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Report on Single Market Integration and Competitiveness in the EU and its Member States

Accompanying the document

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Upgrading the Single Market: More Opportunities for People and Business

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This limited capacity of generating mid-paid jobs will be of key importance for the digitisation of industry. Available estimates for the US conclude that in less than two decades up to 47 % of total employment will be at risk of disappearance due to computerisation,[69] with the risk increasing the lower the wage or the educational attainment. This means that there is a need to find other tasks and sectors capable of absorbing these employment losses, probably in areas which demand creativity and social intelligence. It is therefore necessary to eliminate obstacles to the reallocation of resources both within Member States and in the Single Market.

In this respect, it is important to consider not only the impact of the composition of the economic structure, but also the impact of regional specialisation on wages. Data from the European Cluster Observatory analysed in a recent study[70] not only illustrates the substantial variety in wages between sectors (at a more detailed level), but also that wages depend on the extent to which the employment is regionally concentrated and specialised in clusters. The wage gap between clusters and non-clusters shows that, overall, average wages are higher in clusters (EUR 25,672 compared to EUR 24,870 outside clusters), pointing to somewhat higher productivity levels. The wage differences can be particularly large in high-tech and medium-tech manufacturing industries such as chemicals, aerospace, biopharmaceuticals, communications equipment and medical devices. Also in high-wage services sectors, such as financial and business services and insurance services, the wage difference is substantial.[71]

([69]) Frey, CB.; Osborne, M.A. (2013), *The future of employment: how susceptible are Jobs to computerisation?*, OMS Working Paper.

([70]) ECORYS et al. (2015), *An empirical assessment of the contribution of clusters to smart specialisation*, report for the European Commission, DG GROW.

([71]) Clusters can be broadly defined as a group of firms, related economic actors, and institutions that are located near each other and have reached a sufficient scale to develop specialised expertise, services, resources, suppliers and skills. See European Commission, *The concept of clusters and cluster policies and their role for competitiveness and innovation: Main statistical results and lessons learned*, SEC (2008) 2637.

2.2 Overall evolution of productivity

It is essential to boost productivity to make the recovery sustainable and avoid the risk of falling back to weak growth rates. A recovery based on factor accumulation may lead to an undesirable misallocation of production factors. The negative effects of such scenario became apparent in the case of Spain, where a period of economic expansion with negative total factor productivity (TFP) growth led to the deterioration of competitiveness and the emergence of significant imbalances.[72] Promoting productivity growth is therefore crucial to improving competitiveness in Europe.

Reducing the distortions hampering a more efficient allocation of resources towards most productive firms could lift productivity. There are indications that the productivity slowdown has been largely due to policy-induced misallocations within sectors.[73] The payoffs of structural reforms tackling these hurdles are potentially large. Yet there is no “one size fits all” solution and reforms should take into account the varying structural conditions of sectors and Member States.

([72]) Garcia-Santana, M., Moral-Benito, E., Pijoan-Mas, J., Ramos, R.: *Growing like Spain: 1995-2007*, May 2015.

([73]) Cf. Dabla-Norris, E., Guo, S., Haksar, V., Kim, M., Kochhar, K., Wiseman, K., and Zdzienicka, A., *The new normal: a sector-level perspective on productivity trends in advanced economies*, Staff discussion note SDN/15/03, March 2015, International Monetary Fund.

2.2.1 Labour productivity in industry

Labour productivity[74] indicates how efficiently the production inputs related to workforce are combined to produce goods and services, offering a measure of economic growth, competitiveness and living standards.

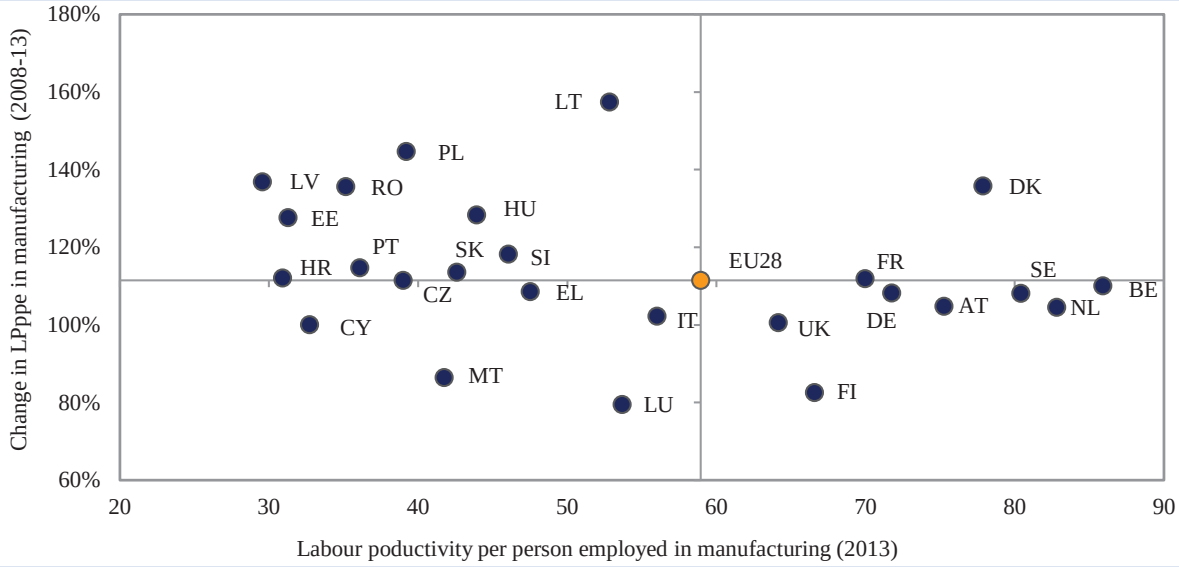
Figure 2.11 depicts labour productivity in manufacturing on the horizontal axis, while the vertical axis shows growth from 2008 to 2013.[75] Denmark is the only country reporting both above-average productivity and sustained growth in the period 2008-2013. Countries in the upper left quarter show a convergence trend. Their productivity levels are still below average but have been growing consistently, reducing their gap with the best performers. A number of countries in this group are catching up rapidly (Estonia, Hungary, Lithuania, Latvia, Poland, and Romania). The other Member States in this group (Czech Republic, Portugal, Slovakia, Slovenia and Croatia) have also improved their performance with respect to the average; however, considering their initial level and the performance of other countries, there seems to be considerable scope for accelerating the convergence path in many of these countries. Most countries laying on the right hand side part of the figure report consistent and stable performance (Austria, Belgium, France, Germany, the Netherlands, and Sweden) but some of them have seen a reduction of their relative competitiveness (Finland and United Kingdom).

Finally, countries in the lower left quarter have experienced a deterioration of their relative productivity (Cyprus, Greece, Italy, Luxembourg, and Malta).

([74]) In this section labour productivity is measured by means of value added per person employed in manufacturing and is evaluated by taking into account variations in manufacturing workforce and profitability.

([75]) The choice of the 2008-2013 period has been tested for robustness over a ten year period and provides a proxy of the labour productivity trends in the Member States. Figures for Ireland (EUR 132 030 in 2013) are the highest in the EU; however, as this result reflects the behaviour of a large number of foreign multinationals and contains effects of transfer pricing, it has been considered an outlier and excluded from Figure 2.11.

Figure 2.11: Performance and change in manufacturing productivity (2008-2013)



Note: Horizontal axis = value added per person employed in manufacturing (thousand EUR); Vertical axis = difference in percentage with respect to EU compound annual growth rate (2008-2013). Data for Ireland have been excluded from this chart. Data for Bulgaria and Spain were not available. Romania: last available data 2012.

Source: Eurostat

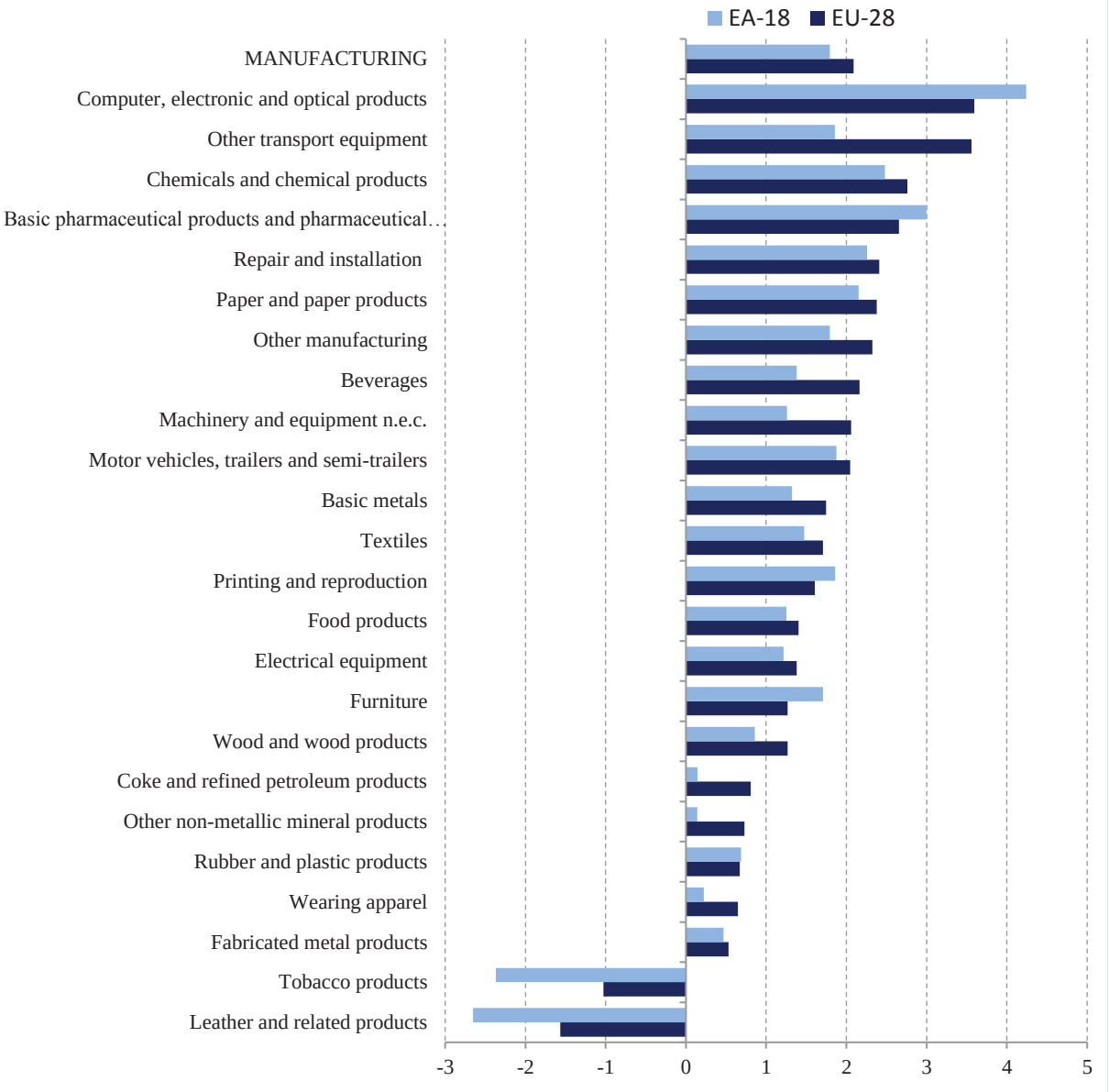
Figure 2.12 shows the evolution of labour productivity at sector level.[76] The growth rates are calculated as averages for the period 2003-2013. We show results for both the EU-28 and the euro area (18 countries). For manufacturing, there has been a moderate improvement for the EU-28 as a whole. But there are significant differences across sectors. The largest improvements for the EU-28 are observable in

([76]) Calculated as production per hour worked using more recently updated data from Eurostat Structural Business Statistics.

other transport equipment, as well as in computer, electronic and optical products. Note that both sectors are characterised by high technological intensity, but had a below the EU average productivity level until 2012. On the contrary, the lowest improvements are observable for low-tech industries producing tobacco, leather and wearing apparel.

But the pattern is different for the euro area. When considering this aggregate, the largest labour productivity gain was achieved in the manufacture of computers, electronic and optical products, followed by pharmaceutical products. This could be a reflection of the different specialisations of countries, as well as the outcome of delocalisation of plants in Eastern Europe (in particular for transport equipment).

