Council of the European Union

Brussels, 12 September 2014
(OR. en)

13141/14

IND 241
COMPET 504
RECH 363
ESPACE 67
TRANS 418
ENER 391
REGIO 97
ECOFIN 816
MI 648
EDUC 280
TELECOM 160

COVER NOTE

From:	Secretary-General of the European Commission, signed by Mr Jordi AYET PUIGARNAU, Director
date of receipt:	11 September 2014
To:	Mr Uwe CORSEPIUS, Secretary-General of the Council of the European Union
No. Cion doc.:	SWD(2014) 277 final PART 1/4
Subject:	COMMISSION STAFF WORKING DOCUMENT European Competitiveness Report 2014 Helping Firms Grow

Delegations will find attached document SWD(2014) 277 final PART 1/4.

Encl.: SWD(2014) 277 final PART 1/4

EUROPEAN
COMMISSION

Brussels, 11.9.2014
SWD(2014) 277 final

PART 1/4

COMMISSION STAFF WORKING DOCUMENT

European Competitiveness Report 2014
Helping Firms Grow

EUROPEAN COMPETITIVENESS REPORT 2014

HELPING FIRMS GROW

Table of Contents

List of abbreviations

BRIC	Brazil, Russia, India and China
CIS	Community Innovation Survey (CIS3, CIS4, CIS2006, CIS2008, CIS2010)
CPA	Classification of products by activity
EFIGE	European firms in a global economy
EC	European Commission
ECB	European Central Bank
EFTA	European Free Trade Agreement
EIB	European Investment Bank
ESSLait	ESSnet on Linking of Microdata to Analyse ICT Impact
EU	European Union
Eurofound	European Foundation for the Improvement of Living and Working Conditions
FDI	Foreign Direct Investment
FISIM	Financial Intermediation Services, Indirectly Measured
GDP	Gross domestic product
GERD	Gross domestic expenditure on R&D
GFCF	Gross Fixed Capital Formation
GVA	Gross value added at market prices
HGF	High growth firm
ICT	Information and communication technology
ISIC	International standard industrial classification
IEA	International Energy Agency
IID	Independent and identically distributed
IMF	International Monetary Fund
IOT	Input-Output table
LFS	Labour Force Survey
LNG	Liquefied natural gas
NACE	Nomenclature statistique des activités économiques dans la Communauté
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Squares
PIAAC	Programme for the International Assessment of Adult Competences
PISA	Programme for International Student Assessment
PPI	Producer Price Index
RCA	Revealed Comparative Advantage
R&D	Research and development
RoW	Rest of the world
SBA	Small Business Act
SBS	Structural Business Statistics
SME	Small and medium-sized enterprise
SUT	Supply and use table
TFP	Total factor productivity
TJ	Terajoule
ULC	Unit labour cost
UN	United Nations
VA	Value added
VC	Venture capital
WGI	World Bank's Worldwide Governance Indicators
WIOD	World Input-Output database
WIOT	World Input-Output table
WTO	World Trade Organization

COUNTRY ABBREVIATIONS

EU code	ISO code	Country name
AL	ALB	Albania
AT	AUT	Austria
BA	BIH	Bosnia and Herzegovina
BE	BEL	Belgium
BG	BGR	Bulgaria
CA	CAN	Canada
CN	CHN	People's Republic of China
CY	CYP	Cyprus
CZ	CZE	Czech Republic
DE	DEU	Germany
DK	DNK	Denmark
EE	EST	Estonia
EL	GRC	Greece
ES	ESP	Spain
FI	FIN	Finland
FR	FRA	France
–	MKD	FYROM (former Yugoslav Republic of Macedonia)
HR	HRV	Croatia
HU	HUN	Hungary
IE	IRL	Ireland
IS	ISL	Iceland
IT	ITA	Italy
JP	JPN	Japan
KR	KOR	South Korea
LT	LTU	Lithuania
LU	LUX	Luxembourg
LV	LVA	Latvia
ME	MNE	Montenegro
MT	MLT	Malta
NL	NLD	Netherlands
PL	POL	Poland
PT	PRT	Portugal
RO	ROU	Romania
RS	SRB	Serbia
SE	SWE	Sweden
SI	SVN	Slovenia
SK	SVK	Slovakia
TR	TUR	Turkey
UK	GBR	United Kingdom
US	USA	United States of America

MAIN FINDINGS OF THIS REPORT:

- As EU manufacturing emerges from the recession, its competitive strengths remain intact: highly skilled workers, high domestic content of export goods, and comparative advantages linked to complex and high-quality product segments.
- The fall in recent years in the value-added share of manufacturing is due mainly to falling relative prices of manufacturing in relation to services, which in turn stem from higher productivity growth. Discounting for the relative price effect, the actual fall has been much more gradual. On the other hand, the positive impact of reindustrialisation on the value-added share may not be strong enough to outweigh the opposite effect of falling relative prices.
- Otherwise viable projects appear to be held back by financial markets imperfections. Smaller and younger firms are especially affected and policy measures to improve their access to external financing may be justified.
- Smaller and younger firms are also less likely to enter foreign markets. Most internationalisation strategies by SMEs are focused primarily on exports and driven by factors in their home country and in the target country.
- The efficiency of public administration has an impact on the growth of firms, both in terms of employment and the share of high-growth firms. There are, however, only weak indications that public administration plays an important role as an input to different sectors of the economy.
- Product innovation has a positive and large effect on employment growth in all phases of the business cycle, in both manufacturing and service sectors. The effects of process and organisational innovations on employment growth are smaller and often statistically insignificant. The absolute effect of product innovation is largest in boom periods, which are characterised by high demand. However, in recessions, it plays a very important employment-preserving role.
- Electricity and gas prices are higher, and have recently risen more, in the EU than a number of other economies, mainly due to rising taxes, levies and network costs.
- Econometric analysis shows that, for several manufacturing industries, energy efficiency improvements have not fully offset the negative impact of increasing energy prices, even though European industries have achieved more than international competitors in reducing their energy intensity.
- Increasing electricity costs had a negative impact on export competitiveness. The impact can be particularly challenging for certain energy-intensive industries in the EU.

Post-recession fallout: manufacturing's strengths and challenges

Building on existing strengths…

As the economy emerges slowly from the longest and deepest recession in EU history, it is important to build on the existing strengths of EU manufacturing going forward. First, EU exporters have comparative advantages in a number of manufacturing sectors, including those characterised by high technology intensity, such as pharmaceutical products, and by medium-high technology intensity, such as chemical products, machinery and equipment, motor vehicles and other transport equipment. Similarly, in value added terms, the EU has great advantages in chemical products, machinery and transport equipment, but also in metal products, wood and wood products, paper, printing and recorded media.

Secondly, the domestic content of EU manufacturing exports is high — around 85% of value added — and comparable to the domestic content of Japanese or US manufacturing exports. The domestic content of Chinese and South Korean exports is much lower, as their export goods include much more foreign embedded value added, of which more than 5% is of EU origin.

Thirdly, EU manufacturing exports are characterised by a higher degree of sophistication and complexity than goods exported by many other economies, and from 1995 to 2010 all accession countries of 2004/2007 managed to raise the complexity of their exports.

Fourthly, EU manufacturing is characterised by growing share of high-skilled workers carrying out advanced and often specialised tasks.

…but challenges remain

At the same time, many challenges lie ahead and the EU economy is still far from reaching its targets for manufacturing value added, R&D expenditure, gross fixed capital formation and investment in machinery and equipment. This report shows that the increasing distance to the 20% reindustrialisation is primarily the result of higher productivity growth in manufacturing than in the rest of the economy, which in turn pushes the relative price of manufactured goods down in relation to services, and thereby the value-added share of manufacturing. Net of the relative price effect, the fall in the value-added share is much smaller.

Focus on firm growth

Structure of the report

With the recession now behind them in most Member States, EU firms can look forward and have a chance to prosper and grow — as will the many start-up firms not yet in existence. Because the growth of firms (in terms of employees, turnover, profitability, or market shares) is now of crucial importance, four chapters of this report are dedicated to various factors and drivers thereof such as access to finance (Chapter 2); SME internationalisation (Chapter 3); the efficiency of public administration (Chapter 4); growth of firms, innovation, and the business cycle (Chapter 5). Energy costs and energy efficiency — at least as crucial to EU competitiveness — are addressed in Chapter 6.

Financial market imperfections may hold back otherwise viable projects

External financing is crucial for firms to grow…

Europe's economic success depends on the competitiveness and growth of European enterprises. Access to external financing is essential for enterprises to invest, innovate and grow. As a consequence of financial market imperfections, for example caused by *information asymmetries*, 'financing gaps' may limit enterprises' investment and growth options if viable projects cannot be financed. Since 2008, the proportion of successful bank loan applications has fallen significantly, along with the level of enterprise investment. While the sharp fall in private sector investment is largely a consequence of weak demand, financial market imperfections may have also played a role.

The results of an econometric analysis of ECB survey data and EU firm accounts, from the Amadeus and EFIGE datasets, indicate that the difficulties that small and young firms have in obtaining external finance cannot be linked entirely to risk. Small and young firms have more difficulty than other firms in obtaining bank credit, even if their financial performance is the same. This indicates that the market for bank credit is not functioning efficiently. The financial market imperfections most likely stem primarily from information asymmetries. On the one hand, banks may not have sufficient financial information on firms who want to borrow, which discourages them from lending. On the other hand, firms may not have sufficient knowledge of potential lenders or may be discouraged from borrowing due to a belief that banks will not lend to them, and so may miss out on borrowing opportunities.

External finance has an effect on the growth of firms by providing resources to support investment, productivity, employment and expansion into international markets. The results of an econometric analysis of firm accounts from the Amadeus database indicate that lending is more important for small and young firms seeking to finance new investment than for other types of firm. However, as noted above, small and young firms find it more difficult to obtain loans. Also, they are more sensitive than other types of firm to the interest burden on loans. Because young firms, in particular, have difficulty obtaining long-term credit, they are being driven to accept shorter-term credit arrangements, which are unsuitable for funding long-term investment projects.

…and for job creation

Long-term credit is very important to all firms' moves to take on new staff, but most crucial for domestically-owned small and medium-sized enterprises (SMEs) and very small (micro) firms seeking to expand their workforce. In general, for young firms there is a strong positive relationship between increased cash flows and total factor productivity (TFP). In terms of enabling new employment, the high-tech knowledge-intensive services sector is more reliant on external finance than other sectors.

Firms that are less financially constrained are more likely to export, possibly because they have the available funds to overcome the sunk costs of entry

into export markets. However, financial constraints do not affect the export sales (intensity) of firms that are already exporting. Access to external finance is more important as a driver of new investment for manufacturing and construction sectors than for services.

Measures to improve supply of and demand for external financing

On the side of lenders, information asymmetries could be addressed by standardising financial information on SMEs, for example through the establishment of centralised credit rating agencies at national or EU level. These could be used as a source of reference by all banks, similar in purpose to the credit ratings issued on government, municipal and corporate debt. On the side of borrowers, policy measures should be introduced that boost the market knowledge of small and young enterprises, as well as training in the preparation of loan proposals.

While current policy measures focus on supporting existing exporters, specific support measures may be needed to enable export participation of SMEs, possibly in the form of export credits and insurance, or other measures. To answer these questions the report dedicates a chapter on the link between internationalization and growth of firms

SMEs entering foreign markets

Exporting is most common way for SMEs to go international

Policymakers are increasingly focusing on the growth and employment potential of SMEs. Comprising over 99% of all firms and 60% of total output in the EU, SMEs are central to efforts to improve long-run competitiveness, particularly in international markets, where historically they have underperformed as compared with larger firms.

SMEs tend to enter foreign markets primarily as exporters because of the lower levels of capital investment and associated risk. Foreign direct investment is another form of internationalisation, although this is less common among SMEs than larger firms. Other forms, such as non-equity contractual modes, are relatively uncommon in manufacturing and business services. Franchising and licensing are important foreign entry modes in the retail, accommodation and restaurant sectors, where exports play a less significant role.

Strategies depend on firm and country characteristics

Not all SMEs have the same opportunities to internationalise their production activities. Internationalisation strategies differ according to inherent firm characteristics such as initial productivity, skill intensity, innovation performance and management characteristics. The factors influencing their internationalisation decisions can be divided into two categories: internal and firm-specific factors, or external factors. The former include firm size, labour productivity, skill intensity, innovation activities, and foreign ownership. The latter consist of home-country characteristics such as export promotion programmes, administrative and transport costs associated with exporting, and host-country characteristics such as tariffs, regulations, political risk factors, geographical distance and cultural factors.

Patterns and drivers of SME internationalisation

The report presents in chapter 3 SME internationalisation patterns, highlighting key trends and their impact on the growth of firms. It distinguishes between SME size classes (small, medium and micro enterprises), internationalisation modes (exporting and outward FDI activity), types of exports (goods and/or services) and activity sectors (services and key manufacturing sectors). Some of the key findings include variations in SME export propensity, with higher participation rates in manufacturing and in software and business services, and the influence of home-country administrative burdens, such as heavier export and business regulations, leading to lower SME export participation rates. In broad terms, SME export participation increases with size and age of the firm, apart from some exceptions in technology-driven sectors, and is also positively linked to levels of innovation, R&D activity and skill intensity. Target country factors, including market size, language and geographical distance, also have a significant influence on SME internationalisation activity, particularly for the smallest firms, which are the most susceptible. In terms of technological considerations, skill-intensive SMEs have higher output and employment growth rates than those with a less skilled workforce, while overall there is a strong link between innovative SMEs and levels of export participation.

An efficient public administration is an important driver of competitiveness

It is becoming widely accepted in the EU that efficient public administration (PA) is a key driver of EU competitiveness. The demand for more efficient PA in the Member States has created a need for empirical evidence in addition to 'business perceptions', which are currently the only available form of feedback on the link between PA efficiency and business performance. While the need for more efficient PA can be supported empirically, assessing PA efficiency via microeconomic channels, with a view to providing 'hard evidence', is much more challenging. The report is identifying indicators of PA efficiency that can be related to the distribution of firms' growth, the share of high-growth firms and the turnover of firms in an economy?

An efficient public administration increases the share of high-growth firms and job creation

The results show that greater PA efficiency induces higher rates of fast-growing firms, in particular by increasing firm turnover and net entry. This holds especially for general indicators that measure the overall governance system, including the presence of an independent judiciary and freedom from corruption. From this perspective, PA efficiency is tied to the quality of a country's institutions and general (including political) governance.

Tax administration corruption and ineffective justice systems seem to impede most firms'

Employing input-output analysis the reports finds in chapter four evidence that public service provision that relies more on fees than on taxes may be associated with higher efficiency.

Empirical results of a within-country analysis, presented in the chapter show that tax administration, corruption and ineffective justice systems are seen as

growth

the factors that most impede firms' growth in virtually all countries in the sample.

Impact of innovation on growth of employment

Innovation can have different, contrasting effects on employment: it can create jobs by creating additional demand for new products, but it can also destroy jobs because of productivity effects and lower demand for old products. It is likely that the extent to which innovation can stimulate demand and the extent to which process innovations are used to reduce costs vary over the course of the business cycle, with important implications for employment. Chapter 5 studies how the relationship between innovation and employment growth changes over various phases of the business cycle and how this relationship is affected by different firms' characteristics. It uses data from Community Innovation Survey, and it covers a large sample of firms in 26 European countries, in manufacturing and services sectors, for the period 1998-2010, which includes the recent economic crisis.

The chapter provides evidence that innovative firms have higher employment growth than non-innovative firms. This pattern can be observed in all sectors and in all phases of the business cycle, but is particularly pronounced in downturn and recession periods.

Impact of different types of innovation

The results of econometric estimations suggest that product innovation has a positive and large effect on employment growth in all phases of the business cycle, in both manufacturing and service sectors. In most cases, a 1% increase in successful product innovation leads to a 1% gross increase in employment. The effects of process and organisational innovation on employment growth are smaller and often statistically insignificant.

The contribution of product innovation to employment growth is largest during boom periods, when favourable economic conditions lead to higher sales of new products. However, in recessions, product innovation plays a very important employment-preserving role. Employment losses of product innovators are much smaller than those of firms that did not introduce product innovations.

Firm size, sector and ownership structure are important determinants of the strength of the effects of product innovation. Product innovation has a much more profound effect on employment growth in high-technology and knowledge-intensive sectors than in low-technology and less knowledge-intensive sectors. The results also suggest that product innovation tends to contribute more to employment growth in large and foreign-owned firms, compared to SMEs and domestic firms. However, large and foreign firms tend to lose more employment due to higher productivity effects than they gain from product innovation, thus leading to mostly jobless growth.

The findings of the report indicate that innovation, and especially product innovation, contributes to increasing and to preserving employment in all phases of the business cycle and in all sectors. They also suggest that

innovation is particularly important during recessions, when it plays an important role in limiting job losses.

The findings underline the importance of innovation support as a policy priority during all phases of the business cycle, but particularly in times of crisis when firms tend to decrease investment in innovation due to fears that demand will grow more slowly, or not at all. The finding that product innovation plays an important role in stabilising employment growth during recessions supports the view that investment in R&D could be a candidate for smart fiscal consolidation.

Energy cost has a significant impact on industrial competitiveness

Rising energy costs put pressure on energy-intensive industries

Electricity and gas prices have grown more in the EU than in many other economies. Although energy cost shares are slightly less than 5% of gross output in advanced economies such as the EU, Japan and the US, they have been generally increasing over time. For energy-intensive sectors energy cost shares are a fundamental determinant of competitiveness.

