangible investment in the US and 10 EU countries, see van Ark *et al.* (2009).

it follows that the intangible-investment gap between the UK and Germany is even greater in market services than it is for the economy as a whole. On balance, the literature suggests that countries with relatively high or rising productivity growth in market services (US, UK, Netherlands) also have market services sectors that invest more in ICT and intangible capital.

7.2 Determinants of innovation in market services

While the positive link between productivity and the resources devoted to intangibles hints at innovation as a key driver of productivity growth, it raises additional questions. First, investment in intangible capital only generates productivity gains as part of an innovative process, *i.e.* through new and improved products, processes and modes of operation. What is the nature of these processes? Second, what underlying business environment gives firms the incentive to invest and innovate in the first place? The answers to these questions are key when designing effective growth policy.

Even the inclusion of intangible investment cannot completely eliminate the unexplained MFP residual in economic growth. The mechanisms behind productivity growth are simply too complex to be fully accounted for as the product of various inputs. From this perspective, the neo-classical production function, while proving a useful benchmark, is too simplistic as a representation of the growth machinery. A second branch of the empirical growth literature accepts this complexity through a freer relationship between economic growth and its many underlying determinants. For instance, growth regressions show that a wide range of structural and policy variables outside the confines of the firm's production technology influence growth. Recognising this complex relationship, one recent OECD study aims to provide a comprehensive set of indicators linked to innovation at the firm level (OECD 2010). The list below provides a summary of some of its key elements at the national level:

Countries with high productivity growth in market services typically rank high on many indicators linked to innovation and economic dynamism.

- The level of investment in ICT hardware and software, and in R&D and other forms of intangible capital;
- The extent of complementary innovation strategies;
- The share of firms with international cooperation on innovation;
- Educational achievement (especially in science and mathematics);
- Employment of university graduates;
- International students in higher education;
- Venture capital investment;
- The patenting activity of young firms;
- Scientific publications;
- Broadband internet access;
- International technology and knowledge flows;

The OECD study shows that countries with high or improving productivity growth in market services (the UK, Sweden and the Netherlands being the stronger cases) typically have relatively high scores on a large number of these indicators, whereas underperforming countries (prominent examples being Italy and Spain) tend not to. As also suggested in the empirical literature, this pattern suggests that high productivity growth in market services will not likely emerge from putting just one or two key elements in place. Instead, success in fostering a more dynamic and innovative market services sector requires a relatively broad-based approach.

Beyond these indicators, productivity growth has been found to be strongly influenced by broader environmental conditions that give firms the incentives and means to engage in innovative activities. Some studies point to elements that are of particular importance in specific industries. One such case is retail and wholesale trade, where the US achieved notable productivity gains from the mid-1990s onwards. Van Ark *et al.* (2003), Timmer and van Ark (2005), Inklaar *et al.* (2005, 2007) and Jorgenson *et al.* (2003, 2005), identify trade as particularly decisive in accounting for the US productivity lead over Europe since the mid-1990s.

Inklaar and Timmer (2008) address specifically the issue of productivity growth in retail trade. As a starting point for their investigation, they refer to the occasional claim that the US productivity boom in the trade sectors was substantially overestimated. Through a rigorous accounting framework for retail trade, the authors find credible and robust evidence that the strong productivity growth in US retail trade has been genuine. Productivity growth in retail trade is known to draw on ICT investment and organisational change to facilitate productivity gains, but other factors such as economies of scale also matter. In this context, Foster *et al.* (2006) link the acceleration in US retail productivity to the spread of national chains and the inroads of “big box” retailing at the expense of traditional smaller stores. Specifically, virtually all of the labour productivity growth in the US retail sector is accounted for by more productive entering establishments displacing much less productive exiting establishments. The productivity gap between low-productivity exiting single-unit establishments and entering high-productivity establishments from large, national chains plays a disproportionate role in these dynamics.