Figure 2.12: Labour productivity growth in EU manufacturing, 2003-2013



Note: Labour productivity average annual growth rate, volume index of production per hours worked

Source: European Commission, *EU Structural Change 2015*, DG GROW.

2.2.2 Labour productivity in services

As shown in Figure 2.13 below, in 2013, labour productivity per person employed in services was the highest in Luxembourg, which may reflect the fact that it also has the highest GDP per capita in the EU, at 2.6 times the EU-28 average, and the important weight of its financial services sector. Productivity is closely related to wages. After Luxembourg there is a cluster of EU-15 Member States (Belgium, Italy, France), who have higher productivity and relatively high wages. At the other extreme, productivity in Bulgaria is the lowest as the GDP per capita in Bulgaria is less than half the EU average. Just ahead of Bulgaria we find a host of new Member States (Estonia, Romania, Hungary, Latvia and Lithuania), again reflecting lower GDP per capita feeding into their productivity results.

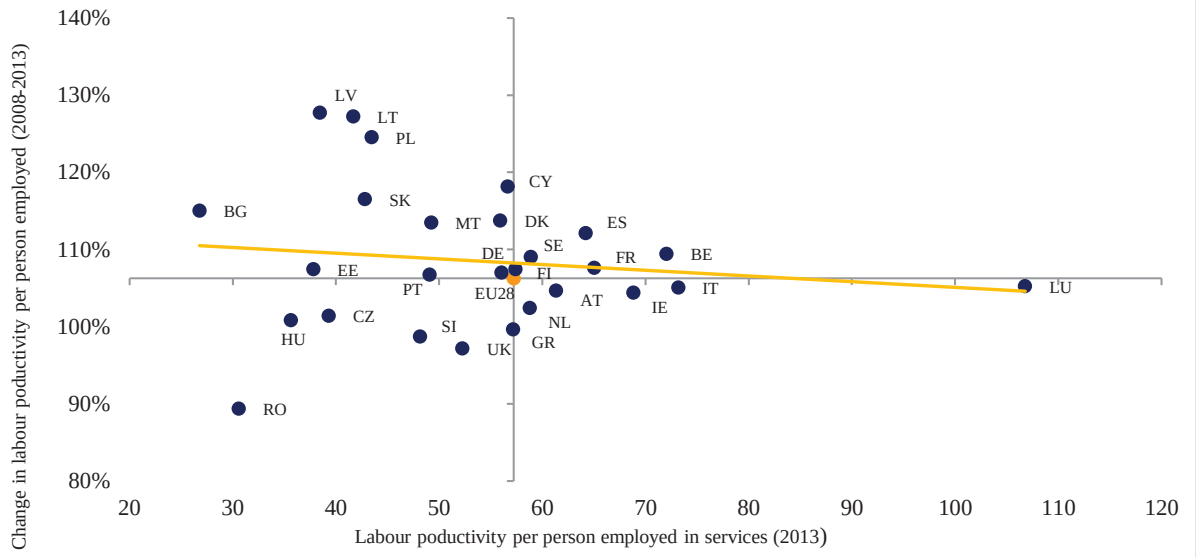
In the period between 2008 and 2013, there was a positive change in labour productivity per person employed in many Member States. This was particularly pronounced in the Member States which joined the EU since 2004, including Latvia, Lithuania, Poland, Bulgaria, and Slovakia. This development may be the result of the catching up of these countries relative to EU-15 Member States, despite the financial crisis. At the opposite end of the scale, Romania had the greatest negative change in labour productivity during this time period.

In the retail sector, the productivity gap vis-à-vis the United States has continued to widen. As indicated in the Commission Staff Working Document accompanying the Single Market Strategy,[77] the difference can be explained by less restrictive entry regulations, bigger investments in ICT and innovation and the creation of new retail formats in the US. The latter in particular forces incumbents to become more productive and replaces less productive firms with more productive ones.

There is also a productivity gap between the retail sector and other sectors of the European economy. For example, the retail sector's wage-adjusted labour productivity is significantly lower than the one of manufacturing (119 % compared to 144 %). When compared at EU country-level, wage-adjusted labour productivity is significantly higher than the EU average in Estonia, Latvia, Luxembourg, Malta, Romania, Slovenia, Slovakia and the UK and significantly lower in Bulgaria, Greece, Italy, Hungary, Portugal and Sweden.[78]

(77) Cf. European Commission, (2015), *A Single Market Strategy for Europe – Analysis and Evidence*, SWD(2015) 202 final.
(78) Eurostat data, 2012

Figure 2.13: Labour productivity in services

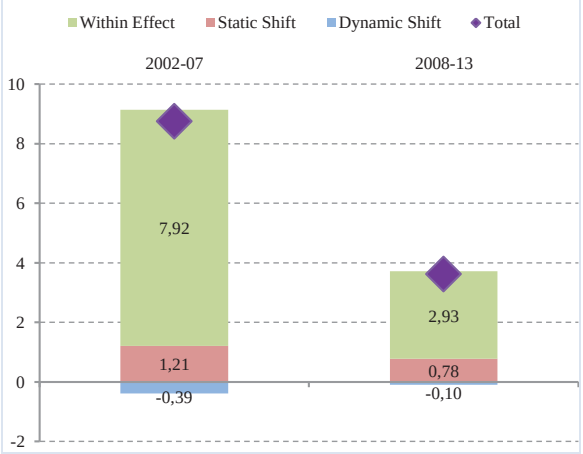


Source: Own calculation on the basis of Eurostat data

2.2.3 Components of labour productivity

Figure 2.14 shows the result of a shift share analysis[79] examining the changes in labour productivity.[80] It shows that in the period 2002-07, labour productivity increased significantly more than in the period 2008-13 (8.75 % vs. 3.61 %). This is not surprising given that the latter period was characterised by the financial crisis and the subsequent recession. Interestingly, most of the change can be explained by a sharp reduction in the contribution of each sector (within effect) in the second period, which dropped from 7.92 to 2.93. In the period 2002-2007, the within effect accounted for 86 % of the total variation (in absolute value), while only 78 % in 2008-2013. This dynamic is mainly explained by the drop of productivity caused by the financial and economic crisis in sectors such as: industry; trade; transport; accommodation services; professional scientific, technical activities; and financial and insurance.

Figure 2.14: Decomposition of labour productivity, EU-28



Note: Shift-Share analysis for 10 sectors classification of economic activities.

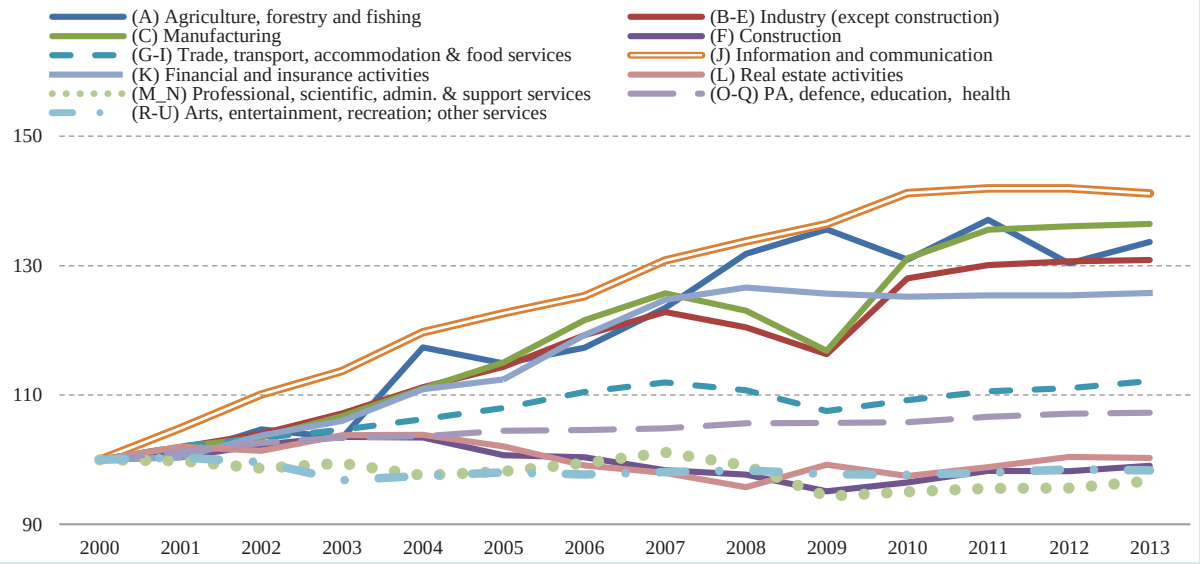
Source: European Commission, EU Structural Change 2015, DG GROW.

At the same time, the productivity growth due to changes in labour shares across sectors with different levels of productivity (static shift) remained more stable in absolute value, slightly decreasing from a value of 1.21 % in 2002-2007 to 0.78 % in 2008-2013, but increasing substantially in terms of share (from 13 % to 21 %). This suggests an ongoing structural change in the European economy, for which a larger share of workers is employed in more productive sectors. Data suggests an outflow of employment from agriculture, forestry and fishing and industry to sectors with higher productivity, such as information and communication, finance and insurance, and services in general.

([79]) Figure 2.13 decomposes changes in labour productivity for the EU-28 into three effects: "within effect", "static shift" and "dynamic shift". The "within effect" measures the contribution of each sector to the total change of labour productivity, The "structural change effect" measures reallocation of resources across sectors. It can be further divided into the "static shift" and "dynamic shift". The "static shift" measures the structural shifts in the economy by considering the changes in labour shares across sectors with different levels of productivity, while the "dynamic shift" measures structural shifts in the economy by considering the changes in labour shares across sectors with different productivity growth.

([80]) Cf. European Commission (2015), *EU Structural Change 2015*, DG GROW.

Figure 2.15: Evolution of labour productivity for the EU-28 (2000=100)



Note: Gross value added at basic prices (chain-linked volumes, reference year 2000) per person employed for the EU-28 aggregate.

Source: European Commission, EU Structural Change 2015, DG GROW.

Figure 2.15 shows the evolution of labour productivity across different sectors. The productivity growth due to changes in labour shares across sectors with different productivity growth (dynamic shift) is negative for both periods considered, but the effect is small in magnitude. This suggests that a small extra fraction of workers have been employed by sectors with declining productivity, in particular professional, scientific and technical activities (which includes also administrative and support service activities).

The same analysis can be repeated for individual Member States. For the period 2002-2007, most of the top performers in terms of total productivity changes are CEE Member States (Estonia, Latvia and Slovakia). But only Latvia managed to keep the same standard for the following period. For the period 2008-2013, one notable case is Ireland, whose performance was excellent. While most countries experienced improvements in labour productivity in the period 2002-2007, the crisis had negative consequences in the subsequent time frame, especially for countries like Greece, Finland and the United Kingdom.

In general, the within sector improvements explain most of the changes in labour productivity. This is probably due to the fact that we consider very large sectoral aggregations. But there are interesting exceptions, like Lithuania in the period 2002-2007, during which the static shift was positive and very large. This can be explained by a sharp decrease of the share of employment in the primary sector, matched by an increase both in industry and in trade, transport, accommodation and food service activities.

2.2.4 Convergence process

Convergence at sectoral level

There are huge differences in the productivity within the same sector across Member States (see introductory chapter). A recent IMF staff research on productivity trends[81] confirmed that even the most technologically advanced countries are lagging in certain sectors and could thus reap large gains from adopting existing best practices. For instance, Member States with leading performances in manufacturing such as Germany and Sweden are lagging in ICT and personal services respectively.