In terms of energy intensity, a strong convergence process has taken place across major economies, particularly in Europe where Member States have been able to reduce their energy intensities. This has been driven mostly by technology, but a structural shift towards high-tech industries has also played a role, particularly in the EU-12 countries. By contrast, in the EU-15 a structural shift towards chemicals and chemical products has limited the reduction in energy intensity.

Higher gas and electricity prices in the EU

End-user gas and electricity prices for industry vary considerably across countries. In the case of natural gas, this reflects the regional fragmentation of wholesale markets, the differences in wholesale gas pricing formulas and varying degrees of end-user price regulation.

In the United States, gas prices are largely independent of the oil markets and tend to be much lower. The recent shale gas ‘revolution’ and the high degree of pass-through have also contributed to keeping industrial prices at around a quarter of the OECD-Europe average. Elsewhere, the cross-country differences in end-user gas prices can be largely attributed to varying degrees of price regulation. In Russia, low gas prices for industry are explained by end-user price regulation and cross-subsidisation of domestic customers at the expense of foreign shipments. Gas prices for industry in China vary widely by region, but on average they are broadly in line with the European level. In Japan, gas prices for industry are currently among the highest in the world, due not only to high upstream prices but also to cross-subsidisation of households by industry.

Due to taxation and exemptions, electricity prices in the EU differ not only between wholesale and retail but also between sectors and Member States. On average they are currently twice as high as those in the US. Network costs and electricity taxation and levies have contributed significantly to strong electricity price growth in Europe. At the same time, energy costs have decreased in some Member States thanks to the expansion of

renewable energy production, since the variable costs of renewable electricity are negligibly low. There are also substantial differences across Member States, reflecting differences in the energy generation mix, in taxation and in the allocation of the cost of support for renewables, including the exemptions from such costs for many industrial sectors.

Energy efficiency cannot fully offset the impact of price rises

Unless they are offset by improvements in energy intensity, cross-country differences in energy prices may have important repercussions for production costs as well as industrial competitiveness. For this reason, the report estimates the price elasticity of energy intensity, i.e. how the energy intensities of individual industries responded to energy price shocks in the period from 1995 to 2009. The estimated elasticities are generally negative and not negligible, but their absolute value is smaller than one for most manufacturing sectors, implying that energy efficiency improvements in response to energy price shocks have generally not been sufficient to fully offset the adverse impact of rising energy prices, resulting in an overall increase of energy-related expenditure.

Growing electricity costs have negative impact on export competitiveness especially for some energy-intensive industries

The report investigates the link between energy prices, energy efficiency and industrial competitiveness (as measured by extra-EU exports). The findings shows that the increasing electricity costs had a negative impact on export competitiveness. Moreover, the high within sectors heterogeneity suggests that energy-intensive industries are most heavily affected.

The results show that, since energy savings in most cases were not large enough to fully compensate for energy price increases, energy represents a growing share of total production costs. Therefore caution is called for when adopting policies that determine a further increase of energy prices, since this creates a real burden that some European firms cannot fully compensate for.

Chapter 1.
FROM RECESSION TO REINDUSTRIALISATION?

This chapter assesses the competitive performance of EU manufacturing and other sectors, and compares it with the competitiveness of established and emerging economies outside the EU. The ability of EU industries to compete, on the single market or in third countries, is determined by a number of factors — some necessary to compete on price, others affecting their ability to develop products with characteristics and qualities that differentiate them from those of their competitors.[1] The following analysis of competitiveness performance is based on a number of traditional indicators (revealed comparative advantage, labour productivity, unit labour costs) as well some as less commonly used indicators.

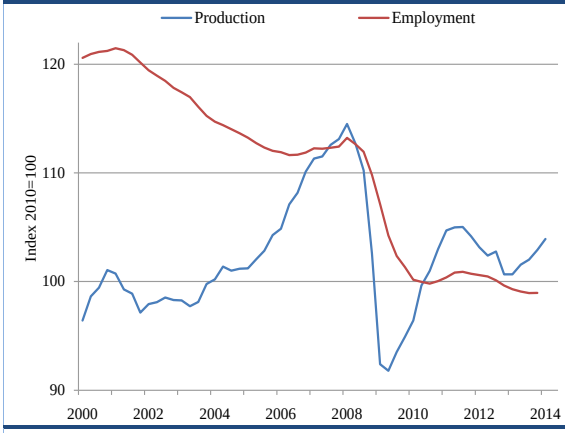
The first section of the chapter presents a brief overview of the state of recovery in EU manufacturing following the recession. The second section focuses on exports by EU industries to third-country markets, followed by four sections explaining their export performance by analysing the drivers of EU price and non-price competitiveness.

1.1. STATE OF EU REINDUSTRIALISATION

Employment in EU manufacturing has been declining steadily for several decades (Figure 1.1). With the onset of the deepest and longest recession in European post-war history, the decline accelerated temporarily but has since returned to its historical, more gradual rate.

EU manufacturing production followed a very different trajectory in the run-up to the financial crisis and the ensuing recession. After a lacklustre start to the century, output expanded for several years until reaching a peak in early 2008. It then fell rapidly by some 20% as the recession took hold. From its lowest point in 2009, it has since regained almost half the ground lost since 2008. It is important to emphasise that, though still far from its peak, EU manufacturing output is now higher than at any point prior to the 2005–2008 expansion depicted in Figure 1.1.

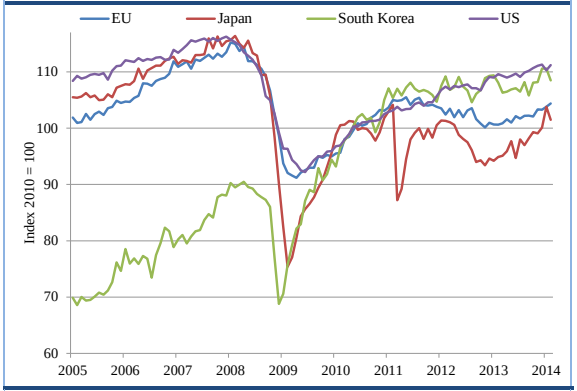
Figure 1.1: Production and employment in EU manufacturing, 2000–2014



Source: Eurostat

Recovery from the global economic crisis has been faster in other parts of the world. While manufacturing started to rebound in the EU before it did in the United States, EU recovery has since fallen behind. Asia, where manufacturing output plunged deeper than in the EU or the United States, is also recovering faster than the EU: South Korean manufacturing, for instance, surpassed its pre-crisis peak in less than 18 months after its trough.[2] Similarly, the rebound in Japan — the hardest hit of the economies in Figure 1.2 — was almost as fast as that in South Korea until it was brought to a halt in 2011 by the Fukushima earthquake and tsunami.

Figure 1.2: Manufacturing output in the EU and selected other economies, 2005–2014



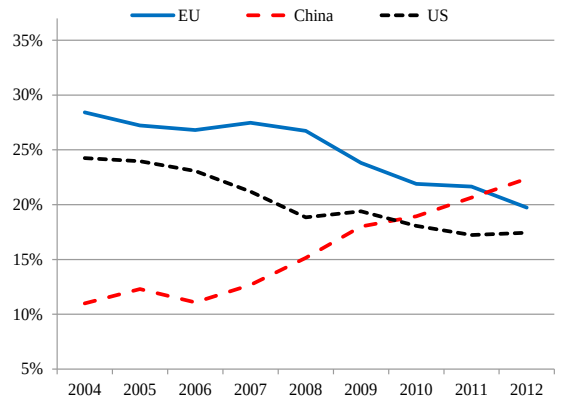
Source: Own calculations based on Eurostat and OECD manufacturing output data

[1] See European Commission (2010) for a thorough analysis and discussion of price and non-price factors; for an empirical analysis of the relative importance of price and non-price factors, see Benkovskis and Wörz (2014).

[2] Explanations for South Korea's recovery are put forward in OECD (2011).

As a result of the faster recovery in Asian manufacturing, China now accounts, according to national accounts, for a larger proportion of world manufacturing output value than the EU or the US, while EU manufacturing still accounts for the highest proportion in global value chains (Figure 1.3).

Figure 1.3a: EU, Chinese and US shares of world manufacturing production value, 2004–2012

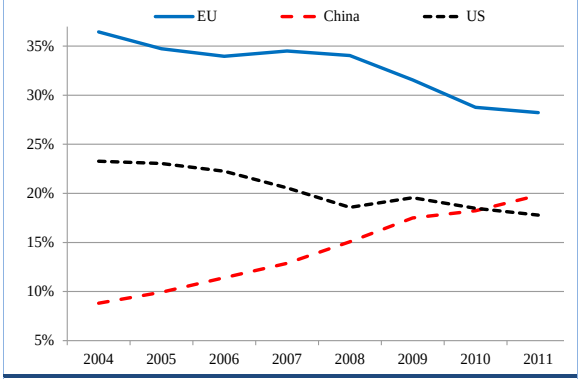


Source: Own calculations based on UN National Accounts Main Aggregates Database

In the EU, recovery has been much slower. While Poland, Slovakia, Romania, Estonia and other Member States have already surpassed their pre-recession peak levels of manufacturing output, most Member States are still producing less than before the crisis, with some (notably Cyprus and Greece) still at, or close to, their lowest point since the start of the recession (Figure 1.4).

A breakdown by sector shows that only a small number of manufacturing sectors (including pharmaceuticals, food, other transport equipment and other manufacturing) are producing at or above pre-crisis levels (Figure 1.5). However, even in sectors such as motor vehicles and beverages, output is close to pre-crisis levels of production following strong growth over the past 12 months.

Figure 1.3b: EU, Chinese and US shares of world manufacturing value added, 2004–2011

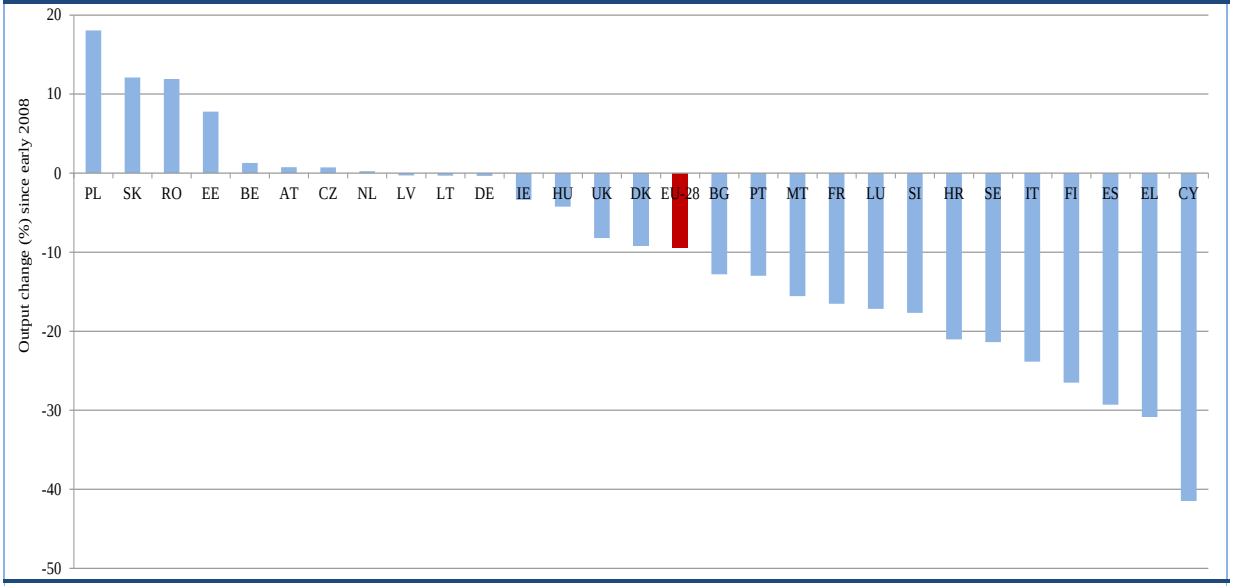


Source: Own calculations based on Timmer et al. (2013)

Capital goods and intermediate goods industries are more sensitive to business-cycle fluctuations than industries producing non-durable consumer goods and necessity goods such as food, beverages and pharmaceuticals, demand for which is less sensitive to variations in income (European Commission 2009, 2011, 2013b).

Outside manufacturing, the recession had an even greater impact on construction and extraction (mining and quarrying), but within extraction the impact was uneven: mining of metal ores quickly recovered after 2008-09 and production now

Figure 1.4: Manufacturing recovery by Member State, 2008–2014

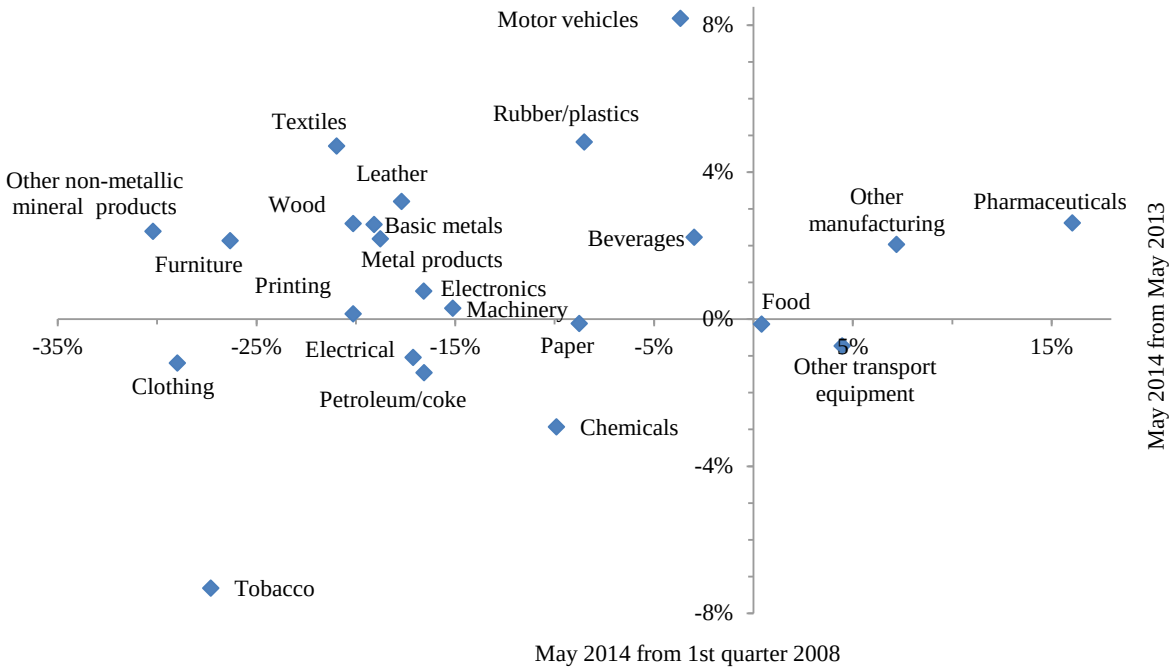


Source: Own calculations based on Eurostat manufacturing output data (as of March 2014)

exceeds the levels of early 2008 by almost 20%, to a large extent as a result of high global demand. On the other hand, industries such as coal and lignite mining and petroleum and gas extraction were already under pressure before 2008

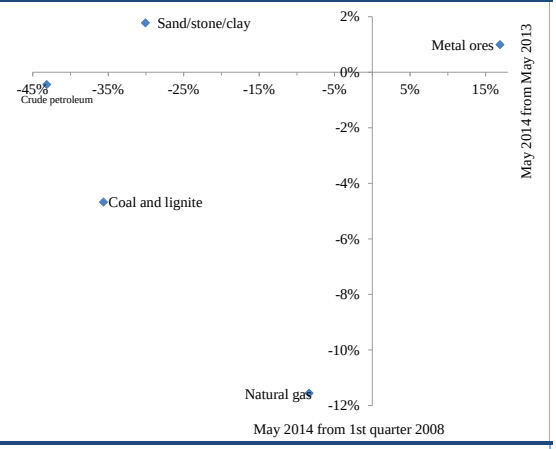
than before the recession, for the EU as a whole as well as in most Member States (Figure 1.7). As pointed out above, declining employment in manufacturing is a long-term trend; it goes hand in hand with a trend towards lower proportions of total

Figure 1.5: Manufacturing recovery by sector



Source: Own calculations based on Eurostat manufacturing output data

Figure 1.6: Extractive industries by sector



Source: Own calculations based on Eurostat industrial output data

and are currently producing 10% to 45% less than at the start of 2008.

The economic crisis and recession were more detrimental to manufacturing than to services: in the five years from the start of 2008 to 2013, services output declined by 9% in the EU, while manufacturing output fell by 12%. Because of this relative shift, manufacturing value added now represents a smaller proportion of total value added

output and total value added accounted for by manufacturing. These long-term trends are driven by shifts in domestic demand due to a combination of factors: on the one hand substitution as a result of higher real incomes, on the other hand lower relative prices of manufactured output due to higher productivity growth in manufacturing than in the economy as a whole (Nickell et al. 2008). The trends can be mitigated by increasing external demand for EU manufactured goods, as long as EU manufacturers compete successfully on world markets.