For many European countries, investment in ICT and associated organisational change are about adopting best practice already in place elsewhere, rather than about home-grown innovation. Conway and Nicoletti (2006) investigate the impact that product market regulation has on the adaptation process. They focus explicitly on the split between ICT-intensive and other industries, and find that restrictive regulations that weaken competition have a direct negative influence on productivity growth in ICT-intensive (*i.e.* ICT-producing and ICT-using) sectors, while no such direct impact is detected in non-ICT sectors. They also find that restrictive regulations indirectly slow down productivity growth by curbing the speed of catching up with the productivity leader.

As outlined by Arnold *et al.* (2008), one channel through which product market regulation may affect productivity is via firm turnover. New firms may be better placed to reap the productivity gains from new technologies such as ICT. As we have hinted at before, the productivity benefits from ICT are linked to both organisational innovation and skill composition. Newcomers may have a comparative advantage in adopting new technologies and recruiting appropriately skilled staff, if the incumbents face adjustment costs from doing the same. Consistent with this view, Bartelsman *et al.* (2004) find that the entry of new firms plays a stronger role in boosting aggregate productivity in high-tech industries than in medium and low-tech industries.

Arnold *et al.* (2008) explore in some depth the link between product market regulation and productivity. On the basis of a wide set of evidence, they conclude that delayed regulatory reforms in a number of key ICT-intensive sectors was a major contributing factor behind the relative inability of EU countries to reap the productivity benefits generated by the positive ICT shock of the 1990s.

The authors also show a strong negative correlation between the level of regulation in selected ICT-intensive non-manufacturing sectors and the level of investment in ICT. Industries operating in a relatively liberal regulatory environment seem more inclined to incorporate ICT into the production process than industries operating in an environment of more restrictive product market regulation.

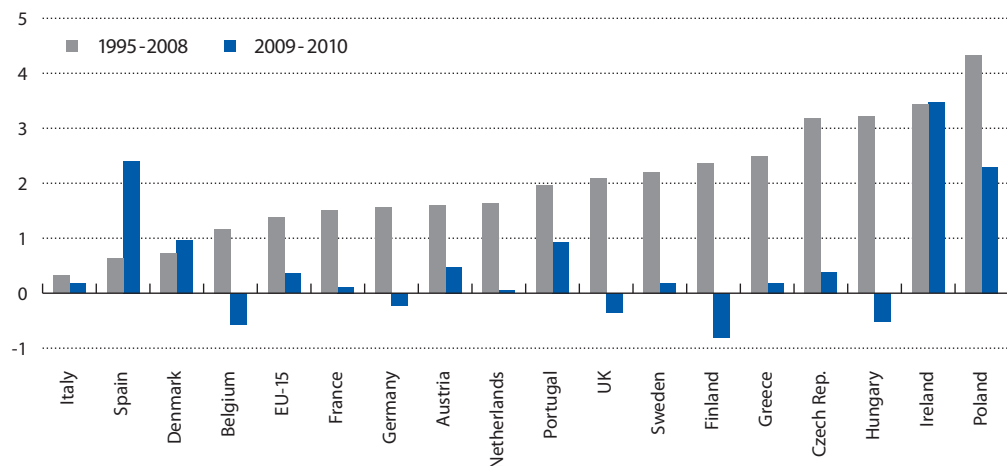
Delayed regulatory reforms in a number of service sectors contributed to the EU's relative inability in reaping productivity gains from the positive ICT shock of the 1990s.

8. EU productivity growth during the crisis

Up to now this paper has looked exclusively at longer-term growth prior to the financial crisis, using data up to 2008. Because of the depth of the financial and economic crisis, however, it is unavoidable that the outlook for growth – even in the longer term – will be affected by it. This brief section discusses a few key issues directly related to the crisis.

