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Investment and Investment Finance in Europe

Investing in competitiveness

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Economics Department
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The mission of the EIB Economics Department is to provide economic analyses and studies to support the Bank in its operations and in the definition of its positioning, strategy and policy. The Department, a team of 30 economists and assistants, is headed by Debora Revoltella, Director of Economics.

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The views expressed in this publication are those of the author(s) and do not necessarily reflect the position of the EIB.

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Executive summary

Europe faces a twofold economic challenge. Post crisis, Europe still suffers from weak confidence, with would-be investors across Europe sitting on ample liquidity but afraid to invest, while deleveraging goes on in both the public and private sector. From a structural point of view Europe faces the long-lasting challenge of declining productivity and competitiveness, which has made it more vulnerable to economic turmoil, is undermining the recovery and threatens its economic well-being over the longer term. Getting the conditions right for investment to take place and to accelerate the competitiveness-enhancing reallocation of resources is crucial for the future of Europe.

The EIB's annual economic publication focuses on investment and investment finance in Europe, discussing both cyclical and structural factors. This year's special topic is investing in competitiveness.

Investing in competitiveness – getting the conditions right for firm productivity growth

Europe is as competitive as its firms. Competitiveness depends on firms' productivity, which hinges on innovation and the reallocation of resources (creative destruction). In an increasingly open world, it is becoming more and more important for firms to be able to perform high value added activities within global integrated production chains.

Competitive and flexible markets promote productivity growth. Institutional conditions such as ease of firm entries and exits, flexible labour markets and open markets for goods and services are essential to create incentives for high-productivity growth.

Investment plays a critical role in enhancing competition and providing the foundations for high value added activity. Competitiveness-enhancing areas of public and private investment include: R&D, education and training, and other intangible assets; and complementary tangible assets, including infrastructure investments, particularly in sectors such as energy and ITC (broadband networks) that can both improve efficiency and remove barriers to competition.

A well-functioning and diversified financial sector is crucial for the efficient reallocation of resources towards more productive activities. The innovation process requires not only finance for activity such as R&D within established firms, but also risk-taking finance that is adapted to the needs of innovative start-ups and growth stage firms and can focus financial resources efficiently on growth opportunities. Targeted and well-managed risk-absorbing finance is also needed to ensure long-term investment in public goods such as infrastructure.

Is Europe investing enough?

European investment in tangible assets remains weak. EU gross fixed capital formation (GFCF) remains weak relative to GDP levels, despite picking up slightly in 2013. It continues to grow at about half the rate of increase in the US. Depressed investment in dwellings and other structures, including infrastructure, continues to weigh heavily on overall investment figures. Public investment has continued to fall, particularly in the vulnerable Member States (since 2009) and the cohesion countries (since 2011).

Infrastructure investment is declining. Latest figures suggest a continued decline in infrastructure investment, with both government and private investment in this sector falling in parallel since 2011.

More investment is needed in intangible assets …
Productivity growth and competitiveness are increasingly linked to investment in intangible assets such as software, data, R&D, designs, advertising, worker training and new organisational processes. Investment in these assets is closely linked to GDP per capita and the ability of firms to compete globally in high-tech, high value added sectors, and also to the diverse financing opportunities provided by

well-developed capital markets. EU firms – particularly SMEs, which also invest less in intangible assets than larger firms – report that high investment costs, limited public financial support and unfavourable tax treatment are the main barriers to greater investment in these assets.

… including R&D. At 2% of GDP, R&D expenditure remains well below the levels in other advanced economies such as the US and Japan, and well below the EU 2020 target of 3%, undermining the ability of EU firms to compete at the high value added technology frontier. EU business investment in R&D remains low because of continued relative specialisation in medium-tech and because there are relatively few young leading innovators in high-tech sectors. EU government and higher education R&D intensity is comparatively high, although fiscal constraints have started to weigh on this investment, and industry-science links and specialisation in strategic technologies are said to be weak points.

What is holding back investment?

Amid ample liquidity, incentives for risk-taking investment are weak. The main drivers of weak investment include:

- Weak expectations of demand.
- High levels of uncertainty.
- High levels of NFC leverage (particularly in relation to expectations for firm growth).
- Reduced banking sector appetite for risk, imposing a potential constraint on recovery.
- Underdevelopment of risk-bearing capital market and equity-based financing alternatives.

SMEs in particular face a difficult investment environment. Perceptions of the risk of lending to small businesses have increased, with the spread between euro area retail interest rates on large and small loans showing little sign of contraction following its dramatic rise in 2011-2012. SMEs have also suffered from their overwhelming dependency on banks for external finance and the relative lack of equity financing options in most European countries. Unsurprisingly, SMEs are most likely to report access to finance constraints in those European countries where banking sectors have been hardest-hit by the crisis.

How is the EU economy changing in the face of global competition?

The structure of EU economies needs to keep evolving to maintain competitiveness. The structure of EU industries and exports has been evolving to keep pace with global trends:

- An EU-wide shift from low-tech to high-tech industries, led by Germany and central-eastern Europe and in line with the shifting composition of world trade.
- The rising share of business services in GDP and value added exports, partly because high-tech industries have a stronger carrier function for services.
- Increasing integration within global value chains, with manufacturing job losses largely offset so far by the increased role of services.

Future productivity growth and trade performance will depend on continued restructuring and a greater focus on high value added activities … Maintaining competitiveness in labour cost-sensitive medium and low-tech industries (still prevalent in southern Europe) and low-tech activities (such as assembly) within high-tech industries will become increasingly hard.

… yet the efficient reallocation of resources to higher-productivity firms and sectors remains a key challenge for Europe. Enhancing competitiveness entails reallocating labour and capital resources from less productive firms and sectors to more productive activities, including young innovative firms. There are wide variations across Europe in allocative efficiency, a measure of the relative concentration of resources in high-productivity firms. Allocative efficiency appears to be lower in all EU countries examined (apart from Sweden) than estimates for the US. Reasons may include institutional barriers to firm entries and exits, labour market inflexibility, overdependence on bank finance and relatively less developed (private) equity markets.

How can we enhance competitiveness?

To compete in an increasingly open world, a dynamic economy is critical. This means innovation, to be at or moving towards the technological frontier, investment to incorporate innovations, and an economy that can respond rapidly to new growth opportunities. Public intervention needs to create the right environment for this process.

There is scope in Europe for a complementary countercyclical and structural approach that can generate the right incentives for investment to restart. Countercyclical policy can be justified if, for example, it targets the maintenance of competitiveness-enhancing investments over the cycle.

There is a role for both "horizontal" and "vertical" industrial policy to address structural issues. Horizontal policies need to include:

- Structural reforms to enhance competition and the reallocation of resources to more productive firms, such as consolidation of the internal market or the promotion of labour mobility.
- Greater investment in research, education and infrastructure, especially where this enhances market competition.
- Financial market reforms to encourage better provision of risk-bearing finance for young innovative firms and other innovation activities, including through venture capital, high-quality securitisation and greater use of credit guarantees.

Vertically targeted intervention is important, but how it is done matters:

- It is needed to address externalities and financing constraints and to ensure that strategic long-term issues – such as climate change or the need to be at the frontier in key emerging technologies – are addressed by the innovation process.
- It should create incentives for firm-level innovation without undermining product market competition. This can be achieved by targeting activities, not specific firms, with clear and verifiable criteria for selecting activities and good governance to prevent capture.

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Introduction

Investing in competitiveness – getting the conditions right for firm productivity growth

This publication takes a closer look at the European competitiveness challenge. Competitiveness gaps are increasingly seen as the main cause of divergent economic development patterns between countries. They are also identified as an important reason for some of the most disruptive downturns, including the latest EU crisis. Therefore restoring competitiveness is broadly acknowledged as the critical building block for achieving sustainable growth. At the same time, when asked what competitiveness is all about, scholars and policymakers will respond rather differently, reflecting the fact that there is more than one definition of competitiveness and that it is also a matter for controversy.

The starting point in the publication is that a country is as competitive as its firms. Therefore, what makes a country competitive is primarily what makes its individual firms competitive. The publication argues that productivity is the key determinant of a firm's competitiveness. In this context, Chapter 6 provides a framework for thinking about productivity growth. It emphasises the importance of innovation as the key driver of a firm's productivity. However, firms need proper incentives and capabilities to excel in their profit-motivated innovation activities. These are spurred by efficient creative destruction and reallocation of resources, appropriate policies and institutions and the ability to quickly benefit from new technological waves. Furthermore, in an increasingly open world it is becoming more and more important for firms in advanced economies to be able to perform high value added activities within global integrated production chains, as discussed in Chapter 7.

The crucial components of an operating environment that enhances productivity include well-functioning product market competition, flexible labour markets, a proper overall regulatory environment, access to frontier research and skilled labour, and access to high-quality intermediates in global markets. The first three components are essential for efficient creative destruction and reallocation of resources, but they also affect more directly firms' innovation activities. Moreover, Chapter 6 shows that the ability to benefit from technological waves depends crucially on complementary structural reforms. Chapter 9 discusses the importance of resource reallocation for productivity in greater detail.

Firms' productivity efforts and a productivity-enhancing operating environment rely on adequate investment. Investment in innovation and intangible assets as well as education and research is increasing in importance, but this does not undermine the complementary role of more traditional gross fixed capital formation. Both are needed. In particular, high-quality infrastructure contributes to reducing costs and improving firms' productivity directly, but it can also provide indirect support by facilitating, for instance, labour market flexibility and competition in product markets.

Yet Chapter 1 shows that gross fixed capital formation in the EU remains weak. Given the prevailing fast pace of technological change, low levels of investment can lead to an unwarranted decline in both the quantity and quality of the productive capital stock. This takes time to rectify. Chapters 2 and 3 highlight the fact that investment in innovation and intangible capital is performing relatively well, but prevailing investment patterns are unlikely to be sufficient to address the competitiveness challenges. Investment is also needed to support the ongoing adaptation to the changing economic structures and the related reorganisation of global production that are depicted in Chapters 7 and 8.

Investment cannot happen without adequate finance. Chapter 9 makes the point that misallocation due to financial frictions can be a significant drag on productivity. Chapters 4 and 5 discuss developments in investment and SME finance respectively and the ability of European financial markets to allocate finance to productive investment.

Is Europe investing enough?

Overall, investment in Europe remains weak …

After the substantial decline during the Great Recession in 2008-2009, gross fixed capital formation (GFCF) has remained very weak in the EU. Although growth resumed in 2013, the volume of GFCF in 2014 was still lower than the levels it attained in early 2008 in almost every country in the EU. Most of this rather weak growth is due to the increase in gross fixed investment in machinery and equipment. The contribution of investment in new construction, both residential and other buildings and structures, was smaller and far lower than its historical share of total investment would suggest. This is particularly the case in the most vulnerable Member States (VMS), namely Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain. In this group of countries, investment in machinery and equipment contributed positively to growth of total fixed investment, but this contribution was more than offset by the decline in gross investment in new construction.

GFCF in the EU is low not only in monetary terms but also relative to economic activity, especially in the VMS. The investment rate in the EU, defined as the ratio between GFCF and GDP, is about 1½ percentage points below the average level over the past 20 years and this difference is largely explained by the very low level in the VMS. If we look at different asset types, the ratio of investment in new construction to GDP is much lower than in the past, while investment in machinery and equipment relative to GDP is in line with the experience of the past 20 years. Chapter 1 of this publication describes these developments in greater detail.

Restrictive fiscal policy in countries with actively deleveraging private sectors further depressed investment levels. Government investment in most of the VMS has fallen significantly since the start of the sovereign debt crisis in 2010. It has declined somewhat in the other EU Member States too, but to a much lesser extent. Compared to the level of economic activity, it is currently close to the historical average in those countries.

… with infrastructure investment falling

Infrastructure investment has continued the downward trend that started in 2008 and ran on into 2013. The decline was initially driven entirely by the collapse of corporate infrastructure investment, as detailed in Chapter 1. With the ending of fiscal stimulus programmes across Europe and advent of fiscal consolidation programmes, however, government investment in infrastructure also fell, especially in the most vulnerable countries. This further reinforced the decline in corporate infrastructure spending. The economic sector with the largest declines was the transport sector.

Given current tight fiscal rules and struggling public finances, the private sector is increasingly expected to contribute more to infrastructure financing. Chapter 4 documents developments in project financing and, in particular, public-private partnerships (PPPs). There is evidence that these are still at a low level compared to infrastructure financing needs. Furthermore, project financing has been declining since 2008. Recent developments on the PPP market provide some grounds for optimism, though: 2013 was the first year since 2007 in which the number of new PPP deals and volume signed exceeded those of the preceding year.

Intangible assets are gaining in importance – are policy frameworks up to date?

Productivity and economic growth in advanced economies such as those of the EU and the US appear increasingly to be linked to firms' investments in knowledge creation. Over the past few decades business investment in intangible assets – such as software, data, R&D, designs, advertising, worker training and new organisational processes – has been rising faster than investment in physical capital such as machinery and buildings.

Chapter 2 shows that over the period 1995-2010 investment in intangible assets increased more rapidly than GDP in both the US and the EU. Such investment has also been relatively resilient to the recent

crisis – unlike gross fixed capital formation. However, as a share of GDP the EU is investing consistently less in intangible assets than the US. Within the EU, even the core countries that invest the most in intangibles fall short of the US level – 7.5 per cent and 11.1 per cent of GDP respectively in 2010. Furthermore, the gap in intangible investment with the US widened over the period 1995-2010 for all EU countries except Slovenia.

Drawing on the recent European Commission survey on intangible assets, Chapter 2 also highlights the importance of intangibles for improving productivity through innovation. Firms reporting that their most important priorities focus on increasing labour productivity, rapid development of new products or services and tailored solutions for their customers are more likely to invest in intangible assets. Firms whose priorities are to ensure lower prices or decrease production costs invest substantially less in intangible assets.

Firms also report that the high costs of the investment, as well as limited public financial support and unfavourable tax treatment, tend to be the main constraints on investment in intangible assets. Although this does not necessarily translate into market failures, the strong association between intangible investment and productivity calls for further investigation. There may be scope for governments to take policy measures and make investment in intangible assets more attractive for firms in the EU. At the same time the diversity of intangible assets should be emphasised, so that policies encompass the broad range of investment in intangibles.

Increased investment in innovation critical for European competitiveness

At 2 per cent of GDP, R&D expenditure in the EU continues to be below the levels in other advanced economies such as the US, Japan and South Korea (Chapter 3), and at current trends China is about to overtake the EU as well. Although R&D investment is only one component of intangible assets, it provides a widely used proxy for investment in innovation – thanks to a long history of systematic data collection. It is also true that while innovation can happen in many ways, it is often the result of a costly process requiring systematic and deliberate investment in R&D activities.

Lower levels of R&D investment in the EU are in general due to lower business sector R&D. For example, the 1 per cent R&D investment gap with the US is mainly due to lower business R&D spending. Improving the situation requires in particular greater specialisation in high-tech sectors and high value added activities. Nevertheless, there is also scope for increasing R&D investment in general.

On a positive note, aggregate business R&D investment in the EU seems to have recovered relatively well from the moderate decline in 2009-2010. This further reinforces the observation that investments in intangible assets have been a priority during the difficult economic environment. Yet the current growth rates are unlikely to close the gap with the US. With the exception of 2009-2010, the US has consistently recorded somewhat higher business R&D growth rates since 2002. There is also an increasing dispersion in business R&D expenditure across EU countries.

Public and higher education R&D expenditure has in general fared well in the EU in general. However, recent developments give rise to some concern. During 2009 and 2010, public and higher education expenditure on R&D provided a countercyclical buffer compensating for moderately declining business R&D. However, since 2011 tight fiscal constraints in most EU countries seem to have taken their toll on public and higher education R&D. If continued, this development risks undermining one of the key building blocks of knowledge-based economies – a high-quality research and education system.

Increasing both private and public R&D expenditure is pivotal in improving Europe's innovation performance, yet the efficiency of this spending needs to be assured. For instance, the EU is often said to be less efficient in extracting the economic benefits from higher education R&D than the US. Boosting R&D investment is also indispensable if the EU2020 target of investing 3 per cent of GDP in R&D is to be achieved.

What is holding back investment?

Weak incentives for risk-taking investment and the legacy of the pre-crisis investment boom

Lacklustre economic activity and limited prospects for improvement in the medium term have been among the main reasons for the recent weak investment recovery across Europe and the low levels of investment compared with the pre-crisis period. They imply low returns on investment and explain the reluctance of companies to accelerate investment plans despite the very low cost of capital in many countries. As discussed in in Chapter 4, European companies have on average been net lenders to the rest of the economy, as their savings and net transfers exceeded investment every year since 2008. While companies from the core euro area countries decreased savings after 2011, thereby reducing their net lending, those from the cohesion countries and most vulnerable euro area countries continued to increase savings.

Policy and economic uncertainty also contributed to weak investment demand. Doubts about the health of the European banking sector continued throughout 2013 and 2014. Instead of investing, companies hoarded own resources to ensure they would have sufficient liquidity in the event of a sudden problem with their financier or an economy-wide credit crunch. These doubts may have receded recently after the publication of the results of the stress tests and asset quality review of European banks. Policy uncertainty related to tax policy and the implementation of structural reforms was also a factor in holding back corporate investment.

With hindsight, the levels of investment attained in several countries before the financial and economic crisis in 2008 were clearly unsustainable. The real estate booms in Spain, Ireland, Bulgaria and other EU Member States led to a pronounced misallocation of resources to their construction sectors and a substantial overhang of both residential and commercial buildings. It is therefore unlikely that these countries will reach pre-crisis investment levels any time soon.

Optimism about the economy, which was also reflected in the European Commission's official forecasts for potential output, led to increased investment in most EU Member States in the years before 2008. As investment accelerated, the private sector increased borrowing both in absolute terms and relative to income and net worth. In 2008, the leverage of NFCs in the EU was 7 percentage points higher than in 2004. The deterioration of medium-term prospects after 2008 meant that all this debt was no longer deemed sustainable for many firms. Acknowledging the large debt overhang on their balance sheets, firms have continuously decreased leverage in the years following the Great Recession, reducing investment spending in the process.

The banking crisis and subsequent sovereign debt crisis left the European banking sector vulnerable and with a severely constrained risk-taking capacity. This may become a binding constraint for the corporate sector if investment demand is to pick up substantially in the near future as European NFCs rely heavily on banks for external finance. In fact, the current state of the banking system may have already been acting as a brake on riskier, external-finance intensive projects. The banking sector's reduced risk-taking capacity has also exposed the need in most European countries for better developed equity and subordinated debt financing.

SMEs in particular face a difficult investment environment

Unlike the "average" company in the EU, small and medium-sized enterprises (SMEs) are more concerned with access to finance, largely due to their reliance on banks, as argued in Chapter 5. In 2013 and 2014, many SMEs continued to experience financing difficulties, especially those from the VMS, which faced higher interest rates and stricter lending conditions.

Financial intermediaries and instruments other than bank financing that focus on financing SMEs also experienced difficulties to a different degree and therefore contributed to SMEs' difficulties in accessing finance. For instance, despite policy efforts private equity financing and the securitisation of SME loans are still reeling from the financial crisis and have not reached their pre-crisis volumes.

Credit guarantee schemes and the financing of micro-enterprises provide more positive signals. While credit guarantees declined somewhat in monetary terms in 2013, the number of guarantees increased, suggesting that more companies benefited from the use of this instrument. At the same time the total value and number of micro loans has been growing vigorously, albeit from a low base. This growth may wane, however, if it is not supported by stable funding.

Credit guarantee schemes and different risk-sharing instruments are important in encouraging additional lending to SMEs. For such instruments to function properly the key design and management features must be adequately taken into account. In particular, it is important for the loan risk to be shared between the lender, the borrower and the guarantors. An improperly designed guarantee scheme can increase moral hazard among borrowers by reducing the default risk they would otherwise incur.