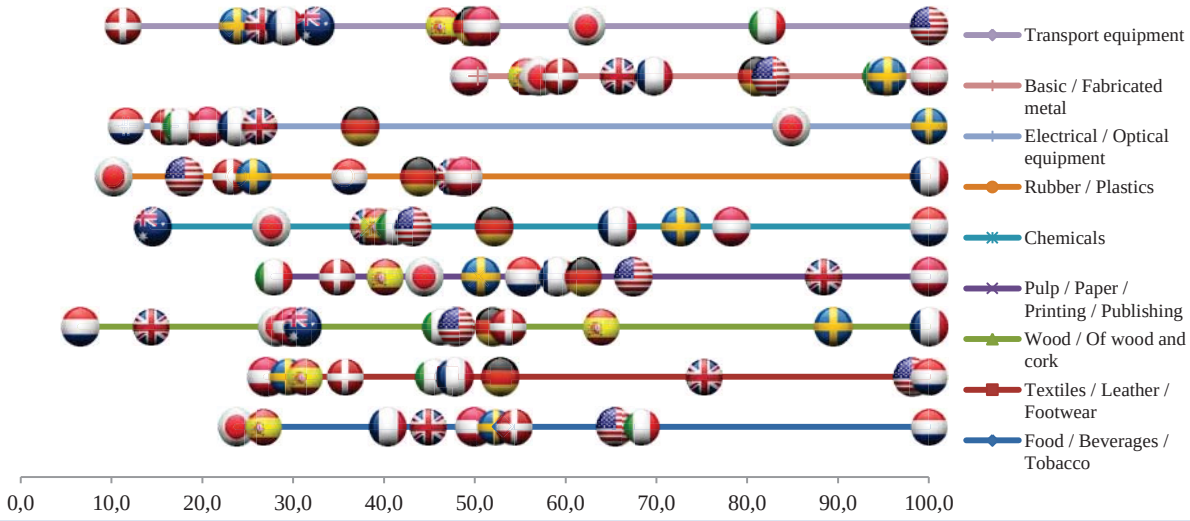
There are also large differences across subsectors within the same sector. For instance, in manufacturing, the Member States analysed[82] are simultaneously leaders and laggards in different industries (Figure 2.16). A clear example is the

([81]) Cf. Dabla-Norris, E., Guo, S., Haksar, V., Kim, M., Kochhar, K., Wiseman, K., and Zdzienicka, A., *The new normal: a sector-level perspective on productivity trends in advanced economies*, Staff discussion note SDN/15/03, March 2015, International Monetary Fund.

([82]) Austria, Germany, Denmark, Spain, United Kingdom, Italy, the Netherlands, Sweden, and France.

Netherlands, which is leading on: food, beverages, tobacco; textiles, leather, footwear; chemicals; and basic, fabricated metals. Yet it is largely lagging on wood and cork; transport equipment, and recycling. Overall, there appears to be a larger margin for improvement in the following industries: rubber and plastics, transport equipment; and recycling.

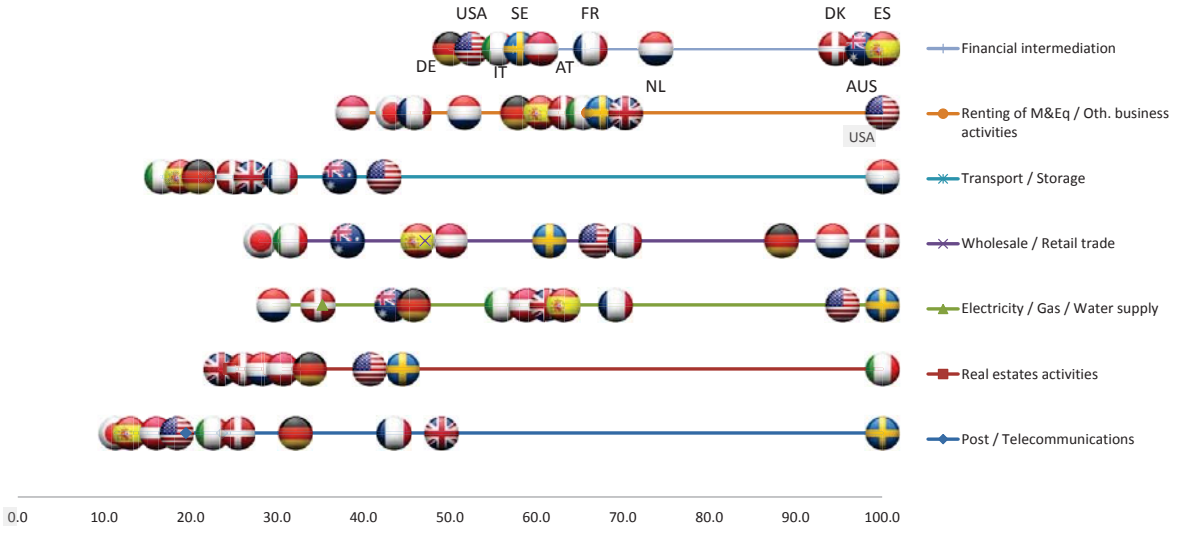
Figure 2.16: Total Factor Productivity level in manufacturing (2000-2007 average, weighted by VA-share; normalized: leader in sector = 100)



Source: IMF (special thanks to Vikram Haksar and his colleagues for this information)

In the services sector, we encounter a similar situation (Figure 2.17). Only the Netherlands appears among the leaders in all subsectors analysed. Yet, even in this case, there are areas with margin for improvement such as renting of machinery and equipment, and other business activities. Overall, the analysed Member States outperform in finance and business services, but underperform in distribution services, particularly on transport and storage.

Figure 2.17: Total Factor Productivity level in services (2000-2007 average, weighted by VA-share; normalized: leader in sector=100)



Source: IMF (special thanks to Vikram Haksar and his colleagues for this information)

It should be noted that the ICT sector appears to offer the larger margin of improvement. Only Sweden is leading in this sector, with all other Member States showing a laggard performance.

To a certain extent, these productivity gaps can be anticipated due to factors such as sectoral R&D intensity or agglomeration spillovers (e.g. manufacturing in Germany). However, the above mentioned analysis suggests that policy distortions are playing a significant role. For instance, regulatory or tax exemptions, subsidies, size-dependent policies, labour and product market rigidities, may all lead firms to make inefficient choices and investment decisions. These policy distortions generate massive losses due to lost productivity gains. If they are tackled, productivity and thus economic growth would be boosted. The wide variation in the regulation of each sector across Member States seems to confirm this result. Fostering Single Market integration would decrease regulatory dispersion and contribute to reduce productivity gaps.

The productivity losses generated by policy distortions in the service sector are among the biggest. Indeed, the heaviest drags on productivity growth have come from service sectors which are often closed to competition, such as non-market, personal and business services.[83] The liberalisation of regulated services sectors could thus be an important source of job creation and output growth.

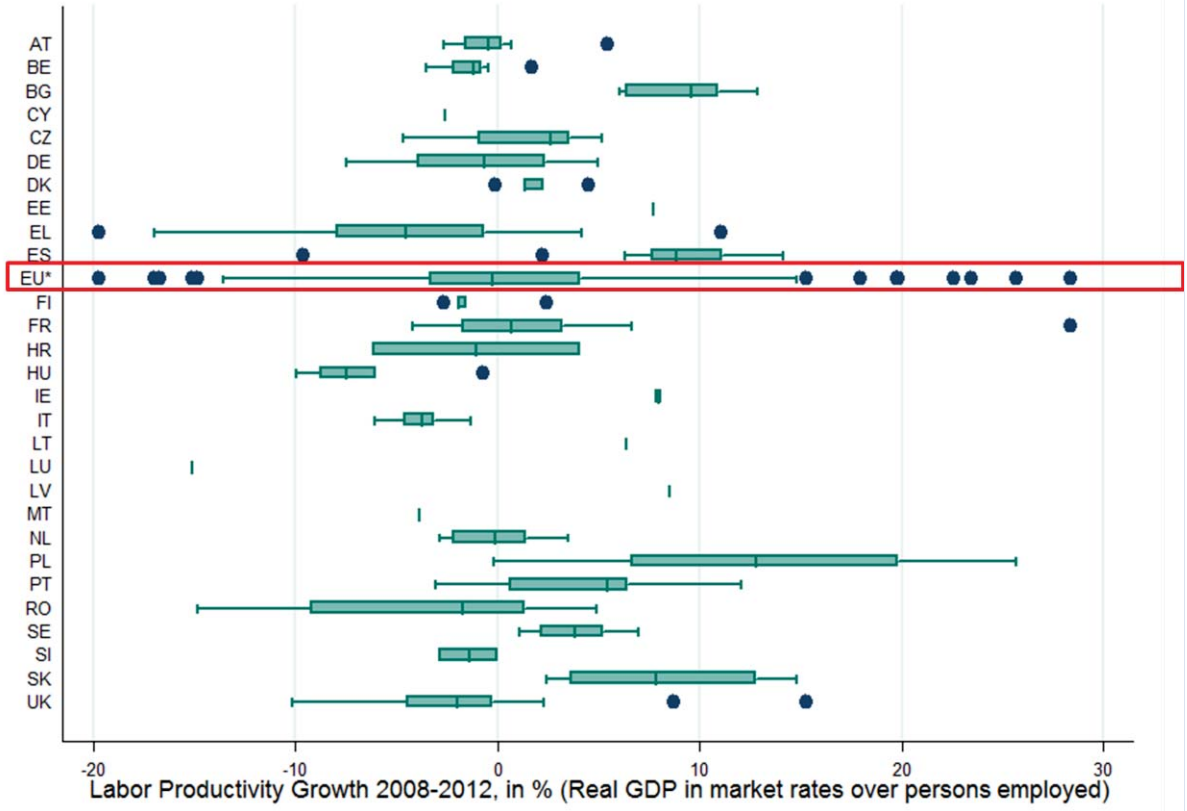
Convergence at national and regional level

The productivity growth of an economy depends on the productivity of each sector but also on whether the resources are allocated to those sectors with higher productivity growth. However, policy measures can alter that process and lead to the allocation of resources to less productive sectors, thus hampering economic growth. The analysis referred to above suggests that the payoffs from improving factor allocation across sectors are potentially large. Productivity gains from a better allocation within countries could already reach more than 10 % in some cases, boosting economic growth.

There is a wide dispersion between and within Member States as regards regional labour productivity growth from 2008 to 2012 (Figure 2.18). Within Member States, the range from lowest to highest labour productivity change was particularly wide in Greece, Poland and Romania, indicating growing internal competitiveness differentials and divergence.

([83]) The economic analysis underpinning the Single Market Strategy confirms that reducing the main restrictions in the business services sector would significantly enhance the efficient allocation of resources within this subsector. Cf. European Commission, (2015), *A Single Market Strategy for Europe – Analysis and Evidence*, SWD(2015) 202 final.

Figure 2.18: Regional distribution of labour productivity changes (2008-2012)



Source: PWC, (2015), Exploring the potential role of human, physical and knowledge capital investments in a smart specialisation context, a study for the European Commission, DG GROW

While in most countries there were regions with increasing as well as regions with decreasing labour productivity from 2008 to 2012, in some Member States there was positive or negative labour productivity growth in all regions: Bulgaria, Ireland, Slovakia and Sweden (positive growth in all regions); Hungary, Italy and Slovenia (negative growth in all regions). Whilst this may generate convergence at the national level, it adds to the divergence between Member States.

Labour productivity growth took place mainly in regions of Bulgaria, Spain, Portugal, Ireland, Sweden, Poland, Slovakia and the Baltic States. In the central European Member States as well as in Finland, the UK, Greece and Cyprus, most regions experienced falling labour productivity. In many cases, this was due to output cuts greater than labour cuts. In other cases, output grew but not as much as the number of persons employed.

The process of convergence of productivity at regional level seems to have stalled given the wide dispersion in growth rates (Figure 2.18). Indeed divergence has been a stronger force than convergence in the last few years. Resuming the convergence process could produce huge economic gains. A recent study[84] suggests there are three main ways to improve the competitiveness of underperforming regions without hampering that of the best performing: internal and external R&D collaboration; investment in human capital, knowledge, R&D and innovation; and regional absorptive capacity. These areas could therefore be the focus of any regional cluster policies and smart specialisation strategies that need to also consider the strength and bottlenecks of their specific regional economic structure.

Convergence across firms

Recent OECD research[85] shows that there is a rising gap in productivity growth between different types of

([84]) PwC, (2015), *Exploring the potential role of human, physical and knowledge capital investments in a smart specialisation context*, study for the European Commission, DG GROW.

([85]) McGowan, M.A., Andrews, D., Criscuolo, C., Nicoletti, G., (2015), *The future of productivity*, OECD report, July 2015.