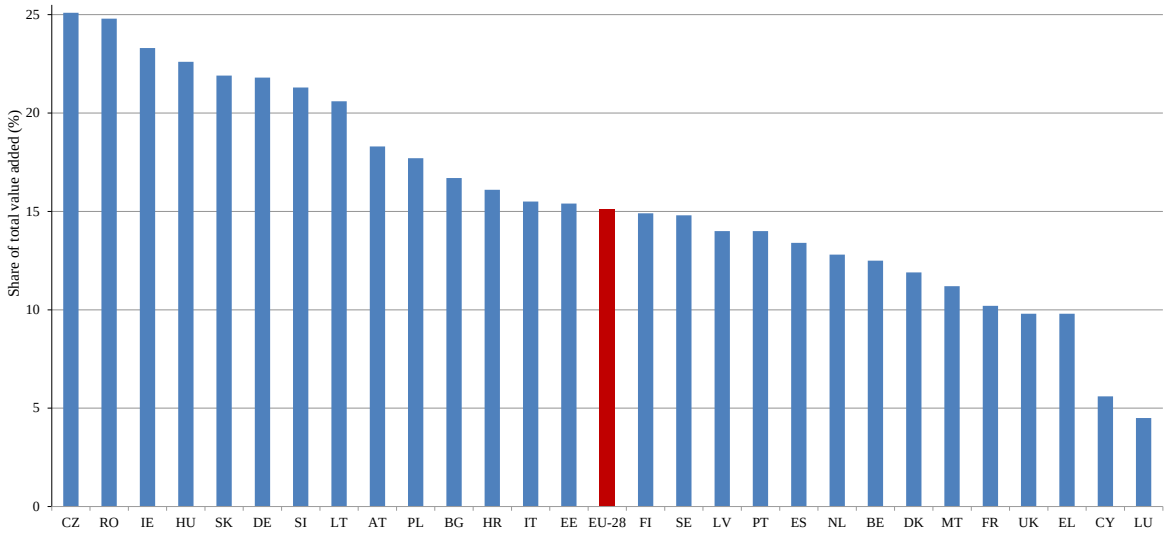
Figure 1.7 also shows that the EU is still relatively far away from its reindustrialisation target: for manufacturing to approach a share of 20% of total EU gross value added. The aggregate proportion fell from 18.5% in 2000 to just over 15% in 2013.

On the other hand, in eight Member States (the Czech Republic, Romania, Ireland, Hungary, Slovakia, Germany, Slovenia and Lithuania) manufacturing sectors already account for more than 20 % of total value added, and in all Member States the proportion can be expected to rise as the EU economy returns to its historical growth rate in the coming years.

As pointed out above, the declining share of manufacturing value added in the EU — from 18.5% in 2000 to just over 15% in 2013 — is the result of several factors, not least the falling relative price of manufactured goods (in relation to services) as a consequence of productivity growing more in manufacturing than in services.

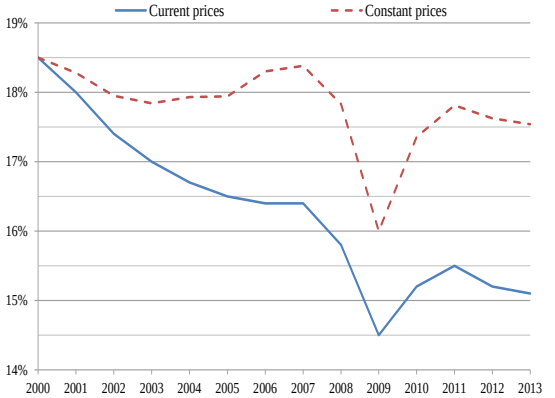
trend is not irreversible and that reindustrialisation is a realistic prospect. What appears to be unavoidable,

Figure 1.7: Manufacturing's share of total value added in the EU and in Member States



Note: Columns represent 2013 shares in all cases except Bulgaria, Romania, (2012 shares); current prices.
Source: Eurostat and the World Bank

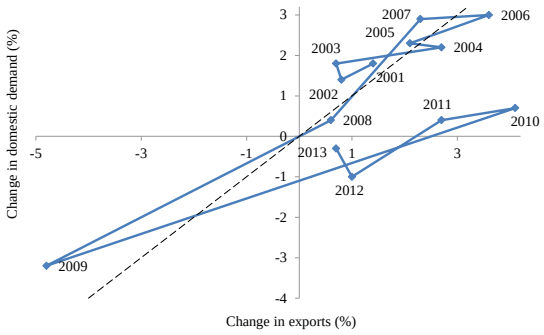
Figure 1.8: Manufacturing share of total value added in the EU in constant and current prices



Source: Own calculations based on Eurostat data

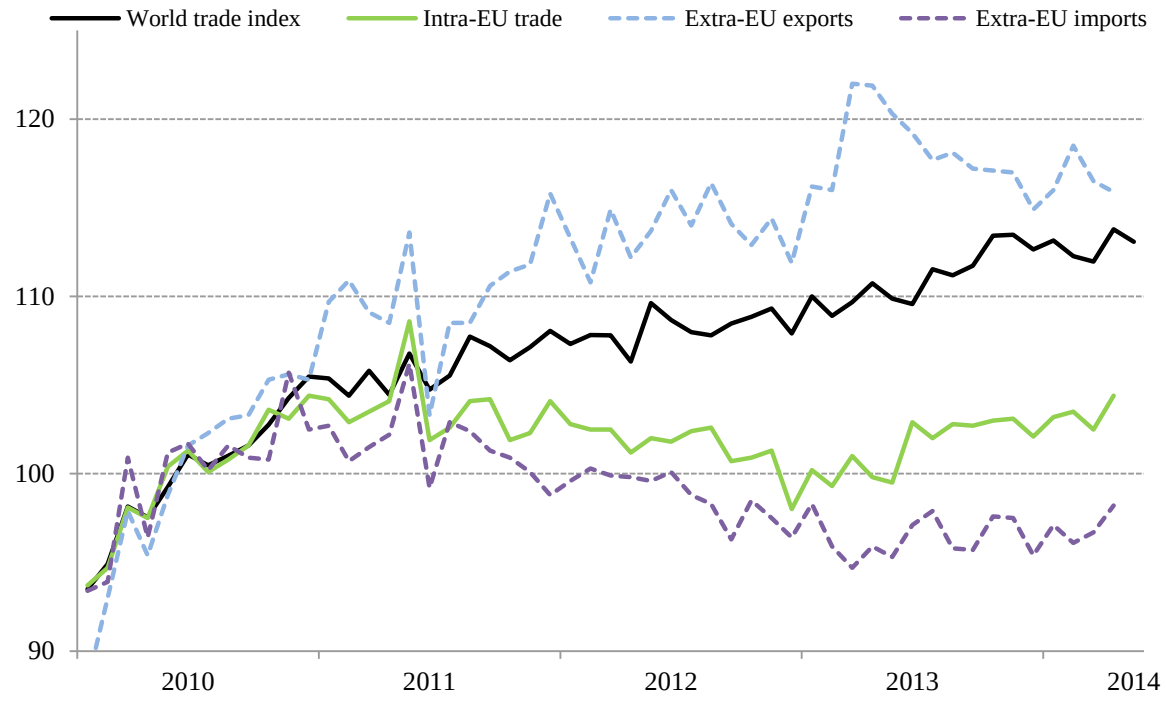
Figure 1.8 illustrates the impact on the value-added share of manufacturing by contrasting it with the same share measured in constant (2000) prices. Instead of falling from 18.5% to just over 15% over 14 years, the share decreases by less than one percentage point, to just over 17.5%. The difference between the two lines represents the relative price effect; the negative impact on the value-added share of manufacturing of falling relative price of its output (in relation to services). The much smaller decrease resulting when constant prices are used is net of the relative price effect; this captures structural changes such as de-industrialisation, offshoring, outsourcing, falling EU market shares, and possibly even EU manufacturers falling behind on the quality ladder and in global value chains. Whatever the explanation for the modest decline over the 14-year period, Figure 1.8 suggests that the

Figure 1.9: Contribution of EU exports and domestic demand to GDP growth, 2001–2013



Note: Relative changes from previous year. Equal contributions of changes in exports and domestic demand along the 45-degree line
Source: AMECO database (Directorate General for Economic and Financial Affairs)

Figure 1.10: World trade, EU exports and imports, 2010–2014



Source: CPB World Trade Monitor and Eurostat (seasonally adjusted monthly volumes)

though, are falling relative prices of manufactured goods in relation to services. In other words, reindustrialisation will lead to an increasing value-added share of manufacturing in constant prices but may not be strong enough to outweigh the effect of falling relative prices when measuring the value-added share in current prices.

Figure 1.9 shows how changes in exports and domestic demand contributed to GDP growth in the run-up to and during the recession. Before the start of the recession, GDP was growing at a steady pace in the EU. Growing exports and increased domestic demand made very similar contributions to GDP growth in 2001 and 2005, whereas in other pre-crisis years, growth in either exports or domestic demand tended to dominate. During the recession (from 2008 onwards), changing exports played a more prominent role than changes in domestic demand, except for 2012 when falling domestic demand caused real GDP to drop.

By 2013, the situation had deteriorated in many of the Member States still in recession at the time. While exports still made a positive contribution to growth, that contribution was much smaller than in 2010, 2011 and 2012. Domestic demand changed very little from 2012 to 2013, and real GDP increased only by a fraction.

1.2. EU INDUSTRIES ON WORLD MARKETS

The severe global impact on manufacturing following the start of the recession in 2008 is evident in Figure 1.2. It affected demand for EU exports of finished products, intermediate goods and raw materials, between Member States as well as from the rest of the world. The combined effect was a sharp decrease in intra-EU trade and extra-EU exports.

Table 1.1: EU manufacturing: revealed comparative advantages and disadvantages (2012)

	Manufacturing sectors with the highest RCA	Manufacturing sectors with the lowest RCA
EU	Beverages (2.25) Basic pharmaceutical products and pharmaceutical preparations (1.96)	Clothing (0.52) Textiles (0.54)
Brazil	Food products (5.17) Paper and paper products (2.99)	Clothing (0.04) Computer, electronic and optical products (0.10)
China	Clothing (2.72) Textiles (2.54)	Beverages (0.09) Tobacco products (0.15)
India	Other manufacturing (5.37) Coke and refined petroleum products (3.07)	Beverages (0.10) Wood and wood products (0.11)
Japan	Machinery and equipment (2.09) Motor vehicles (2.01)	Clothing (0.02) Leather and related products (0.02) Wood and wood products (0.02)
Russia	Coke and refined petroleum products (7.83) Wood and wood products (3.45)	Clothing (0.02) Other manufacturing (0.03)
US	Other manufacturing (1.52) Chemicals (1.41)	Clothing (0.15) Leather and related products (0.20)

Colours reflect technology intensity:
High / Medium-high / Medium-low / Low
Source: Statistical annex

However, as Figure 1.2 also shows, the impact of the crisis turned out to be more short-lived in parts of Asia and the Americas than in the EU. While many Member States have only recently come out of recession (two are still technically in recession), several economies in South-East Asia suffered only a brief drop in demand, mainly from Europe and North America, which was soon more than compensated for by growing demand from other parts of the world (chiefly from other Asian economies). As a consequence, economic activity in South-East Asia was relatively quickly back to pre-crisis growth rates, leading to growing demand for imports from the EU, North America and other parts of the world.

Meanwhile, high public and private debt continued to hold back domestic demand in many Member States, thereby delaying the EU recovery from the crisis and dampening intra-EU trade. Instead, strong demand from outside the EU kept the export economy going throughout the recession, partially compensating for weak domestic demand (Figure 1.9).

Outside the EU, world demand picked up after 2009 and global trade recovered relatively quickly. A particularly strong rise in Chinese imports spurred the recovery in other Asian countries.[3] EU exports to the rest of the world also benefited from the increase

in global demand from 2010 onwards (Figure 1.10), whereas extra-EU imports and intra-EU trade were largely unaffected. Intra-EU trade remains slightly above, and extra-EU imports slightly below, their 2010 levels. The growing gap between expanding exports and stagnant imports helped create large trade surpluses in many Member States, with exports (until recently) acting as the main engine of economic recovery.

Looking specifically at EU exports of manufactured goods in 2011, indices of revealed comparative advantage (RCA) can give an indication of the manufacturing sectors in which the EU has an advantage or disadvantage in relation to its competitors.

For the purposes of this section, the RCA index is calculated by manufacturing sector and compares EU exports in that sector (as a proportion of total EU manufacturing exports) with the same sector's share of total exports from a group of reference countries. RCA values higher than 1 mean that a given industry performs better than the reference group and has a comparative advantage; values below 1 are indicative of comparative disadvantages.[4] As Table 1.1 demonstrates, the EU has advantages in beverages (low technology intensity) and pharmaceuticals (high technology intensity), while it has comparative disadvantages in clothing and textiles.

Despite the EU's revealed comparative advantage in pharmaceuticals, its high-technology exports represent a smaller proportion of its total manufacturing exports than that of high-technology exports in world trade. In other words, the EU has a revealed comparative disadvantage (RCA=0.85) in high-technology goods at their highest level of aggregation. On the other hand, the proportion of high-technology EU exports was stable from 2009 to 2012, whereas in Japan, the US and China it diminished over the same period (Figure 1.12).

[3] European Commission (2012).
[4] Alternatives to the specification proposed by Balassa (1965) include European Commission (2010) and Leromain and Orefice (2013).

In sectors characterised by medium-high technology intensity, EU manufacturing has comparative advantages in four aggregated sectors (chemicals, machinery and equipment, motor vehicles, and other transport equipment), while it has a slight disadvantage in one (electrical equipment). On aggregate across all five sectors characterised by medium-high technology intensity, the RCA index of EU manufacturing is higher than in high-technology, medium-low or low-technology industries.

Of the five manufacturing sectors characterised by medium-low technology intensity (coke and refined petroleum products, rubber and plastic products, non-metallic mineral products, basic metals, fabricated metal products), EU manufacturing has comparative advantages in two — non-metallic mineral products, fabricated metal products — and disadvantages in the remaining three. On aggregate across all five sectors, the revealed comparative disadvantage of EU manufacturing is similar to that in high-technology sectors.

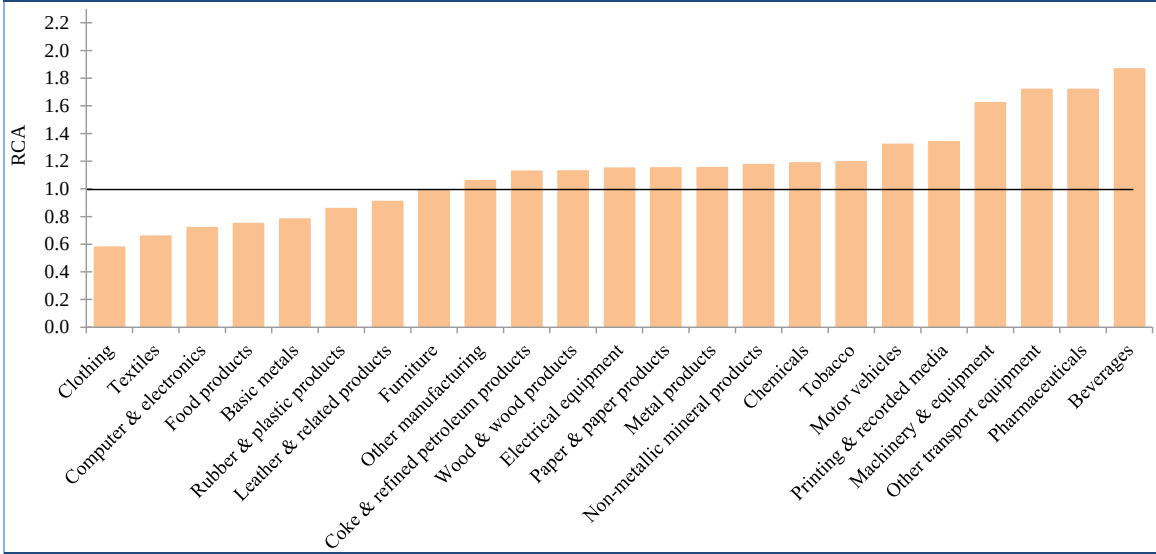
The remaining eleven sectors in Figure 1.11 are characterised by low technology intensity. EU manufacturers have comparative disadvantages in most of these; only in beverages, printing and recorded media, and tobacco products do they have revealed comparative advantages.[5]

comparative disadvantages in twelve.[6] However, half of the sectors in which the EU had comparative advantages are characterised high or medium-high technology intensity.

Calculations of revealed comparative advantages for Brazil, China, India, Japan, Russia and the US show that the Brazil and China are the only major economies in which the sectors with the highest RCAs are characterised by low technology intensity. In Japan and the US, on the other hand, some of the highest RCAs are in sectors characterised by medium-high technology intensity, while the lowest RCAs are in low-tech sectors. Similar results were obtained by Leromain and Orefice (2013) on the basis of 2010 data and an alternative approach to calculating RCA indices.

Revealed comparative advantage indices are traditionally calculated using trade data, which are detailed and can be disaggregated to the level of individual products or groups of products. Using such disaggregated data to calculate revealed comparative advantage indices gives a more complete picture of the advantages and disadvantages of EU manufacturers vis-à-vis their competitors, and also allows for a more precise discussion of sectors with high, medium-high, medium-low and low technology intensity than in this chapter. However, it fails to measure the real sophistication of the output of the EU economy.