The obstacles to investment and the financing difficulties for SMEs resulted in the ongoing prolonged period of low gross fixed investment. Weak investment in turn further weakens economic activity and creates a feedback loop for potential growth, as productive potential depends crucially on the amount of capital available for production. As a result policy initiatives to promote investment are currently being put in place in Europe. While they may contribute to improving the economic environment, they cannot succeed without accompanying structural reforms and policy actions to address legacy debt problems where they exist.

Is Europe likely to benefit from evolving economic structures and efficient reallocation of resources?

EU export performance supported by evolving economic structures, but further restructuring needed

Chapter 8 shows that the EU is undergoing significant changes in its industrial structure. Global manufacturing market shares are declining as they are in other advanced economies, while the EU has gained world market share in the export of services, in contrast to the US and Japan. Within the EU, Member States can be divided into two fairly distinct groups with regard to shifts between manufacturing and services. In what can be termed the "central European manufacturing core", manufacturing as a share of GDP has remained relatively stable (Germany, Austria, Slovak Republic and Poland) or has risen (Czech Republic and Hungary). In the rest of the EU, manufacturing has generally declined in importance in terms of both GDP share and trade performance, this trend being countered by increasing specialisation in services.

Within manufacturing industries, there has been a shift at the aggregate EU level from low-tech to high-tech industries in line with the shifting composition of world trade. Within the EU, this shift has been led by Germany and the central European "new Member States", with Italy and the southern "old Member States" remaining relatively specialised in medium and low-tech industries.

Evolving economic structures are linked to a pivotal transformation in the global production process, which is discussed in detail in Chapter 7. The emergence of global value chains (GVCs) has brought about an increasing fragmentation of production in which different stages of the production process – such as R&D, design, production, marketing, logistics and distribution – are divided between different firms located in different countries. Instead of handling all the production stages in-house and competing for market share in high value added industries, companies increasingly compete for high value added activities in GVCs. Competition takes place within complex production networks where intermediate goods and services are produced, exported, bundled and re-exported across countries. These changes also challenge the prevailing policy thinking on competitiveness.

Chapter 7 shows that European countries appear to be highly integrated into GVCs and this increased interconnectedness has strengthened over time. The relevance of GVCs is as important in the EU as in

China, and more important than in the US and Japan. A special feature of the EU is that the role of GVCs rose in parallel with enhanced integration with the eastern European countries. This increase in regional interlinkages translated into deeper integration within a European value chain and enabled European firms to specialise vertically in those activities in which they have a comparative advantage. A key manifestation of this development is the "central European manufacturing core" discussed in Chapter 8.

Changes in the labour market reflect the emergence of GVCs. There has been a loss of manufacturing jobs in most EU Member States, but so far it has been largely offset by job creation in service activities. This reflects the increased service sector inputs in global value chains. The share of business services in GDP and in value added exports has increased, partly because high-tech industries have a stronger carrier function for services.

Developments highlighted in Chapters 7 and 8 show that in general economic structures in the EU are evolving in the right direction. Nevertheless, more needs to be done to improve competitiveness. A persisting focus on medium and low-tech industries in southern Europe, as well as on low-tech activities within high-tech industries, is a cause for concern as labour costs are more important for medium and low-tech activities, which means that it will be harder for those industries to remain competitive while maintaining EU living standards. In addition, it is important for the EU as a whole to build a system that further enhances the ongoing restructuring towards high value added activities.

The "smile curve" presented in Chapter 7 highlights the fact that the opportunities that exist in a value chain to produce higher value added components are located upstream and downstream of manufacturing and assembly. Policymakers should – when formulating their policies – bear in mind where their respective country mostly lies within the "smile curve". For instance, while nations such as China, which is located at the bottom of the curve, have principally focused on investment policies in order to attract offshored industries, OECD countries should focus on innovation and educational policies.

In addition, policies should strengthen production factors that are "sticky" and less likely to cross borders. This includes investment in high-quality infrastructure (such as sophisticated IT services, as well as efficient railways, highways and airports) and human capital, which are both sources of vital importance in supporting the "upgrading" of GVCs. The upgrading process should be a top priority for industries and therefore governments.

Scope to improve the reallocation of resources to higher-productivity firms

European economies need to become more dynamic in order to adapt to a rapidly changing environment. Improving the reallocation of resources to higher-productivity firms can go a long way in that direction. Chapter 9 discusses the importance of reallocation between firms for aggregate productivity performance and highlights the fact that the misallocation of resources such as labour and capital across firms could be important in explaining differences in aggregate productivity.

Most studies show a significant contribution of reallocation to aggregate productivity growth. However, results differ across the studies. In particular, the few studies focusing on the EU countries tend to find a relatively low contribution of reallocation to aggregate productivity growth. Similarly, figures for allocative efficiency suggest that there may be weaknesses in the reallocation process in the EU.

The reallocation of resources across firms is ultimately determined by market conditions and (opportunity) costs related to the entry and exit of businesses. It is clear that inherent industry-specific characteristics affect both. However, market conditions and the ease of entry or exit are also shaped by a myriad of factors that together build up the overall institutional conditions and can exert a significant influence on the reallocation process.

Potential channels for misallocation include: regulatory factors that can create rigidities in the labour or product market or distort firms' entry or exit decisions; distorting taxes; favourable treatment of inefficient firms, for example through tax incentives or subsidies; trade barriers; size-dependent policies that end up distorting the size distribution of firms; and financial frictions. In the European context,

a critical challenge arises from rigidities related to the regulatory framework. Furthermore, the slow healing of the European financial system following the disruption caused by the financial crisis has increased concerns about the ability of financial markets to support an efficient allocation of resources.

Credit market imperfections are the most studied channel underlying misallocation. Financing frictions, if not mitigated sufficiently by asset markets and markets for risk sharing, are a drag on productivity because they decrease the efficiency of capital allocation across existing heterogeneous firms and the entry and exit decisions of firms. Studies reviewed in Chapter 9 suggest that financial frictions may distort the latter in particular (entry and exit decisions). Misallocations generated by financial frictions are an important drag on aggregate productivity in developing countries, but studies find conspicuous aggregate effects even in countries with very advanced financial systems.

Combining horizontal and vertical policies: A new approach

In order to improve the productivity performance of EU companies and consequently Europe's overall competitiveness, Philippe Aghion proposes a European growth pact in Chapter 6. The growth pact builds on horizontal policies complemented by a properly designed and governed vertical industrial policy.

The core of the growth pact consists of horizontal policies, that is, policies that apply across different activities in the economy. The essence of the horizontal policies is structural reforms. In particular, Chapter 6 stresses the need for structural reforms that enhance competition, the reallocation of resources to more competitive firms and access to frontier research and skills. All these are found to be important productivity levers in advanced countries. Such reforms should address issues such as product and labour market liberalisation, the completion of the EU's internal market, trade liberalisation, reforming higher education and research systems, restructuring of the state, ease of firm entries and exits and removing obstacles to firm growth. Aghion argues that EU structural funds should be partly reoriented towards facilitating the implementation of structural reforms.

In the context of horizontal policies, the chapter emphasises yet another productivity lever – the organisation of financial markets. Of crucial importance for advanced economies in particular is the capability of financial markets to finance frontier innovations entailing a higher level of risk than imitation activities.

The horizontal policies should be complemented by a properly designed and governed vertical industrial policy. Key components of such a more innovation-enhancing and competition-friendly industrial policy include: targeting activities and sectors with growth potential; providing horizontal support within those sectors instead of picking the winners; and providing support in a way that preserves and enhances product market competition.

Member States' commitment and efforts to implement structural reforms should be rewarded by increased macroeconomic flexibility. This would increase the scope for more countercyclical macroeconomic policies. However, the increased macroeconomic flexibility should not serve as a pretext for the countries in question not to reform.

Atanas Kolev and Tanja Tanayama

Part I

Gross fixed investment and intangible capital

Chapter 1

Investment in tangible capital

Atanas Kolev and Philipp-Bastian Brutscher[1]

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Investment in tangible capital

Chapter at a glance

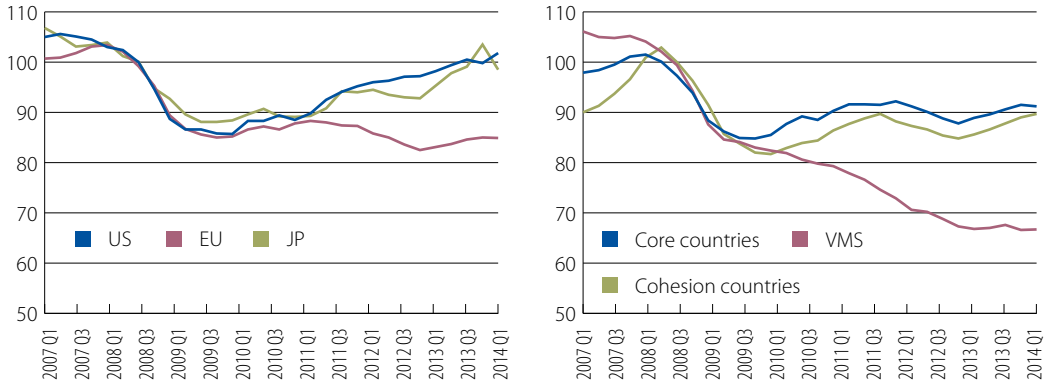
Gross fixed capital formation (GFCF) in the EU fell substantially during the recession in 2008 and has remained at depressed levels since then in most EU countries. Such a long period of low investment further weakens current economic activity and potential growth, and has spurred policy initiatives to promote investment. In order to assess investment trends and the factors influencing them, this chapter discusses recent developments in GFCF in the EU. The main findings of the chapter are that investment activity is still at a very low level but that the decline in fixed investment has bottomed out in most European countries, with Italy being a notable exception. This development has been driven mostly by investment in machinery and equipment. Investment in new construction, both residential and non-residential, has been a drag on the investment recovery in most countries. Similarly, infrastructure investment has continued the downward trend that started in 2008 and ran into 2013, largely driven by declines in the transport sector. Government investment has been close to historical levels given the level of economic activity, except in the most vulnerable European countries. The main reasons for the very weak investment recovery across Europe have been lacklustre economic activity and accelerated balance sheet adjustment in the private sector, accompanied by the still ongoing fiscal consolidation in several countries. Uncertainty has further contributed to depressing GFCF.

1.1. Recent developments in European fixed investment

1.1.1. Real GFCF has picked up again in most EU economies

Gross fixed capital formation declined substantially during the Great Recession in 2008-2009 in most European countries. Some of them saw declines in investment in excess of 20 per cent in the course of six quarters between the beginning of 2008 and mid-2009. After a brief period of stabilisation and tepid growth in the wake of the Great Recession, GFCF in the EU started to fall again in 2011 Q2, as the European economy plunged into a second recession (see Figure 1, left-hand panel). The decline continued until 2013 Q1, by which time gross fixed investment had fallen by about 6½ per cent relative to 2011 Q2 and 17½ per cent relative to the average level in 2008.[2] Since the beginning of 2013 gross fixed investment has grown by about 2½ per cent.

Figure 1 Evolution of GFCF in the EU, US and Japan, index average 2008 = 100



Source: Eurostat, OECD.

Notes: Index based on quarterly seasonally adjusted GFCF in 2005 chained volumes in national currency for single countries and euros for country groups. Average quarterly level in 2008 = 100. "Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.

US and Japanese experiences during this period have been very different from those of the EU. While investment dynamics in the US and EU were similar in 2008 and 2009, since the beginning of 2010 US GFCF has risen almost without a pause and had surpassed its 2008 level by the end of 2013. Japanese GFCF fluctuated more over the period but had also regained its average 2008 level by end-2013.

Within the EU, performance has not been uniform either (Figure 1, right-hand panel). GFCF in core EU countries fell less than the EU average during the second recession (-4.7 per cent) and has grown more since the beginning of 2013 (3.9 per cent). Of the core EU countries, four have reached or exceeded the average level of GFCF in 2008 (Austria, Germany, Luxembourg and Sweden). In Finland and France, however, GFCF has been in continuous decline since 2011.

In the cohesion countries fixed investment has followed a path broadly similar to that of the core European countries since the end of the recession in 2009.[3] In 2010 and 2011, investment in these

2 In this chapter GFCF, fixed investment and gross fixed investment are used interchangeably.

3 The cohesion countries group here consists of all members that joined the EU in or after 2004, except Slovenia and Cyprus, which form part of the group of vulnerable Member States (VMS) in this chapter. The name of the group derives from the fact that all these countries are eligible for financing from the EU's Cohesion Fund for the period 2014-2020.

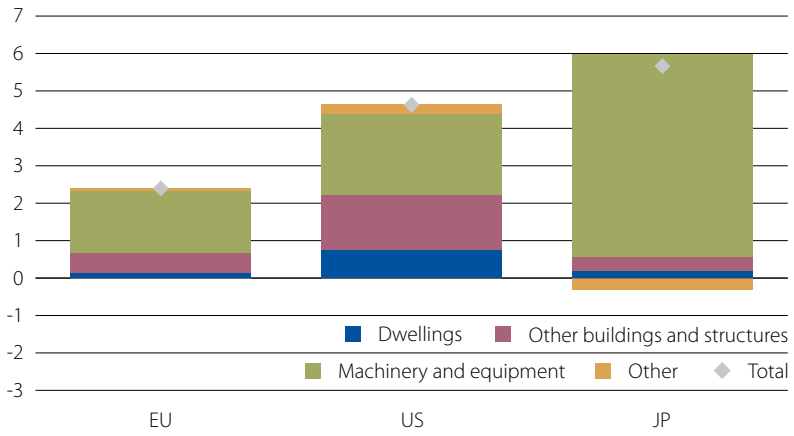
countries increased, thereby offsetting one third of the 19 per cent decline during the recession in 2009. The subsequent recession in the euro area that started at the end of 2011 pushed it back down. Since the beginning of 2013 GFCF in cohesion countries has increased by more than 5 per cent. The four largest economies in this group, which account for 73 per cent of combined GDP, have had very different experiences since 2011 though. While GFCF in Poland and Hungary has been increasing, it has been stagnating in the Czech Republic and falling in Romania.

The financial crisis in 2007-2008 and the subsequent recessions that began in 2008 and 2011 had a particularly large impact on a group of seven countries: Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain (the "VMS").[4] Fixed investment in these countries plummeted in 2009 and continued to fall unabatedly until early 2013, when it stabilised at about two-thirds of the 2008 average level.[5] Fixed investment has clearly picked up only in Ireland and has stagnated in the rest of the countries in this group.

Although Italy is in the VMS, its gross fixed investment has had different dynamics from that of the other countries in this group. Until 2011 Italian GFCF followed a path broadly similar to that of the core European economies. However, in 2011 gross investment declined sharply and has still not bottomed out.

Since 2013 investment has started to pick up in many European countries. However, this has taken place against a backdrop of very weak economic growth, high and persistent unemployment and deteriorating external demand. Not surprisingly, growth of GFCF in the EU has been much weaker than in other developed countries. Figure 2 shows the rate of change of GFCF between 2013 Q1 and 2014 Q2 and the contribution by fixed asset types to this change for the EU, US and Japan. The rate of increase of gross fixed investment in the EU was about half that in the US and less than half that in Japan. Across asset types US gross fixed investment is much more balanced than in the EU and Japan.[6] About half of the increase in GFCF in the US was due to investment in new construction and almost as much was due to investment in machinery and equipment. In the EU, the contribution of machinery and equipment was more than two-thirds, whereas in Japan it was above 90 per cent.

Figure 2 Real GFCF in the EU, USA and Japan, contribution of asset types, change 2013 Q1–2014 Q2



Source: Eurostat, OECD.
Notes: Quarterly seasonally adjusted GFCF by asset type in 2005 chained volumes in national currency. Percentage change in 2014 Q2 relative to 2013 Q1 level and contributions of different asset types to growth of total GFCF. "Other" denotes investment in intangible assets and cultivated assets.

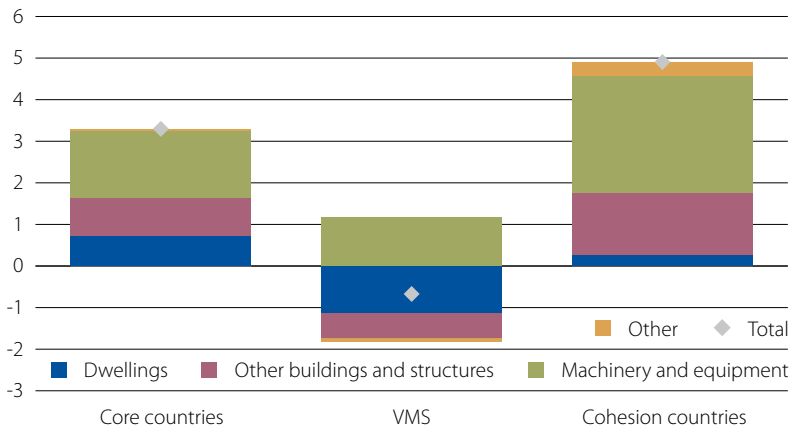
4 "VMS" stands for vulnerable Member States.

5 In Cyprus, Greece and Ireland GFCF fell to between 40 and 50 per cent of the 2008 level, whereas in Slovenia, Spain and Portugal it stabilised at around 60 per cent. Italian GFCF had fallen to 75 per cent of its average 2008 level by 2014 Q2 but still did not seem to have reached a trough.

6 Over the past 20 years machinery and equipment's share of total fixed investment has been about one third, while the share of investment in new construction, both dwellings and other buildings and structures, has been about two-thirds of the total.

The lack of balance in investment growth across asset types is largely explained by developments in the most vulnerable Member States of the EU, and to a lesser extent, by developments in cohesion countries. Figure 3 presents the contribution of fixed asset types in different country groups within the EU. The size of the contributions of the different fixed assets in the core European countries is very similar to that in the US. In cohesion countries the distribution is slightly more tilted to machinery and equipment, while in the VMS group investment in new construction has made a substantial negative contribution that could not be fully offset by the positive contribution of investment in machinery and equipment.

Figure 3 **Real GFCF in the EU, contribution of asset types, rate of change 2013 Q1 – 2014 Q2, in per cent**



Source: *Eurostat.*

Notes: *Quarterly seasonally adjusted GFCF by asset type in 2005 chained volumes in euros. Percentage change in 2014 Q2 relative to 2013 Q1 level and contributions of different asset types to growth of total GFCF. "Other" denotes investment in intangible assets and cultivated assets. "Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.*

Among all the VMS, investment developments have been weakest in Italy, with GFCF falling by 1½ per cent between 2013 Q1 and 2014 Q2. Gross investment in new construction accounts for about 70 per cent of this decline. The average share of investment in this asset type over the past 20 years has been about 42 per cent in Italy.

Ireland shows the opposite development. Gross investment in dwellings stabilised in 2012, albeit at a low level, and gross investment in other buildings and structures picked up appreciably, offsetting about one half of the decline that started in 2008.

1.1.2. Level of GFCF low relative to level of economic activity

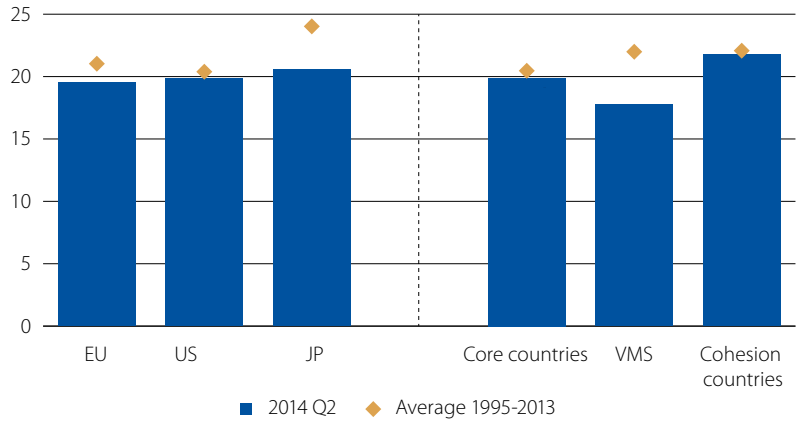
Since 2009 economic activity in the EU has been quite weak. EU GDP fell 5.8 per cent between 2008 Q1 and 2009 Q2 but has grown only 4.8 per cent in the five years since then. This makes for average annual GDP growth of just under 1 per cent since the end of the Great Recession in 2009. This rate of growth is in stark contrast with the average annual EU growth rate of 2.4 per cent over the 15 years preceding the economic and financial crisis. Had the EU economy continued to grow in the post-crisis period at the pre-crisis average growth rate, today's EU GDP would have been about 7½ per cent higher than it currently is.[7]

7 This calculation assumes that growth resumed in 2009.

Against this background, it is reasonable to expect investment to also grow more slowly. In particular, given that in the long run investment grows at about the same rate as GDP, investment could be expected to have grown at a rate of about 1 per cent per year since 2009. In reality, gross fixed investment declined over the period at an average rate of 2 per cent per year. Due to these divergent developments, the ratio of GFCF to GDP, the so-called investment rate (IR), has fallen and is currently well below its long-term average.