First, Figure 24 illustrates the short-term evolution of productivity growth (here more precisely measured as GDP per hour worked as we do not look far back in time). In a majority of EU countries, productivity growth fell sharply during the crisis. Closer scrutiny of output and hours worked data shows that this is the result of output falling relatively more steeply than employment during the crisis. In many countries, employment cuts were initially resisted by employers who wanted to retain access to their skilled labour, sometimes encouraged by government subsidies aimed at dampening unemployment. Interestingly, some countries with particularly severe recessions did not see productivity growth decline during the crisis. In Spain and Ireland, in particular, cutbacks in hours worked were sufficiently steep to sustain or even boost measured productivity growth. According to the European Commission forecast of November 2010, however, a delayed productivity slump was projected for 2011-2012, even as productivity was expected to recover in the EU as a whole.

Figure 24. Average annual growth in real GDP per hour worked (percent)



Source: European Commission Forecast Database (AMECO), autumn 2010

Cross-country comparison of growth prospects is misleading when based on short-term developments due to unsynchronised cyclical swings in output and employment.

These trajectories point to the difficulties of assessing long-term growth prospects on the basis of short-term movements in productivity. Unsynchronised short-term swings in output and employment distort the relationship between short-term and long-term growth in labour productivity. Beyond these short-term cyclical swings, the long-term growth potential of individual EU countries continues to be propelled by the underlying structural drivers discussed at length in this paper.

The crisis may, however, have a more profound impact on long-term growth in some countries. Specifically, in many countries, unsustainable asset price bubbles and borrowing fuelled domestic demand in the run-up to the crisis, leading to peaks in output and productivity growth. The failure to recognise the temporary nature of these developments led to overestimating the productivity potential in a number of sectors. If the ensuing debt overhang and substantial cost competitiveness problems in these countries lead to a persistent drop in the rate of growth in aggregate demand, productivity too may shift down to a slower growth trajectory. The strong productivity performance of Greece in the years leading up to the crisis looks particularly suspect in this context.

As suggested in a recent study by the European Commission (2010), restoring growth in Europe amidst the current imbalances would be easier if more structural flexibility was introduced, *i.e.* if existing nominal price and wage rigidities were removed. This would allow for a smoother reallocation of resources towards industries with a higher growth potential.

9. Concluding remarks

Drawing on the OECD's STAN database, this paper has provided a decomposition of value added, employment and labour productivity growth in the US and the EU, across major economic sectors, across EU countries, and across three time periods. Its main contribution lies in illustrating Europe's productivity slowdown since the mid-1990s. Concerns about the EU's relatively feeble productivity performance emerged towards the end of 1990s, following a remarkable acceleration of US productivity growth which Europe had failed to replicate. But if the main ambition of the resulting Lisbon strategy was to invigorate EU productivity growth in the decade that followed, it has for the most part not succeeded. During this period, the EU-15 saw productivity growth decline even further, even as the US extended its run from the dot-com years.

If the main ambition of the Lisbon strategy was to invigorate EU productivity growth, it has for the most part not succeeded.

One key observation is that the continuing US productivity lead has been relatively broad-based, originating in both manufacturing and market services. As demonstrated by the broader empirical literature, those EU-15 countries that have been able to replicate the US productivity performance (at least to some extent), typically also share with the US a broad set of growth-friendly structural and institutional characteristics, accompanied by higher levels of investment in ICT, and in human and intangible capital. Rather than drawing on the US as a benchmark for high productivity growth, trailing European countries can thus find several role models closer to home. As frequently stressed by academic researchers and international institutions, these European examples show that, putting in place the proper conditions for growth pays off.

The picture has been somewhat complicated by the outbreak of the financial and economic crisis at the end of 2008. Several of the strongest-performing countries of the past couple of decades (including the US, the UK, and Ireland) have been hard-hit by the crisis. They all experienced high financial sector growth in the years leading up to the crisis, boosted in part by financial bubbles that have since been deflated. We chose to limit the bulk of our analysis to the period before 2009, as it is still premature to assess the long-term growth consequences of the crisis. But one can nevertheless not avoid asking whether the pre-crisis growth patterns were distorted by the existence of financial bubbles and unsustainable debt-fuelled demand growth. Some of the strongest pre-crisis performers will not likely sustain their high growth in coming years. Be that as it may, the sectoral distribution of high productivity growth has been sufficiently broad-based to suggest that the financial bubble was not the main driver of past productivity gains.