Figure 1.11: EU manufacturing: revealed comparative advantages, 2012



Source: Statistical annex

In all, the EU had comparative advantages in ten aggregated manufacturing sectors in 2012 and

Even at the most disaggregated product level, two

[5] The classification of NACE rev. 2 sectors into high, medium-high, medium-low and low technology intensity follows Annex 3 to Eurostat (2014).

[6] It should be pointed out that the manufacturing sectors discussed here are highly aggregated (two-digit NACE level). At a more disaggregated level, there is considerable dispersion and variability within each sector, including with respect to RCAs and technology intensity.

products with the same trade data identifier can differ in terms of sophistication or complexity. Aspects such as quality and complexity are not easily captured by trade data. Also, trade data do not reveal the domestic and foreign content in a traded product (the domestic and foreign proportions of its value added). In other words, an exported product assembled in one country using components from other countries will appear in trade data as identical to the same product made entirely in the exporting country.

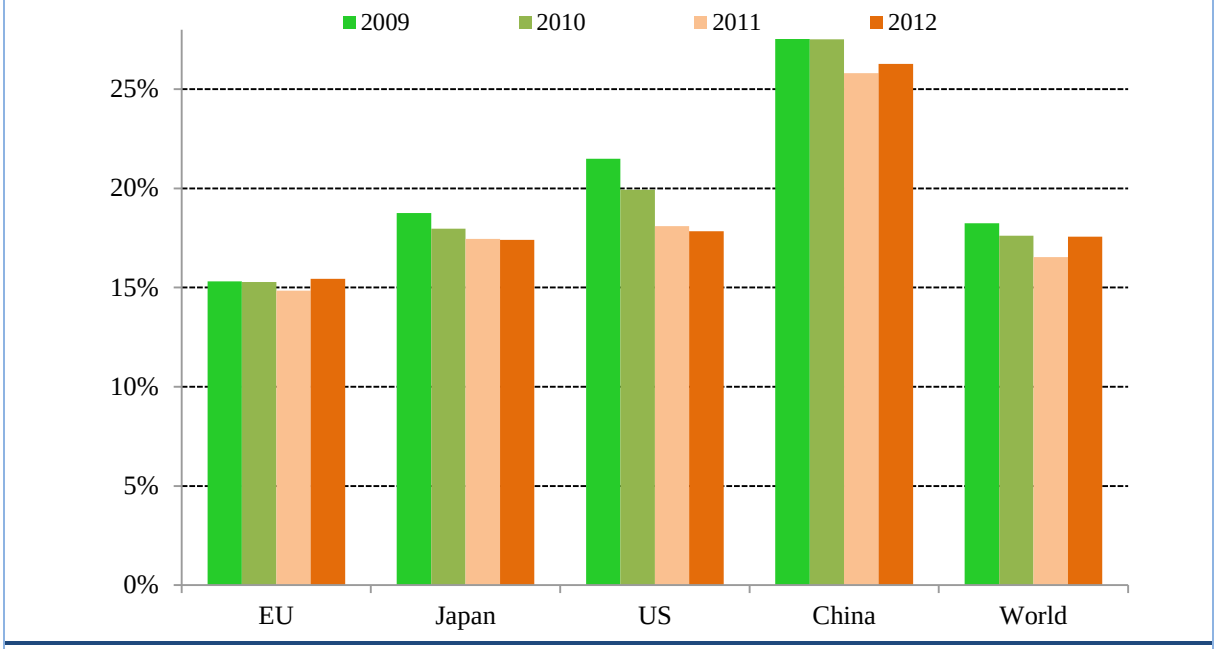
At this high level of aggregation — across industries as well as Member States — EU manufacturing has comparative advantages in one high-technology sector (pharmaceuticals) and disadvantages in the other (computer, electronic and optical products). Pharmaceutical products and preparations are especially over-represented in the export baskets of Belgium, Ireland and Cyprus, while they represent a very small part of the total exports of Estonia, Luxembourg and Slovakia. Computer, electronic and optical products are under-represented in the export baskets of most Member States, with some exceptions: they are slightly over-represented in the exports of Hungary, Malta and Slovakia.

complexity of EU exports by analysing their sophistication and the diversification of exporting economies by means of the 'product space' analytical framework developed by Hidalgo et al. (2007) and Hidalgo and Hausmann (2009). The two most important findings in concern the levels of complexity of various EU exports with comparative advantages (in the sense that RCA>1) and the dynamics of product complexity between 1995 and 2010.

As regards the complexity of EU exports with RCA>1, the report found that almost all such exports in sectors such as tobacco, clothing, leather and footwear, and wood and wood products are relatively unsophisticated and of low complexity, making it difficult for EU exporters to compete on quality. By contrast, in sectors such as office machinery and computers, electrical machinery, radio/TV and communication equipment, scientific and other instruments, and motor vehicles, most EU exports with RCA>1 are highly sophisticated and complex, enabling exporters to compete on quality.

The other important finding was that, from 1995 to 2010, EU exporters of goods with RCA>1 managed to increase the average complexity of their exports

Figure 1.12: High-technology exports as a proportion of total manufacturing exports, 2009–2012



Source: World Bank

These limitations complicate comparisons of industrial competitiveness. They also mean that the picture of EU competitiveness based on RCAs, as presented in Figure 1.1 and Table 1.1, needs to be extended to account for these additional dimensions of international competitiveness.

Last year's edition of this report (European Commission 2013a) addressed the quality and

in many sectors, most notably in radio/TV and communication equipment, non-metallic mineral products, furniture and other manufacturing, wood and wood products, leather and footwear, and coke and refined petroleum products. At the same time, EU exports of tobacco products, basic metals, office machinery and computers, printed material and recorded media, pulp and paper and from some other

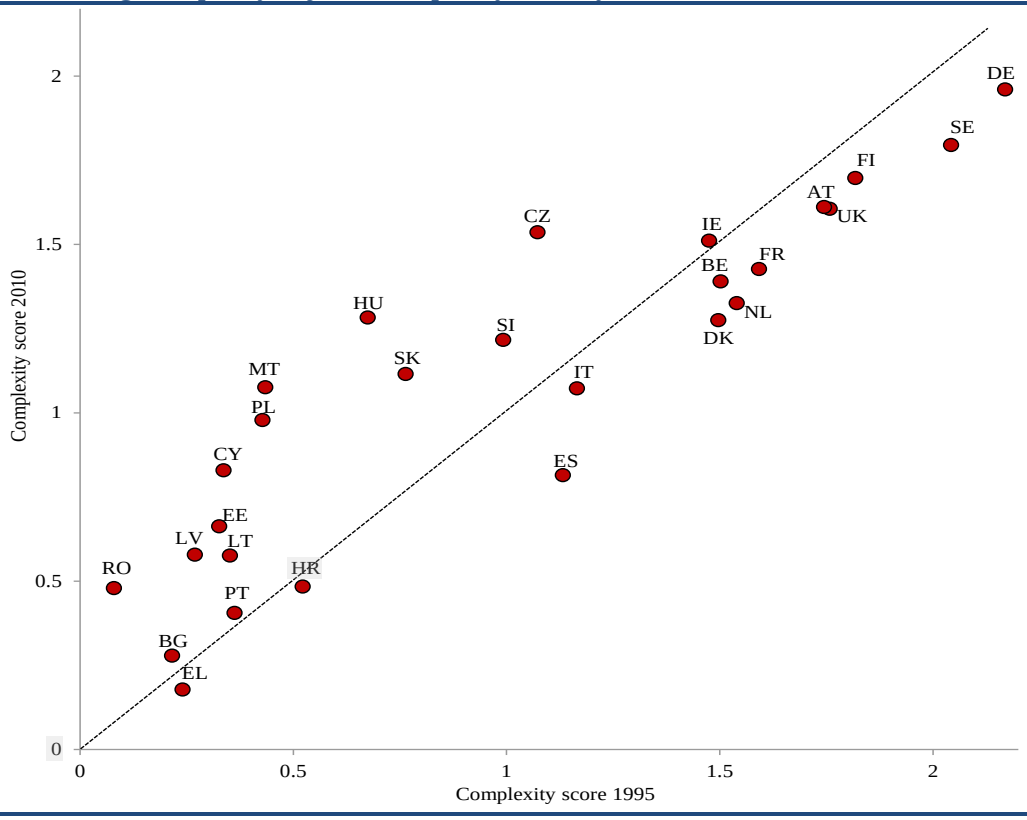
sectors were, on average, less complex in 2010 than in 1995.

In this context, it is striking how all Member States that joined the EU in 2004 and 2007 managed to raise the complexity of their exports between 1995 and 2010, whereas Croatia and virtually all pre-2004 Member States saw the average complexity of their exports fall over the same period (the only exceptions being Ireland and Portugal). To the extent that there was, in 1995, a cluster of southern and eastern Member States with comparative advantages in relatively unsophisticated and simple export goods and another cluster of northern and western Member States with comparative advantages in more sophisticated and complex exports, by 2010 there were no clear clusters. Most Member States in the former 'low-complexity' cluster (except for Greece, Spain, Croatia and Italy) had increased the complexity of their exports, while most Member States in the more sophisticated cluster (except Ireland) had seen the complexity of their exports fall.

studied in European Commission (2012a). In order to take global value chains into account and compensate for the fact that RCAs based on export value exaggerate the competitiveness of economies relying on imported intermediate goods for their exports of finished goods (and underestimate the competitiveness of economies exporting mainly intermediate goods), one approach is to use input-output tables to calculate how much foreign and domestic value added is embedded in each economy's exports.

This approach was followed by the European Commission (2012a, 2013a) to demonstrate that from 1995 to 2009, the proportion of non-EU value added content in EU manufacturing exports increased from 8.9% to 14.4%, while consistently remaining more than twice as high in the 2004 and 2007 accession countries as in the pre-2004 Member States. The rise was very similar to the increase (from 6.7% to 14.6%) in the proportion of non-Japanese value added content in Japanese manufacturing exports over the same period, but

Figure 1.13: Changes in quality-adjusted complexity score by Member State, 1995–2010



Note: Dotted line denotes no change in complexity between 1995 and 2010. 'BE' combines Belgian and Luxembourg data.
Source: European Commission (2013b)

As regards the second shortcoming identified above — the lack of information in trade data about the domestic and foreign content of exported goods — it is important to note that trade data do not fully reflect the impact of fragmentation of production in global value chains, a development comprehensively

smaller than the non-US proportion in US manufacturing exports (13.1% in 1995; 15.5% in 2009). Chinese and South Korean exported goods have much higher foreign value added content: for China, the proportion rose from 17.3% in 1995 to

26.4% in 2009, while in South Korea it rose from 26.7% to 38.7% over the same period.

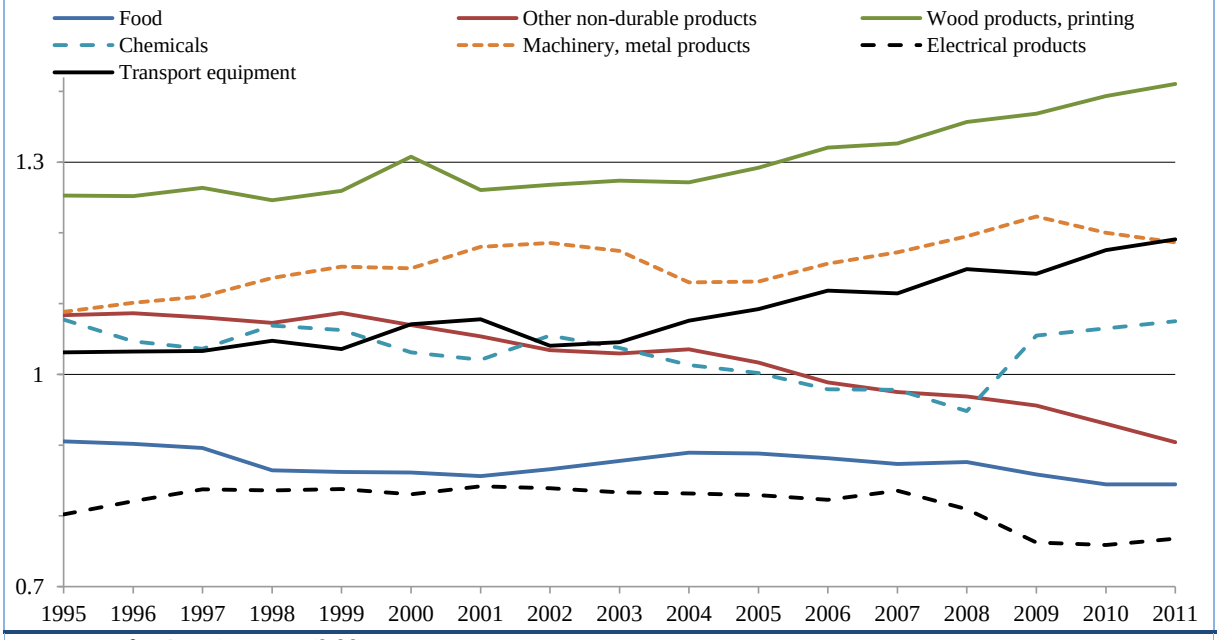
In both China and South Korea, approximately a sixth of the foreign value-added content in 2009 came in the form of intermediate goods from the EU.

Of the 14.4% of value added in EU manufacturing exports in 2009 that originated outside the EU, most was embedded in intermediate goods from the US, China, and Russia.

An alternative approach, also based on global value chains and using input-output tables, is to break down the value of final products into the respective value added by each economy involved in their production, in order to calculate RCA indices not on the basis of export proportions but using the proportions of global value chain income added by each economy. If an economy adds relatively more value to the global value chain of a certain product or sector than it does for manufacturing in general, the index exceeds 1 and the economy can be said to have a comparative advantage in the global value chain of that product or sector. Conversely, index values below unity indicate that the economy in question has a comparative disadvantage in the global value chain of that particular product or sector.

Figure 1.14 shows that, from 1995 to 2011, EU-27 manufacturers of transport equipment, wood products and printed material, machinery and fabricated metal products generated a higher proportion of total value added along the global value chain than for EU-27 manufacturing sectors on average, and in those sectors their comparative advantage increased over time. By contrast, EU-27 manufacturers of food and electrical products generated a smaller proportion of total value added along the global value chain than EU-27 manufacturing in general, and their comparative disadvantage increased over time. EU-27 manufacturers of chemical products and non-durable products other than food initially generated a higher share of value added along the global value chain than other EU manufacturers, but by 2006 they had lost their comparative advantage. While makers of non-durable products continued to lose out in terms of value added along the global value chain, chemical products benefited from the gradual

Figure 1.14: Comparative advantage indices for EU-27 based on global value chain income, 1995–2011



Note: Data for Croatia not available
Source: Timmer et al. (2013)

Figure 1.15: Average annual ULC growth in EU manufacturing, construction, and mining and quarrying, 2007–2012

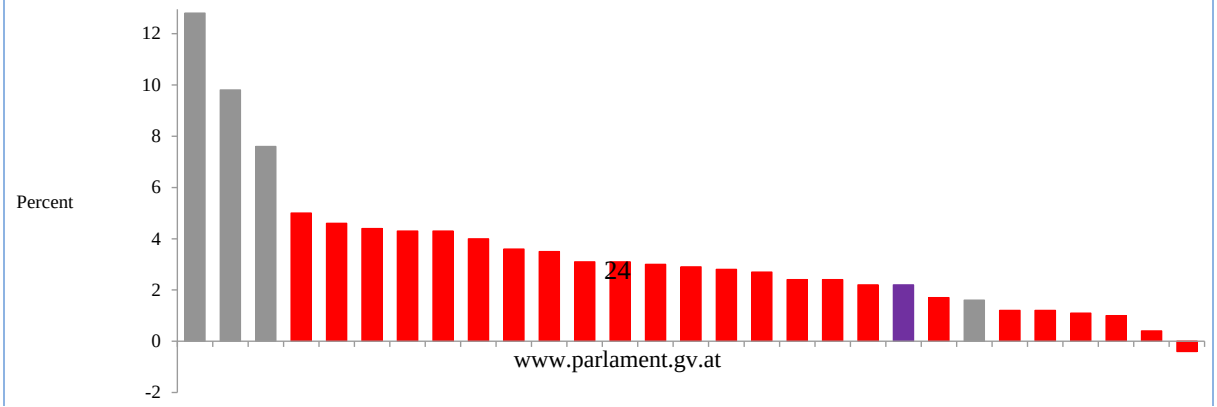
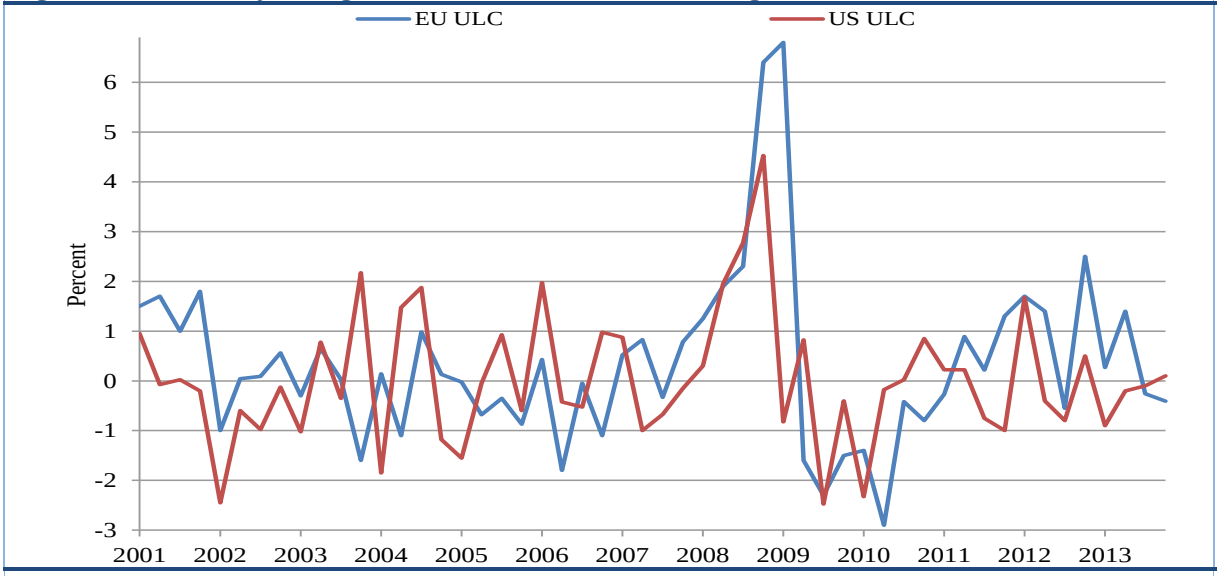


Figure 1.16: Quarterly ULC growth in EU and US manufacturing, 2001–2013



Source: Own calculations based on Eurostat and Bureau of Labor Statistics data, seasonally adjusted

recovery of the EU economy from 2009 onwards and regained the comparative advantage they had previously enjoyed.