Growth of real GFCF in the US and Japan has lagged growth in real GDP too. The left-hand panel of Figure 4 illustrates this observation. In 2014 Q2 the investment rate in the EU was 1.5 of a percentage point below the average rate over the past 20 years. In the US the difference is 0.5 of a percentage point, while in Japan it is 3.5 percentage points. Within the EU, this gap is broadly accounted for by the gap in the VMS, which amounts to 4.2 percentage points. The gap in the core European countries is about 0.5 of a percentage point, while in the cohesion countries it is just below 0.3 of a percentage point.

Figure 4 Investment rate in 2014 Q2 and average IR since 1995, as a percentage of GDP

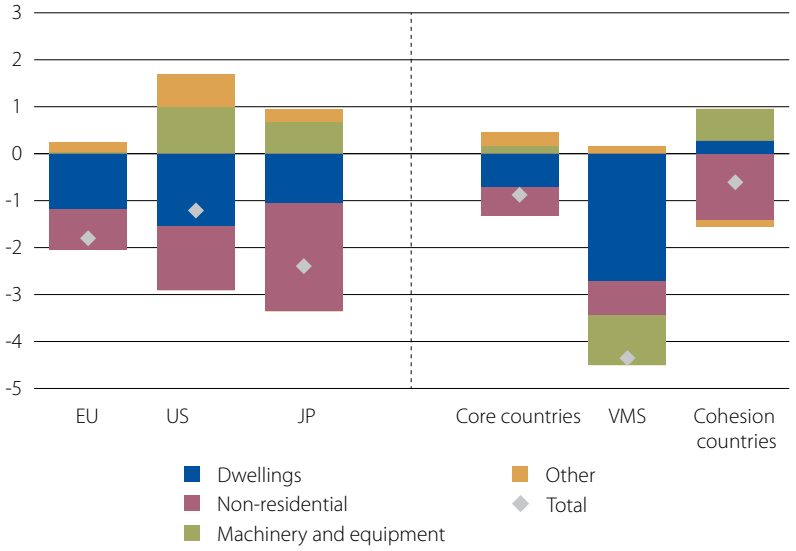


Source: Eurostat, OECD, AMECO.

Notes: The investment rate for 2014 Q2 is the ratio of quarterly seasonally adjusted GFCF and GDP in 2010 chained volumes in euros and in national currency for the US and Japan, multiplied by 100. The average IR is the average of the ratio of annual GFCF and GDP in 2010 prices in euros over the period 1995–2013, multiplied by 100. "Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.

If we look at the breakdown by asset type, the gap in relation to the long-term average is largely due to low investment rates in dwellings and non-residential construction across developed economies. Figure 5 plots the gap between the investment rate in 2014 Q2 and its long-term average and the contributions to this gap of different types of fixed assets in the EU, US and Japan. In the EU, the gap is fully accounted for by underinvestment (relative to the long-term average) in new construction – both in dwellings and in other buildings and structures. The rate of gross investment in machinery and equipment is equal to its long-term average, while investment in intangible and cultivated assets (denoted by "Other" on the chart) is above its average level over the past 20 years. In the US and Japan investment rates in machinery and equipment are significantly higher than their long-term averages, as are investment rates in intangible and cultivated assets. In the case of the US these are so large that they result in a smaller investment gap than the EU, despite the bigger drag from construction.

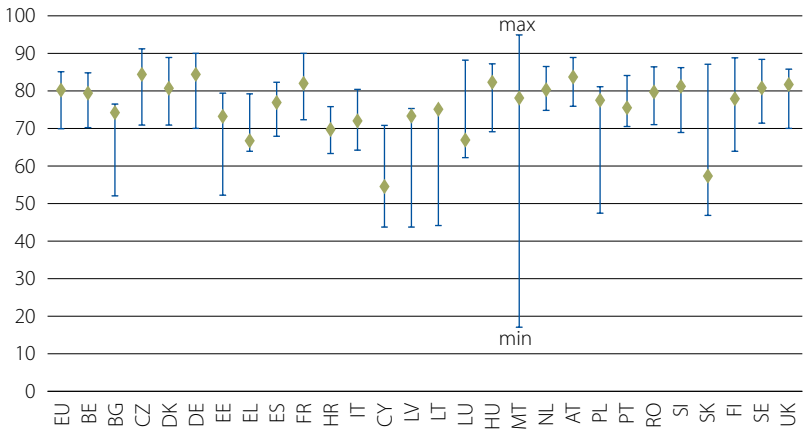
Figure 5 **Difference in relation to long-term investment rates and contribution of investment by asset type, in percentage points**



Source: *Eurostat, OECD, AMECO.*
Notes: *The investment rate for 2014 Q2 is the ratio of quarterly seasonally adjusted GFCF and GDP in 2005 chained volumes in euros and in national currency for the US and Japan, multiplied by 100. The average IR is the average ratio of annual GFCF and GDP in 2005 prices in national currency over the period 1995–2013, multiplied by 100. "Other" denotes investment in intangible assets and cultivated assets. "Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.*

The share of investment in machinery and equipment in GDP is higher than its 20-year average in most countries of the EU, despite weak overall fixed investment figures. Even in countries such as Greece, Ireland and Spain, it is near or above the average. Survey data further corroborate this finding. The European Commission's industry survey reveals that, in most countries, no significant capacity constraints exist in European industry (see Figure 6), despite investment lagging GDP growth significantly over the past seven years.

Figure 6 **Rate of capacity utilisation in European industry in 2014 Q4, in per cent**



Source: *Eurostat.*
Notes: *Current level of capacity utilisation in per cent, seasonally adjusted. The chart plots historical maxima and minima along with the value of 2014 Q4.*

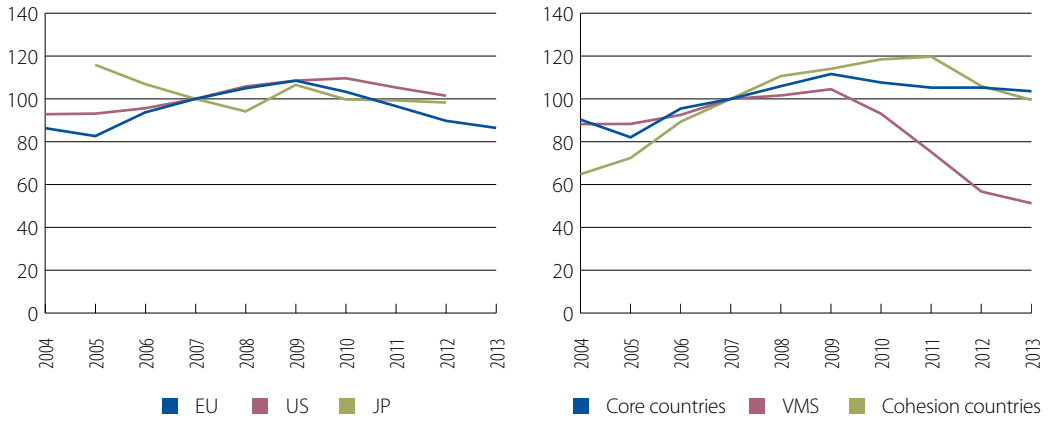
Using data from this survey, Figure 6 plots capacity utilisation rates (in per cent) in European industry in 2014 Q4 (red diamonds), together with the historical minima and maxima for these rates. Even in countries where rates are above 80 per cent, they are well below their historical maxima. In only three countries is the capacity utilisation rate close to or virtually equal to the historical maximum (Bulgaria, Latvia and Lithuania). Among factors limiting production in the same survey, industrial managers put equipment only as the third most important factor, with net positive answers of 9 per cent of total answers, well below "no constraining factors" (45.5 per cent) and "insufficient demand" (37.5 per cent).

1.1.3. Government investment

Government investment has, on average, accounted for about 15 per cent of total gross fixed investment in the EU over the past 20 years. Although it is implicitly included in the discussion above, this section takes a closer look at it, since it is the part of GFCF that policymakers can directly control. In the light of fiscal consolidation since 2011, real government investment in the EU has fallen below the levels it attained before the crisis and during 2009 and 2010, when the European Economic Recovery Plan was implemented. It is currently at levels last seen in 2004-2005 (Figure 7, left-hand panel). In comparison, the US continued its fiscal stimulus programme for one more year than the EU and then started to phase it out only gradually. The level of GFCF in Japan was, in 2012, at its pre-crisis value. Thus, in comparison to other developed economies, real government investment in the EU declined more and, in 2013, was about 10 per cent below its 2007 level.

Within the EU, it becomes evident that the decline relative to the level in 2007 is entirely explained by the large decline in government investment in the vulnerable Member States (VMS in the right-hand panel of Figure 7). Real government investment in this group is only half its level in 2007. In the core countries of the EU, real government investment is about 3½ per cent above the 2007 level. Government investment in the cohesion countries is at its pre-crisis level (Figure 7, right-hand panel) and significantly down from the levels attained in 2011.

Figure 7 Real government investment index, 2007 = 100

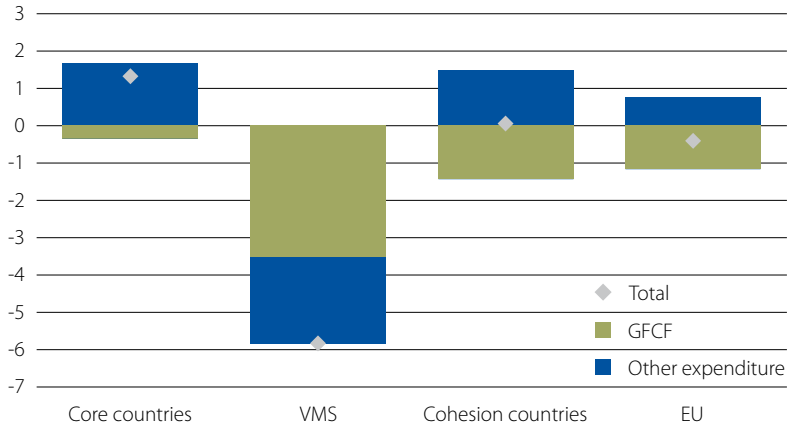


Source: Eurostat, OECD.
Notes: The index is constructed from time series of total general government investment in current prices in euros (EU Member States) or national currencies and the investment deflator for each country or group of countries. "Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.

Overall, government investment accounted for the lion's share of the cut in government spending over the past three years in the EU, even though its share of total expenditure is only about 5 per cent, on average, in the EU (Figure 8). Between 2009 and 2013, the decline in real government investment in the VMS accounted for about two-thirds of the reduction in total expenditure. Total real government expenditures declined somewhat in the cohesion countries and the decline was entirely due to real

government investment. In the core countries, however, real total government expenditure increased by 1½ per cent despite the negative contribution of government investment. Disproportionate reductions in investment during periods of fiscal consolidation are not unusual, as it is much easier, politically, to postpone investment plans than to cut entitlements, for example. This is nevertheless at odds with previous European experience. Stančik and Välilä (2012) show that, for the period 1990-2010, during both structural and cyclical fiscal consolidations the share of investment in government spending increased in EU countries.

Figure 8 Contribution of government investment to the change in total government expenditure, 2009-2013



Source: *AMECO.*

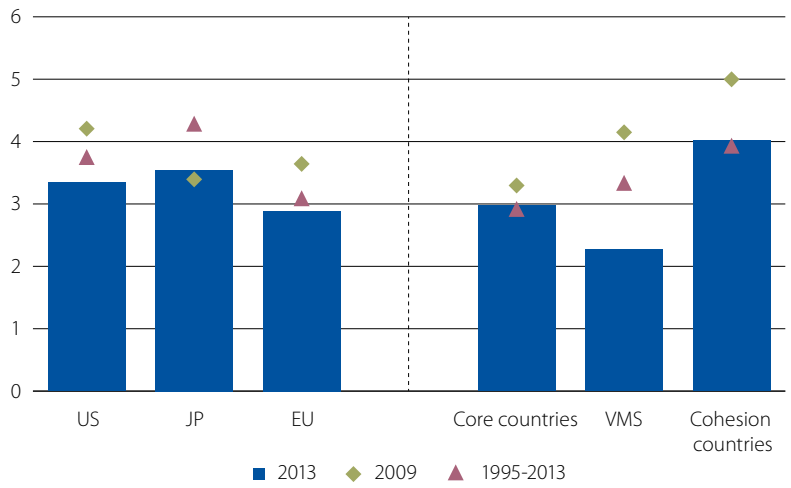
Notes: *The computations are based on time series of total expenditure and GFCF by general government in current prices in euros and the GDP deflator. Results are similar if the investment deflator is used for the GFCF series. "Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.*

Despite the cuts of the last three years, government investment as a share of GDP in the EU in 2013 was only slightly (0.2 of a percentage point) below its 20-year average (Figure 9). As such, it was somewhat closer to the long-term average than that of the US (where the difference compared to the long-term average was 0.3 of a percentage point) and Japan (where the difference was 1 percentage point). Furthermore, the difference compared to the long-term average is entirely due to the VMS group, where government investment is about 1 percentage point of GDP below the long-term average. Government investment rates in both the core and cohesion countries are broadly equal to their respective long-term averages.

That said, government investment in 2013 was considerably lower than in 2009, when it attained its highest level, as a share of GDP, over the past 20 years. The large fiscal stimulus programmes in Europe and the US in 2009 and the relatively low level of GDP in that year mean that the government investment rate for 2009 was significantly above current values for the cohesion countries, the VMS, and the US. Core EU countries are only 0.2 of a percentage point from the 20-year maximum. In Japan government investment in 2013 increased to the level of 2009, when a large fiscal stimulus programme was implemented to counteract the recession.[8]

8 The long-term average is distorted by the very high levels of the 1990s, when the government investment rate was about twice as high as over the past five years.

Figure 9 **Government investment, as a percentage of GDP**



Source: *AMECO.*
Notes: *The computations are based on annual time series of GFCF by general government in current prices in euros, the investment deflator and GDP in 2010 market prices. Long-term averages are computed for the period 1995-2013. "Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.*

1.1.4. Infrastructure investment

Infrastructure is an important sub-class of fixed assets due to the network and spillover effects associated with long-term economic growth. In national accounts infrastructure investment is part of gross investment in other buildings and structures, but neither Eurostat nor national statistical offices report infrastructure statistics separately. This section provides estimates of infrastructure investment, based on the methodology developed by Wagenvoort, de Nicola and Kappeler (2010). As there are no official statistics on infrastructure investment, the closest one can get to it is by estimating gross fixed investment in infrastructure-intensive sectors from national accounts, i.e. transport, utilities, education and health. Then, with the help of other data sources, the share of four different institutional sectors in infrastructure investment can be computed, namely investment by government, the corporate sector, public-private partnerships and other project companies.

Historically, government accounts on average for about one-third of total infrastructure finance. Finance by the corporate sector accounts for about half, and the remaining one-tenth or so is distributed between PPPs and other project financing.

Over the past ten years real infrastructure investment in the EU has broadly followed developments in other fixed investment, although fluctuations have been somewhat more attenuated.[9,10] The initial decline during the recession in 2008-2009 was entirely driven by the decline in private infrastructure investment. In contrast, public infrastructure investment increased slightly immediately after the financial crisis, mostly as a consequence of the European Economic Recovery Plan (Figure 10, right-hand panel). This changed with the onset of the sovereign debt crisis in 2011 and 2012. Fiscal consolidation led to an overall decline in government spending on infrastructure – thereby reinforcing the general downward trend in infrastructure investment. Thus, overall real infrastructure investment in 2012 turned out to be well below its 2008 level both for the government (-4 per cent) and the corporate sector (-7 per cent). Total infrastructure investment also continued to decline in 2013, falling by 3 per cent relative to 2012 and 11 per cent relative to 2008.

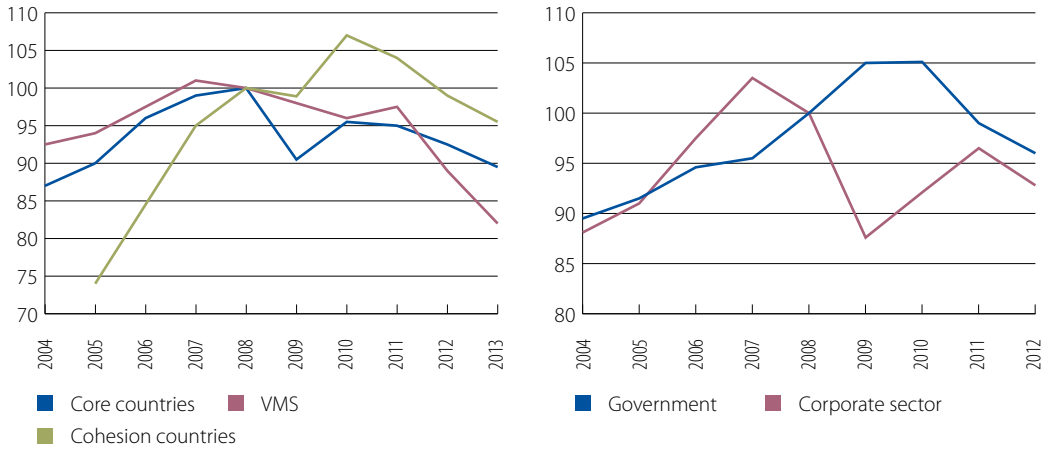
9 The GDP deflator is used to derive real investment values.

10 Two main reasons are, first, that government infrastructure investment is often counter-cyclical, thereby dampening the pro-cyclical fluctuations of the total. Second, investment by utilities is regulated and this results in a more stable investment pattern over the business cycle.

The decline in infrastructure investment has varied widely across the EU. Unlike other fixed investment, however, infrastructure investment in 2013 fell in all three groups of countries. The left-hand panel of Figure 10 shows the evolution of real infrastructure investment by country group. Real infrastructure investment peaked in different years in different groups. In the most vulnerable Member States group, real infrastructure investment peaked in 2007 and since then has been on a declining trajectory, apart from a short pause in 2011. In fact, after 2011 the decline accelerated as real infrastructure investment fell by 16 per cent.

Real infrastructure investment in the core countries peaked in 2008. By 2013, it was more than 10 per cent below that peak. The cohesion countries continued to increase infrastructure investment until 2010, apart from a small decline during 2009. In the three years following 2010, real infrastructure investment in the cohesion countries declined by 11 per cent.

Figure 10 Real infrastructure investment by country group, index 2008 = 100



Source: Eurostat, EIB staff calculations.
Notes: "Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.