Perhaps a more constructive way to frame the issue going forward is to focus on the causes of underperformance among trailing countries rather than on the precise extent and nature of the leaders' outperformance. Even if some of the past gloss will eventually fade on the likes of the US and the UK, there is still enough evidence that the impediments to efficiency gains and innovation in a number of European countries are causing them to fall dangerously behind. Specifically, many EU countries have been too slow in implementing competition-friendly product market reforms. These remain essential in unleashing innovative and fast-expanding market services capable of taking over from stagnant or retreating traditional manufacturing as an engine of long-term growth.

Annex 1: The OECD STAN database for Structural Analysis

OECD Industry classification	Sectoral aggregates in this paper
CTOTAL TOTAL	All sectors
C01T05 AGRICULTURE, HUNTING, FORESTRY AND FISHING	Agriculture and mining
C10T14 MINING AND QUARRYING	
C15T37 MANUFACTURING	Manufacturing, total
C15T16 Food products, beverages and tobacco	1. Food, textiles, wood and paper products (Sector 1)
C17T19 Textiles, textile products, leather and footwear	
C20 Wood and products of wood and cork	
C21T22 Pulp, paper, paper products, printing and publishing	
C23T25 Chemical, rubber, plastics and fuel products	2. Chemicals, fuel and metal products (Sector 2)
C26 Other non-metallic mineral products	
C27T28 Basic metals and fabricated metal products	
C29T33 Machinery and equipment	3. Non-transport equipment and other (Sector 3)
C36T37 Manufacturing n.e.c. and recycling	
C34T35 Transport equipment	4. Transport equipment (Sector 4)
C40T41 ELECTRICITY GAS AND, WATER SUPPLY	Utilities
C45 CONSTRUCTION	Construction
C50T74 BUSINESS SECTOR SERVICES	Market services
C50T55 WHOLESALE AND RETAIL TRADE - RESTAURANTS AND HOTELS	1. Trade and tourism
C60T64 TRANSPORT, STORAGE AND COMMUNICATIONS	2. Transport and communications
C65T74 FINANCE, INSURANCE, REAL ESTATE AND BUSINESS SERVICES	3. Finance and business services
C75T99 COMMUNITY, SOCIAL AND PERSONAL SERVICES	Social services
C50T99 TOTAL SERVICES	Total services

Annex 2: Breakdown of real value-added growth (RVA) into productivity and employment growth