For the four aggregated sectors in Figure 1.14 with index values greater than 1, the results are very similar to the export value-based RCA values in Figure 1.11. In other words, their over-representation in the EU-27 export basket (see Figure 1.11) is similar to their over-representation in terms of value added. For electrical products, on the other hand, a picture of EU comparative disadvantage emerges from Figure 1.14 which is not evident in Figure 1.11: when using export value to calculate the RCAs in Figure 1.11, electrical products are found to be very close to RCA=1. In other words, they represent more or less the same proportion of EU exports as they do of world exports. In terms of value added though, Figure 1.14 clearly shows a less than proportionate (and falling) contribution of EU-27 manufacturing to this global value chain. The implication is that EU manufacturers of electrical products import intermediate products and export final goods, but add relatively less value than EU manufacturers in other sectors.

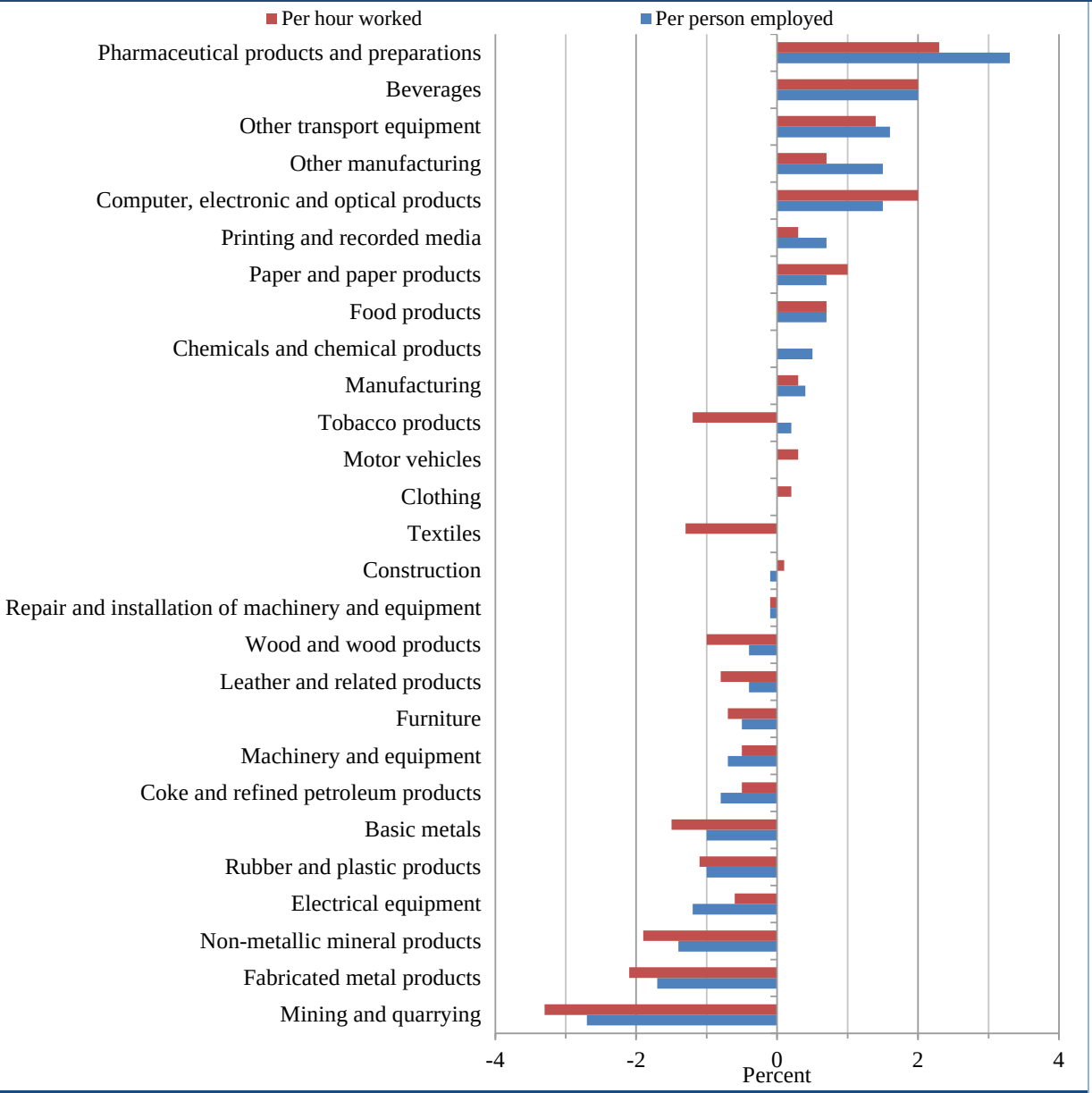
1.3. LABOUR PRODUCTIVITY AND LABOUR COSTS BY SECTOR

A measure commonly used to assess the development of labour costs in relation to labour productivity is unit labour cost (ULC) — the ratio between labour compensation and labour productivity. It measures the extent to which labour costs rise in line with productivity gains, going up if compensation rises faster than productivity — a possible indication of falling cost competitiveness. Conversely, if labour productivity increases faster than compensation, ULC goes down: a possible sign of improved cost competitiveness.

It should be noted, however, that ULC developments tend to be dictated (perhaps more in Europe than in other economies) by business fluctuations which affect labour productivity growth by causing production and value added to fluctuate more over the cycle than the input of labour. Also, cost competitiveness is not determined by unit labour costs alone, as the cost of capital, energy, raw materials and other inputs is not taken into account. ULC comparisons are therefore more useful for labour-intensive sectors than for sectors primarily intensive in capital, energy or material.

Figure 1.15 indicates that, on average between 2007 and 2012, the highest ULC increases in the EU were in certain extractive industries (in grey), followed by a number of manufacturing sectors mostly characterised by low technological intensity, and by construction. On the whole, average ULC growth rates were lower in manufacturing and construction than in mining. In pharmaceutical products — a sector characterised by high technology intensity — labour productivity grew more than labour compensation over the period, giving rise to negative ULC growth, on average, between 2007 and 2012.

Figure 1.17: Average annual labour productivity growth in EU manufacturing sectors, construction and mining, 2007–2012



Source: Own calculations based on Eurostat data

Because unit labour costs are more useful as indicators of cost competitiveness for labour-intensive sectors than for sectors with high intensities in other production factors, it is often more meaningful and interesting to compare unit labour costs across economies rather than sectors. Such a comparison could, for instance, benchmark the competitiveness of a sector in the EU economy against the corresponding sector in other economies (with similar labour intensity).

For instance, Figure 1.16 shows quarterly growth rates of ULCs in EU and US manufacturing. For most of the time, the two growth rates have been relatively similar, with no systematic patterns suggesting an advantage for one or the other — both frequently shifting from positive to negative growth. On one occasion, in connection with the financial and economic crisis that triggered the recession, EU manufacturing ULCs shot up much more than their US equivalents. In both economies, ULCs rose because labour productivity fell while labour compensation adjusted less, and much more slowly. That it rose much more in EU than in US manufacturing is indicative of a less flexible labour market, causing a sharper fall in labour productivity as well as slower adjustment of labour compensation. Moreover, in the early years of the recession, there may have been more 'labour hoarding' in EU than in US manufacturing (whereby firms attempt to avoid the costs associated with redundancies, and subsequently with recruiting and

training, by keeping staff on their payroll until demand picks up again).

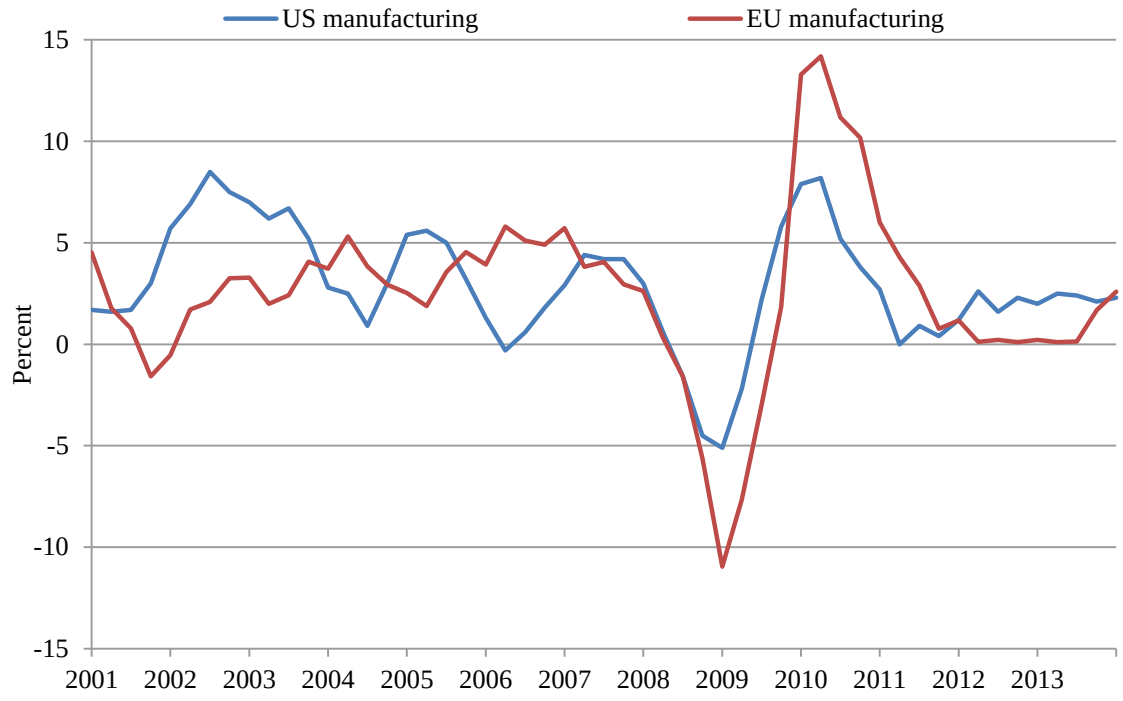
In fact, in most economies ULCs are driven more by labour productivity developments than by labour compensation. At the same time, labour productivity growth also matters for price and non-price competitiveness and is often regarded as an indicator of technical progress. The ability to produce more or higher-quality output with less input of labour — by means of technological improvements, organisational reforms, or in other ways — is an important way to gain a competitive edge, as it allows firms to lower their prices (or increase their margins) at given labour costs.

Labour productivity can be measured either per person employed or per hour worked. As shown in Figure 1.17, the difference between the two can be considerable, notably during a recession, when firms may be forced to cut down on staff. Remaining employees typically have to work more as a consequence in order to keep production up, which in turn causes labour productivity per person employed to grow more (or contract less) than when measured per hour worked. Another reason for discrepancies between the two measures is that no distinction is made between full-time and part-time employees when labour productivity is measured per person employed.

From 2007 to 2012, average labour productivity growth in EU manufacturing was 0.3% per year when measured per hour worked and 0.4% per year when measured per person employed. Manufacturing sectors with higher-than-average annual productivity growth include the two high-technology sectors (pharmaceutical products and preparations; computer, electronic and optical products) and several low-technology sectors (food products, beverages, paper and paper products, printing and recorded media, other manufacturing). In most sectors characterised by medium-low or medium-high technological intensity, labour productivity hardly grew at all, or diminished, between 2007 and 2012, whether measured by hours worked or persons employed. Outside manufacturing, labour productivity in mining and quarrying also fell from 2007, while in the construction sector it remained relatively stable.

As in the case of ULCs, the interpretation of labour productivity is less straightforward when comparing labour-intensive sectors with sectors more intensive in other production factors (such as capital, energy or raw materials). Also, there is no clear link between labour productivity and market share: firms under attack from competitors trying to undercut their prices may need to downsize, which is likely to result in higher labour productivity, while their market share may go up or down depending on how

Figure 1.18: Manufacturing labour productivity growth in the EU and US, 2001–2013



Note: Changes in labour productivity per hour worked, as compared with four quarters earlier
Source: Own calculations based on Eurostat and Bureau of Labor Statistics quarterly data

the competitive situation evolves.

For these two reasons, it may be more useful to compare labour productivity developments in specific EU sectors with similar sectors in other economies. Figure 1.18 shows quarterly labour productivity developments in EU and US manufacturing. The first thing to note is that in both economies, manufacturing productivity growth is positive most of the time. This is characteristic of manufacturing in most economies, not only the EU and US, and a reflection of the stylised fact illustrated in Figure 1.1 that manufacturing production tends to go up while employment decreases.

Another thing to note is that labour productivity has grown more in US than EU manufacturing: on average from 2001 to the first quarter of 2014, US manufacturing labour productivity grew by 2.9% and the EU equivalent by 2.5% (both year-on-year). Both averages are of course influenced by the sharp drop in labour productivity from 2008 to 2009 and the subsequent upswing on a similar scale (mainly a base-year effect), but the figure clearly shows that before as well as after the swings of 2008-09, labour productivity growth was stronger in US than in EU manufacturing. In fact, for most of 2012 and 2013, there was hardly any increase at all in EU manufacturing labour productivity, while US manufacturing labour productivity increased at close to its average growth rate.

Finally, at the start of recessions (2001 and 2008), manufacturing productivity has tended to drop more in the EU than the US because the input of labour (hours worked) fell further and faster in the US.[7]

A slightly different picture emerges when zooming in on manufacturing SMEs. It should be stressed that definitions differ between the EU and the US: in the EU, SMEs are defined as having up to 250 employees and a turnover of no more than € 50 million or a balance sheet total of no more than € 43 million, while US manufacturing companies are typically defined as 'small' if they have fewer than 500 employees.

Bearing these differences in mind, the start of the recession caused much larger labour productivity losses in 2008 and 2009 in EU manufacturing SMEs than in the EU economy as a whole, followed in 2010 by greater gains than in the rest of the EU economy. The much larger drop in labour productivity than elsewhere in the economy may be explained by the fact that the recession hit manufacturing SMEs harder than other businesses, while the way in which SMEs and large firms adjusted their input of labour in response to the recession may have differed less.

The loss of labour productivity in US manufacturing SMEs in 2008 was virtually identical to the loss for SMEs in the economy as a whole, and smaller than that for SMEs in the EU. This suggests that the US labour market operated more flexibly than the EU labour market during the recession and that US manufacturing SMEs were not hit harder than other US SMEs by the crisis — unlike EU manufacturing SMEs.

It is also clear from Table 1.2 that, while US manufacturing SMEs made labour productivity gains already in 2009, manufacturing SMEs in the EU had not yet reached that point and their labour productivity was still going down. Incidentally, the same can be said for Japanese SMEs in manufacturing (European Commission 2013c).

1.4. SKILLS AND HUMAN CAPITAL

Differences in skills can be important when trying to explain differences in competitiveness or growth. Since human capital does not readily adjust — geographically or between sectors — to changing demand for labour, and because skills take a long time to build up, including through retraining when necessary, it is easy to see how mismatches can arise between available and required skills. Such mismatches, whether at firm, sector or economy level, are crucial to success and competitive performance; avoiding or minimising skills mismatches inevitably gives the firm, sector or economy a competitive advantage over rivals and puts it in a stronger position to gain market shares.