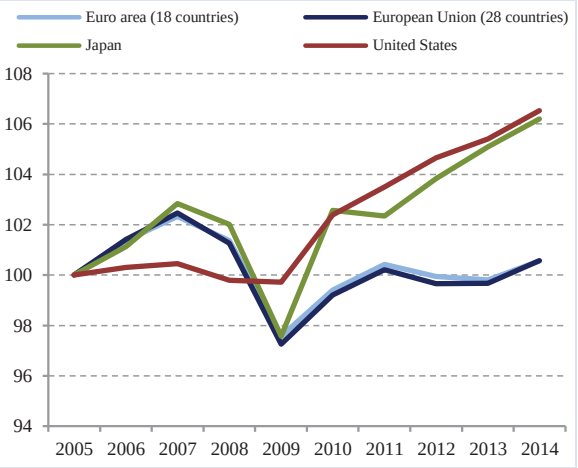
firms. Productivity growth of the globally most productive firms has remained strong, while that of the rest of firms has slowed. This performance is stronger in the services sector than in manufacturing. Effective measures facilitating the diffusion and adoption of technologies across firms could therefore boost productivity.

The above mentioned research also finds that even if the most advanced national firms have high levels of productivity, they may fail to significantly impact aggregate productivity due to their relative small size. A more efficient allocation of resources towards most productive firms would help them grow and thus boost productivity growth.

2.2.5 Comparison with global competitors: TFP and benchmarking with US

Total factor productivity (TFP) captures changes in productivity which are not accounted for by the changes in the quantities of capital and labour inputs, but rather by the way they are combined, i.e. the degree of their utilisation and the technology or organisation employed in the production.[86] Figure 2.19 shows the evolution of TFP from 2005 to 2014 for the EU-28 against that of some major competitors. During the crisis and in its immediate aftermath, TFP decreased everywhere, reaching its lowest level in 2009. This may be the effect of short run excess capacity due to the drop of demand following the crisis. The crisis hit overall EU TFP severely. The EU lost more than the US by 2009, and the US recovered much faster their pre-crisis levels and continued to grow. Japan – where the damage was similar to that of the EU – also managed to recover faster and to follow a recovery path similar to that of the US.

Figure 2.19: Evolution of Total Factor Productivity (2005-2014)



Note: Index 2005=100

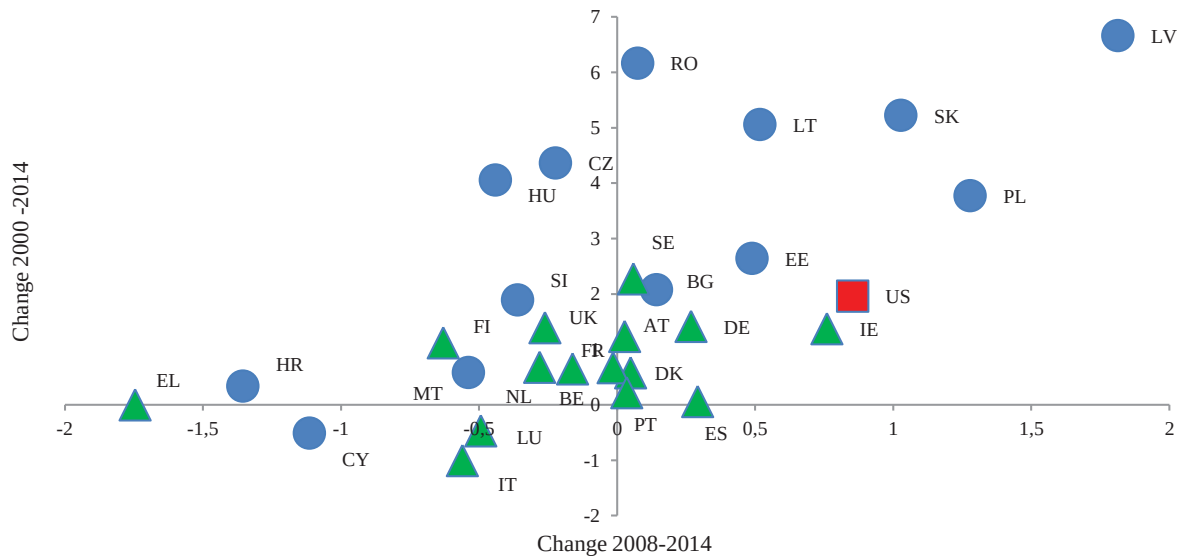
Source: European Commission, EU Structural Change 2015, DG GROW.

Figure 2.20 analyses in more details changes of TFP for the EU Member States and the US.[87] The US has improved its TFP both with respect to 2000 and since the beginning of the crisis. This hints to a stronger resilience of the US economy as compared to Europe. A wide majority of the European Member States performs better compared to their 2000 level of productivity. This is particularly true for some of the new Member States (represented by blue circles), which is an evidence for convergence, in some cases from low starting levels. Yet, the convergence trend seems to be weaker since the beginning of the crisis.

([86]) The European Commission produces estimates of TFP based on the production function methodology approved by the ECOFIN Council (see European Commission (2014)). It accounts for the fact that first due to cyclical shifts of demand or other market frictions, the economy may not utilise its capacity fully; and second inputs can be combined in different ways, depending on the technologies available and the efficiency of the organization. These corrections are measured by total factor productivity, which should be interpreted as an indicator of both the degree of utilisation of inputs as well as the efficiency of their combination.

([87]) The horizontal axis shows changes in the period 2008-2014, i.e. the evolution since the start of the financial crisis. The vertical axis shows the long-run change for the period 2000-2014.

Figure 2.20: Changes in Total Factor Productivity



Note: Solow Residuals in log, total changes for the periods considered

Source: European Commission, EU Structural Change 2015, DG GROW.

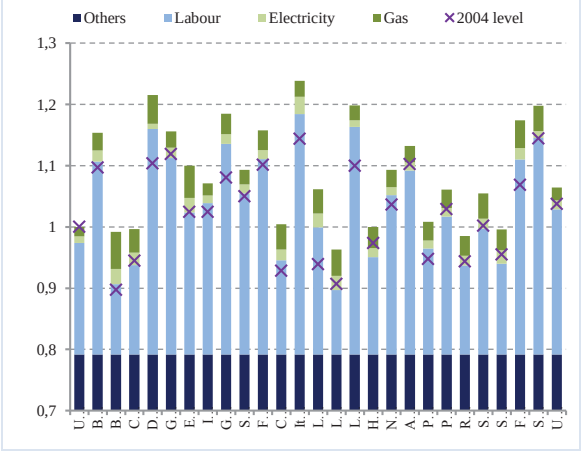
The crisis had different impacts on TFP across Member States. Today still more than half of EU Member States have not yet managed to recover their pre-crisis levels (i.e. they are in the left half of the figure), with Greece, Italy, Luxemburg and Cyprus being at or below their 2000 level. For Spain, Italy and Luxembourg, TFP started to decline or stagnated long before the crisis. In the case of Spain the positive development after the crisis could only just offset pre-crisis losses in productivity with regard to 2000. On the other end of the spectrum, some Member States have recorded considerable gains even during the crisis, such as Slovakia, Poland, the Baltic countries, Ireland and Denmark. Overall, the crisis did not interrupt their longer-term TFP performance. Romania stands out with large TFP gains relative to 2000, but the crisis seems to have put it on halt.

Benchmarking with the US

European producers face relatively high input prices, especially as labour and capital are concerned. A recent study by the Boston Consulting Group[88] compares the evolution of production costs in the EU and in 10 of the most dynamic US States and with relatively lower labour costs. The study shows that productivity increases can compensate higher input costs, especially as regards labour costs. Energy costs, especially higher gas cost prices, seem to be more difficult to offset than higher input prices.

Using a similar methodology, Figure 2.21 compares the cost competitiveness of 26 EU Member States (data are not available for Malta and Cyprus) with the US in 2014. We also use labour productivity per hour and different energy input prices from the International Energy Agency (IEA). This explains the differences in the results between the two studies.[89]

Figure 2.21: Industry cost index by input components: EU vs US

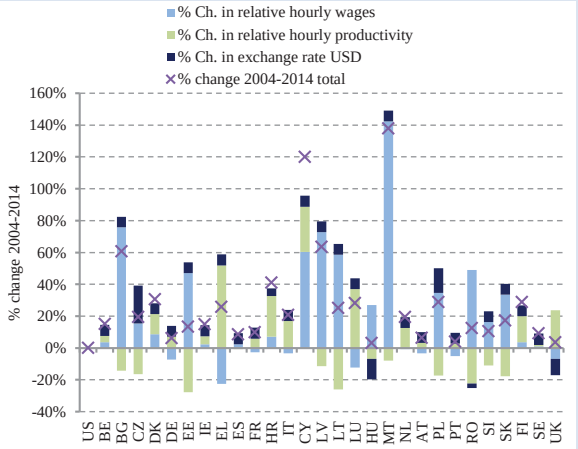


Source: Own calculations with Eurostat and IEA data.

([88]) Sirkin, H.L., Zinser, M., Rose, J.R. (2014), *The Shifting Economics of Global Manufacturing*, Boston Consulting Group ('BCG study').

([89]) Here we use a different sectoral definition to the one used by the BCG study taking industry defined as the difference between groups B and E in NACE. Prices for electricity and gas concern industrial consumers and exclude taxes.

Figure 2.22: Changes in Industry Cost Index 2004-2014, labour component



Source: Own calculations with Eurostat and IEA data.

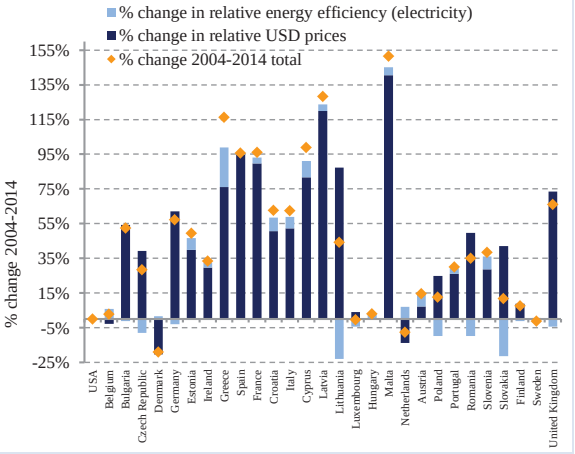
This comparison shows that lower labour costs still allow several Member States to remain below the US benchmark of competitiveness in 2014. The figure also shows the difference in total costs in 2014 with 2004. Total costs have increased in all Member States but these cost increases have been more limited in Germany, Austria, Spain, Hungary, Portugal, Sweden and the UK.

Figure 2.22 gives a more detailed account of the evolution of labour costs. In many Member States, the change between 2004 and 2014 in the labour component of production costs has been below the increase in hourly wages. The factors behind this evolution are very different across countries though. Reductions in wages per hour have contributed to smaller increases in the labour component of production costs in Greece, Luxembourg and the UK, and slightly less in Germany and Portugal. Improvements in the productivity per hour have been a major factor limiting labour costs in Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Malta, Poland, Romania, Slovenia and Slovakia. The exchange rate has been a significant factor in Hungary and the UK, too.

Over the last ten years, reductions in the energy component of production costs have been limited. Energy prices are the main driver of this cost component. Only in very few cases, energy efficiencies have been capable of reducing the contribution of energy to production costs (Figures 2.23 and 2.24).

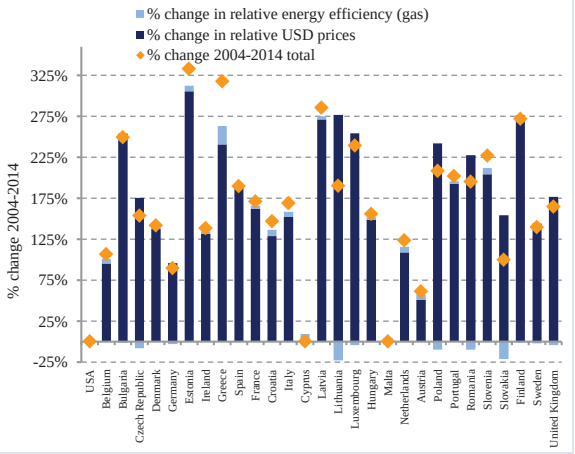
Thus, productivity growth and resource efficiency can compensate to some extent for higher input prices within Europe. However, this requires further investment. This may have an impact on the cross-sectoral reallocation of resources in the near future.

Figure 2.23: Changes in Industry Cost Index 2004-2014, electricity component



Source: Own calculations with Eurostat and IEA data.