Average annual growth rates, percent

		Total business sector			Manufacturing			Utilities			Construction			Market Services		
		RVA	Prod.	Emp.	RVA	Prod.	Emp.	RVA	Prod.	Emp.	RVA	Prod.	Emp.	RVA	Prod.	Emp.
US	1980-1995	3.0	1.4	1.6	3.2	3.8	-0.6	3.8	3.7	0.0	1.1	-0.2	1.3	3.4	1.0	2.4
	1995-2008	2.9	1.9	1.0	3.3	5.1	-1.8	0.6	1.9	-1.3	-0.1	-2.2	2.1	3.8	2.4	1.4
	1995-2001	3.8	2.1	1.6	3.6	4.2	-0.6	-1.5	0.2	-1.6	2.9	-0.7	3.6	5.3	3.0	2.3
	2001-2008	2.2	1.7	0.5	3.0	6.0	-2.8	2.3	3.4	-1.0	-2.7	-3.5	0.8	2.5	1.9	0.6
Japan	1980-1995	3.2	2.3	0.9	3.2	3.1	0.1	2.9	1.8	1.1	0.8	-0.2	1.0	4.3	2.5	1.8
	1995-2006	1.2	1.6	-0.3	1.7	3.7	-1.9	2.4	2.9	-0.4	-2.1	-0.1	-2.0	1.4	1.1	0.2
	1995-2001	0.9	1.4	-0.5	0.0	2.2	-2.1	2.7	2.5	0.2	-2.4	-0.6	-1.8	1.5	1.2	0.4
	2001-2006	1.6	1.8	-0.2	3.8	5.6	-1.7	2.1	3.3	-1.2	-1.9	0.4	-2.2	1.2	1.1	0.1
EU-15	1980-1995	2.2	1.8	0.4	1.4	3.1	-1.7	2.7	3.4	-0.6	0.7	1.3	-0.6	3.0	1.4	1.6
	1995-2008	2.2	1.0	1.2	1.5	2.3	-0.8	2.2	3.4	-1.1	0.8	-0.1	0.9	3.1	1.0	2.1
	1995-2001	2.7	1.2	1.5	2.3	2.4	-0.1	2.7	4.9	-2.1	0.7	0.1	0.6	3.7	0.9	2.8
	2001-2008	1.8	0.9	0.9	0.8	2.2	-1.4	1.8	2.2	-0.3	0.8	-0.3	1.2	2.5	1.0	1.5
UK	1980-1995	2.4	2.2	0.2	1.4	4.2	-2.7	2.5	6.6	-3.9	2.3	2.6	-0.4	3.2	1.8	1.4
	1995-2008	2.8	1.8	0.9	0.3	3.1	-2.7	1.6	3.4	-1.8	2.2	0.5	1.7	4.5	2.9	1.6
	1995-2001	3.3	2.1	1.2	0.8	2.3	-1.5	3.0	5.8	-2.7	1.8	1.1	0.7	5.5	3.2	2.2
	2001-2008	2.3	1.6	0.8	-0.1	3.8	-3.8	0.4	1.5	-1.0	2.5	0.0	2.5	3.7	2.7	1.0
France	1980-1995	2.0	1.9	0.1	0.7	2.9	-2.1	4.9	4.4	0.5	0.4	2.4	-2.0	2.6	1.4	1.2
	1995-2008	2.1	1.1	1.0	1.5	2.8	-1.2	2.8	3.2	-0.4	0.9	-0.8	1.7	2.9	1.0	1.8
	1995-2001	2.6	1.1	1.5	3.0	3.2	-0.3	3.8	3.4	0.4	0.4	0.0	0.4	3.5	0.7	2.8
	2001-2008	1.7	1.0	0.6	0.3	2.5	-2.1	1.9	3.1	-1.1	1.3	-1.5	2.8	2.4	1.3	1.0
Germany	1980-1995	2.3	1.6	0.7	0.8	2.2	-1.4	1.9	2.2	-0.3	0.2	-0.3	0.6	3.7	1.7	2.0
	1995-2008	1.7	1.2	0.5	1.8	2.6	-0.7	2.2	4.4	-2.0	-3.0	-0.1	-2.9	2.5	0.8	1.7
	1995-2001	2.1	1.3	0.7	2.1	2.7	-0.6	2.5	6.0	-3.4	-3.4	0.2	-3.6	3.1	0.6	2.4
	2001-2008	1.5	1.1	0.3	1.5	2.4	-0.9	2.0	2.9	-0.9	-2.7	-0.3	-2.4	2.0	1.0	1.0
Italy	1980-1995	2.1	1.9	0.1	2.0	3.4	-1.4	1.8	1.4	0.4	-0.1	0.8	-1.0	2.6	0.8	1.8
	1995-2008	1.2	0.1	1.1	0.2	0.2	-0.1	1.7	3.5	-1.7	1.4	-0.7	2.1	1.7	-0.4	2.1
	1995-2001	1.8	0.6	1.2	0.9	1.2	-0.2	0.6	3.4	-2.8	1.8	-0.1	1.9	2.5	-0.2	2.7
	2001-2008	0.7	-0.4	1.1	-0.4	-0.5	0.1	2.8	3.6	-0.9	1.2	-1.2	2.3	1.0	-0.6	1.7

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