Table 1.2: Labour productivity growth rates in EU and US manufacturing SMEs, 2008–2011

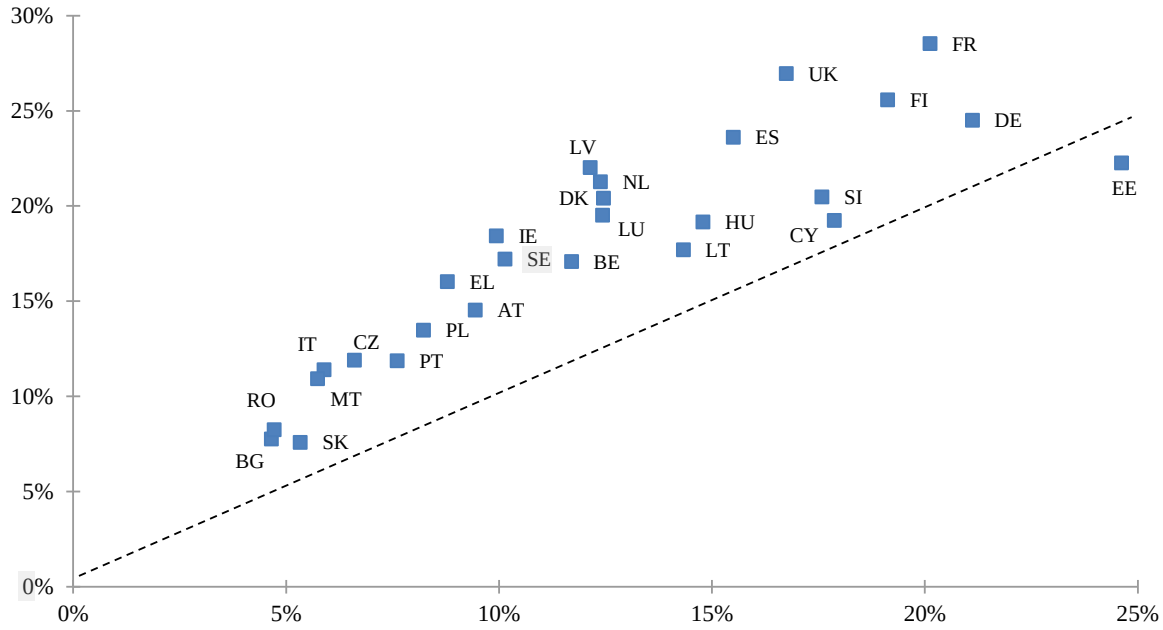
	2008	2009	2010	2011
EU manufacturing SMEs	–0.4%	–10%	+12%	+3%
US manufacturing SMEs	–3%	+10%	NA	NA

Note: NA = not available
Source: Key figures on European business (Eurostat 2011); Are EU SMEs recovering from the crisis? (2011); EU SMEs in 2012: at the crossroads (2012)

Analysing the importance of skills to competitiveness is complicated, however, by their very nature: skills are not directly observable and can be hard to measure, even indirectly. Any analysis of skills supply typically relies on proxy

[7] For a comprehensive discussion of the EU-US productivity gap and its causes, see European Commission (2013a).

Figure 1.19: Shares of high-skilled labour (ISCED 5 and 6) in the value added of global value chains, 1995 and 2008



Note: ISCED 5 & 6 correspond to stages of tertiary education. The dashed line indicates no change from 1995 to 2008. Data for Croatia not available.
Source: Timmer et al. (2014)

variables. For instance, European Commission (2013a), where EU Labour Force Survey (LFS) data on educational attainment were broken down by sector, found that the manufacturing sector with the highest proportion of tertiary-educated employees was pharmaceutical products and preparations, followed by coke and refined petroleum products, and computer, electronic and optical products. This result is entirely in line with Eurostat's aggregations of knowledge-intensive activities (Eurostat 2014). The manufacturing sectors with the smallest proportions of tertiary-educated employees were leather and related products, clothing, wood and wood products (European Commission 2013a).

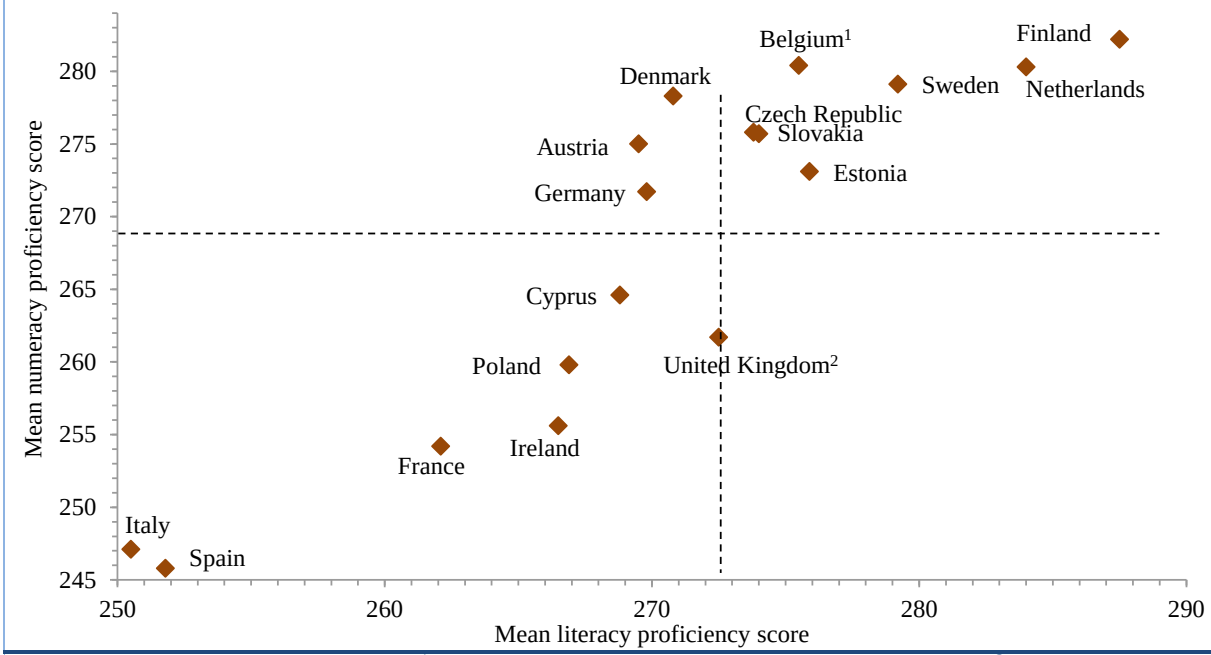
Educational attainment is used as a proxy for skills also by Timmer et al. (2014), who use input-output tables to calculate the factor shares of capital and low-skilled, medium-skilled and high-skilled labour in 560 identified global value chains across 40 countries (including all Member States but Croatia). One of the results obtained is that between 1995 and 2008, the share of high-skilled labour in the value added of the global value chains increased in all EU-27 Member States except Estonia. The lowest shares of high-skilled labour were in Bulgaria, Romania and Slovakia, where it rose from around 5% in 1995 to around 7% in 2008 (Figure 1.19). The highest shares were in France, the UK, Finland and Germany, rising from around 20% in 1995 to around 25% in 2008. In the 26 Member States with rising shares of high-skilled labour, the increase was often at the expense of low-skilled labour (except for the Czech Republic, Latvia and Romania, where both factor shares went up). In some Member States, the share of capital or medium-skilled labour decreased when the share of high-skilled labour went up.

However, educational attainment is a far from perfect proxy for skills because it does not take account of the often significant time that has elapsed since primary, secondary or tertiary education was attained; it does not reflect the accumulation of skills and experience by means of additional training, learning and development over time; and it does not take into account the relevance of the education attained to the activities of the firm, sector and economy concerned (OECD 1998).

An alternative approach, though not without shortcomings of its own, is to use survey results to assess adult skills. They can be more useful than educational attainment data, for the three reasons mentioned above.

Two recent surveys on adult skills are OECD (2013a) and Eurofound (2014). The OECD Survey of Adult Skills, conducted as part of its Programme for the International Assessment of Adult Competences (PIAAC), is the larger of the two. It tests adults aged 16 to 65 years for literacy, numeracy and their ability to solve problems in technology-rich environments.

Figure 1.20: Adult numeracy and literacy skills in selected Member States/regions, 2012



Note: Lines represent OECD averages. [1] *Belgian scores represent the region of Flanders only.* [2] *UK scores represent England and Northern Ireland only.*
Source: OECD (2013a)

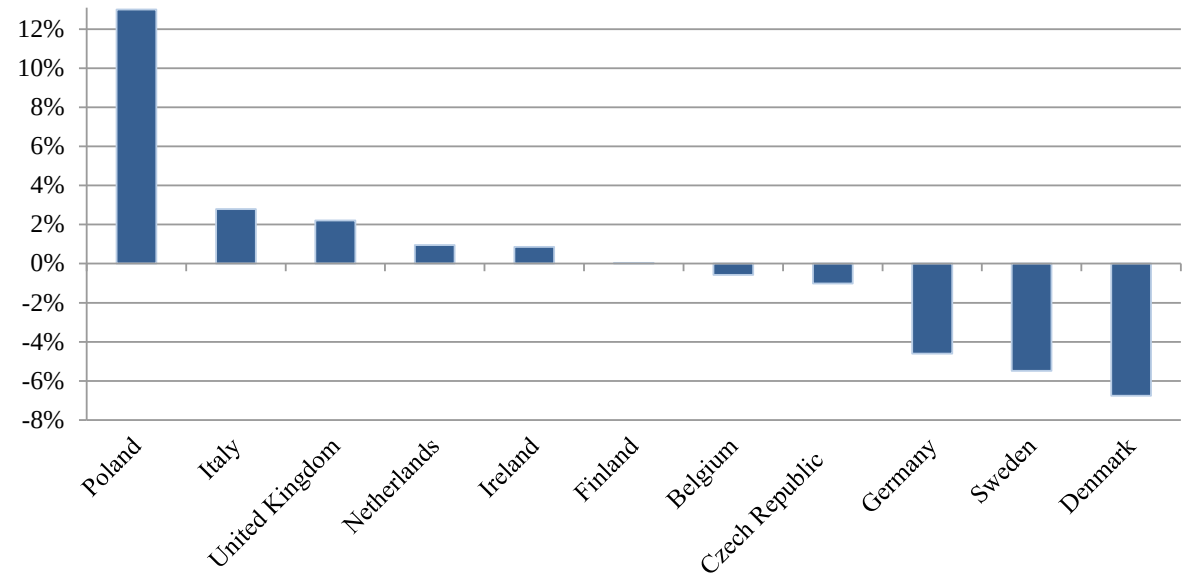
Figure 1.20 shows the results of the 17 participating Member States (or, in two cases, Member State regions) in the 2012 assessment of literacy and numeracy proficiency. At the top end of the scale, the average results for adults in Finland were second only to Japanese adults (not shown) in both. In six other cases, average scores exceeded the OECD average both for literacy and numeracy, while the average results in Denmark, Germany and Austria exceeded the OECD average for numeracy but did not reach the OECD average for literacy. In the remaining seven countries, results were below the OECD average in both numeracy and literacy. In Spain and Italy, average proficiency levels were not only much lower than for other participating Member States and regions, but also lower than for any of the 24 OECD countries and partner countries taking part in the survey. Regarding the ability to solve problems in technology-rich environments (results not shown in Figure 1.20), it was found that 25% of adults lack the digital skills needed to effectively use ICT.

As might be expected, literacy and numeracy proficiency scores are closely correlated (Table 1.3). There is also a positive correlation between each of them and GDP per capita adjusted for purchasing power, though this is stronger for numeracy than for literacy proficiency.

The positive correlations between average proficiency scores and GDP per capita are not surprising: countries with high GDP per capita are not only better equipped to invest in education systems; they also have an incentive to invest in order to safeguard or raise their high GDP per capita through better education. The converse also holds: the positive correlations also reflect the importance of basic skills such as numeracy and literacy in generating economic growth.

A comparison of numeracy proficiency results over time is unfortunately possible for only two of the Member States represented in Figure 1.20. In terms of literacy proficiency, on the other hand, most of the Member States and regions in Figure 1.20 were surveyed also in 1994–98, so the development over time of their average literacy proficiency can be assessed and related to their economic development over the same period. Figure 1.21 shows the relative changes in average literacy proficiency scores between 1994–98 and 2012 for the eleven Member States (or regions of Member States) for which data exist.

Figure 1.21: Change in adult literacy skills in selected Member States/regions, 1994/98–2012



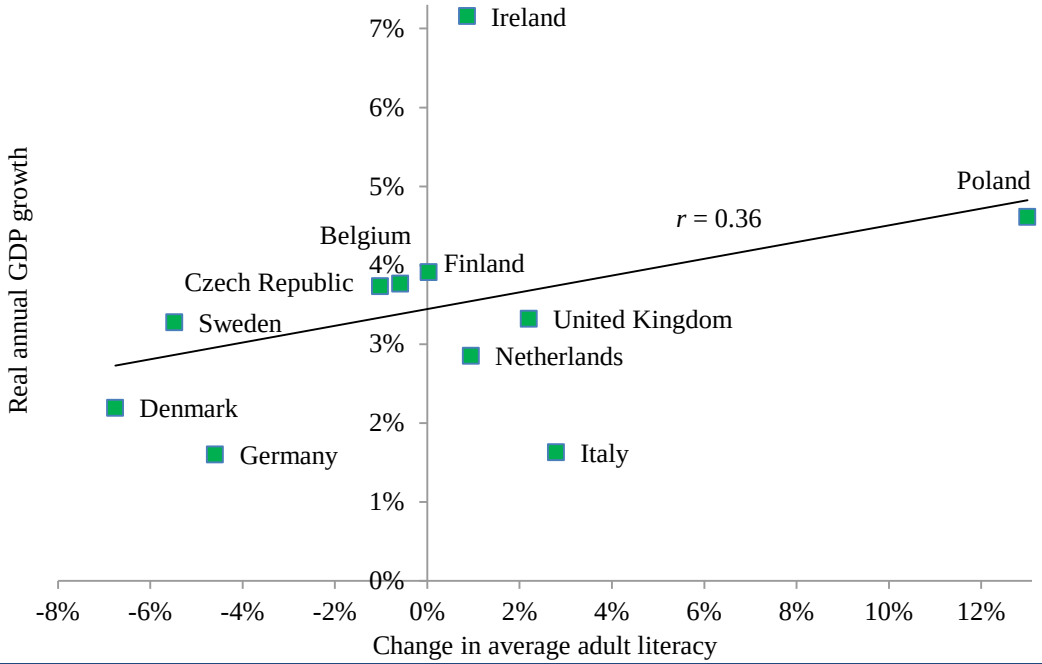
Note: Belgian data represent the region of Flanders only; UK data represent England and Northern Ireland only.
Source: Own calculations based on PIAAC data

Table 1.3: Correlations between adult numeracy and literacy scores and GDP per capita (PPS) in selected Member States/regions, 2012

	Numeracy	Literacy	GDP
Numeracy			
Literacy	0.89		
GDP per capita PPS	0.25	0.19	

Note: based on data for Belgium (region of Flanders only), Czech Republic, Denmark, Germany, Estonia, Spain, France, Ireland, Italy, Cyprus, Netherlands, Austria, Poland, Slovakia, Finland, Sweden, and the UK (England and Northern Ireland only)
Source: Own calculations based on PIAAC data

Figure 1.22: Real GDP growth 1994–2007 and changes in adult literacy skills 1994/98–2012



Note: Belgian data represent the region of Flanders only; UK data represent England and Northern Ireland only.
Source: Own calculations based on PIAAC and Eurostat data

Over that period, average literacy proficiency rose in Poland, Italy, the UK (England and Northern Ireland), the Netherlands, Ireland and Finland, while it decreased in Belgium (Flanders), the Czech Republic, Germany, Sweden and Denmark.

Table 1.4: Correlations between adult literacy and numeracy scores 2012 and previous PISA scores in reading and mathematics

	Literacy	Numeracy
PISA 2000/ aged 26 to 28 in 2012	$r = 0.60$	$r = 0.75$
PISA 2003/ aged 23 to 25 in 2012	$r = 0.77$	$r = 0.85$
PISA 2006/ aged 20 to 22 in 2012	$r = 0.72$	$r = 0.85$
PISA 2009/ aged 17 to 19 in 2012	$r = 0.60$	$r = 0.70$

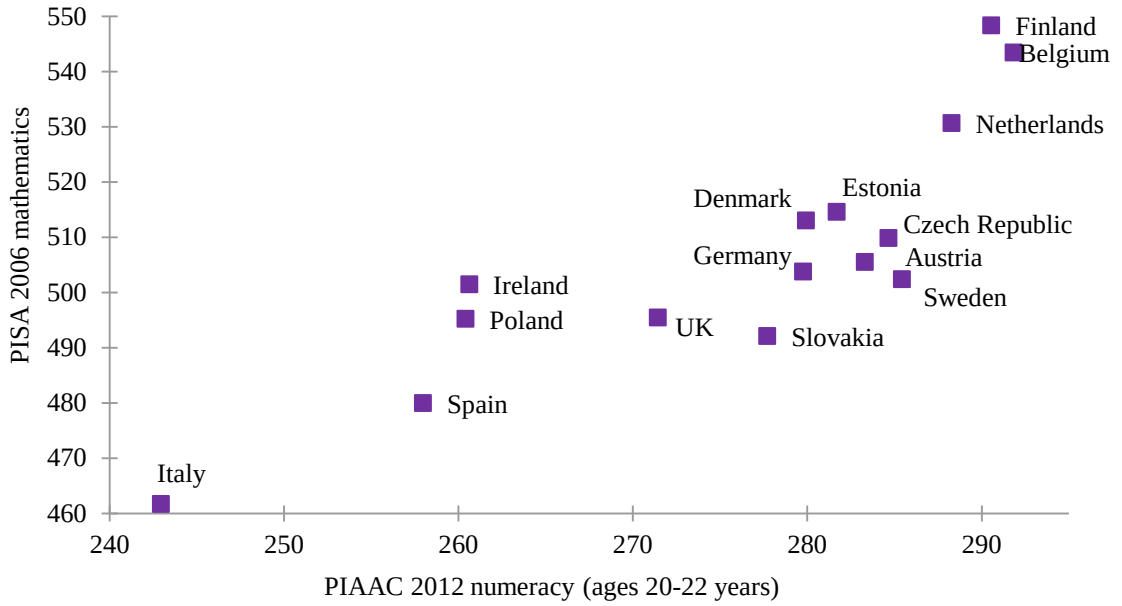
Note: based on data for Belgium (Flemish region only), Czech Republic, Denmark, Germany, Estonia, Spain, Ireland, Italy, Netherlands, Austria, Poland, Slovakia, Finland, Sweden, UK (England and Northern Ireland only)
Source: Own calculations based on PIAAC and PISA data

Relative changes in average literacy proficiency for this subset of Member States show the extent to which the changes correlate (if at all) with real GDP growth over the same period. The idea is that literacy proficiency is a basic and generic skill that can be regarded as a proxy for the more specialised and job-specific skills needed in the economy. Therefore, increased literacy proficiency should coincide with increased skill levels across the whole economy, which in turn should lead to higher productivity and economic growth. To test this idea, Figure 1.22 shows the same changes as Figure 1.21, but in relation to real GDP growth rates between 1994 and 2007 (GDP data for 2008–2012 were excluded to avoid a distortion of the results due to the recession).