Figure 2.24: Changes in Industry Cost Index 2004-2014, natural gas component



Source: Own calculations with Eurostat and IEA data.

2.3 Sources of productivity growth

2.3.1 Digitisation and other advanced technologies

The adoption of a particular technology may have an impact on how efficiently input factors are combined. Accordingly, the use of advanced technologies available may foster the long-term growth of a sector by lowering costs, improving quality and ultimately promoting competitiveness. In recent years, digital technologies are redefining traditional business and production models, resulting in a wide range of product and service innovations. In this way, digitisation has the potential to unfold a catalytic impact on the productivity of large companies and SMEs alike. Ensuring adequate standards in this area is important for keeping and enhancing the comparative advantage of the EU industries, as shown in the economic analysis underpinning the Single Market Strategy.[90]

While the digitisation of EU businesses and digital entrepreneurship have increased, significant differences remain across Member States.[91] Moreover, taking into account four advanced technologies (mobile internet, social networks, cloud and big data), overall only 2 % of EU enterprises make full use of all four, while 41 % are not using any of them.[92]

Also as regards other advanced technologies, EU companies are not adopting such technologies fast enough or in enough scale. A recent survey[93] shows that almost half of European manufacturing companies have not used advanced manufacturing technologies[94] in the past and do not plan to use them in the next year.

Europe is however a global leader in advanced manufacturing technologies in terms of the share of patents but also in terms of the share in total exports. Europe also has a high and increasing trade surplus compared to East Asia and North America in this sector. A main reason for the good performance of the EU in advanced manufacturing components is that new technological solutions in Advanced Manufacturing Technology rest on the integration of other technologies (such as micro- and nanoelectronics, advanced materials or photonics) into complex products where Europe has a comparative advantage. Moreover, the EU can benefit from its long history in developing and applying advanced technologies in manufacturing, and a dense network of Advanced Manufacturing Technology producers and users.[95]

However, when considering a broader set of new technologies, the so-called Key Enabling Technologies (KETs)[96], Europe's performance lacks

(90) Cf. European Commission, (2015), *A Single Market Strategy for Europe – Analysis and Evidence*, SWD(2015) 202 final.

(91) As measured by the relevant sub-dimension of the indicator "Integration of Digital Technology" which is part of the Digital Economy and Society Index (DESI). Indeed, the DESI 2015 groups Member States according to their performance in four clusters:
- High performance (Denmark, Sweden, the Netherlands and Finland): These countries are not only ahead in the EU, but they are world leaders in digital.
- Medium-performance (Belgium, the United Kingdom, Estonia, Luxembourg, Ireland, Germany, Lithuania, Spain, Austria, France, Malta and Portugal): These countries are doing well in certain areas but still need to progress in others.
- Low performance (The Czech Republic, Latvia, Slovenia, Hungary, Slovakia, Cyprus, Poland, Croatia, Italy, Greece, Bulgaria and Romania): These countries need to step up their performance in a number of areas and catch up with the rest of the EU.
http://ec.europa.eu/digital-agenda/en/desi

(92) IDC-EY 2013 *Digital Entrepreneurship Monitor*, https://ec.europa.eu/growth/tools-databases/dem/monitor

(93) European Commission (2015), *Innobarometer survey on innovation trends at EU enterprises*, Flash Eurobarometer 415.

(94) "Advanced manufacturing technologies" comprise: Sustainable manufacturing technologies (i.e. technologies which use energy and materials more efficiently and drastically reduce emissions); ICT-enabled intelligent manufacturing (i.e. technologies which digitalise the production processes); High performance manufacturing which combines flexibility, precision and zero-defect (e.g. high precision machine tools, advanced sensors or 3D printers).

(95) First annual report of the KETs Observatory: https://ec.europa.eu/growth/tools-databases/ketsobservatory/sites/default/files/library/kets_1st_annual_report.pdf

(96) Six Key Enabling Technologies have been identified as important for Europe's future competitiveness: Advanced Manufacturing Technologies, Advanced Materials,

the lustre it has in Advanced Manufacturing Technology, one of the six KETs. East Asian economies strongly develop their own scientific & technological assets in key enabling technologies, with a global share of KET-related patent applications reaching 44 % in 2011. Europe's share in KETs development has progressively declined from 32 % of patent applications in 2000 to 27 % in 2011 (23 % for North America). Also with regard to performance in trade, East Asia experienced a sharp increase in total exports of KETs-based components and intermediary systems during the last decade, holding now a share of about 57 % compared to 23 % for the EU-28 and 20 % for North America. Europe succeeded however in holding its trade share relatively constant over the past decade.

Among the EU Member States, Germany holds the strongest position in all KETs. In general, Germany performs well above the other European countries in terms of share of patents, share of production, share in total export, and share in turnover. France, Italy and the UK are often among the top five of each KET for several indicators, while Member States like Belgium and Denmark have excellent positions in individual KETs. In terms of trade balance, only Germany, the Netherlands, Belgium, Ireland and Austria have a trade surplus in all six KETs.

Nanotechnology, Micro- and Nanoelectronics, Industrial Biotechnology and Photonics. Cf. European Commission (2009), *Preparing for our future: Developing a common strategy for key enabling technologies in the EU*, COM(2009) 512 final.

2.3.2 R&D and innovation

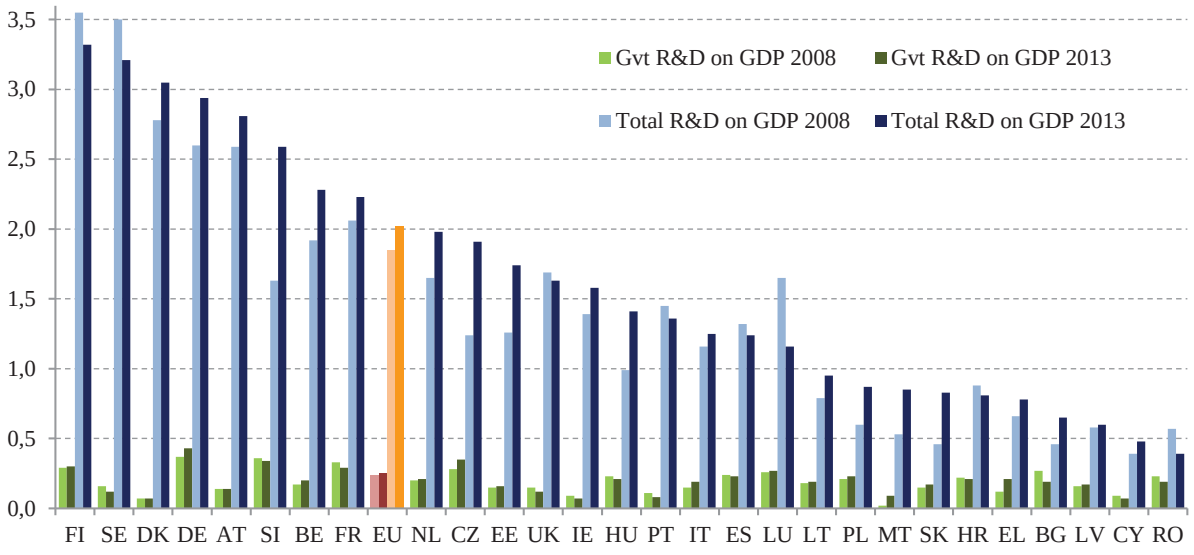
R&D expenditure as innovation input

In the monitoring of innovation processes, both inputs and outputs need to be considered. Research and development (R&D) expenditures can be regarded as the main input indicator. On the public sector side, government efforts in R&D investment have been largely upheld over the course of the crisis. In about half of EU Member States, the government budget for R&D grew faster (or decreased less) than GDP despite severe budgetary constraints.[97] In parallel, private R&D expenditure as a share of GDP slightly increased between 2008 and 2013. As a result, gross domestic expenditure on R&D (R&D intensity) increased from 1.85 % in 2008 to 2.02 % in 2013 (Figure 2.25). Indeed, at the onset of the economic crisis, EU R&D intensity increased to 1.94 % in 2009 as many EU Member States made an effort to maintain public R&D investment to counter the impacts of the crisis on private investment. This increase is remarkable as it followed a relative stagnation around 1.77 % for the period 2004 to 2007. R&D intensity has then continued to grow marginally since 2011. However, it still remains significantly below the target of 3 % by 2020, pointing to the need for additional investment efforts.[98] In absolute terms, investment in research and innovation has actually decreased during the crisis and remains too low.

([97]) If the indirect efforts (e.g. in the form of tax incentives) are added, an even larger number of Member States have achieved genuine smart fiscal consolidation.

([98]) The Europe 2020 strategy sets the aim of increasing combined public and private R&D investment to 3 % of GDP by 2020.

Figure 2.25: R&D expenditure on GDP (%) in the EU



Note: For IE total R&D expenditure data refers to 2012; for EL government expenditure on R&D refers to 2007.

Source: Eurostat

Innovation performance in the aftermath of the crisis

In fact, the crisis has left a notable impact on the private sector's innovative activity, with the commercial uptake of innovations constituting a particular weakness. The number of innovative firms is in decline, as are SMEs' innovations, patent applications, exports of high-tech products, venture capital investments, and sales of innovative products. While there have been improvements in human resources, business investments in research and development and the quality of science, these are not enough to result in an overall stronger innovation performance. This poses serious risks for the long-term growth potential of the EU, as do other aspects relevant to innovation performance.

The sharpest declines in the share of innovative businesses have been observed in Cyprus, Germany, Romania, the Czech Republic and Spain. On the other hand, the share of innovative enterprises increased the most in Malta, the Netherlands, Latvia and the United Kingdom. During the period 2010-2012, the highest share of enterprises with innovation activity was recorded in Germany (66.9 % of enterprises), Luxembourg (66.1 %) and Ireland (58.7 %). On the contrary, less than 30 % of enterprises had innovation activity in that period in Romania (20.7 %), Poland (23.0 %) and Bulgaria (27.4 %).[99]

From the perspective of SMEs, a lack of financial resources is viewed as the main problem in the commercialisation of innovative products or services. In this context, the few innovative businesses that receive public financial support for R&D or other innovation activities consider it as not effective enough.[100] As explained in the Commission Staff Working Document accompanying the Single Market Strategy[101], the difficulty in accessing and enforcing Intellectual Property Rights (IPR) also deters SMEs' investments in innovation. The significant cost exposure for IPR and patent litigation is a serious deterrent for SMEs to engage in patenting.

On EU level, the average annual growth rate of innovation performance (as measured by the Innovation Union Scoreboard) has reached 1.0 % with most Member States improving their innovation performance over the eight-year period 2007-2014. However, compared to last year, innovation performance has increased for only 15 Member States, while it has declined for 13 Member States. Overall, innovation performance has been converging

([99]) Community Innovation Survey 2012.

([100]) In the Innobarometer 2014, 91 % of surveyed companies said that they had not received public financial support for R&D or other innovation activities since January 2011. For companies that received public financial support of some kind there was an even split between those who said this support was important for developing innovations (48 %) and those who said the support was not important (49 %). Cf. Innobarometer 2014: The role of public support in the commercialisation of innovations, European Commission.

([101]) Cf. European Commission, (2015), *A Single Market Strategy for Europe – Analysis and Evidence*, SWD(2015) 202 final.

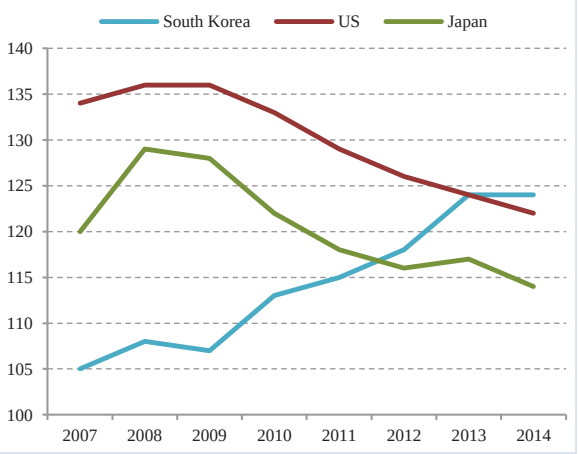
across Member States but performance differences remain high.[102]

It is particularly noteworthy that the most innovative countries perform best on all dimensions: from research and higher education systems, through business innovation activities and intellectual assets up to innovation in SMEs and economic effects, reflecting balanced national research and innovation systems. Yet, the level of development and structural conditions of the relevant country, region and sector should be taken into account when designing innovation policies. These factors determine the capacities to access, absorb and create new technologies.[103] Effective innovation policies must therefore take into account the specificities of the relevant country, region and sector.