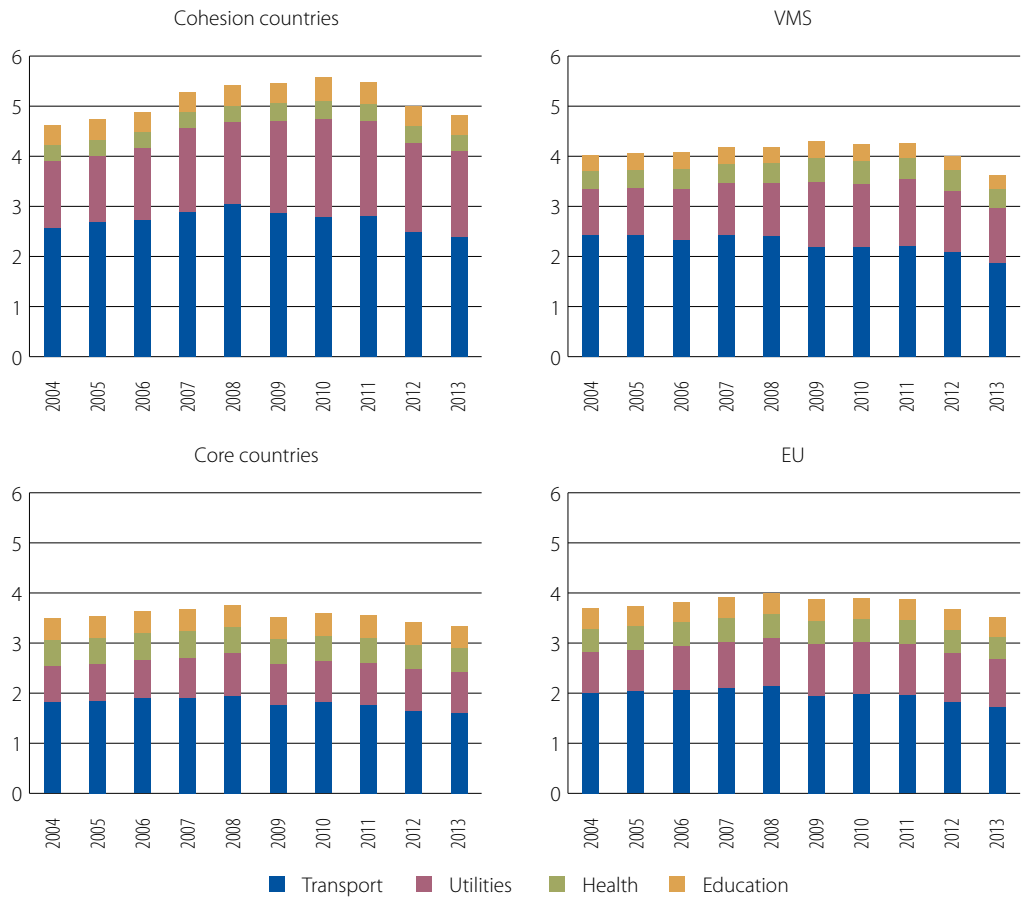
Most of these changes across countries are clearly due to the specificities of the crisis, and its intensity, in the respective countries. A recent study by the IIF and Swiss Re suggests, however, that – at least when it comes to the speed of recovery – the type of financial system in place may also have played a role in the development of infrastructure investment. The more capital market-based systems in the core countries typically worked better in channelling funding into infrastructure in times of crisis than the bank-based systems in the vulnerable countries.

Infrastructure investment fell not only in absolute terms but also relative to GDP across the EU. Figure 11 plots infrastructure investment as a share of GDP and its distribution by sector. Relative to GDP, the largest declines in infrastructure investment were in the cohesion countries and most vulnerable countries groups, reaching 0.7 of a percentage point between the peak year and 2013. In the core countries the decline was 0.25 of a percentage point. The decline in infrastructure investment both in real terms and as a share of GDP did not slow down in 2013, despite positive developments in total investment.

Within industrial sectors, the transport sector registered the largest decline in real terms: -17 per cent relative to its level in 2008. In fact, the decline in the infrastructure investment rate in the transport sector accounts for 87 per cent of the total decline in infrastructure investment between 2008 and 2013, whereas the share of infrastructure investment in transport is only a half of the total in the EU (Figure 11). The remaining sectors showed more resilience. Yet, while their shares in GDP remained broadly stable or declined very little, only education has increased in absolute terms since 2008 (1 per cent in real terms).

As for sectoral dynamics, Figure 11 suggests similarities as well as differences across regions. The three groups of countries are similar to one another in that they all experienced a sharp decline in infrastructure investment in the transport sector. The main difference occurred in the utilities sector. While the cohesion and VMS group countries have propped up their activities in this sector in recent years as a share of GDP, no such increase took place in the other country groups. Given that transport infrastructure, unlike infrastructure in highly regulated utilities, is financed mostly by government budgets, the relatively large decline in the transport sector looks plausible against the background of significant fiscal consolidation efforts across Europe.[11]

Figure 11 Infrastructure investment by sector, as a percentage of GDP



Source: Eurostat and EIB staff calculations.
Notes: "Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.

11 Part of the large decline in infrastructure investment in the transport sector may be explained by the way in which infrastructure investment is estimated here. As Wagenvoort, de Nicola and Kappeler (2010) warn in their paper, this method most likely overestimates infrastructure investment, because it includes not only investment in buildings and structures in the infrastructure-intensive sectors, but also all other types of fixed investment that may be very volatile over the business cycle, especially in the transport sector.

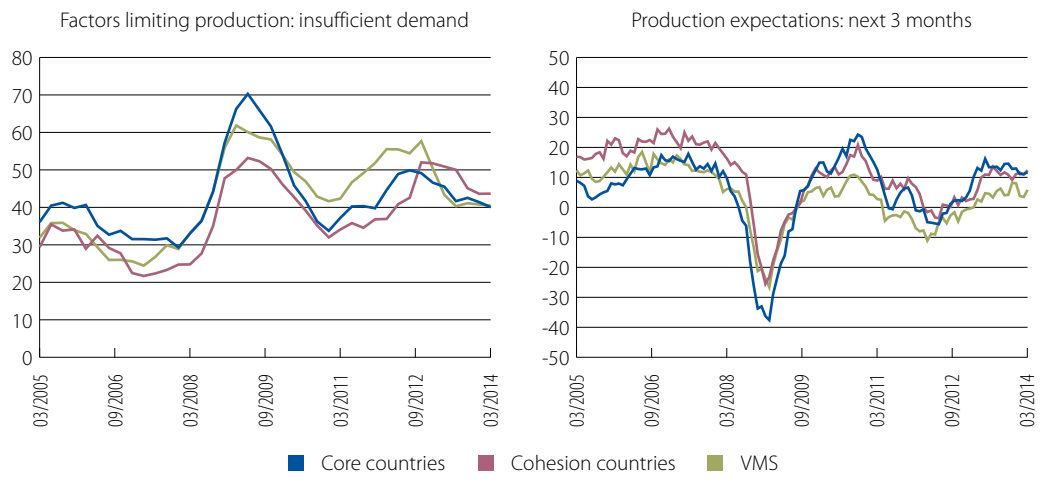
1.2. Drivers of recent developments in investment

It is difficult to single out the most important driver of investment dynamics in the period since the Great Recession of 2009. Weak economic activity in general has been a very important factor, but so apparently has been high leverage, combined with a persistently worsening economic outlook. The simultaneous deleveraging of the private sector and fiscal consolidation have created feedback loops in some countries that have exerted an additional drag on investment. Economic and policy uncertainty is also partly responsible for the decline in investment. This section briefly discusses the impact of these factors.

1.2.1. Demand

Weak economic activity over the past seven years has been a major reason for depressed investment. The EC industrial surveys have consistently reported insufficient demand as one of the most important factors limiting production. The left-hand panel of Figure 12 plots the share of firms that cite insufficient demand as a factor limiting production for the three groups of EU countries. The high share of such firms since 2012 has very likely had an impact on investment decisions. The recent rapid decline, however, may be a sign of a more robust pick-up in investment in 2015. Similar developments are evident from production expectations over the next three months in European industry (Figure 12, right-hand panel). Whereas net balances of firms expecting increased production over the next three months were zero or negative at the end of 2012 and in the first half of 2013, these have been increasing to more normal levels, even in the most vulnerable Member States.

Figure 12 Expectations of European industry, net balances; EC business surveys



Source: Eurostat.

Notes: Data are net balances of positive and negative responses in percentage points of total answers. Numbers in the left-hand panel show the percentage of firms that cite insufficient demand as a factor limiting their production. Numbers in the right-hand panel show the net balance (in percentage points of total answers) of views on the evolution of own production over the next three months. Positive numbers mean that more firms expect their output to increase. "Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and lovakia. Group indices are constructed as weighted averages of underlying country indices, with GDP-based weights.

More formal statistical analysis confirms that weak economic activity can explain the mostly low investment levels. For instance, the IMF (2014), using several investment models, estimates that output dynamics can account for much of the observed weakness in non-residential fixed investment in the euro area.

1.2.2. Credit and leverage

1.2.2.1. Importance of credit in recoveries

Bank credit is a much more important source of external finance for non-financial corporations (NFCs) in Europe than in the US and Japan. Hence its availability is considered crucial for an investment recovery in Europe to occur. As documented in Chapter 4 of this publication, bank credit in most European countries has been very weak, as many banks have had weak balance sheets and suffered substantial liquidity shocks.

Recent research suggests that GDP growth during creditless recoveries tends to be about one-third lower than during other recoveries (Abiad, Dell'Ariccia and Li, 2011), while industries dependent on external financing tend to experience slower recoveries than other sectors (Kannan, 2010). Allard and Blavy (2011) show that economies with market-based financial systems tend to recover faster than more bank-based ones, with a growth gap of 0.8 to 1.4 percentage points. Both Kannan (2010) and Abiad et al. (2011) argue that in market-based countries there is more scope for the issuance of debt securities to substitute for reduced availability of bank lending.

A recent EIB study (see Brutscher, 2014) looks at the recovery process of investment after both banking and sovereign debt crises, rather than the recovery of output. The study also explores to what extent differences in financial structure affect the recovery process of investment in the two cases (see Box 1). It finds that investment tends to recover more quickly from a banking crisis in market-based than in bank-based economies, even after controlling for a large set of additional factors. Statistical tests confirm that – at least for the first few years after the beginning of a banking crisis – the evolution in investment is statistically different for the two groups of countries, with market-based countries outperforming bank-based countries.

When it comes to sovereign debt crises, the study finds that there is a much more marked drop in investment in bank-based systems than in market-based systems. However, the time needed for investment to recover is much the same. Once the bank-based countries have bounced back from the initial drop, the recovery path is statistically identical to that of market-based countries.

Brutscher (2014) finds some evidence to suggest that the channels through which the financial structure affects post-crisis investment, after a banking crisis, have been changes in banks' risk-taking capacity and liquidity shortages, which is consistent with the idea that firms in bank-based countries tend to lack funding alternatives after banking crises (see Box 1 for details). When it comes to a sovereign debt crisis, no evidence is found to suggest that changes in banks' risk-taking capacity and liquidity shortages have a stronger effect in bank-based than market-based systems. Rather, it seems that it is the extent of the shock after a sovereign debt crisis – which tends to be larger in bank-based systems –that drives the differences in recovery patterns.

Given the strong dependence on banks in most EU economies – particularly in the most crisis-hit countries – and the still impaired risk-taking capacity of many banks across the EU, the findings lend evidence to the hypothesis that problems in the credit channel may hold back investment in some EU Member States.

Box 1 The role of the type of financial system for recovery after financial crises.

Brutscher (2014) combined data on banking crises and sovereign debt crises by Reinhart and Rogoff (2008 and 2010) with national accounts information from the World Penn Tables (Heston, Summers and Aten, 2008) and the World Bank's Global Financial Development Database (Čihák et al., 2012). This provides a dataset spanning 67 countries and 50 years – with 121 banking crises and 85 sovereign debt crises.

This dataset reveals that, for both banking and sovereign debt crises, it takes on average three to four years for real investment to recover to its pre-crisis level. Investment-to-GDP ratios, on the other hand, need more than six years to reach 95% of their pre-crisis peak level, on average, with full recovery to pre-crisis levels taking more than a decade.

To investigate the impact on investment recovery of relative dependency on banks, the countries in the sample are split into two groups ("market-based" and "bank-based") depending on the relative importance of bond and equity financing vis-à-vis bank financing. The median is used as a cut-off point.[12]

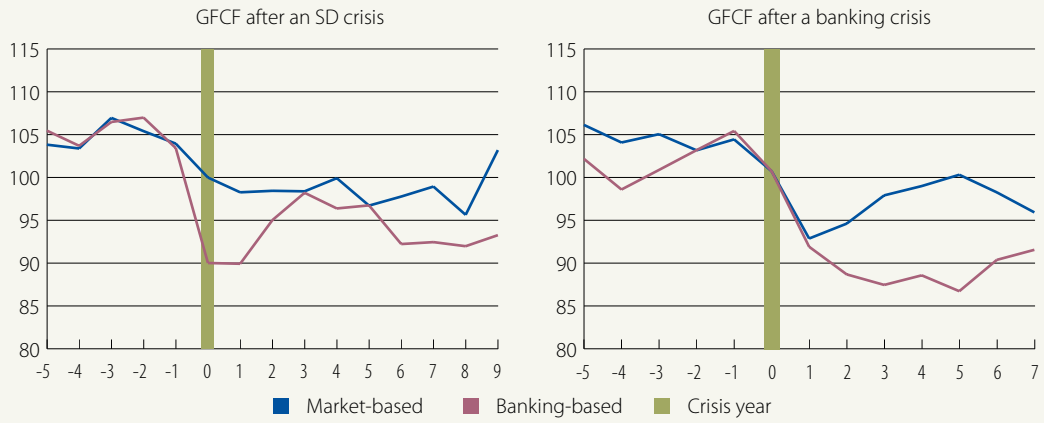
To take into consideration the possibility that factors other than the relative importance of market and bank financing could influence our results, the study follows a methodology proposed by Rioja, Rios-Avila and Valev (2012) and estimates an equation of the following form:

$$(1) \quad Investment_{i,t} = \alpha + \sum_{k=1}^{10} \theta_k crisis_{i,t-k} * banking_i + \sum_{k=1}^{10} \upsilon_k crisis_{i,t-k} + \gamma banking_i + e_{i,t}$$

where $investment_{i,t}$ stands for gross fixed capital formation in country i at time t (as a percentage of GDP) and $crisis_{i,t-k}$ is a variable that takes on a value of one in the event of a financial crisis (in a particular country/year) and zero otherwise. To allow for differences in the effect a crisis has on investment in bank-based and market-based countries, we interact $crisis_{i,t-k}$ with the measure of financial system difference.

Country fixed effects are also included in the regression analysis – to control for unobservable country-specific characteristics, e.g. with respect to economic and financial development – and a set of variables that capture year-specific events, such as international business cycle and contagion effects, that might affect the countries in one sub-sample but not the other. Figure 13 plots the results from a simple least squares estimation of equation (1).

Figure 13 Investment after a financial crisis – regression results



Source: Brutscher (2014).

12 An alternative measure using the 60/40 percentiles was used to confirm the robustness of this grouping.

Results indicate that – even after controlling for a large set of potentially confounding factors – investment tends to recover more quickly from a banking crisis in market-based systems than in bank-based systems. The picture is slightly different for sovereign debt crises – where the main difference between market-based and bank-based systems is that in market-based systems the initial drop in investment is less pronounced than in bank-based systems.

In order to further interpret these findings, Brutscher (2014) conjectures that:

- Banking crises lead to persistent problems in credit supply, which translate into slower recoveries in countries where firms are more dependent on bank finance or have fewer alternatives to bank finance.
- Large holdings of government bonds by the banking sector can lead to (temporary) liquidity shortages in the banking sector when a sovereign debt crisis hits. This leads to lower lending activities which, in turn, drag down investment activities more in bank-based systems, where firms have fewer alternatives to bank finance than in market-based systems (see, for instance, Gennaioli, Martin and Rossi, 2014).
- A similar effect can occur after a sovereign debt crisis, when banks divert funds from lending to the private sector to buy additional government bonds. This could be a result of reaching for yield, government suasion or bailout guarantees, as argued by Livshits and Schoors (2009) and Broner et al. (2013).

To study these explanations in more detail, Brutscher (2014) uses a simple regression exercise, exploring what variables are correlated with the differential impact of banking and sovereign debt crises on investment in bank-based and market-based economies. As the main difference between bank-based and market-based countries occurs with respect to the speed of the recovery in the case of banking crises and the depth of the crisis in the case of sovereign debt crises, the analysis focuses on these two variables – that is, speed of the recovery for banking crises and depth of the crisis (in terms of lower investment) for sovereign debt crises.

$$(2) \quad \textit{Crisis impact}_i = \alpha + \beta \textit{Lending Channel}_i * \textit{Banking}_i + \gamma \textit{Lending Channel}_i + \delta \textit{Banking}_i + \mu_i,$$

where, in the case of banking crises, *crisis impact*$_i$ is a measure of the time it takes investment to recover and, in the case of sovereign debt crises, it is a measure of the depth of a crisis (measured as the initial decline in investment in percentage points of GDP).[13] As for the explanatory variables, *Lending Channel*$_i$, the analysis focuses on two variables: changes in non-performing loans and changes in bank deposits.[14] These are taken as rough proxies for the degree to which bank lending is impaired in a country either due to insufficient bank risk-taking capacity (changes in NPLs) or pressure on liquidity in the banking sector (changes in bank deposits).

All specifications of equation (2) include pre-crisis liquid liabilities in the financial sector as a control variable to account for differences in financial sector development across countries. Since the speed of recovery depends to some extent also on the depth of a crisis, the specification for banking crises also includes 'crisis depth' as a control variable. Finally, to account for the fact that investment does not return to pre-crisis levels after a banking crisis in some countries in the sample, a Tobit model specification of equation (2) is used.[15]

13 The time it takes investment to recover is measured as the time it takes the investment-to-GDP ratio to move from its trough to 95% of its pre-crisis level. This definition is in line with the literature looking at the speed at which output recovers after a crisis.

14 The NPL variable is defined as post-crisis NPL levels in the top 33 per cent. Changes in bank deposits are defined as those falling in the top 33 per cent of the difference between the pre-crisis maximum and post-crisis minimum (+/- five years from crisis).

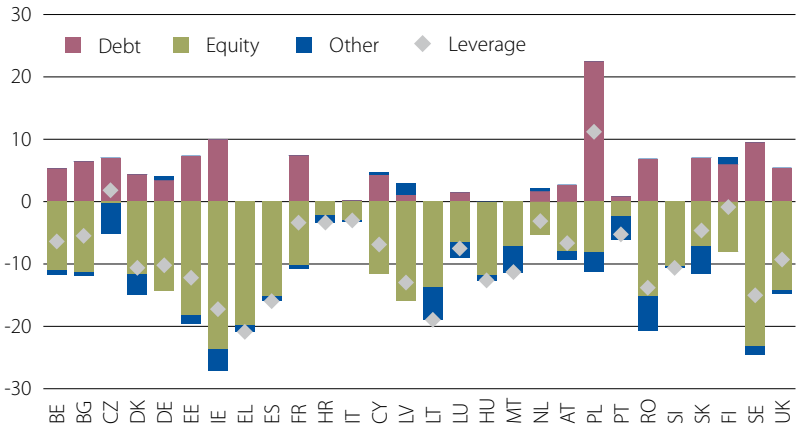
15 The time it takes investment to recover is a right-censored variable insofar as some countries do not reach 95% of their pre-crisis investment levels within the time frame of the dataset. In addition, one can argue that it is also left-censored, as the developments of investment in countries with a zero time-to-recover may actually differ markedly from each other. Taking into account left-censoring when estimating equation (2), however, does not affect the findings. All results are therefore reported under the assumption of right-censoring only.

1.2.2.2. Leverage

High indebtedness may be another reason for weak investment activity, as lenders are less willing to extend credit to highly indebted companies. Whether indebtedness is considered high or low depends a lot on a company's growth outlook. Dynamic, high-growth companies may be able to sustain higher levels of debt than companies whose outlook is stable or worsening. In other words, when a firm's growth prospects deteriorate, the level of indebtedness that previously seemed optimal may now appear too high, prompting the firm to reduce its debt. Indeed, after the financial crisis there was a substantial re-assessment of the growth prospects of European economies. The average rate of growth of potential GDP in the EU in the period 2008-2013 declined by 1½ percentage points relative to the period 2002-2007. As a result, European firms' business prospects on average also deteriorated. This coincided with a widespread reduction of debt levels and key debt ratios.