For this limited subset of Member States and regions of Member States, there is a modest positive correlation between changes in literacy proficiency and real growth ($r=0.36$), as demonstrated by the fitted line in Figure 1.22. Ireland is an obvious outlier: its strong growth prior to the recession can be attributed to a number of factors, many of which are more important than increased skills levels. Excluding the Irish outlier improves the fit considerably among the remaining ten Member States or regions, to $r=0.53$.

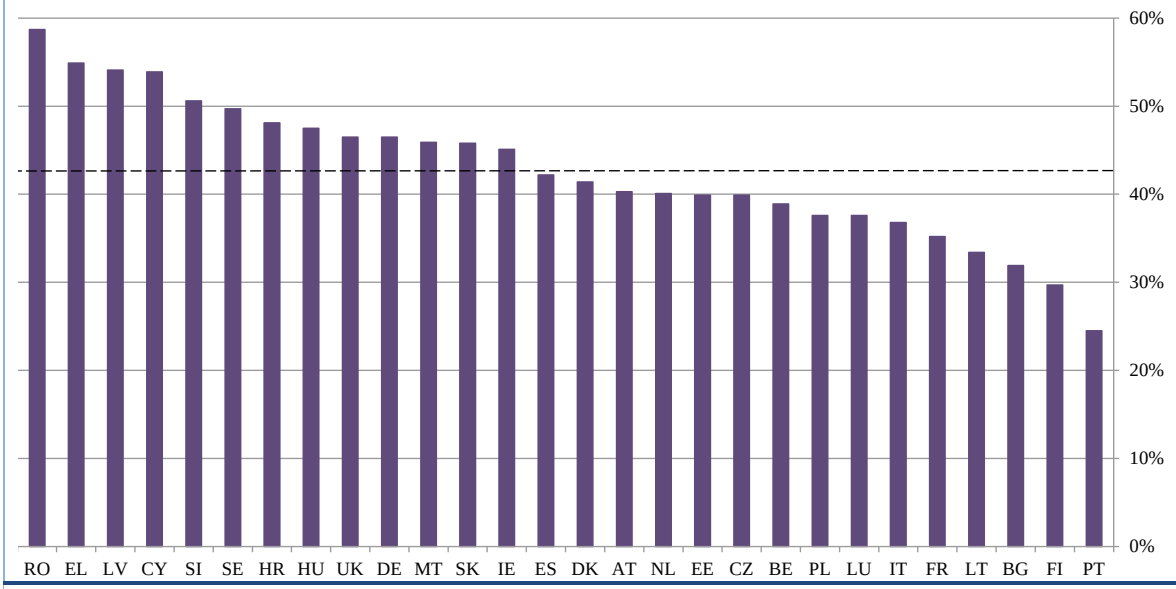
A final remark about the OECD's Survey of Adult Skills concerns the degree to which it confirms earlier results from the Programme for International Student Assessment (PISA), a much larger survey run by the OECD every three years to assess the skills of 15-year-old students in reading, mathematics and science. The results of the 2012 PISA survey, which covered around 510 000 students in 65 economies (including all Member States except Malta), show that in 14 Member States, average scores were higher than in 2009 in all three disciplines, while in five Member States they were lower in all three disciplines (OECD 2013b).

Figure 1.23: PISA 2006 and PIAAC 2012 results for selected Member States/regions



Note: Belgian scores represent the region of Flanders only; UK scores represent England and Northern Ireland only
Source: Own calculations based on PIAAC and Eurostat data

Figure 1.24: Perceived mismatch between skills and duties: share of surveyed industry workers, 2010



Note: Combined share of responses 'I need further training to cope well with my duties' or 'I have the skills to cope with more demanding duties' among surveyed workers in EU industry. The dashed line indicates EU average.
Source: Own calculations based on Eurofound data

However, when relating PISA results to recent surveys of adult skills and to economic performance, it is more informative to look at the cohorts of 15-year-olds in 2000, 2003, 2006 and 2009, and compare their average PISA scores in reading and mathematics with the average literacy and numeracy proficiency scores in 2012 for the corresponding cohorts in the Survey of Adult Skills.

Table 1.4 shows the strength of positive correlations between literacy and numeracy proficiency scores in the 2012 survey with previous PISA scores.

One of these correlations is illustrated in Figure 1.23 to show the fit by Member State (or region). It is clear that, where PISA scores in mathematics were high in 2006, six years later adults did well in numeracy in the Survey of Adult Skills, and vice versa. The conclusion is that, while school education is not the only determinant of adult skills, it is clearly the most important factor. Investing in good education for young students pays off later in the form of a highly skilled adult population, which in turn leads to higher productivity and economic growth, as seen in Figure 1.22.

A much smaller survey of adult skills (as well as other working conditions) is carried out every five years by the European Foundation for the Improvement of Living and Working Condition (Eurofound). In its most recent survey (2010), one of

the questions asked how workers felt about the adequacy of their skills in relation to their duties. Respondents could reply that their skills corresponded well to their duties; that further training was needed to cope well with their duties; or that their skills would enable them to cope with more demanding duties.

Almost 44000 workers in 34 European countries (including all Member States) were interviewed, with results broken down by 33 aggregated sectors, including five manufacturing sectors (textiles and clothing, chemical industry, metal industry, the agro food industry, and furniture) and construction.[8]

Looking specifically at the proportion of surveyed industry workers in each Member State who responded either that they needed further training to cope well with their duties or that they had the skills to cope with more demanding duties, Figure 1.24 reveals that the perceived mismatch was high in Romania, Greece, Latvia and Cyprus, where it was felt by more than half the respondents, and low in Portugal, Finland and Bulgaria. Across all Member States, 58% of all surveyed industry workers responded that their skills corresponded well to their duties, a higher figure than for services (54%).

1.5. INVESTMENT

Table 1.5: Skills in relation to duties, 2010

	Skills and duties correspond well	Need further training to cope well with duties	Current skills would allow new duties
Construction	58%	11%	31%
Textiles and clothing industry	63%	2%	35%
Chemicals	57%	14%	29%
Metal industry	54%	14%	32%
Agro food	60%	10%	29%
Furniture	62%	12%	26%
All sectors	55%	13%	32%

Source: Own calculations based on Eurofound data

Across all 33 sectors and all Member States, 55% of the surveyed workers considered that their skills corresponded well to their duties, while 13% felt underqualified for their duties and 32% considered that they had skills that would enable them to take on more demanding duties. Based on these results, the skills mismatch on the EU labour market could therefore be estimated as affecting 45% of the EU workforce (Table 1.5).

In construction and four of the five aggregated manufacturing sectors, the mismatch was generally smaller, as a higher proportion of respondents felt their skills corresponded to with their duties. Metal industry was the only manufacturing sector with a slightly higher perceived mismatch (46%) than that across all sectors in all Member States.

The manufacturing sector with the lowest perceived mismatch was textiles and clothing (37%). At the same time, of the 468 workers surveyed in that sector, only 2% reported that they needed further training to cope with their duties. Accordingly, to the extent that they perceived themselves as mismatched in terms of skills, they were much more likely to think that their skills enabled them to take on more demanding tasks.

By investing in physical capital such as buildings, machinery and equipment, firms can increase their output capacity, capital stock and innovative capacity. Investing in physical capital also facilitates reorganisation, streamlining, and rapid adaptation to changing market conditions.

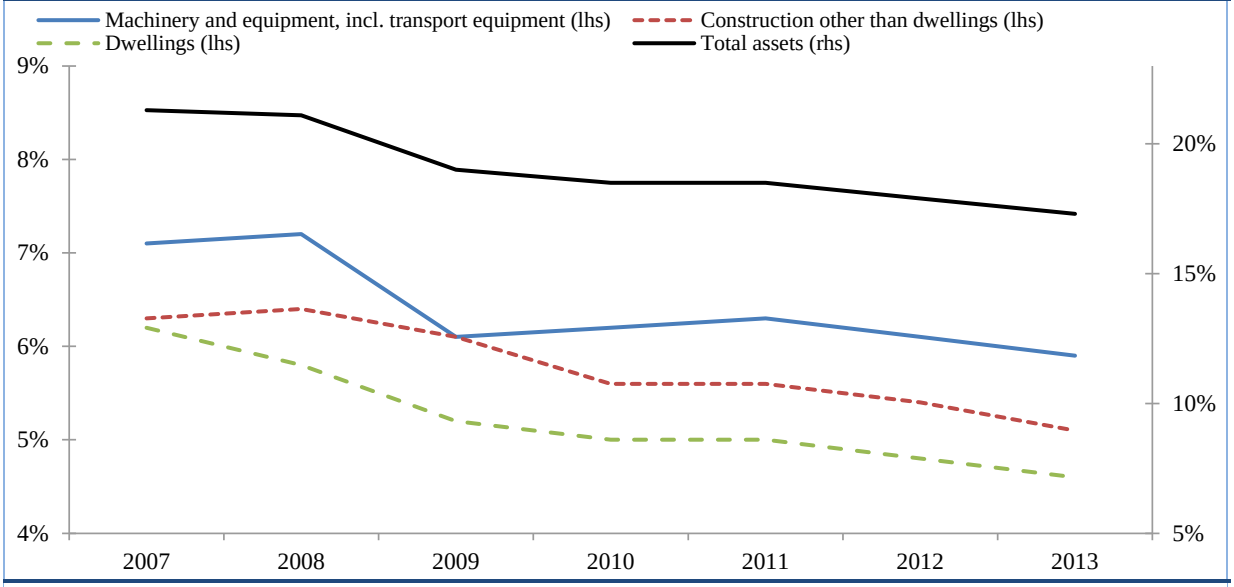
The Commission has identified low investment by EU manufacturers as a major obstacle to restoring growth, noting that '*if Europe does not keep up with investment in the adoption and diffusion of these [new] technologies, its future competitiveness will be seriously compromised*' (European Commission 2012b).

To rise to this challenge, the Commission has put forward specific targets for gross fixed capital formation (GFCF) and investment in equipment (one of the most important components of GFCF), to be achieved in the short term and by 2020: GFCF should reach pre-crisis levels in 2015 and average levels above 23% of GDP until 2020, while investment in equipment should return to pre-crisis levels and grow steadily at rates above 9% of GDP by 2020.

However, as Figure 1.25 shows, EU investment levels are falling short of the targets and are going down in relation to GDP: total GFCF dropped from 21.3% of GDP in 2007 to 17.3% last year, while investment in machinery and equipment has decreased from over 7% to less than 6% of GDP in the same period.

[8] Textiles and clothing correspond to C13–14 in NACE Rev. 2; chemical industry to C20–22; metal industry to C25–30; agro-food industry to C10–11; furniture to C31; and construction to class F.

Figure 1.25: EU gross fixed capital formation as a proportion of GDP, 2007–2013



Source: Own calculations based on Eurostat data

In its 2012 Communication, the Commission also noted that investment and innovation are impossible without adequate access to finance. Chapter 2 of this report, which examines the role of such access and how important it is to the growth of firms, addresses many aspects, including the sensitivity of investment at the firm level to a number of financial factors: long-term and short-term credit flows; leverage and interest burden; trade credit; stocks and flows of internal cash.

On the basis of data for over 22000 firms in eleven Member States[9] for the period 2004–2012, statistically significant (at the 5% level) sensitivities have been found for firm-level investment with respect to long-term credit flows, internal cash flows and leverage (European Commission 2014a). The results show that changes in leverage or in flows of internal cash or long-term credit have a significant impact on firm-level investment, in the same direction as the change, and that changes in leverage are more influential than changes in internal cash flow or long-term credit flows.

Returning to gross fixed capital formation at a more aggregated level, Table 1.6 presents the ratio of GFCF to value added for a range of EU sectors in industry and services. Because the denominator is value added rather than GDP, the investment ratios in Table 1.6 are slightly higher than the GFCF-to-GDP proportion in Figure 1.25. Interestingly, unlike the proportion in Figure 1.25, the GFCF-to-GVA ratio is no longer falling: it reached its lowest point in 2010 and has since recovered slightly. This is a denominator effect and reflects that GDP has so far recovered slightly more than GVA.

Sectors with high investment ratios, reflecting a high proportion of capital-intensive firms, are mainly industrial sectors such as motor vehicles, coke and refined petroleum products, mining and quarrying, electricity and gas production, water supply, sewerage and waste. Other industrial sectors, such as construction, textiles, clothing and leather products, furniture and other manufacturing, are more labour-intensive, so their investment ratio is much lower.

Most services sectors have lower investment ratios than industry, but real estate activities, transportation and storage, telecommunications and arts, entertainment and recreation are sectors with remarkably high ratios. It is understandable that in real estate, transportation and storage, and telecommunications, large investments are needed to generate value. In the case of arts, entertainment and recreation, the high ratio may be due to low value added rather than high investment.

[9] Belgium, Bulgaria, Czech Republic, Germany, Spain, France, Italy, Portugal, Finland, Sweden and the UK.

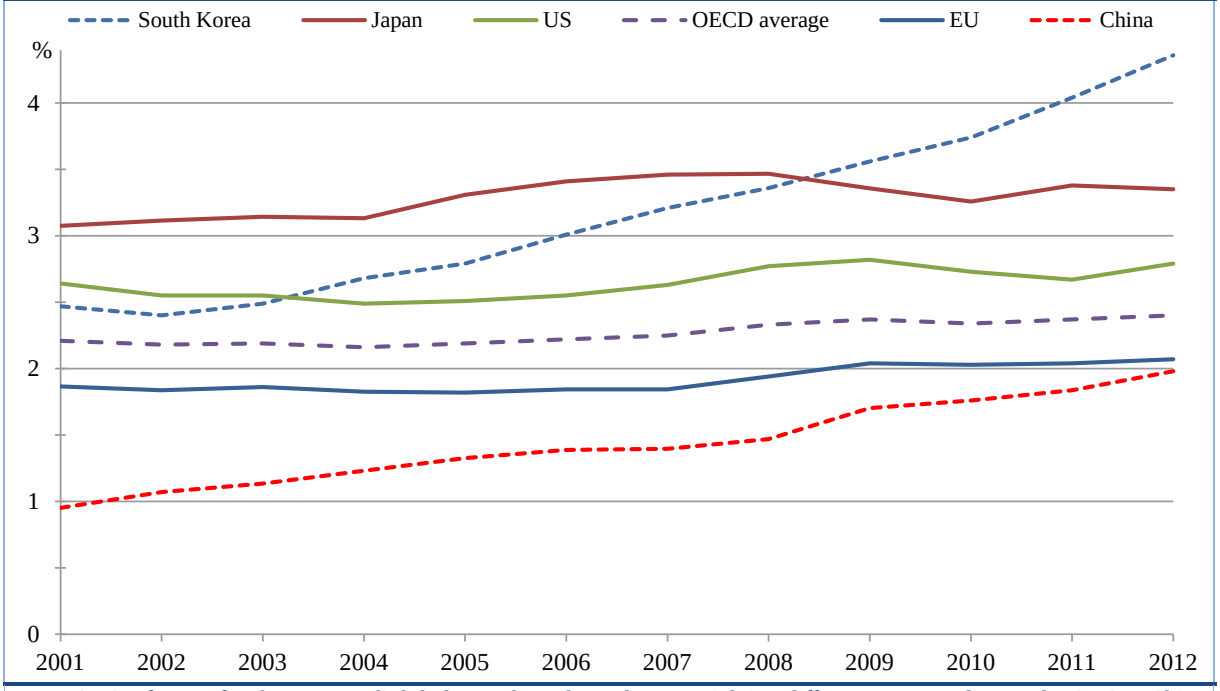
Table 1.6: Investment ratios in the EU, 2007–2012 (%)