International comparison

When looking at the performance of innovation systems in a global context, South Korea, the US and Japan have a performance lead over the EU. While EU innovation performance has been improving at a higher rate than in the US and Japan, the innovation gap with South Korea is widening (Figure 2.26).

Figure 2.26: Innovation performance gap with non-EU countries (EU=100)



Source: European Commission, *Innovation Union Scoreboard 2015*, DG GROW.

South Korea, the US and Japan strongly outperform the EU in business R&D expenditure, and, to a lesser extent, in public-private co-publications. Firms in these countries invest more in research and innovation, and the collaborative knowledge-creation between public and private sectors is better developed.[104]

The difference in the share of business R&D expenditure between the EU, on the one hand, and South Korea (222 % of EU value), Japan (199 %) and the US (151 %), on the other hand, is striking. As concerns the level of R&D intensity per sector, the EU shows a higher intensity than the US in very few sectors, in particular computer electronic and optical products, electrical equipment, and chemicals. Although the overall ranking across sectors is very similar, American firms, on average, tend to invest much more than European firms in innovation and technology. This is a matter of concern.

Manufacturing represents 64 % of total R&D expenditures in the EU, while the services sector accounts for 34 % of them.[105] In comparison with the US, the EU focuses more on motor vehicles while the former invests a larger share in high-tech sectors like computer, electronic and optical products, and pharmaceuticals. This signals a different type of specialisation. In other sectors, the differences are

([102]) European Commission, *Innovation Union Scoreboard 2015*. The Innovation Union Scoreboard measures the performance of EU national innovation systems. It groups Member States into four different performance groups:
- "Innovation leaders" with innovation performance well above the EU average (Denmark, Finland, Germany, Sweden);
- "Innovation followers (Strong innovators)" with innovation performance above or close to the EU average (Austria, Belgium, France, Ireland, Luxembourg, Netherlands, Slovenia and the UK);
- "Moderate innovators" with an innovation performance below the EU average (Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Italy, Lithuania, Malta, Poland, Portugal, Slovakia and Spain); and
- "Modest innovators" with innovation performance well below the EU average (Bulgaria, Latvia and Romania).

([103]) Cf. EBRD, (2014), *Innovation in transition*, Transition report 2014, November 2014.

([104]) European Commission, *Innovation Union Scoreboard 2015*.

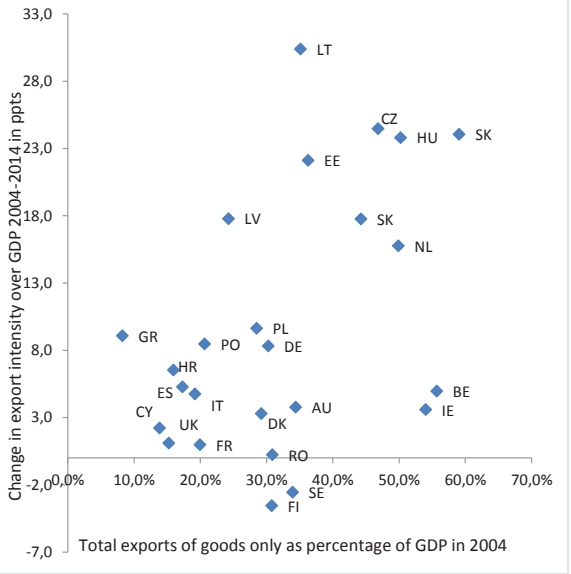
([105]) 2011 data for all EU Member States except: Malta, Bulgaria, Lithuania, Latvia, Cyprus, and Croatia. The remaining share corresponds to the energy sector (1 %), the primary sector and mining (0.5 %), and construction (0,5 %). Source: own calculations based on OECD statistics.

less relevant in magnitude, pointing to a more similar pattern.

2.3.3 The external competitiveness of EU firms

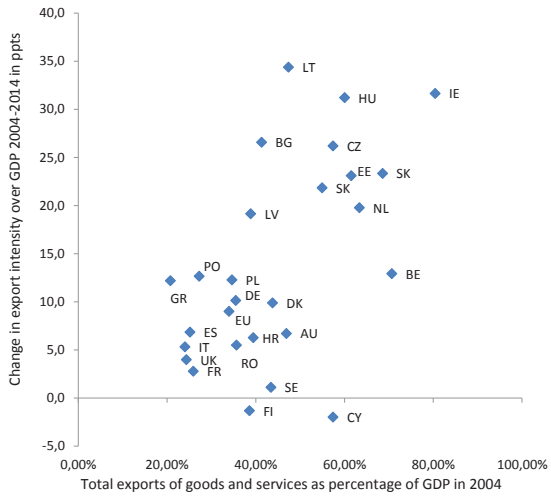
Driven by improvements in productivity in some Member States and by the internal devaluation, EU exports have increased considerably after the crisis with respect to the 2004-2008 period. This expansion applies equally to goods and services. However, there are big differences in the export performance of Member States within and outside the EU. The vigorous growth in global demand resulted in an increase of extra EU exports of goods of 28 % in the 2010-2014 period compared to the five years previous to the crisis. A more subdued internal demand limited sales to other Member States growing just at a 3.5 % rate within the Single Market.

Figure 2.27: Growth in total exports of goods to the EU and to the rest of the world (2004-2014)



Source: Eurostat

Figure 2.28: Growth in total exports of goods and services to the EU and to the rest of the world (2004-2014)



Source: Eurostat

There is a very clear distinction in the exporting performance of different Member States compared to their results in 2004 (Figures 2.27 and 2.28). Seven of the Central and Eastern European Member States have improved their performance in a remarkable way. Their exports to the EU and to the rest of the world have increased by over 20 percentage points. Ireland and the Netherlands are the only EU-15 countries exhibiting a comparable performance. These have and remain very open countries with a high degree in the internationalisation of their activities. There are just two EU Member States where exports have contracted in the last decade: Finland and Cyprus.

The situation looks similar when focussing on the exports of goods, but the growth rates are relatively more modest with a maximum growth of exports of around 30 percentage points in Lithuania. Obviously, this implies a relatively faster expansion in the exports of services. Finland and Sweden are the two countries reporting export contractions as far as goods are concerned.

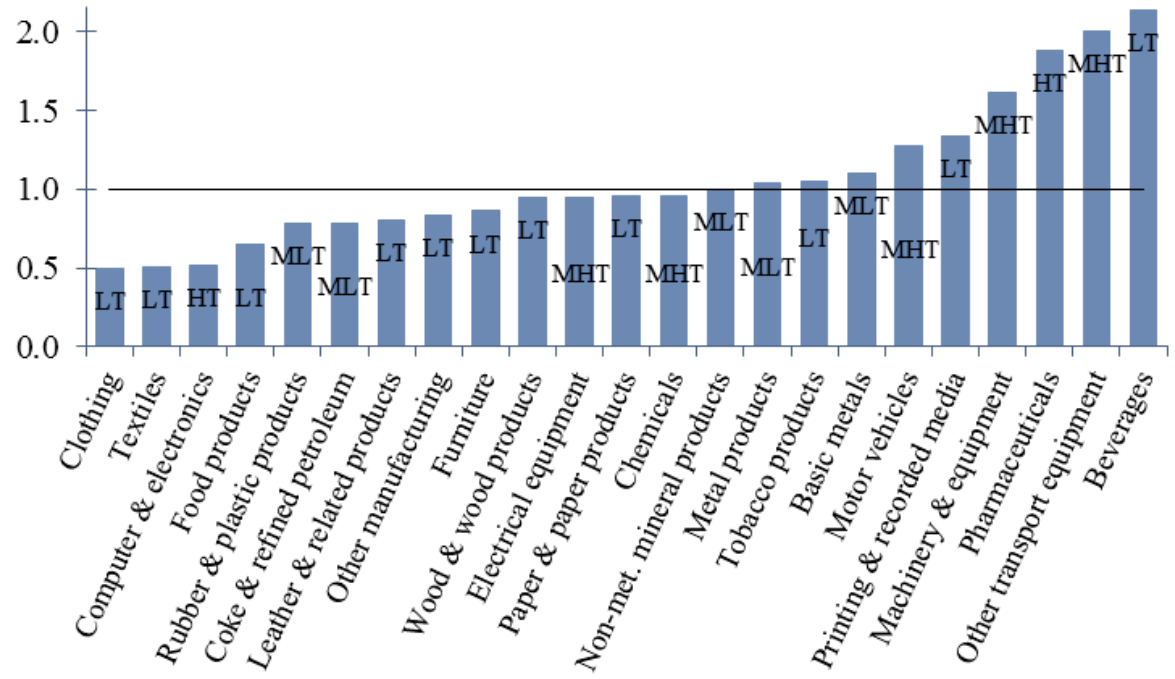
As explained in the next chapter, the EU is now integrating faster with third countries than internally, which reflects the globalisation process and the faster demand growth in many emerging markets. There is however no trade-off between intra-EU trade and global trade. Member States which integrated further

in the global economy are also those that have shown the highest integration dynamics within the EU.[106]

and extra-EU trade in goods (measured as change between 2004-2008 and 2010-2014 in percentage points of GDP) across the Member States.

([106]) There is indeed a positive correlation (0.5) between EU trade

Figure 2.29: EU manufacturing sectors: revealed comparative advantage (2013)



Note: Low technology (LT), Medium-low technology (MLT), Medium-high technology (MHT), High technology (HT) in accordance with Annex 3 of Eurostat (2014)

Source: EU Structural Change (2015)

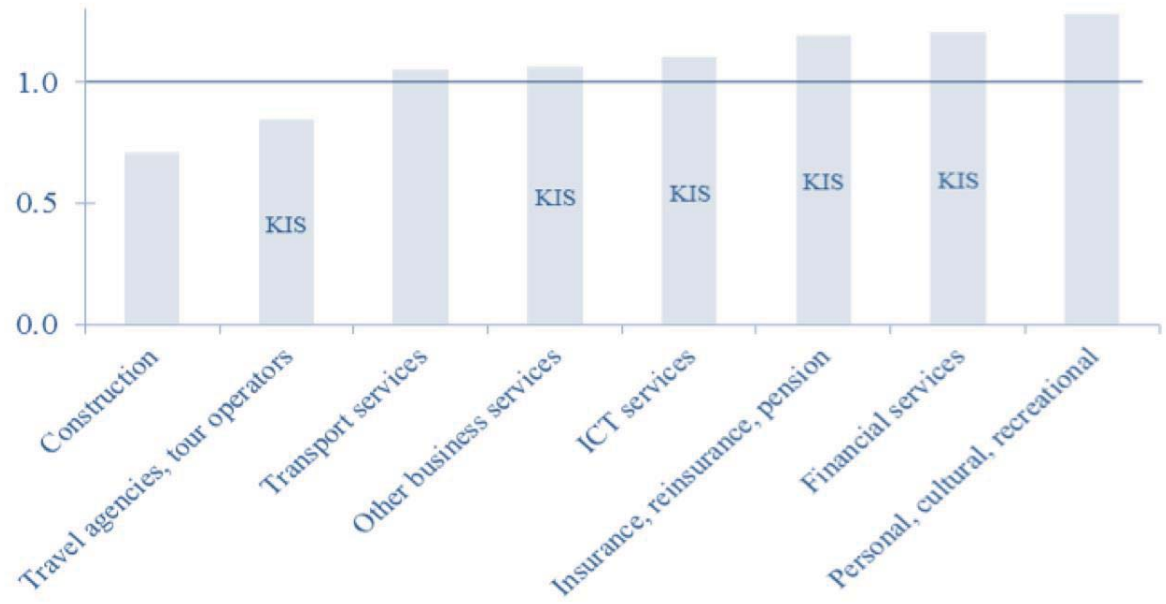
Among the Member States with an increasing integration in the Single Market, most of them have experienced an improvement of their price competitiveness position.[107] Some of these countries (Estonia, Latvia, Romania as well as Luxembourg) benefited from improving the quality of their exports as well.[108] As regards the group with decreasing or stagnating integration, Belgium, Luxemboug, Malta, Finland and Greece suffered from cost competitiveness losses. Only Finland and Sweden exported less in 2010-2014 than in 2004-2008. Ireland leads the table in services exports, followed by Portugal, France, Malta and Belgium. Bulgaria, Cyprus, Italy, Slovakia and Croatia are the only countries presenting worse results in 2010-2013 than in 2004-2008.