The level of debt is meaningless in itself unless it is related to the size of the company or its ability to repay its debt, hence the use of the leverage ratio – the ratio of debt to equity or total financial liabilities. In the years before 2007 both average debt levels and average leverage increased in the EU, as productivity and potential growth were relatively high in most EU Member States. In the period since 2009, NFCs in all members of the EU, except the Czech Republic and Poland, have decreased leverage on average. Figure 14 plots the overall change in the ratio of debt to total financial liabilities as a percentage of the 2009 level, and the contributions of debt and equity to that change. In most countries NFCs continued to increase their average nominal debt levels, but this was more than offset by the increase in equity. In 2013 nominal debt levels were lower than in 2009 in seven countries.[16] The increase in equity was mostly financed by retained earnings and reduced dividend payouts.[17] This can be largely attributed to efforts to reduce dependence on external financing due to NFCs' increased concerns about access to credit.

Figure 14 Change in ratio of debt to total financial liabilities during 2009-2013 and contributions of components, in per cent



Source: Eurostat.
Note: Leverage is defined as the ratio of total debt, securities other than shares, and loans, to total financial liabilities in EUR millions. For the Czech Republic the period is 2009-2012, while for Estonia it is 2010-2013.

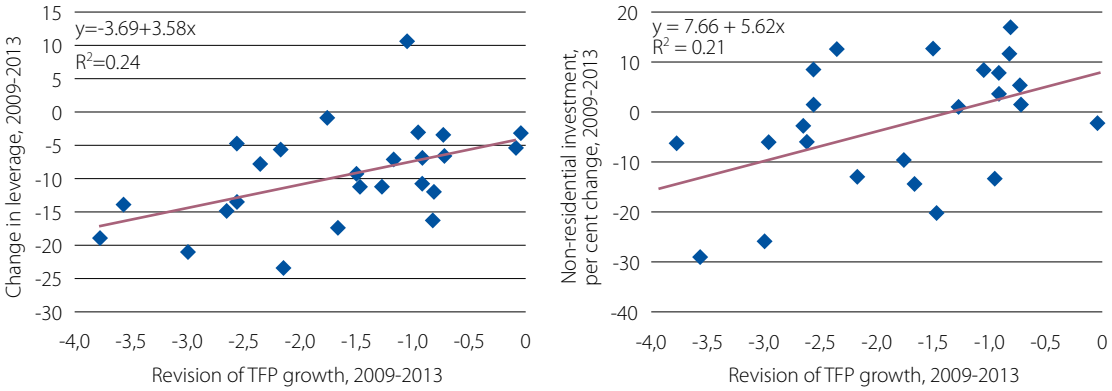
There is some evidence to suggest that, in addition to efforts to reduce dependence on external finance, these changes in leverage may be due to lower expected returns. Using firm-level data, Wagenvoort and Torfs (2013) show that the fall in European companies' operational returns explains an important part of the decline in investment activity. Figure 15 (left-hand panel) finds that changes in leverage between 2009 and 2013 are positively correlated with the size of the revision of the forecast of

16 In 2013, relative to the previous year nominal debt levels fell in 14 EU Member States, supporting the finding of the European Commission (2014) that in 2013 deleveraging relied increasingly on reductions in nominal debt levels.

17 Wagenvoort and Torfs (2013) document the substantial decline in NFC equity payout ratios, especially in SMEs, in the period since 2009. They find that net equity raised outside the firm has been negative on average in the EU.

total factor productivity (TFP) growth in 2009. The chart plots the change in leverage of non-financial corporations in 2013 as a percentage of the 2009 figure, against a measure of the revision of TFP growth in the wake of the economic and financial crisis in 2008-2009 (see also the notes in Figure 15). This positive correlation implies that, in the period 2009-2013, the larger the negative revision of TFP growth by the EC in its 2009 autumn forecast relative to its 2008 spring forecast, the more NFCs in a given EU Member State on average reduced leverage.

Figure 15 Leverage and investment of non-financial corporations are significantly related to revisions in expected TFP growth across the EU



Source: *Eurostat, AMECO.*

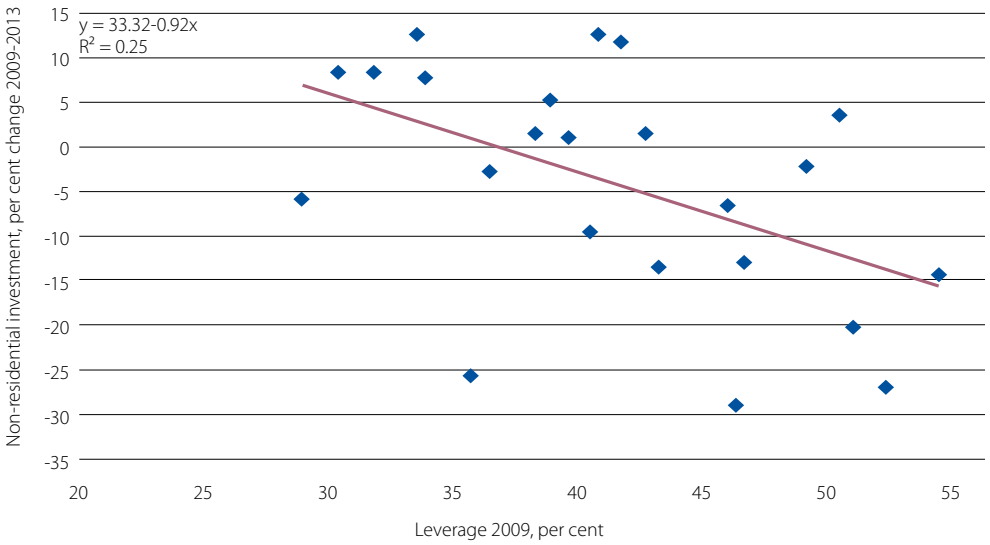
Notes: *Non-residential investment is total GFCF minus gross investment in dwellings in national currency 2005 chain-linked volumes. Leverage is debt to total financial liabilities, where debt is the sum of loans and securities other than shares in millions of national currency. Revision of potential TFP growth denotes the difference between the average projected rate of growth of TFP for the period 2009-2013 in the EC 2008 spring forecast and that in the EC 2009 autumn forecast. Data include all EU Member States, except Croatia, Cyprus, Greece and Portugal.*

The right-hand panel of Figure 15 shows that the change in non-residential fixed investment in 2013 relative to 2009 is also positively correlated with the same measure of revisions of expected TFP growth over the period in question.[18] At the same time it is negatively correlated with the leverage of non-financial corporations in 2009 (Figure 16).[19] The higher the level of leverage they had at the beginning of the crisis, the more NFCs in the EU on average reduced investment. Thus, the evidence seems to imply that weak investment since the end of the recession in 2009 has been associated with high pre-crisis leverage, reduction of corporate leverage (especially by increasing corporate savings) and weakening short and medium-term growth prospects.

18 The simultaneous decline of NFCs' leverage and investment, however, may also be the result of the aftermath of real estate booms and busts in several European countries or of some other reason. If Spain, Ireland and the UK are excluded, this preserves the positive correlation and somewhat decreases the explanatory power of the revisions of TFP growth for leverage and increases it for investment.

19 Excluding Greece, Ireland, Spain and Portugal reduces only slightly the negative correlation and the explanatory power of leverage.

Figure 16 Investment and leverage of non-financial corporations in a cross-section of EU countries, 2009-2013



Source: *Eurostat.*
Notes: *Non-residential investment is total GFCF minus gross investment in dwellings in national currency 2005 chain-linked volumes. Leverage is the ratio of the sum of loans and securities other than shares in millions of national currency and total financial liabilities. Data include all EU Member States except Croatia, Cyprus, Greece and Estonia.*

Recent studies by the European Commission (2014) and the IMF (Bornhorst and Ruiz-Arranz, 2013) find that deleveraging by NFCs and households may have not finished yet, hence the drag on investment from weak balance sheets is likely to continue. The European Commission study (2014) finds that deleveraging by the private sector in many European countries accelerated in 2013 and the contribution of declining nominal debt levels to that deleveraging increased. This has had an adverse impact on economic activity in the countries in question. Moreover, private sector deleveraging in many countries still has quite some way to go. The same study estimates that in several of the vulnerable Member States debt-to-GDP will have to decline by a further 30 percentage points in order to be sustainable and in line with historical episodes. The speed of this adjustment, as well as its cost, is highly uncertain and is a function of economic conditions and the financial sector.

On the basis of past deleveraging episodes, Bornhorst and Ruiz-Arranz (2013) find that increases in debt during booms are almost entirely reversed during the adjustment period for both households and corporations. According to their analysis, deleveraging in the euro area has just started and therefore has a long way to go before adjustment will be successful. Furthermore, with current policies it is likely that the adjustment will rely more on reductions in nominal debt rather than higher GDP growth, which may lengthen its duration and the cost to the economy.

The confluence of government, corporate and household deleveraging can create self-reinforcing feedback loops that further weaken economic activity, as explained by Bornhorst and Ruiz-Arranz (2013). We showed at the beginning of this chapter that gross investment in dwellings has been a major contributor to the observed weak aggregate investment. This has been driven by the need of households to decrease debt, as argued in Bornhorst and Ruiz-Arranz (2013) and European Commission (2014), but also by weak economic activity ensuing from, among other things, deleveraging and weak investment. There is a strong association, across European countries, between the rate of change of gross investment in dwellings, employment growth and change in unemployment. Furthermore, existing stocks of dwellings built during the housing boom in some countries, lower starting wages for the newly employed and the uncertainty about current jobs put additional pressure on residential investment.

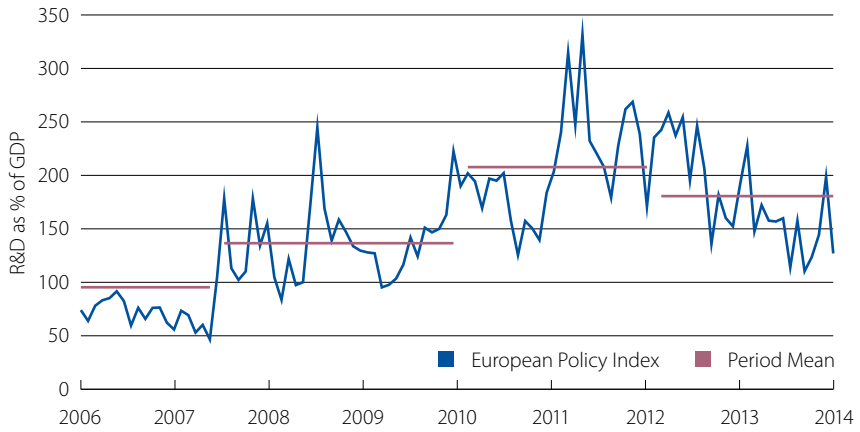
1.2.3. Uncertainty and worsening longer-term prospects

Productive investment is forward-looking and depends on the expected future return. The return is, in turn, a function of new and future technology, demand for and prices of output, labour supply and competition. The exact role played by all these factors is uncertain and sometimes even the distribution of expected outcomes is not known. As a result, episodes of high uncertainty may have a detrimental impact on investment. This impact is stronger for investments that have longer economic lives and require the mobilisation of more, possibly external, funding.

Uncertainty is notoriously difficult to measure. Measures of financial market volatility are often used to describe uncertainty. Such measures show a decline in uncertainty in Europe. Spreads on sovereign bond yields in the euro area, which tracked the evolution of the sovereign debt crisis, have declined significantly. Volatility on European stock markets is also down. These, however, describe a rather fragile status quo, as we were forcefully reminded by a recent episode of turbulence related to a mooted Greek exit from its bailout programme.

Another often used and cited measure of uncertainty is the index of economic policy uncertainty (EPU) developed and maintained by Baker, Bloom and Davis. Figure 17 plots the evolution of the index for Europe, together with its average values during the various stages of the financial and euro area sovereign debt crisis. During the period between the outbreak of the financial crisis in August 2007 and the escalation of the euro area sovereign debt crisis in early 2010, the EPU index increased above the pre-crisis average. It rose even further, to its highest levels since the start of the index in 1997, during the euro area sovereign debt crisis. After the ECB announcement in August 2012, which was subsequently fleshed out with the announcement of the outright monetary transactions, EPU subsided somewhat but is still even higher than during the financial crisis. These heightened levels of uncertainty have certainly affected fixed investment, especially in long-term, big-ticket items such as buildings and structures.[20]

Figure 17 Economic policy uncertainty index for Europe



Source: "Measuring Economic Policy Uncertainty" by Scott Baker, Nicholas Bloom and Steven J. Davis at www.PolicyUncertainty.com.

Another possible explanation for weak investment is that the past boom and bust cycle hid and then exposed a longer-term trend of slowing investment, related to aging populations, increasing inequality, high and growing government debts and slowing productivity growth. It is, however, difficult to know in real time whether a significant part of the current weakness of investment is indeed caused by these factors. At the same time, there is a strong case to make that rigid labour markets and lack of competition in certain markets are significant and tangible barriers to higher economic growth and investment in the EU.

20 More on the relationship between the EPU index and investment can be found in last year's volume of this publication – "Investment and investment finance in Europe, 2013", EIB, and on the index's website at www.PolicyUncertainty.com.

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Part I

Gross fixed investment and intangible capital

Chapter 2

Intangible assets

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Intangible assets

Chapter at a glance

Economic growth in high-productivity economies such as those of the EU and the US appears increasingly to be linked to firms' investments in knowledge creation. Over the past few decades, business investment in intangible assets – such as software, data, R&D, designs, advertising, worker training and new organisational processes – has been rising faster than investment in physical capital such as machinery and buildings. This reflects the growing importance of intangible assets for firms' productivity and market value.

Investment in intangible assets was relatively resilient during the recent global economic and financial crisis. Compared to investment in physical capital, intangible investment did not contract sharply after 2008. The proportion of firms investing in intangible assets is also greater in countries with higher GDP per capita and more developed financial markets. This finding may be attributed to a greater propensity to invest specifically in intangible assets in higher-productivity countries but may also be related to greater financing opportunities in those countries.

Perhaps unsurprisingly, smaller firms and firms that do not export their products or services are less likely to invest in intangible assets. However, intangible investment is not concentrated in one specific sector of economic activity or industry. According to recent firm-level data, the main reasons for investing in intangible assets include better relationships with customers, higher economic returns, larger market shares and greater efficiency of internal business processes. Firms also report that the high costs of the investment, as well as limited public financial support and unfavourable tax treatment, tend to be serious constraints on investment in intangible assets. This indicates that economic or monetary barriers (e.g. costs, tax, or lack of support) are more relevant for firms' decisions than non-monetary barriers such as the regulatory framework of an industry (e.g. environmental regulations and technical standards).

Investment barriers are of high importance for policy purposes. The strong association between intangible investment and productivity and GDP growth suggests that there is scope for governments to take policy measures and make investment in intangible assets more attractive for firms in the EU. At the same time the diversity of intangible assets should be emphasised, so that policies do not only promote R&D investment.

2.1. Introduction

Economic growth in high-productivity economies such as those of the EU and the US appears increasingly to be linked to firms' investments in knowledge creation. The last few decades have witnessed an expansion in the relative importance of those investments. Unlike investments in physical capital, they weathered the recent economic and financial crises reasonably well.[2] Investments in knowledge creation include expenditure on items such as worker training, software development, R&D, design of products and services, reputation and branding, business process improvements and organisational developments. These types of expenditure, which are also intended to reduce costs and raise future profits for firms, are called *intangible assets*.[3]

Intangible assets represent strategic investments of individual firms and are increasingly recognised as playing an important role in the growth of developed economies, although their impact is difficult to quantify. For example, van Ark et al. (2009) argue that the development of software for online banking has provided customers with 24/7 financial services and has substantially reduced labour costs in retail banking. In addition, marketing (brand name, reputation and customer satisfaction) and management practices help determine whether or not a firm is competitive in a market in the long run. In some industries, marketing expenditure for a new product (or service) can be even higher than resources spent on product development. In fact, firms in the business sector spend substantial resources on marketing and selling: marketing expenditure in the US makes up more than 5% of GDP, with advertising alone amounting to almost 2% of GDP (see, e.g., Arkolakis, 2010).

Some stylised facts on the importance of intangible assets

- The market value of a firm not only reflects the value of its stock of physical capital (e.g. plant and machinery) but also that of its intangible assets (e.g. employee skills, brand name and customer base). In fact, a substantial part of the value of a firm is explained by intangible assets. Hulten and Hao (2008) find that the book value of conventionally reported equity explains only a small fraction (around 30%) of the market value of firms but that this fraction increases to 75% when the capitalised costs of intangible assets are added to firms' balance sheets.[4] In addition, the importance of intangible assets for the market value of firms has been increasing over time (see, e.g., Hall, 2001).
- At the aggregate country level, investment in intangible assets (as a share of GDP) is significant and increased steadily in most advanced economies between 1995 and 2010. It also increased much more rapidly than investment in physical capital in many countries. This reflects the growing importance of intangible assets as a component of GDP and productivity. Van Ark et al. (2009) find that investment in intangible assets accounted for about one-quarter of labour productivity growth in the EU and the US over this period.
- Investment in intangible assets was relatively resilient during the recent global economic and financial crisis (see OECD, 2013). Compared to investment in physical capital, investment in intangible assets did not contract sharply after 2008.
- Higher rates of intangible investment are associated with higher GDP per capita. This finding may be attributed to a greater propensity to invest specifically in intangible assets in higher-productivity countries but may also be related to greater financing opportunities in those countries.

Intangible assets are typically classified under three different categories: computerised information, innovative property and economic competencies (see Table 1). Computerised information refers to "knowledge embedded in computer programs and computerised databases", innovative property to "knowledge acquired through scientific R&D and non-scientific inventive and creative activities", and economic competencies to "knowledge embedded in company-specific human and structural resources including brand names" (see Corrado et al., 2012). For instance, innovative property covers the

2 See Chapter 1 of this publication for a description of recent developments in gross fixed capital formation.

3 While this chapter provides an overview of intangible assets, the following chapter in this publication zeroes in on a special class of intangible assets, namely R&D.

4 The market value of a company is the value of its shares as determined by the stock market. The book value of a company is based on generally accepted accounting rules, and tends to reflect the historical cost of acquiring assets.

costs of (industrial and non-industrial) design and services innovation (including investments by financial services firms not captured by R&D surveys), while economic competencies cover the costs of marketing and launching new products – including ongoing investments to maintain the value of a brand – as well as innovations in organisation and human capital management. The second column in Table 1 briefly lists the mechanisms through which each sub-category can contribute to output growth in a firm.

In order to understand how intangible assets can be a driver of value creation for individual firms and a source of economic growth, it is important to measure them properly. In recent decades the treatment of intangible assets in national accounts has changed with the decision to capitalise software expenditure as capital formation. Software is an important category of intangible assets as it can transform knowledge into computerised information. With the recent adoption of the European System of National and Regional Accounts 2010 (ESA 2010, which replaces ESA 1995), R&D expenditure will also be capitalised as capital formation. However, other intangible assets are notoriously difficult to measure or are simply not measured systematically or consistently across firms or countries and over time. These include assets such as management capability, marketing and employee-training expenditures – which have been shown in the economic literature to be important determinants of a firm's performance in a market (see, e.g., Bloom and Van Reenen, 2010, for management practices; Belo et al., 2014, for marketing expenditures; and Black and Lynch, 1996, for firm training).

Table 1 Classification of intangible assets

Type of intangible asset	Mechanisms of output growth for the investor in the asset
Computerised information	
Software	Improved process efficiency, ability to spread process innovation more quickly, and improved vertical and horizontal integration.
Databases	Better understanding of customer needs and increased ability to tailor products and services to meet them. Optimised vertical and horizontal integration.
Innovative property	
Research and development (R&D)	New products, services and processes, and quality improvements to existing ones. New technologies.
Mineral exploration	Information to locate and access new resource inputs – possibly at lower cost – for future exploitation.
Copyright and creative assets	Artistic originals, designs and other creative assets for future licensing, reproduction or performance. Diffusion of inventions and innovative methods.
New product development in financial services	More accessible capital markets. Reduced information asymmetry and monitoring costs.
New architectural and engineering designs	New designs leading to output in future periods. Product and service quality improvements, novel designs and enhanced processes.
Economic competencies	
Brand-building advertising	Improved consumer trust, enabling innovation, price premia, increased market share and communication of quality.
Market research	Better understanding of specific consumer needs and ability to tailor products and services.
Worker training	Improved production capability and skill levels.
Management consulting	Externally acquired improvement in decision making and business processes.
Own organisational investment	Internal improvement in decision making and business processes.