		2007	2008	2009	2010	2011	2012
TOTAL	**Total**	**24.0**	**23.7**	**21.2**	**20.8**	**20.9**	**21.0**
B	Mining and quarrying	32.4	26.8	31.6	27.5	27.9	29.2
C10–12	Food, drink and tobacco products	18.6	19.5	16.1	17.4	17.7	19.8
C13–15	Textiles, clothing, leather and related products	9.6	10.4	8.7	8.9	9.0	9.8
C16	Wood and products of wood and cork	18.7	18.8	15.5	15.4	16.7	15.4
C17	Paper and paper products	19.0	24.8	17.9	16.6	17.5	32.2
C18	Printing and recorded media	12.6	13.9	13.4	13.8	14.6	13.4
C19	Coke and refined petroleum products	36.4	34.1	52.8	37.9	36.4	37.8
C20	Chemicals and chemical products	18.6	20.4	19.3	15.4	16.7	21.4
C21	Pharmaceuticals	14.9	14.0	12.5	11.8	12.4	16.5
C22	Rubber and plastic products	19.1	20.6	15.8	16.6	17.8	18.4
C23	Other non-metallic mineral products	20.7	23.0	17.8	16.9	18.1	17.6
C24	Basic metals	20.7	25.0	28.7	20.9	22.1	26.4
C25	Fabricated metal products	14.7	15.7	14.6	13.2	13.6	14.8
C26	Computer, electronic and optical products	18.8	19.2	18.6	18.0	20.7	24.8
C27	Electrical equipment	12.7	13.3	11.5	10.4	11.6	14.6
C28	Machinery and equipment	13.9	14.1	13.2	12.8	12.9	12.4
C29	Motor vehicles, trailers and semi-trailers	22.5	29.1	29.4	19.5	22.1	36.1
C30	Other transport equipment	16.1	17.5	16.9	15.5	16.2	13.0
C31–32	Furniture, other manufacturing	11.8	13.2	12.5	9.5	10.4	13.1
C33	Repair and installation of machinery and eq.	9.6	10.4	10.5	7.8	8.9	6.1
D	Electricity, gas, steam and air conditioning	44.5	43.2	42.7	44.0	50.8	37.1
E	Water supply, sewerage, waste	58.7	58.9	54.3	46.7	47.1	38.8
F	Construction	14.2	14.9	9.9	11.7	11.1	8.9
G	Wholesale and retail trade	11.9	11.7	9.7	9.6	10.1	9.5
H	Transportation and storage	40.3	41.9	38.9	41.0	37.9	35.0
I	Accommodation and food service activities	12.6	13.8	10.8	10.9	11.4	11.5
J58–60	Publishing, motion picture and broadcasting	24.2	24.0	21.6	20.7	19.9	27.7
J61	Telecommunications	32.5	32.5	27.2	29.9	30.5	31.2
J62–63	Computer programming and consultancy activities	13.9	14.6	13.0	14.5	14.3	17.0
K	Financial and insurance activities	10.8	12.2	9.7	9.8	11.4	11.0
L	Real estate activities	76.6	69.3	61.4	59.2	55.7	56.8
M69–71	Legal and accounting activities and architectural and engineering activities	8.3	8.3	7.2	7.6	7.3	9.4
M72	Scientific research and development	25.2	26.3	25.5	24.3	26.3	27.2
M73–75	Advertising and market research, other professional services, scientific and veterinary activities	8.7	9.2	7.6	8.5	7.3	11.0
N	Administrative and support service activities	29.9	27.2	21.7	22.2	22.6	27.8
O	Public administration and defence	22.5	20.1	21.2	19.1	17.4	20.4
P	Education	16.0	15.4	15.2	13.3	15.6	9.0
Q86	Healthcare	12.2	10.9	9.9	8.4	9.6	10.9
Q87–88	Residential care activities and social work activities	11.8	13.8	11.4	11.3	11.7	7.1
R	Arts, entertainment and recreation	32.4	32.0	31.7	32.3	31.8	25.4
S	Other service activities	9.7	9.3	7.9	7.4	7.2	7.1

Source: Own calculations based on Eurostat data

In general, investment ratios are relatively stable over time. However, the sharp fall in production and value added in many industries in 2009, at the start of the recession, was not accompanied by a commensurate falls in investment. As a result, investment ratios in many of the worst affected sectors — motor vehicles, coke and refined petroleum products, mining and quarrying — shot

Figure 1.26: R&D expenditure as a share of GDP (GERD), 2001–2012



Note: OECD figures for the EU are slightly lower than above due to weighting differences; according to the OECD, China bypassed the EU in 2012
Source: Eurostat, OECD and World Bank

up in 2009, before returning to more normal levels in 2010 and subsequent years. In sectors less affected by the recession, including all services sectors, investment ratios remained more or less unchanged during the recession. In this context it is worth recalling that investments are longer-term in sectors such as motor vehicles, mining and quarrying than in sectors such as food products and beverages, making it more difficult for the former to adjust to sudden cyclical swings.

It is important to note that, while investment has again started to increase faster than value added in many manufacturing sectors (as in the EU economy as a whole), some manufacturing sectors were still characterised by falling investment ratios in 2012. This was the case notably in machinery and equipment, other transport equipment, printing and recorded media (and possibly also in the case of other non-metallic mineral products). As the recovery of the EU economy has since made further progress, it is reasonable to expect investment ratios to have meanwhile risen in these sectors, too.

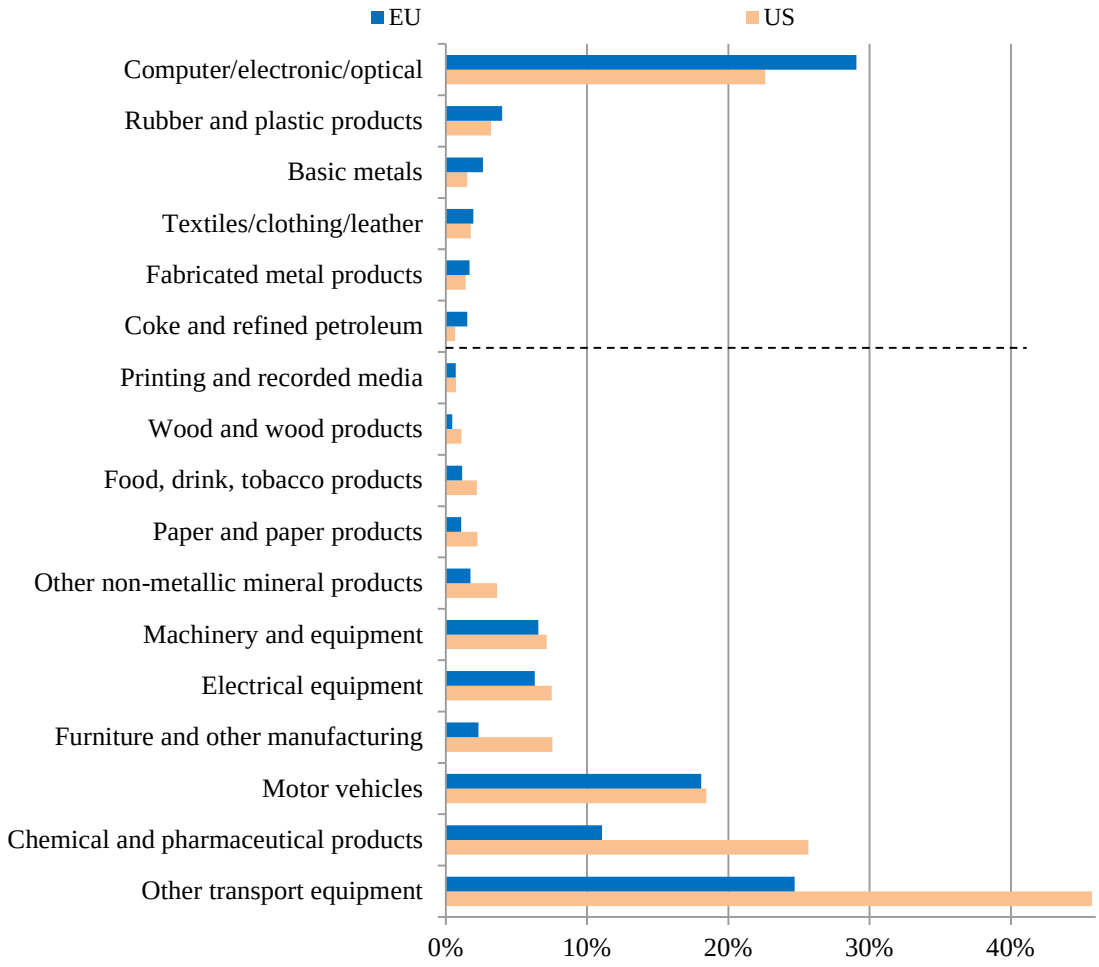
1.6. RESEARCH, DEVELOPMENT AND INNOVATION

Research, development and innovation efforts are important drivers of non-price competitiveness, as they can lead to increased demand for goods and services following the development of new, improved or differentiated products or services. R&D and innovation efforts can also affect the production process by making it more efficient, for instance through the introduction of new technology or new organisational solutions. The adoption of new, improved technology determines the efficiency frontier for the combination of production factors and inputs, and thereby the upper bound on potential long-term growth.

The Commission has pointed out that in order fully to harness the potential of research and innovation to generate growth, it is crucial that Member States prioritise growth-enhancing expenditure, notably on research and innovation, and that such expenditure should be accompanied by reforms to improve the quality, efficiency and impact of public spending on research and innovation, including by leveraging business investment in research and innovation (European Commission 2014c).

Because R&D&I efforts are so important to production, prosperity and growth, defining and measuring relevant R&D&I indicators and setting targets has become a priority in most economies. One of the most commonly used indicators is gross domestic expenditure on R&D as a share of GDP. In the Europe 2020 strategy for smart, sustainable and inclusive growth, the EU set itself a target of 3% of GDP by 2020. As Figure 1.26 shows, R&D expenditure has increased slightly faster than GDP in the EU over the last ten years, resulting in a gradual increase in R&D expenditure from below to just above 2% of GDP, but still far from the 3% target (and below the OECD average).

Figure 1.27: R&D intensity by manufacturing sector in selected Member States and the US, 2010



Note: EU represented by BE, CZ, DK, DE, FR, IT, HU, NL, AT, SI and FI. The dashed line separates the sectors with higher intensity in the EU from those with higher intensity in the US.
Source: Own calculations based on OECD data

The relatively stable development in the EU is similar to the development over time in Japan, the US and the OECD as a whole. In South Korea and China, on the other hand, R&D expenditures have increased much faster than GDP, leading to considerably higher ratios than a decade ago. Chinese R&D spending has increased to a GDP proportion very close to or above the EU share (it has been claimed that China actually overtook the EU in 2012) and is set to continue rising faster than in the EU or the OECD.

As shown in the figure, R&D expenditure in the EU and the US has been relatively stable in relation to GDP in recent years, with the EU spending around 2% and the US more than 2.5%.

To show how the higher US expenditure ratio translates into R&D in different manufacturing sectors, Figure 1.27 illustrates differences between sectors for a subset of Member States and the US for those sectors. It shows that in many manufacturing sectors, R&D investments represent only a few per cent of gross value added. This is the case, in both the EU and the US, in sectors such as textiles, clothing, leather and related products; fabricated metal products; coke and refined petroleum products; printed matter and recorded media; wood and wood products; food, drink and tobacco products; and paper and paper products. It could be argued that any differences between the EU and the US in R&D spending in such sectors are less important than other factors, such as differences in unit costs or productivity (see Section 1.3) or in value added.

There are, however, several manufacturing sectors with high or even very high R&D intensities: computer, electronic and optical products; motor vehicles and other transport equipment; chemical and pharmaceutical products. In motor vehicles, the subset of Member States had almost the same R&D intensity in 2010 as the US: 18% of gross value added in the sector. For other transport equipment though, the US sector invested a much higher proportion (46%) in R&D than the subset of

Table 1.7: US outward R&D investment flows to the EU-27, 2007–2010		
	USD billion	**Proportion of total**
2007	21.4	62.0%
2008	25.1	60.3%
2009	23.4	59.8%
2010	22.6	57.2%

Source: Dachs (2014)

Member States (25% of value added). As the sector includes not only shipbuilding, trains and trams, but also aircraft and spacecraft, it is not surprising that it is highly R&D-intensive, both in the EU and the US, nor that the intensity is higher in the latter.

Another sector with considerably higher R&D intensity in the US than in the subset of Member States is chemical and pharmaceutical products, where US manufacturers invested 26% of value added in R&D in 2010, and EU manufacturers only 11%. However, part of the explanation may lie in the high level of aggregation and in differences in the sector composition between the EU and the US. Manufacturing pharmaceutical products and preparations is exceptionally R&D-intensive, while the manufacture of chemical products is much less so, at around 5–7% of value added (European Commission 2013a). Economies with a high proportion of pharmaceutical manufacturing in the 'chemical and pharmaceutical products' aggregate will therefore have higher R&D intensity than those with a lower proportion.

The only aggregated sector in which the subset of Member States had a clearly higher R&D intensity than the US was computer, electronic and optical products, where EU manufacturers invested 29% of value added in R&D, while US manufacturers invested 23%. In rubber and plastic products, basic metals, light industries, metal products, and coke and refined petroleum products, their R&D intensity was slightly higher than for the US.

In order to fully understand the origin and nature of these differences and the implications related to reaching the 3% target by 2020, it is useful to study company data of cross-border activities (production and sales, as well as R&D investments abroad).[10] Industrial activities of foreign-controlled companies account for a large share of the domestic industry, in particular in high-technology manufacturing. Significant differences in R&D intensities across sectors and between home and host countries occur because companies do not delocalise production and R&D facilities in the same way and to the same extent. In each sector (such as pharmaceuticals or ICT), R&D intensities reflect the internationalisation strategies of individual companies and the capacity of regions or countries to attract multinational companies.

When discussing R&D investments in the EU and the US, it is important to take into account the cross-border flow between the two economies. Most inward R&D investments in the EU are made by US firms — the EU is by far their preferred investment destination. Conversely, when EU firms make R&D investments outside the EU, they prefer to invest in the US market, where they represent the lion's share of all inward investments in R&D. Another important property of R&D investment across borders is that most of it is related to manufacturing.

Table 1.7 shows US outward R&D investment flows to the EU (except Croatia). Measured in current US dollars, the flows peaked in 2008 and have since fallen back as a consequence of the recession. At the same time, in terms of its share of total US outward R&D investments, the EU has become a less attractive destination than it used to be. Though it still attracts more than half of all US R&D investments abroad, US firms are gradually redirecting their international R&D investments away from the EU, in favour of China and other emerging economies.

Conversely, a survey of the largest R&D investing companies in the EU showed that they expect their R&D investments to grow by around € 1.2bn over three years outside the EU (similar to the increase in R&D investment in the EU), with the fastest growth rates in China and India, followed by the US and Canada. As in the case of the US investment flows in Table 1.7, their growing interest in non-EU R&D investment is a reflection of their participation in an increasingly globalised economy and should not be interpreted as steps in the direction of a radical erosion of the European R&D base (Tübke et al. 2013).

1.7. CONCLUSIONS

As the EU economy emerges from recession and the recovery gains momentum, it is clear that the recession has taken a heavier toll on manufacturing than other sectors and that EU manufacturing suffered greater losses than manufacturing in many other economies, as shown in Figure 1.2.

[10] EU Industrial R&D Scoreboard 2012.

At the same time, the considerable variation between Member States, industrial sectors and individual firms should not be ignored. The Polish economy avoided recession thanks to strong domestic demand, while Germany and other strong exporters were helped by growing extra-EU demand for their export goods. Manufacturing sectors producing food products, pharmaceutical products and preparations, and transport equipment other than motor vehicles fared much better than EU manufacturing as a whole, while non-metallic mineral products, furniture, clothing and textiles fared much worse.

In terms of de-/reindustrialisation, the chapter has demonstrated that the gradual fall in the proportion of total EU value added coming from manufacturing is driven mainly by falling relative prices in relation to services, which in turn are the result of faster productivity growth. Only a small part of the drop can be attributed to structural factors such as deindustrialisation, as shown in Figure 1.8.

Looking ahead, it is important to recognise that EU manufacturing remains highly competitive in several sectors. Whether measured by export value or by global value chain income, the EU's revealed comparative advantage in manufacturing sectors such as transport equipment, printing, wood and wood products, chemicals, machinery, and metal products is evident. Conversely, it is clear from both types of RCA analysis that the EU does not have a comparative advantage in the production of electrical equipment.

Of the two manufacturing sectors characterised by high technology intensity, the EU has comparative advantages in one (pharmaceuticals) but not the other (computer, electronic and optical products). Of the five aggregated sectors characterised by medium-high technological intensity, the EU has comparative advantages in all but one.

EU manufacturing output is often highly sophisticated and specialised, and many Member States, especially in Central and Eastern Europe, managed to raise the complexity and sophistication of their manufacturing output between 1995 and 2010.

Many EU manufacturing sectors are also characterised by highly skilled labour needs. In all Member States but one, the proportion of high-skilled labour input has increased in 1995–2010. The demand for skilled workers is met by education and training systems, and on-the-job training, but at the same time surveys suggest that skills mismatches are emerging in some sectors and that, as the EU economy returns to normal levels of output and growth after the recession, shortages may occur in certain manufacturing sectors.

In view of the importance of investment for growth and job creation, the EU has set ambitious targets for the short and medium term. While aggregated data suggest it is further from its short and medium-term targets than when they were set, sectoral data indicate that investment ratios have begun to recover and increase in several manufacturing sectors, a development likely to spread to other sectors as the recovery progresses.

Research and innovation are also of crucial importance. In many Member States, the ratio of R&D expenditure to GDP is lower than before the recession and for the EU as a whole it is still far from the 3% target. At the same time, the ratio is rising fast in economies such as China and South Korea. Member States will need to step up to the plate if they are to meet their individual R&D expenditure targets and the 3% EU target.

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Annex 3 – High-tech aggregation by NACE Rev. 2
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