The importance of export growth for the EU in recent years has been considerable. EU exports have been growing above the world trade index since the crisis. External demand has contributed by around 3 % to GDP in the early years of the recovery and has compensated the negative contribution of internal demand in 2012 and 2013. Although energy prices have been a disadvantage for the international competitiveness of EU firms, the evolution of unit labour costs has contributed to improve it. But this has not been the only factor supporting our export performance.

([107]) Measured as depreciation of real effective exchange rate vs. EU-28 with unit wage cost, manufacturing as deflator. See: http://ec.europa.eu/economy_finance/db_indicators/competitiveness/data_section_en.htm

([108]) See Vandenbussche H. (2014), *Quality in Exports*, Economic Paper 528, DG ECFIN, European Commission.

Figure 2.30: EU services sectors: revealed comparative advantage (2013)



Note: Knowledge-intensive services (KIS) are defined in accordance with Annex 8 of Eurostat (2014)

Source: Own calculations based on WTO data

As shown in Figure 2.29, the EU has a comparative advantage in high-tech sectors (pharmaceuticals), medium-high tech sectors such as machinery and transport equipment, including motor vehicles and low-tech sectors (paper, print and beverages). Over the last twenty years, European comparative advantage has remained stable in most sectors but some improvements can be reported in the motor vehicles, the paper and printed product and the machinery value chains.[109]

Given their nature, revealed comparative advantages can only be reported for a limited number of traded services sectors in Figure 2.30. Europe has a high comparative advantage in personal, cultural and recreational services but it has also a strong specialisation in financial services. ICT and business services that have a crucial importance for manufacturing and other business activities seem to have a positive but relatively low comparative advantage level.

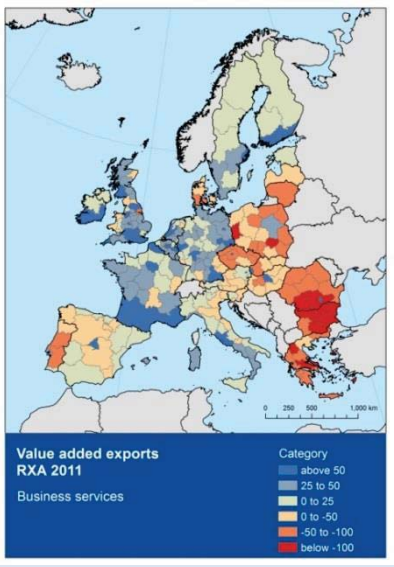
The evolution of comparative advantage is clearly path dependent and this is an important fact to take into account in the design of policies; a background study presents a detailed account of the evolution of specialisation at NUTS 2 level for low to high-tech sectors. A snapshot of this analysis for business services in presented in Box 2.1 below.

Box 2.1: Revealed advantages in value added exports of the business services sector

Over a long time period, Europe has succeeded to be better than the USA and Japan in maintaining relatively high market shares in world trade. The share of the EU in global exports has fallen by 3.5 percentage points (ppt) between 1995 and 2013 while it has decreased by 8.9 ppt for Japan and 4.7 ppt for the USA. China with over 13 ppt gain in the share of global exports is the main beneficiary of the losses reported by the other main global trading partners. In some cases, such as transport equipment, the EU's world market share has increased by 5.2 ppt from 1995 to 2013. Europe has also succeeded in maintaining its comparative advantage in sectors such as machinery and chemicals, but not in the upcoming digital and communication technologies.

([109]) Timmer, M.P., Los, B., Stehrer, R. and de Vries, G.J. (2013), *Fragmentation, incomes and jobs: an analysis of European competitiveness*, Economic Policy, 28(76), 613–661.

The graph shows the geographical distribution of regional revealed advantages in value added exports for business services in 2011. In the context of the analysis, business services are understood to comprise the following elements: a) the renting of machinery and equipment, b) computer and related activities, c) research and development and d) other business activities such as legal and accounting activities, tax and business consultancy, market research. They do not include financial services such as banking and insurance. In the EU, there is a clear geographical divide, as the high income countries and regions tend to have revealed advantages in the value added exports of business services, while the less developed countries and regions in the South (Greece, Portugal and Spain) as well as in the East have revealed disadvantages.

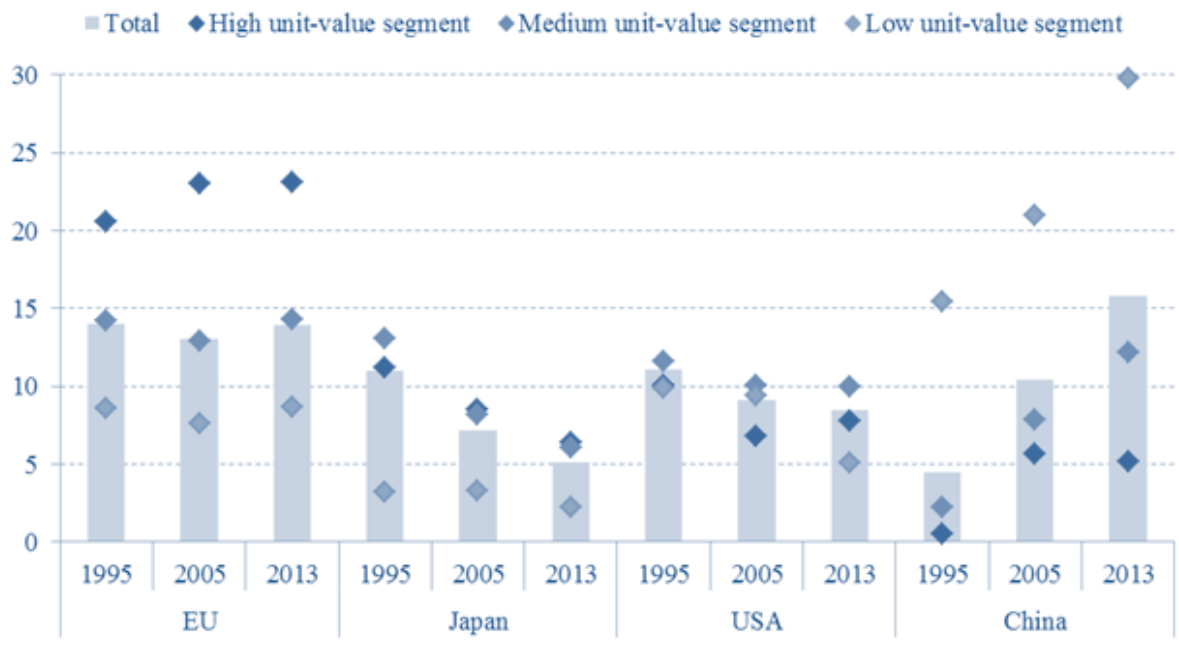


Exceptions to this are the capital city regions, especially in the CEE countries. Accordingly, revealed advantages in business services exports are highly correlated with GDP per capita levels. This correlation and the generally low competitiveness of business services in the peripheral regions are of direct policy relevance, as it opens up the possibility to design concrete policy measures targeting the development of such services in the less developed EU regions. Such policies not only would improve those regions' competitiveness in business services, but at the same time would also create additional employment and contribute to the general economic development of those regions, as improved business services would have positive repercussions on the manufacturing industry sectors, via R&D and the transfer of knowledge, increases in the technological capacities, marketing etc. As a final consequence, such targeted policies would thus also contribute to economic cohesion of the EU regions.

Revealed value added specialisation of exports (RXA) – Value added exports: Business services, 2011
Source: Cordes et al. (2015)

This is a relatively good performance in a world with many and powerful emerging economies like China and stronger competition from the USA. Europe's export performance is particularly remarkable given its relative input price disadvantage.

Figure 2.31: Market shares in unit value segments



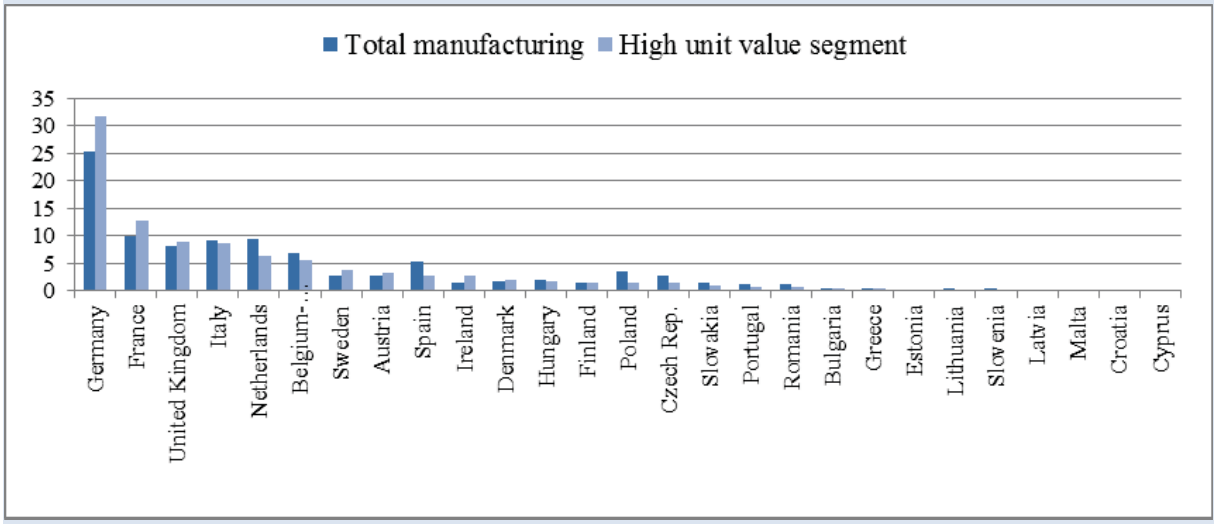
Source: Stehrer et al. (2015)

Quality competition and moving up the ladder in the value added contents of the activities carried out in medium-tech sectors seems to be contributing to sustain EU competitiveness. This appears to be confirmed by evidence provided by the analysis of the qualitative changes in the contents of our exports based on their unit values. These values can be interpreted as quality-adjusted price of products and provide a better insight of the changes in the composition of EU exports.

Figure 2.31 presents the market shares of the EU, USA, Japan and China in 1995, 2005 and 2013 for exports with high, medium and low unit value. Figure 2.32 shows the contribution to manufacturing exports and to high unit value export segment by Member State. The former figure shows a higher and even growing market share of EU exports in the high unit value export segment. These results point out in a similar direction as Vandenbussche H. (2014). However, the EU competitiveness could be further enhanced by reducing the existing barriers on allocative efficiency, which negatively impact competition in a number of Member States, as pointed out in the Staff working document accompanying the Single Market Strategy.[110]

([110]) Cf. European Commission, (2015), *A Single Market Strategy for Europe – Analysis and Evidence*, SWD(2015) 202 final.

Figure 2.32: Contribution to total manufacturing exports and to high unit value export segment by country (2013)



Note: Countries ranked according to market shares in 2013

Source: Stehrer et al. (2015)

2.3.4 Other factors contributing to productivity

Infrastructure and networks

Efficient infrastructure and network industries (e.g. energy, transport and broadband) are fundamental for a competitive business environment. However, the quality and availability of these production inputs still varies considerably across the EU.

Overall, the quality of transport infrastructure in the EU increased slightly over the last five years. The new Member States continue to catch up and significant investment has taken place in the context of cohesion policy since 2007. By contrast, there are indications of under-investment in most advanced EU economies since 2009 (Austria, Belgium, Germany, Finland, France, Luxembourg, the Netherlands, Denmark, Sweden and the United Kingdom).[111] Member States' budgets allocated to maintenance were often not sufficient to prevent a deterioration of the existing network.