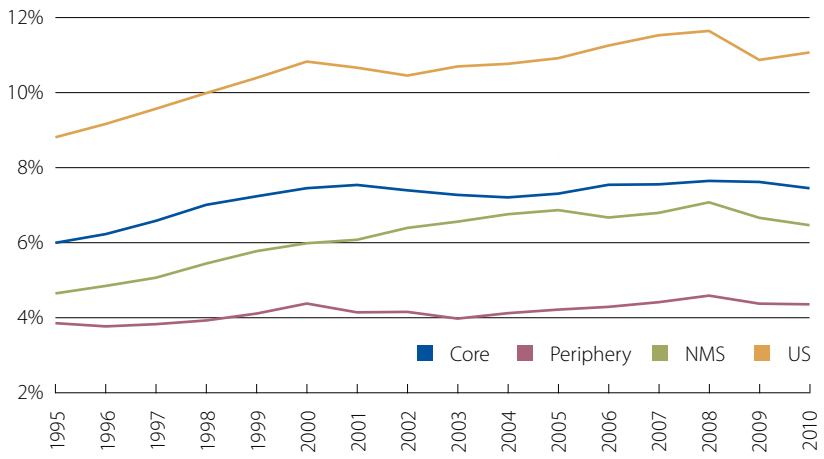
Source: Van Ark et al. (2009) and OECD (2013).

Both firm and national income accounting have historically treated outlays in intangible assets as intermediate expenditure and not as investment. By accounting convention, if an acquired intermediate good contributes to production for longer than the taxable year, then the cost of the good should be treated as investment. The evidence presented below suggests that, for a range of intangible assets, firms expect to benefit from their investment for much more than a year. Aggregate data on intangible assets are only available for a few countries. The INTAN-Invest database covers market sector data on intangible assets for selected countries in the EU from 1995 to 2010.[5] This database enables us to compare the evolution of intangible assets with the evolution of gross fixed capital formation for a period of 15 years.

2.2. The dynamics of investment in intangible assets

Over the last few decades, investment in intangible assets has been increasing more rapidly than GDP in the US and the EU (see Figure 1, covering the period 1995 to 2010). In fact, growth has been relatively smooth, as investments in intangible assets have been very resilient to the recent crisis – much more so than gross fixed capital formation, which collapsed after 2008. Growth is also particularly more marked in the US than in the EU. Unlike gross fixed capital formation, investment in intangible assets appears to be proportional to GDP and as such it is higher in the US (11.1% of GDP in 2010) than in Europe, and higher in the core EU countries (7.5%) than in the periphery (4.4%) and NMS (6.5%).

Figure 1 **Evolution of investment in intangible assets (1995-2010)**

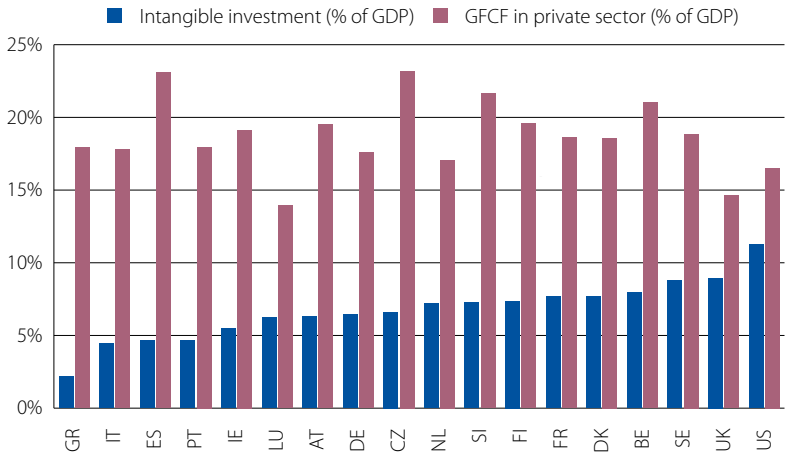


Source: INTAN-Invest and AMECO.

There is substantial variation in intangible investment across EU Member States and the US, with average rates ranging from 2.2% of GDP in Greece to 9% in the UK (and 11.3% in the US) over the period 2006-2010 – as highlighted in Figure 2. These rates of investment in intangible assets are not negligible. For instance, firms in France and the UK invested around EUR 155bn in intangible assets in 2010, while firms in Germany invested just over EUR 165bn.

5 See http://www.intan-invest.net/ and Corrado et al. (2012) for more detailed information on the INTAN-Invest database. The database covers the years 1995-2010 for the US and 17 countries in Europe (Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Slovenia, Spain, Sweden and the UK). Some data are also available for other countries, but only from 1995 (or 1998) to 2005 (Bulgaria, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Norway).

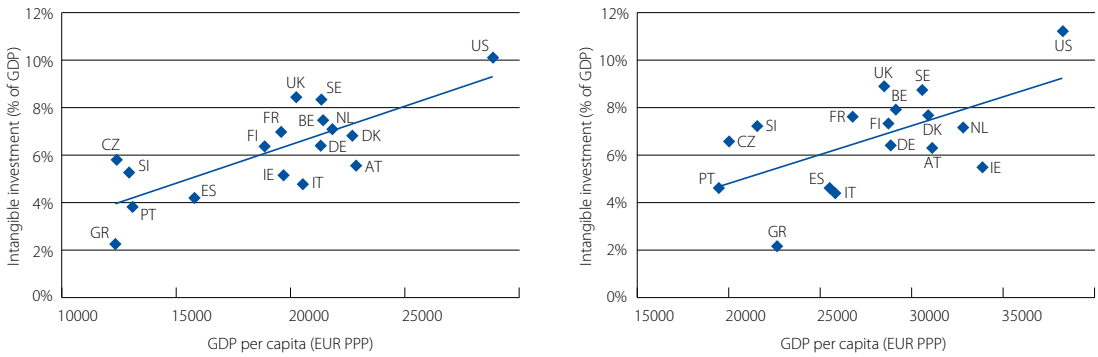
Figure 2 **Investment in intangible assets and gross fixed capital formation in the private sector (averages over 2006-2010)**



Note: *Countries are shown in ascending order of the intangible investment rate. Source: INTAN-Invest and AMECO.*

Investment in intangible assets and GDP per capita appear to be positively correlated. This reflects the fact that firms in more developed economies may be more likely to invest in intangible assets because of the industrial structure in those countries. On the other hand, firms in less developed economies may be more likely to specialise in sectors where low wages provide a competitive advantage and rely on technology and business processes developed elsewhere. However, this tends to change as their production moves up the supply chain to higher valued added activities. Figure 3 provides supporting evidence. It considers average values for two periods (1995-1999 and 2006-2010) and indicates that more advanced economies continued to invest more intensely in intangible assets.

Figure 3 **GDP per capita (EUR PPP) and investment in intangible assets (averages over 1995-1999 and 2006-2010)**



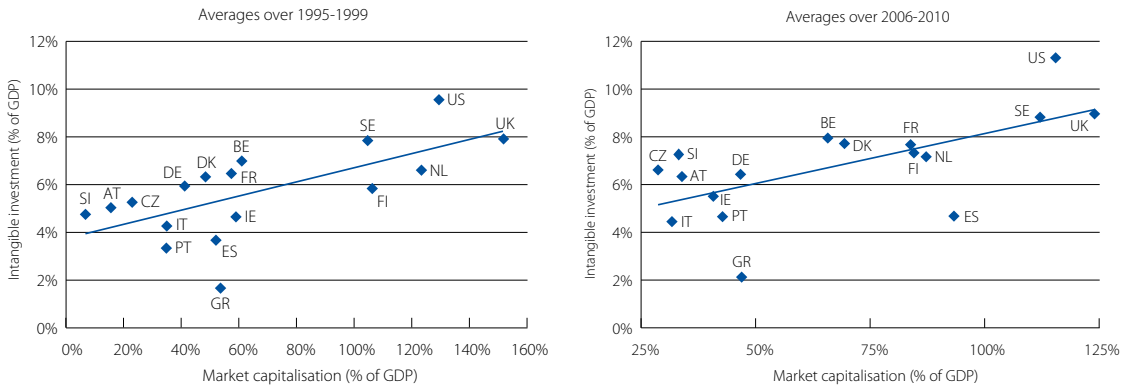
Note: *Investment in intangible assets and GDP per capita are the averages from 1995 to 1999 and from 2006 to 2010 for all countries. Luxembourg is excluded from the graphs because of very high GDP per capita.*
Source: *INTAN-Invest, AMECO and Eurostat.*

Greece is the country where intangible investment intensity (at around 2% of GDP) is the lowest in both periods. Italy is the economy where investment in intangible assets as a share of GDP has increased the least: starting from a low base, intangible investment intensity grew by less than 5% between the two periods. In fact, Italy is the only economy where the gap with Greece in intangible investment intensity fell over time. In other words, Greece has only managed to catch up with Italy but its gap is widening with all the other countries. Between the two periods (1995-1999 and 2006-2010), intangible investment intensity increased considerably in EU economies such as Austria, the Czech Republic, Finland, Portugal,

Slovenia and Spain – although Portugal and Spain started from a low base and the intensity is still low compared to the top performers. At the other extreme, firms in the business sector in the US invest substantially more in intangible assets than in the EU and the gap has been widening over time with all countries – except for Slovenia, which has managed to close its large gap in intangible investment intensity with the US.

While correlation does not imply causation, the results above suggest that policymakers should encourage and promote investments in intangible assets, as they may lay the foundations of higher long-term productivity and economic growth as well as faster convergence to the technological frontier. Public policies should be designed to accommodate and enhance the economic development of countries. Business investment in intangible assets is affected by many areas of policy. As overall business investment in intangible assets increases, some policy settings may require readjustment.

Figure 4 **Market capitalisation of listed companies (% of GDP) and investment in intangible assets (averages over 1995-1999 and 2006-2010)**



Note: *Investment in intangible assets and market capitalisation (as a percentage of GDP) are the averages from 1995 to 1999 and from 2006 to 2010 for all countries. Luxembourg is excluded from the graphs because of very high market capitalisation as a share of GDP.*

Source: *INTAN-Invest, AMECO and World Bank World Development Indicators.*

Financial markets – which are typically more developed in advanced economies – can also help explain why there is more intangible investment in advanced economies. When the financial system is efficient, it can guide savings to investments in promising new technologies, and firms are more likely to be able to afford risky investments – such as expenditure on design or R&D – especially during turbulent times. Figure 4 shows that there is a positive correlation between the market capitalisation of listed companies (as a share of GDP) and intangible investment. In recent years, there have also been innovations in intangible-based lending and equity investment. For example, financial transactions have been based on prospective revenues from products still at a pre-commercial stage of development. In some cases, intangible assets have even been used as loan collateral. This implies that various areas of policy and institutional development could help promote an environment conducive to increased financing of intangible assets.

2.3. Composition of intangible assets

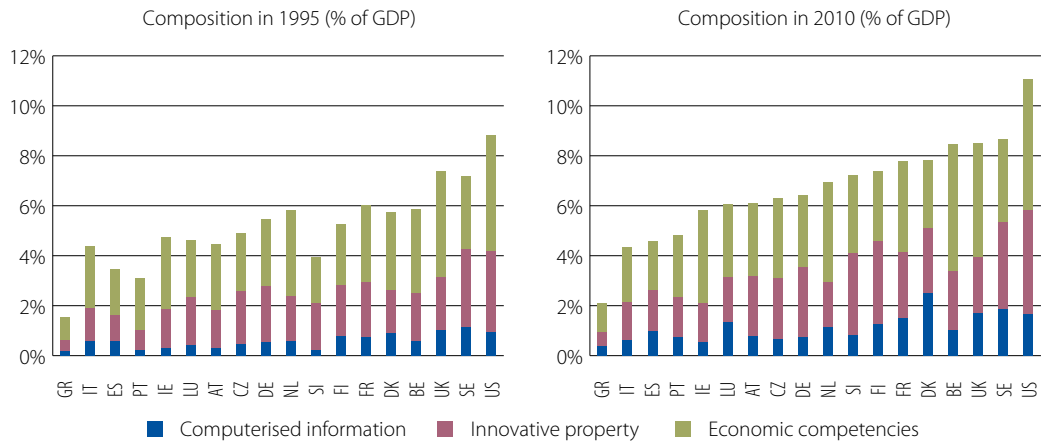
Economic competencies are the largest component of intangible investment in almost all countries and represented around half of total intangible investments in both 1995 and 2010 (see Figure 5, which compares the composition of intangible assets as a share of GDP in 1995 and 2010 and refers to the three broad categories described in Table 1: computerised information, innovative property and economic competencies). In countries such as the Netherlands and the UK, firms invested more than 4% of GDP in economic competencies in 2010; in Belgium and the US, firms spent around 5% of GDP. The relatively high share of economic competencies may be related to the large share of business services in these

countries – service industries tend to rely more on all types of intangible assets, in particular economic competencies.

The second-largest component is innovative property – except in Finland, Slovenia and Sweden, where this component is even larger than economic competencies. Innovative property includes R&D, investment in new architectural and engineering designs, new product development in the financial industry, the cost of developing new motion pictures, films and other forms of entertainment, and mineral exploration. Investment in R&D only amounts to around half of the total of investment in innovative property, while design makes up around a third of the total. Countries differ significantly in the intensity of investment in R&D.

R&D not only enlarges the technological frontier but also enhances firms' ability to absorb existing technologies. Design can also enable firms to pull away from cost-based competition. According to the OECD (2013), a number of successful products owe at least part of their success to different facets of design. For tablet computers and smartphones some of the most prominent intellectual property conflicts in recent years have focused on design. This is because product design affects functionality and the consumer's attachment to the product. Design is often integral to all stages of the business process, from manufacture, brand development and marketing to after-sales service (in a global context, design can help to differentiate products to meet the requirements of different local markets). The impacts of design are not limited to physical products. For instance, the design of graphical user interfaces is increasingly important. Design also plays a major role in services, such as online purchasing.

Figure 5 Composition of intangible assets in 1995 and 2010



Note: Countries are shown in ascending order of the intangible investment rate in 2010.
Source: INTAN-Invest and AMECO.

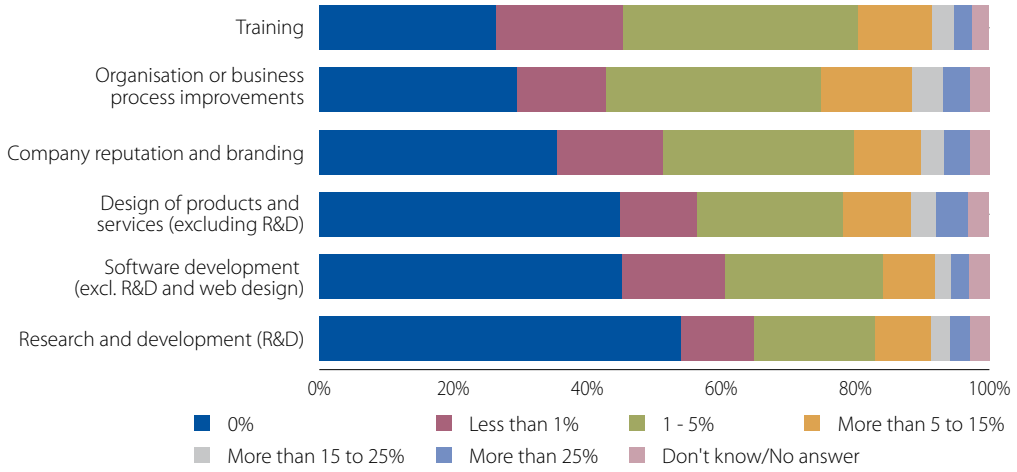
Computerised information is the smallest component of intangible investment in both 1995 and 2010. However, it is the component that has been increasing the most over time (both as a share of GDP and of total intangible investments). While this share represented – on average – slightly more than 10% of total intangible investments in 1995, it amounted to more than 20% of the total in many economies in 2010. In countries such as France, Sweden, the UK and the US, investment in software and databases reached more than 1.5% of GDP in 2010; in Denmark it represented around 2.5% of GDP. Firms have increased their investments in computerised information as the business uses of software, internet websites and digital resources have spread widely over time. The relatively high share of computerised information may also be related to the large contribution of medium and high-tech manufacturing industries in these countries. According to the OECD (2013), 90% of new car features have a significant software component (innovative start-stop systems, improved fuel injection, on-board cameras, safety systems, etc.). The electronic controls that regulate the operation of motors, generators and batteries are important components of a car. For example, hybrid and electric vehicles require huge volumes of computer code.

2.4. Factors driving or constraining investment in intangible assets

Most firms in the EU invest in intangible assets. A recent survey of the European Commission (2013), which was designed to explore firms' investments in a range of intangible assets, finds that around 8% of EU firms did not invest in intangible assets at all in 2011.[6] The proportion of firms that did not invest in intangible assets was higher in the newer Member States (10.6%) and the periphery (8.4%) than in the core EU countries (4.9%) or the US (5.8%). This would be consistent with the patterns presented in Figures 1 and 2, which showed that the economies in the periphery and NMS invested less in intangible assets (as a share of GDP) than the core EU countries or the US.

Perhaps unsurprisingly, the European Commission survey also shows that small firms (fewer than 50 employees) and in particular microfirms (fewer than nine employees) were less likely to have invested in intangible assets in 2011. In addition, firms that do not export their products or services are also less likely to invest in intangible assets. However, there are no large differences across sectors or economic activities. In other words, intangible investment is not concentrated in one specific sector or industry. In general, intangible assets appear to be more relevant for firms searching for a "differentiation advantage" rather than a "cost advantage". In fact, firms reporting that their most important priorities focus on increasing labour productivity, rapid development of new products or services, and tailored solutions for their customers are more likely to invest in intangible assets. Firms whose priorities are to ensure lower prices or decrease production costs invest substantially less in intangible assets.

Figure 6 Percentage of total turnover invested in intangible assets

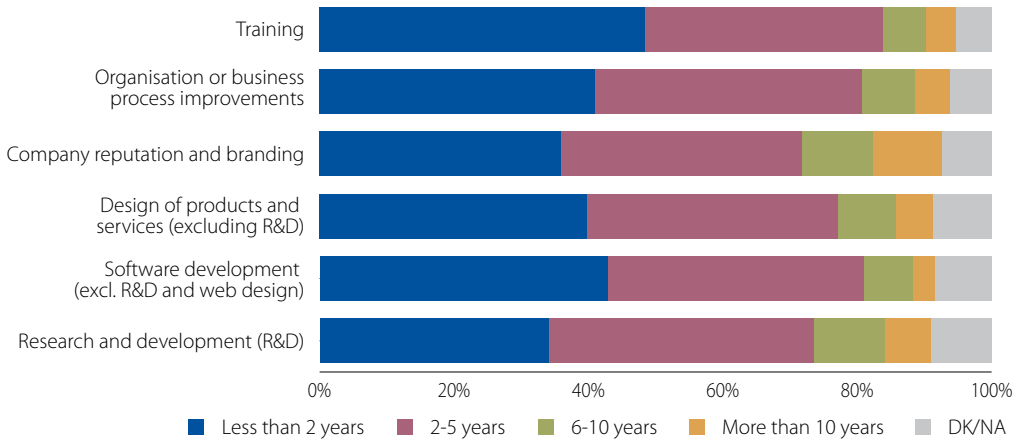


Note: All EU-28 Member States; sample size: 8 915 firms. "In 2011, what percentage of its total turnover did your company invest in the following activities using internal resources or using an external provider for which the company paid?"
Source: Flash Eurobarometer No. 369.

6 The six categories of intangible assets considered in the survey of the European Commission (2013) were: R&D; software development (excluding R&D and web design); design of products and services (excluding R&D); company reputation and branding; organisation or business process improvements; and training. This means that there is only a partial overlap between the survey and all the categories of intangible assets discussed in Table 1. For more information on the data, see Flash Eurobarometer No. 369 at http://dx.doi.org/10.4232/1.11908 .

According to the results of the survey, intangible investments focus mostly on training, organisation or business process improvement, and company reputation and branding (see Figure 6). More than 70% of EU firms invested in training in 2011. Two-thirds of firms also invested in organisation or business process improvement, and in company reputation and branding. At the other extreme, R&D is the intangible asset in which firms are least likely to invest, with less than half of EU firms making investments in R&D in 2011. Figure 6 also suggests that some firms invest a large part of their turnover in intangible assets: a fifth of EU firms invested more than 5% of their turnover in organisation or business process improvements in 2011. And between 15% and 20% of firms also invested more than 5% of their turnover in design, company brand and training.

Figure 7 How long do firms expect to benefit from their investment in intangible assets

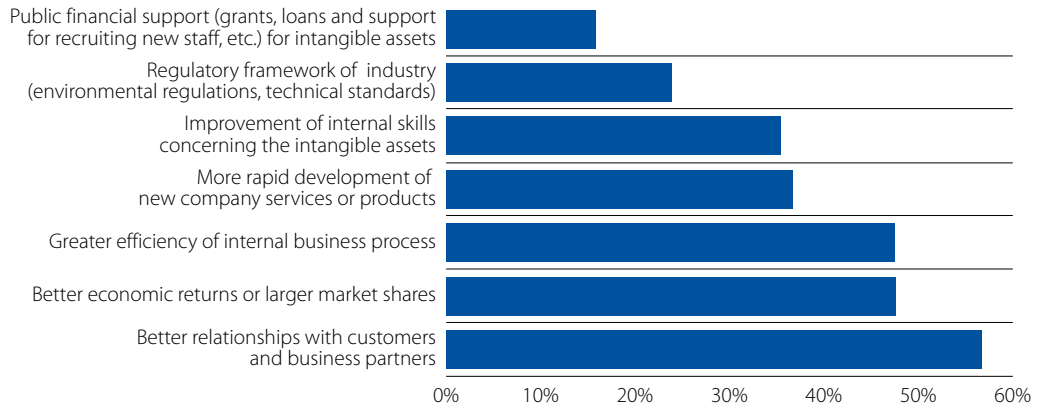


Note: All EU-28 Member States; sample size: 8 915 firms. "On average, for how long does your company expect to benefit from its investments in the following activities?"
Source: Flash Eurobarometer No. 369.

Firms invest in intangible assets because they expect a return on their investment. Only 1% of all EU firms report that they did not benefit from investments in intangible assets. An indicator of the strategic role of intangible investments is the period of time over which they are expected to contribute to the firm. The longer the "useful life" of an intangible asset, the more strategic it can be considered, as it contributes to the company's competitive advantages and growth opportunities over time. R&D and company reputation and branding are areas where at least 25% of all firms expect to benefit from their investment for at least five years (see Figure 7). In fact, more than 10% of the firms surveyed expect the benefit of their investment in company reputation and branding to last for more than ten years. Even though firms invest a large part of their turnover in staff training, this category is considered to have the shortest benefit period – almost half of firms expect the benefit from investing in worker training to be felt for less than two years.

The main reasons behind investments in intangible assets include better relationships with customers and business partners (56%), followed by better economic returns or larger market shares (48%) and greater efficiency of internal business processes (47%) – see Figure 8. For example, the search for better relationships with customers and business partners was selected by more than twice as many firms as those who referred to their industry's regulatory framework (24%) or to the receipt of public support (16%). This suggests that economic motivations appear to be more pervasive than those related to the institutional set-up. Interestingly, firms in the core countries of the EU were more likely to report that the regulatory framework was an important reason for investing in intangible assets than firms in the periphery or NMS. In addition, compared to SMEs, large firms were also much more likely to report that the regulatory framework was an important element in their decision to invest in intangible assets.

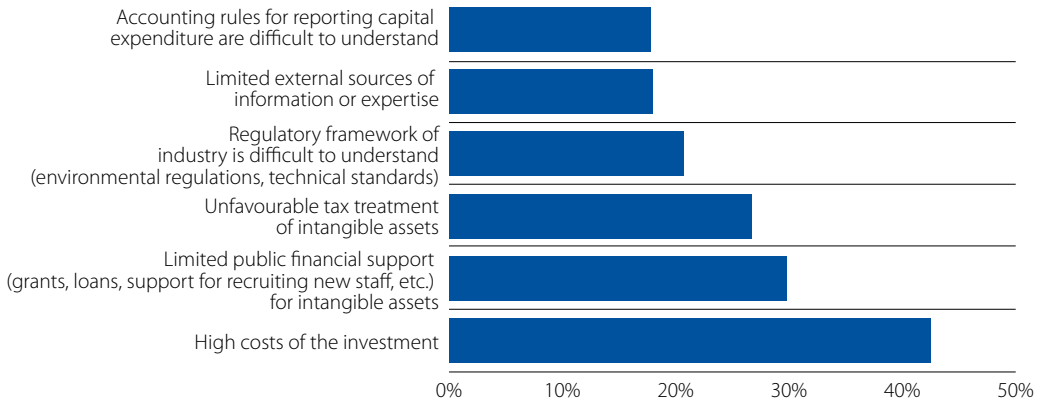
Figure 8 Main reasons for investing in intangible assets



Note: All EU-28 Member States; sample size: 8 915 firms. "Did any of the following motivate you to invest in intangible assets?"
Source: Flash Eurobarometer No. 369.

When it comes to the obstacles to investing in intangible assets, Figure 9 shows that the high cost of investment is the constraint that is mentioned most by firms in the EU (42%), followed by limited public financial support (30%) and unfavourable tax treatment of intangible assets (27%). This indicates that, again, economic or monetary barriers (i.e. costs, tax or lack of support) are more relevant for firms' decisions than non-monetary barriers (i.e. regulatory, accounting and information barriers).

Figure 9 Main obstacles to investing in intangible assets



Note: All EU-28 Member States; sample size: 8 915 firms. "Did any of the following, if any, discourage you from investing in intangible assets?"
Source: Flash Eurobarometer No. 369.

Investment barriers are of high importance for policy purposes. SMEs were much more likely than larger firms to report that they were constrained by these factors – but this is not a surprising finding given that SMEs tend to invest less in intangible assets. More generally, the strong association between intangible investment and productivity and GDP growth (see also Figure 3) indicates that there is scope for governments to take policy measures to make investment in intangible assets more attractive for firms in the EU. At the same time, the diversity of intangible assets should be emphasised, so that policies do not only promote R&D investment. More importantly perhaps, this analysis did not consider public investment in intangible assets, which may also have far-reaching implications.

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Part I

Gross fixed investment and intangible capital

Chapter 3

Recent trends in R&D investment

Tanja Tanayama[1]

1 Tanja Tanayama is a Senior Economist at the European Investment Bank. The views expressed in this chapter are those of the author and do not necessarily represent those of the EIB or EIB policy.

Recent trends in R&D investment

Chapter at a glance

The EU is the second-largest R&D spender in the world after the US, and accounted for some 30 per cent of global R&D expenditure in 2011, 7 per cent lower than 10 years before. The declining R&D share of the EU – as well as that of the US and Japan – is the result of the remarkable growth rate of R&D expenditure in China and also the rapid expansion of R&D in South Korea.

The R&D intensity gap between the US and the EU has remained more or less stable at slightly below 1 per cent since the mid-1990s. The gap is explained by lower business sector R&D intensity in the EU.

The EU and US economies are those where the share of R&D expenditure in the services sector is the highest (33 and 30 per cent respectively in 2011), while in China, Japan and South Korea business R&D remains highly concentrated in the manufacturing sector. Within manufacturing industries, "motor vehicles and other transport equipment" accounts for the largest share of business R&D expenditure in the EU and its share has been increasing.

Aggregate R&D expenditure in the EU continued to grow during 2009-2013, but the contribution of different sectors to growth varied. During 2009-2010 increasing R&D expenditure in the government and higher education sectors compensated for the 0.1 per cent annual decline in business R&D expenditure. During 2011-2013, the roles were reversed. Aggregate business sector R&D regained growth rates comparable to the pre-crisis period, while the average annual growth of government and higher education R&D declined significantly.

The aggregate EU trends hide considerable heterogeneity across the Member States and during 2009-2013 this heterogeneity increased. The dispersion of average annual R&D growth rates during 2009-2013 was wider compared to the period 2003-2008. This was especially due to diverging developments in business R&D expenditure across the EU.

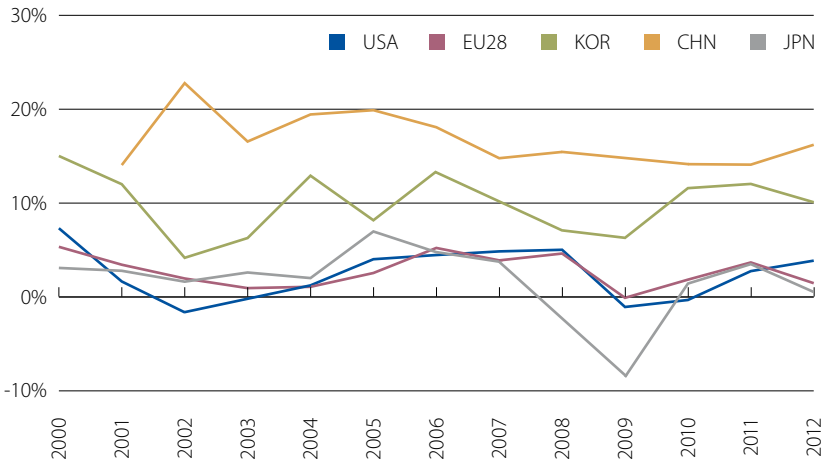
The majority of EU countries experienced recovering R&D expenditure during 2011-2013 following weaker developments during 2009-2010. However, there were still several Member States (such as Finland, Italy, Luxembourg, Portugal, Romania, Spain and the UK) where R&D growth remained weak during 2011-2013.

This section looks at recent developments in research and development (R&D) expenditure. R&D refers to "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications" (OECD, 2002). R&D covers three types of activities: basic research, applied research and experimental development. Although innovation can happen in many ways, it is often the result of a costly process requiring systematic and deliberate investment in R&D activities. R&D expenditure is thus a key component of investments in intangible assets and innovation. Both the public and private sector are engaged in R&D, with crucial and complementary roles. In developed economies, the business sector is the main generator of R&D. However, public research institutes and universities are important generators of the knowledge, human capital and skills that are also essential for business sector R&D. The section starts by shedding light on global trends in R&D expenditure over the past ten years and then discusses in more detail recent EU performance.

3.1. Global comparisons

According to the National Science Foundation[1] (2014), global R&D expenditures amounted to $1 435 billion (current PPP dollars) in 2011 – almost double the figure of $753 billion ten years earlier. Average annual growth of nominal global R&D expenditure over the decade was 6.7 per cent. Even during the crisis years the average annual growth rate remained relatively stable. However, there is considerable variation in the contribution of different countries to the growth. Figure 1 shows the development of annual growth rates for selected countries.

Figure 1 **Annual growth rate of R&D expenditure (constant prices) across selected countries, 2000-2012[2]**



Source: OECD, Main Science and Technology Indicators

The remarkable growth rate in China and also the rapid expansion of R&D in South Korea demonstrate the strong emphasis placed by rising Asian economies on R&D and innovation. In all the other countries covered total R&D has been growing, but at a much slower pace than in China or South Korea. Growth rates also remained at high levels in both China and South Korea during the crisis years (2007-2012). In the US, the EU and especially Japan the crisis had a clear negative impact . The effect was greatest in Japan, where total R&D expenditure in 2012 was still some 4 per cent lower than in 2007. The EU

1 The National Science Foundation (NSF) is an independent US federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense. . . . "With an annual budget of $7.2 billion (FY 2014), NFS is the funding source for approximately 24 per cent of all federally supported basic research conducted by America's colleges and universities (www.nsf.gov).

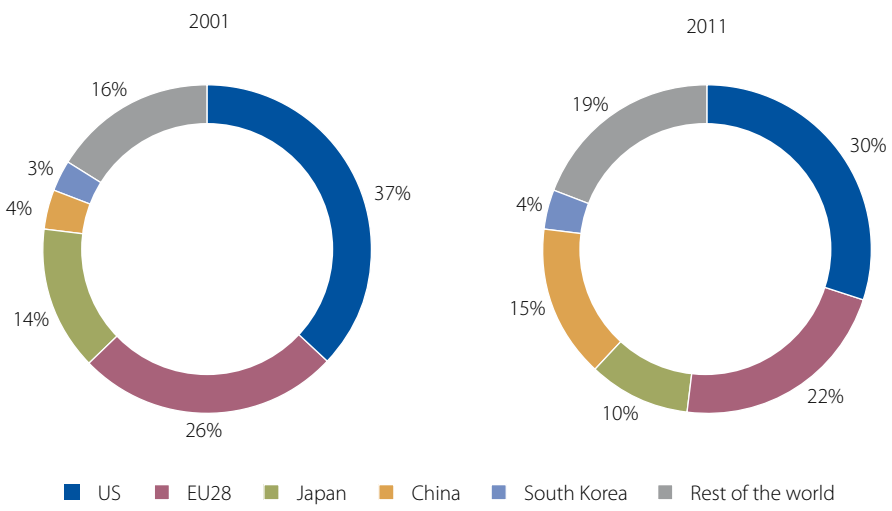
2 Throughout the section average annual growth is calculated at compound rates when the intervals are not annual.

somewhat outperformed the US: R&D expenditure increased by 12 per cent between 2007 and 2012, compared to a 10.5 per cent increase in the US. However, the most recent figures suggest a reversal of this trend, with R&D growth in the US surpassing that in the EU. Section 2.2.2 also demonstrates that the aggregate EU figure hides considerable heterogeneity across the EU Member States.

3.1.1. Geographical distribution of global R&D

The growth differences are reflected in changes in the geographical composition of worldwide R&D expenditure (Figure 2). The US continues to be the largest global R&D spender, but its share declined from 37 per cent in 2001 to 30 per cent in 2011. The EU comes second and its share has also been on the decline, albeit to a lesser extent compared to the US. In 2011, the EU accounted for 22 per cent of global R&D expenditure, down from 26 per cent ten years earlier. Between 2001 and 2011, Japan lost the third position to China, with the latter's share increasing from 4 per cent in 2001 to nearly 15 per cent in 2011. Also the rest of the world increased its share. These changes imply a widening of the geographical distribution of R&D. Nevertheless, global R&D remains highly concentrated in three main regions – North America, Europe, and East and Southeast Asia. Together they accounted for over 80 per cent of global R&D expenditure in 2011 (National Science Foundation, 2014).

Figure 2 **Geographical distribution of world R&D expenditure across selected countries in 2001 and 2011**

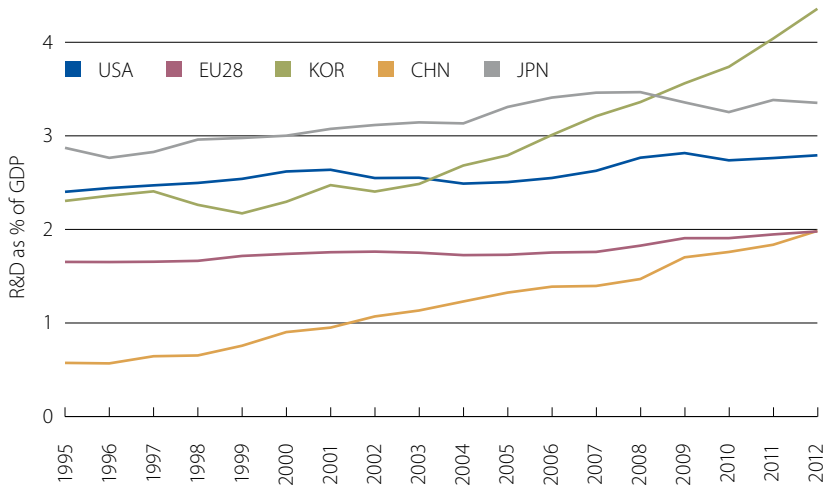


Source: National Science Foundation, Science and Engineering indicators 2014

3.1.2. R&D intensities

R&D intensities (R&D expenditure as a share of GDP) confirm the strong emphasis placed by both China and South Korea on R&D. In South Korea, R&D intensity has almost doubled and in China more than tripled since the mid-1990s (Figure 3). South Korea is the most R&D-intensive of the countries covered and, at 4.3 per cent, its R&D intensity is one of the highest in the world. China in turn has caught up with the EU. In the EU, aggregate R&D intensity has increased only modestly since 1995, from 1.7 per cent in that year to 2 per cent in 2012. The US has experienced a similar trend, with R&D intensity increasing from 2.4 per cent to 2.8 per cent. This has left the R&D intensity gap between the US and the EU more or less stable. The gap reached its peak in 2008 at 0.94 per cent but has now declined back to 0.81 per cent, close to the average of 0.83 per cent over the period 1995-2012. Against these developments, the EU's 2020 target of raising EU R&D intensity to 3 per cent by 2020 appears challenging.

Figure 3 **Evolution of R&D intensities in selected countries**



Source: OECD, Main Science and Technology Indicators

R&D expenditures can be broken down according to who carries out the R&D: the business sector, higher education, government or private non-profit institutions. In a global comparison, the EU has the lowest share of R&D undertaken by the business sector (63 per cent) and the highest share of higher education R&D (24 per cent) (see Table A.1. in the Appendix). In the US, the business sector accounts for 70 per cent of R&D expenditure, while the corresponding figure for China, Japan and South Korea is closer to 80 per cent. In all three Asian countries, the business sector's share has increased since 2000. This holds for China in particular, where the share of R&D expenditure in the business sector increased from 60 per cent in 2000 to 76 per cent in 2012.

Figure 4 shows the development of business R&D intensities (R&D expenditure by the business sector as a percentage of GDP). Clearly in both China and South Korea, it is especially R&D carried out in the business sector that contributed to the strong increase in overall R&D intensity. Also the R&D intensity gap between the US and the EU is entirely explained by lower business sector R&D intensity in the EU – 2.0 per cent in the US compared to 1.2 per cent in the EU. This gap can be due to structural and/or intrinsic factors. Structural factors refer to different industrial sector compositions in the US and the EU. The US may be more specialised in higher R&D intensity sectors than the EU, generating higher R&D intensity in the US than in the EU. Intrinsic factors reflect intrasectoral variations in R&D intensity, i.e. the same sectors may have different R&D intensities in the US and the EU.

The economic literature does not provide a conclusive answer on the role of structural and intrinsic factors in explaining the US-EU R&D gap. The majority of studies find that structural factors play a dominant role but there are also exceptions.[3] The Innovation Union Competitiveness Report 2013 (European Commission, 2014) looks at the issue at a country level and concludes that some countries have scope to increase their R&D intensity within the existing industrial structure, while others need to simultaneously change the existing sector composition. The recent literature has started to dig deeper into the potential causes of the EU's relative specialisation in medium-tech rather than high-tech sectors. Cincera and Veugelers (2012, 2013) find that the fact that there are fewer young leading innovators in the new high technology-intensive sectors is the largest contributing factor to the EU's overall R&D deficit relative to the US, and this is due to lower rates of return from R&D for these firms compared to their US counterparts.