The availability of fixed broadband infrastructure, which is crucial for digital markets, has progressed moderately but steadily. However, fixed rural

([111]) European Commission, *Infrastructure in the EU: Developments and Impacts on Growth*, Occasional paper 203 (2014).

coverage is still below 80 % in five Member States, and remains a challenge in Member States such as Bulgaria, Finland, Latvia, Poland and Slovakia, with some progress registered in Croatia, Slovenia and Romania. Whilst more than two thirds of the EU households are covered by high speed broadband, Italy, Croatia and Greece need to upgrade most of their networks to keep pace.

Upgrading and better connecting the energy infrastructure are among the key objectives of the Energy Union Strategy. The work on infrastructure projects has accelerated in recent years and many Member States have launched large-scale projects which are now in the implementation phase, including the "Projects of Common Interest" identified in 2013 under the trans-European energy networks Regulation (TEN-E).[112]

Cleantech economy

European manufacturing firms spend on average 40 % of their costs on raw materials, with energy and water pushing this to 50 % of total manufacturing costs, to be compared to a share of 20 % for labour costs. ([113]) Resource efficiency is thus an important driver of innovation and competitiveness and will play a crucial role for industry to open up new markets. Resource productivity varies considerably across Member States due to their different GDP levels, their stages of economic development, and the structure of their economies. Countries showing highest values in resource productivity include the Netherlands, Luxembourg, the UK, Spain and Italy. The lowest resource productivity can be observed in Finland, Latvia, Bulgaria, Estonia and Romania. Energy intensity in the industry is the lowest in Ireland and Denmark whilst Lithuania and Bulgaria have the highest energy intensity.

Boosting productivity, employment and economic growth, while exploiting the benefits of energy and resource efficiency and the green economy is a challenge and an opportunity in many Member States. For example as regards eco-innovation, the gap between the best performers (including Sweden, Finland, Germany, Denmark and the UK) and the Member States lagging behind (including Bulgaria, Poland and Cyprus) remains significant. Accelerating the market uptake of eco-innovations in all sectors could be effectively promoted by addressing the obstacles faced by eco-innovative businesses and through supporting market replication and clusters of SMEs, developing targeted financial instruments, and the public procurement of cleantech innovations.

Skills

Long-term growth can be achieved by improving the quality of labour input since highly qualified workers can help firms innovating and make the best use of high-tech processes. Human capital is not a perfectly substitutable input which can be transferred between sectors at no cost. It is therefore an input factor which can explain differences in growth across countries, although it is not easy to measure.

Most European countries are faced with skills challenges, as a consequence of the ongoing structural changes taking place in their economy. For instance, in the period 2008-2013, the share of low-skilled workers has decreased for all sectors[114], whereas the share of high-skilled workers has slightly increased. The overall picture for medium-skilled workers is less clear, since roughly half of the sectors experienced a decrease. This finding might be explained in different ways. First of all, since the level of education is generally increasing in Europe, this can partly explain the general decrease of low-skilled workers. Secondly, the economic and financial crises may have hit stronger low pay jobs, determining an overall decrease of low-skilled workers (and medium-skilled workers in some sectors), while high-skilled ones managed to keep their position. Finally, labour hoarding is more likely to be observed for highly educated and specialised workers.

The availability of both high-skilled and medium-skilled workers is critical for companies:

Manufacturing sectors that produce goods requiring a high proportion of high-skilled labour are:

([112]) European Commission, (2015), *Energy Union Package: A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy*, COM(2015) 80 of 25 February 2015.

([113]) Europe INNOVA, Guide to resource efficiency in manufacturing: experiences from improving resource efficiency in manufacturing companies, 2012.

([114]) But a decrease of the share of low-skilled workers does not necessarily correspond to a decrease of the number of low pay jobs in employment. In fact, people can accept jobs for which they are overqualified. The fact that the share of medium-skilled workers increased in some low-skilled intensity sectors like Accommodation and food service activities or Agriculture, forestry and fishing may suggest that some low-skilled low pay jobs have been taken by more qualified workers.

pharmaceuticals; computer, electronic and optical industries; and coke and refined petroleum. While the first two are sectors with high technological intensity, coke and refined petroleum is classified as a mid-low-tech sector. However, this sector has an above average labour productivity, and is dominated by large enterprises (more than 250 employees), mostly operating in the global markets.[115]

Service sectors among the most human-capital-intensive include: education, information and communication; professional, scientific and technical activities; and financial and insurance activities. Shortage of highly required professionals, such as ICT programmers, poses increased risks to EU competitiveness, especially in high-tech sectors, but the shortage of ICT specialists is generally affecting all sectors.[116]

The lowest proportion of low-skilled labour (4.67 %) is found in financial and insurance activities, closely followed by professional, scientific and technical activities (4.7 %). More than 25 % of the workforce in chemicals, other transport equipment, beverages and tobacco manufacturing are high-skilled. Low-technology manufacturing industries such as textiles, clothing, leather products and wood products employ small proportions of high-skilled labour. The same applies to labour-intensive service industries such as accommodation and food, and agriculture and forestry.

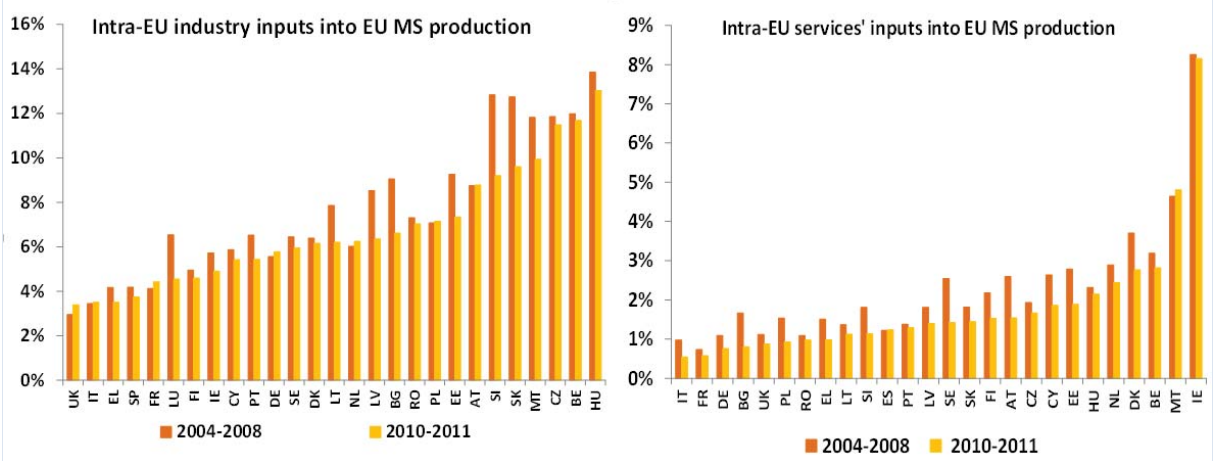
2.3.5 Integration in international value chains

The overall trends in EU outsourcing over the period 2004–2011 indicate that the role of intra-EU outsourcing has diminished both in industry and services (Figure 2.33). The level of intra-EU outsourcing in the industry has diminished in several Eastern European EU Member States (LT, LV, BG, EE, SK, SI, MT, CZ and HU) after the crisis. Similar developments, though at a much lower scale, given the lower starting point, were observed in services. Similar trends were observed for extra-EU industry outsourcing into Eastern EU Member States (Figure 2.34). On the contrary, the share of output supplied by third countries in services increased in almost all EU Member States, indicating increasing involvement of third countries services' providers into EU value chains.

([115]) For more information, see http://ec.europa.eu/eurostat/statistics-explained/index.php/Manufacture_of_coke_and_refined_petroleum_products_statistics_-_NACE_Rev._2.

([116]) European Commission, *A Digital Single Market Strategy for Europe - Analysis and Evidence*, SWD(2015) 100 final, May 2015, page 69-73.

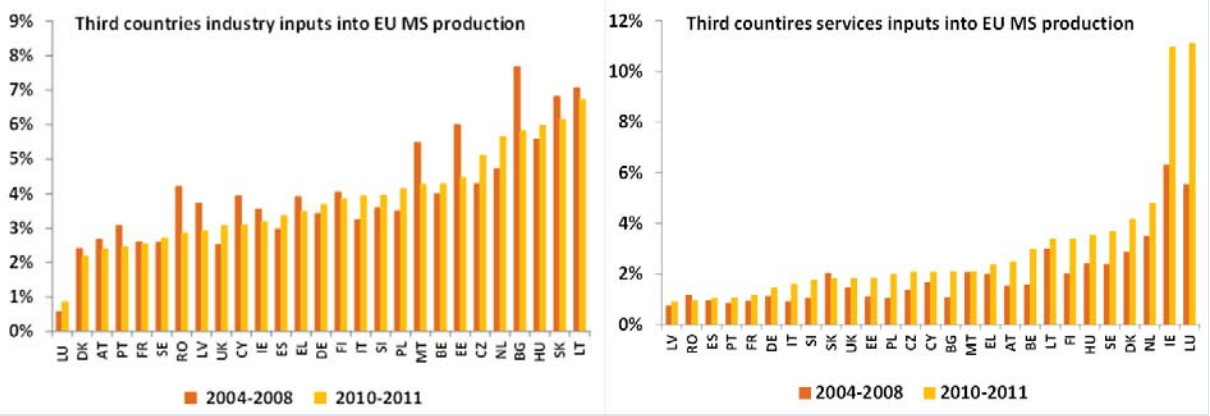
Figure 2.33: Level of intra-EU direct outsourcing across the EU Member States



Note: Direct outsourcing only i.e. production inputs only from my suppliers but not from my suppliers' suppliers divided by total output in the destination country. An outlier with a very high level of trade outsourcing in services (LU) is omitted.

Source: WIOD

Figure 2.34: The level of extra-EU direct outsourcing across the EU Member States



Note: An outlier with a very high level of trade integration (LU) is omitted. Trade= Imports +Exports/2*GDP.

Source: WIOD

In general, larger countries use relatively less intra-EU production inputs, both from industry and from services, reflecting their sizeable domestic production capacities. The UK, Italy, France and Spain were the lowest users together with Greece of intra-EU industry inputs, and these countries (UK, IT, FR) together with Bulgaria and Germany were the lowest users of intra-EU services. In contrast Hungary, Belgium, Czech Republic, Malta and Slovakia were the top five Member States with the largest level of intra EU cross-border outsourcing of industry and Luxembourg, Ireland, Malta, Belgium and Denmark were the top five Member States with the largest level of intra EU cross-border outsourcing of services.

2.4 Conclusions

A major resource re-allocation across sectors is taking place in most developed economies. This structural transformation may lead to higher growth and competitiveness if it is driven by technological progress and efficient allocation of resources.

Yet, the convergence of productivity amongst EU economies is stalling. As product and process innovation may be running out of steam, this slowdown reduces growth prospects. For certain EU Member States the problems of declining or stagnating TFP date back to before the crisis. For countries like Italy, Spain and even France and Belgium, the stagnation in terms of TFP in manufacturing started long before the crisis, providing strong evidence for structural rather than cyclical problems. TFP performance is also affected by the quality of factors of production, as measured, for instance, by energy prices, infrastructures, skills and technology.

Productivity can be increased by technological progress (expansion of the technological frontier) and by the adoption of existing technology (catching up process by laggards). These processes take place along national lines and across sectors. However, policy distortions and regulatory fragmentation can hamper them and lead to an inefficient allocation of resources towards less productive firms.

Fostering the completion of the Single Market would facilitate the allocation of resources to the sectors with higher productivity growth. This could increase the competitiveness of EU industrial and service sectors thus boosting growth and job creation. There is room for policy and structural reforms to foster productivity growth by improving the use of productive inputs (adoption of best practices) and resource allocation (allocative efficiency) across sectors, countries and regions. Tackling the existing barriers in the Single Market with EU-wide actions such as those proposed by the Single Market Strategy will contribute to a better allocation of resources across firms and sectors. Yet, sector and country specific product market reforms should also be adopted by Member States in those cases where structural reforms must take into account national and regional specificities of the national or regional economic structure.

The innovation performance of Member States is converging but only gradually. It is noteworthy that more innovative Member States (Denmark, Finland, Germany, Sweden) are hardly converging amongst themselves, while innovation performance amongst more modest innovators (Bulgaria, Latvia, Romania) is even diverging. Moreover, several Member States show poor results in business innovation activity. Yet, it is precisely in this area where the gap vis-à-vis global competitors is larger, that one would expect more rapid growth. Effective innovation policies must take into account the specific conditions of the relevant country, region and sector.