In terms of R&D carried out in the higher education sector, the EU is well positioned. It has the highest higher education R&D intensity among the countries covered (Figure 4). However, there is relatively little variation in higher education R&D intensity between the EU, US, Japan and South Korea, as the

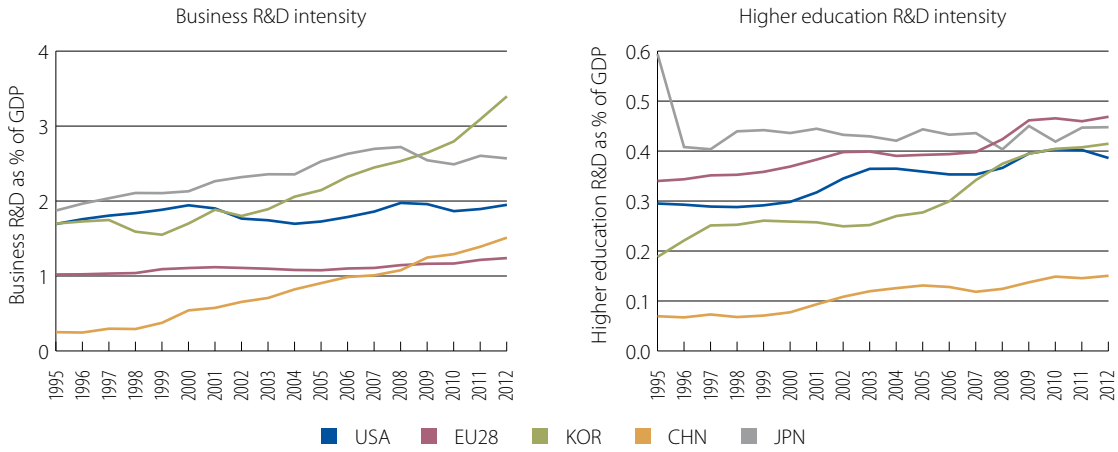
3 See Stančík and Biagi (2012) and references therein.

intensities have converged close to one another. Nonetheless, the EU is often said to be less efficient in extracting the economic benefits from higher education R&D than the US for instance (CEPR, 2012). This has been attributed to both weaker industry-science links (Veugelers, 2012) and the lower relevance or quality of scientific research (Ruiz-Castillo, 2012). Also the Innovation Union Competitiveness Report 2013 (European Commission, 2014) highlights the fact that the US outperforms the EU in overall scientific excellence, especially in strategic areas such as health and biotechnology, information and communication technology (ICT), nanoscience, materials and science for new production technologies.

Figure 4 shows that in terms of higher education R&D intensity, China still has some catching up to do. The share of R&D carried out in the higher education sector in China was 7.6 per cent in 2012, compared to the EU and OECD averages of 23.9 per cent and 18.2 per cent respectively. The figure for China is the lowest among the 41 countries covered by the OECD Main Science and Technology Indicators Database. The relatively low higher education R&D intensity in China suggests that despite impressive increases in total R&D expenditure, there is still some way to go in transforming China from a manufacturing powerhouse to a cutting-edge innovator. In Chapter 5, Philippe Aghion highlights the increasing importance of the higher education sector as a country moves closer to the technology frontier. In the catching-up phase, countries tend to rely more on adaptive innovations by imitating technologies developed elsewhere, while the importance of high-quality basic research becomes more important when countries move closer to the frontier and need to start relying more on independent R&D and frontier innovations.

In the US, 2012 saw the first constant-dollar decline since 1974 and ended a period of modest growth between 2009 and 2011 (National Center for Science and Engineering Statistics).

Figure 4 Evolution of business and higher education R&D intensities in selected countries



Source: OECD, Main Science and Technology Indicators

3.1.3. Industrial structure of R&D expenditure

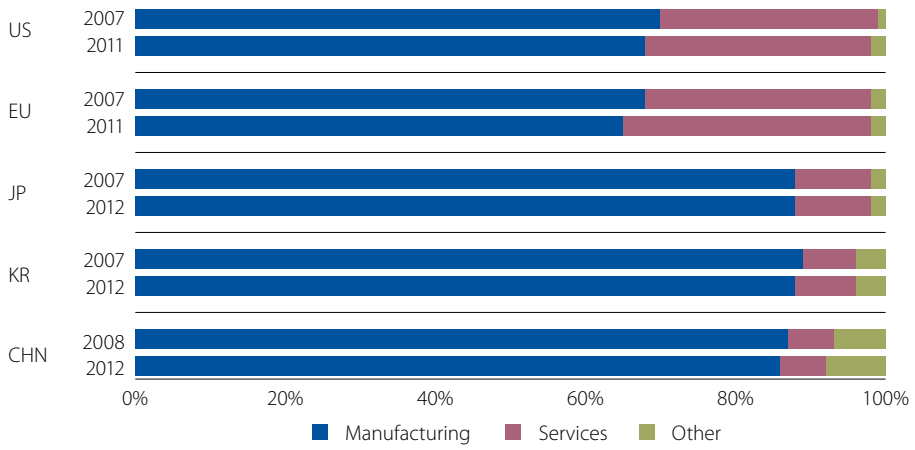
Structural change towards more service-based economies has been an ongoing process in the highly industrialised countries since the 1960s. Nowadays the services sector accounts for 71 per cent of the EU's GDP and on average 67 per cent of total employment. Nevertheless, business R&D expenditure remains concentrated in the manufacturing sector (Figure 5).[4] The share of business R&D expenditure

4 Cross-country comparisons of the sectoral distribution of business sector expenditure on R&D (BERD) should be made with care as there are differences in how countries allocate R&D to various industries and whether they classify a sizable share of BERD under R&D services (OECD, 2013). Moreover, it is important to acknowledge that R&D expenditure covers only the formal and systematic R&D undertaken by firms, whereas innovation can also arise from informal R&D (R&D conducted without specific financial and managerial resources or formalised procedures). R&D expenditure is likely to underestimate the innovation activities of services sector firms in particular.

in the services sector is highest in the EU (33 per cent), followed by the US (30 per cent).[5] The EU share also increased the most during the crisis years, boosted by a close to 5 per cent annual increase in R&D expenditure in the services sector. The contribution of the services sector to business R&D is considerably lower in Japan, South Korea and China.

Country-specific figures for the EU reveal that the aggregate development is strongly driven by Germany, the largest R&D spender in the EU. In Germany, the share of R&D carried out in manufacturing (86 per cent) is the highest among the EU countries covered, only slightly below the 88 per cent recorded in Japan and South Korea and the 87 per cent recorded in China. If Germany is excluded, the EU's share of R&D in manufacturing in 2011 declines from 65 per cent to 53 per cent.

Figure 5 Distribution of business R&D expenditure across sectors (based on main activity)[5,6]



Source: OECD, Structural Analysis (STAN) Databases

Within manufacturing sectors, countries also exhibit different specialisation patterns in business R&D (Figure 6). The share of R&D carried out in the low and medium-to-low technology sectors is relatively higher in China than in other countries. This is in line with Veugelers (2013), who finds that China is still not specialised in knowledge-intensive goods and activities but remains mostly an assembler of goods, the value of which is created elsewhere. However, China's determined innovation ambitions are paving the way for upgrades in this respect. In South Korea, manufacturing R&D expenditure is strongly concentrated in "Computer, electronic and optical products" (electronics) and its dominance increased between 2007 and 2012.

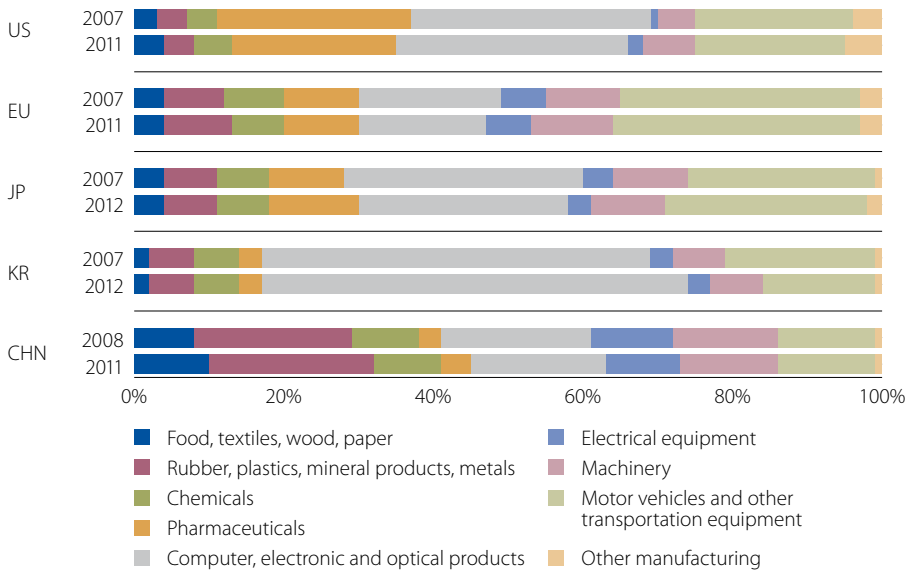
Japan has experienced a notable decline in the share of R&D carried out in the electronics sector. Growth rates of business R&D expenditure by sector (Table A.2 in the Appendix) reveal that this compositional change is due to declining levels of R&D expenditure in electronics rather than a lower growth rate in that sector compared to other sectors. In Japan, R&D expenditure in the electronics sector declined on average by some 4 per cent annually during 2008-2012. The EU[7] witnessed a similar trend but to a lesser extent – R&D expenditure in the electronics sector declined annually by 0.7 per cent on average during 2008-2011.

Motor vehicles and other transport equipment accounts for the largest share of business R&D expenditure in the EU and its share has been increasing. The average annual growth rate of business R&D expenditure in that sector was some 2.7 per cent during 2008-2011, the same as in machinery.

5 EU comprises here AT, BE, CZ, DE, DK, ES, EE, FI, FR, UK, HU, IT, PL, PT, RO, SK and SL.
6 Data for the EU refer to the period 2007-2011, except for Denmark, for which 2007 data are missing and are replaced with 2009 data.
7 EU comprises here AT, BE, CZ, DE, ES, EE, FI, FR, HU, IT, NL, PL, PT, RO and SL.

An interesting development between the US and the EU is the diverging trend in business R&D expenditure in the manufacture of motor vehicles. In Europe, business R&D (constant PPP dollars) in the sector increased by 12 per cent between 2007 and 2011 compared to a 32 per cent decline in the US. In the US, over half of R&D expenditure is in the high-technology sectors of pharmaceuticals and electronics, although the share has been falling due to a 2.4 per cent annual reduction in pharmaceutical R&D and stagnation of R&D in electronics.

Figure 6 Distribution of industrial business R&D across different sectors (by main activity)[7,8]



Source: OECD, Structural Analysis (STAN) Databases

3.2. EU-28 R&D performance

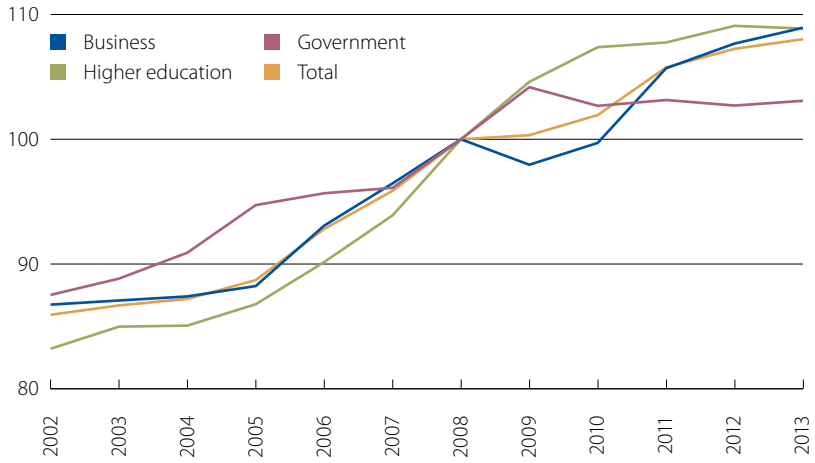
3.2.1. Overall development

In the EU, total R&D expenditure[9] continued to grow throughout the crisis (Figure 7), but the contribution of different R&D performers to growth varied. In 2009, the business sector reduced its R&D expenditure, but this decline was balanced by countercyclical public R&D expenditure. In 2010, firms' R&D expenditure started to recover, while the sovereign debt crisis and related austerity programmes weighed on government R&D. Compared to government R&D, higher education R&D expenditure fared somewhat better, but since 2010 R&D growth in the higher education sector has also stalled. Overall, the growth of total R&D expenditure is still below the pre-crisis average of 2.6 per cent (2003-2008) due to weaker public sector R&D. Aggregate business sector R&D seems to have recovered relatively well compared to the pre-crisis situation (Table 1).

8 Data for the EU refer to the period 2007-2011, except for the Netherlands, for which 2007 data are missing and are replaced with 2008 data.

9 Throughout this subsection, R&D expenditure refers to R&D expenditure in constant 2005 prices derived using GDP deflators. Country-specific figures are expressed in national currencies while EU aggregates are expressed in euros.

Figure 7 **EU-28 R&D expenditure by performer (2008=100)**



Source: Eurostat

Table 1 **Evolution of average annual growth rates of aggregate EU-28 R&D expenditure by different performers (per cent)**

	2003-2008	2009-2013	2009-2010	2011-2013
Total R&D	2.6	1.6	1.0	2.0
Business R&D	2.4	1.7	-0.1	3.0
Government R&D	2.2	0.6	1.3	0.1
Higher education R&D	3.1	1.7	3.6	0.5

3.2.2. Heterogeneity within the EU

Aggregate R&D expenditure in the EU is largely driven by a few large R&D spenders. This is due to the fact that R&D expenditure in the EU continues to be geographically concentrated. Germany alone, the largest R&D spender in the EU, accounts for 30 per cent of the expenditure. The combined share of the three largest R&D spenders (Germany, France and the UK) is 61 per cent. On the other hand, the cohesion countries[10] account for only some 4 per cent of total R&D expenditure. It is therefore not surprising that the aggregate trends hide considerable heterogeneity across the Member States. In fact, heterogeneity increased during the post-crisis period. The standard deviation of country-specific average annual growth rates increased from 4.9 during 2002-2008 to 5.4 during 2009-2013. The dispersion was highest during 2009-2010, with a standard deviation of 7.2, and declined to 5.6 in 2011-2013.

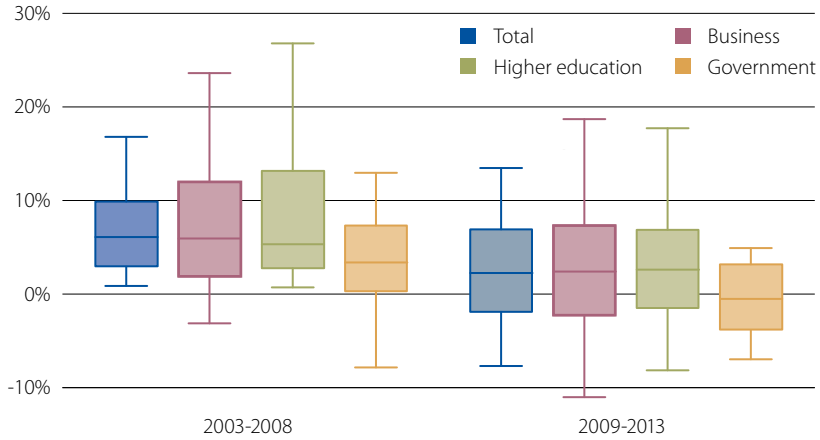
Visually, the increase in the dispersion of the average annual growth rate of total R&D expenditure can be assessed by the increase in the range spanned by the blue boxes in Figure 8 from the pre- to post-crisis periods.[11] Red, green and yellow boxes show the dispersion of growth rates of R&D carried out by different sectors. Clearly the range shifted downwards for all the different R&D performers. All the medians were lower during the post-crisis period and also the dispersion below the median increased, except for government R&D. Overall, as indicated by the standard deviation, the dispersion of the average annual growth rate of total R&D expenditure increased (blue boxes in Figure 8). The range

10 The cohesion countries group consists of all the members that joined the EU in or after 2004, except Cyprus. The name of the group derives from the fact all these countries are eligible for financing from the EU's Cohesion Fund for the period 2014-2020.

11 The bottom edge of the box plots the lower quartile, meaning that 25 per cent of observations are below that value. The horizontal line inside the box plots the median value. The upper edge of the box plots the upper quartile indicating that 25 per cent of observations are greater than that value. Top and bottom bars represent the maximum and minimum values excluding outliers. An observation is considered an outlier if it is more than 1.5 times the upper or lower quartile.

widened from 0.8–16.8 per cent to -7.8–13.5 per cent, indicating increasing heterogeneity in the R&D performance of EU countries. This is especially due to increased dispersion of the growth rate of business R&D expenditure across the EU (red boxes in Figure 8). The average annual business R&D growth rate varied between -11.2 and 18.7 per cent during 2009-2013 to a range of between -3.2 and 23.6 per cent during 2003-2008.[12] In contrast, government R&D growth rates converged to relatively low levels, as a consequence of government budgetary constraints across the board.

Figure 8 **Dispersion across the EU of annual growth rates of total R&D by different performers during pre- and post-crisis periods**



Source: Eurostat

Figure 9 plots the average annual R&D growth rates during 2009-2013 for all the EU countries except Greece, for which no complete data are available. The countries are classified into four different performance groups based on their average innovation performance according to the Innovation Union Scoreboard 2014 (European Commission, 2014). The groups are "Innovation leaders", "Innovation followers", "Moderate innovators" and "Modest innovators". The black lines in the figure show the average annual growth rates of GDP during 2009-2013. The figure shows that the dispersion of R&D growth rates is widespread. The level of "innovativeness" – as measured by the Innovation Union Scoreboard – does not seem to explain the diverging developments, given that in all the country groups R&D expenditure declined in some countries and increased in others. Looking at the average annual growth rate of GDP during the period (black lines) suggests that differences in the recent economic performance alone do not seem to explain the heterogeneity either.

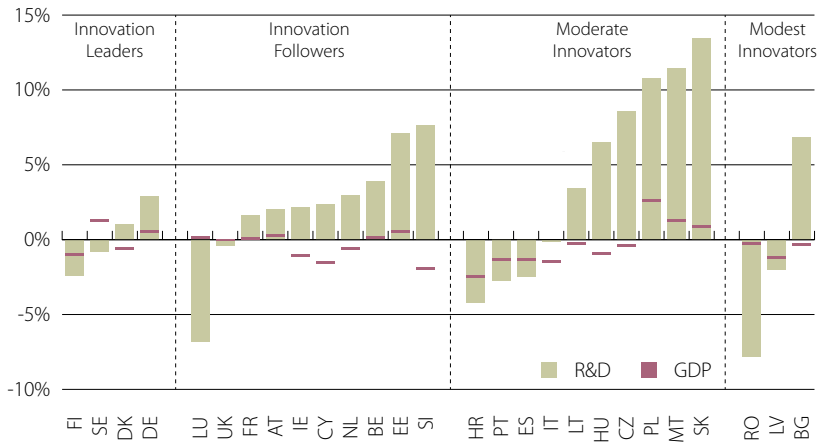
Similarly the evolution of R&D expenditure diverges within the core Member States, crisis-hit countries and cohesion countries.[13] Of the crisis-hit countries, Spain and Portugal experienced a decline in R&D expenditure during 2008-2013, while in Ireland and Cyprus R&D expenditure rose – despite weak overall economic performance. In Ireland, the increase was entirely due to R&D carried out by the business sector, whereas in Cyprus increased spending on higher education R&D explains the positive growth rate (see Table A.3 in the Annex). Among the core countries, R&D expenditure declined in Luxembourg and the UK, but also in the most R&D-intensive countries Finland and Sweden. These declines were mainly the result of weak business sector R&D combined with reductions in government R&D (except for Luxembourg). Cohesion countries show the most consistent behaviour, with R&D expenditure increasing strongly in the majority of the countries. But even in this group of countries, Croatia, Romania and Latvia experienced weak R&D performance. High growth rates in the majority of cohesion countries demonstrate the increasing emphasis of those countries on improving their innovation capabilities.

12 Both periods have one outlier above the range that is excluded.

13 The core countries group comprises Austria, Belgium, Denmark, Finland, France, Germany, Italy, Luxembourg, the Netherlands, Sweden and the UK. Crisis-hit countries consist of those that were most severely affected by the crisis, namely Cyprus, Greece, Ireland, Portugal and Spain. Greece, however, is not covered in this chapter because of incomplete data.

Strong R&D growth in the business sector is often combined with significant increases in higher education R&D but also in government R&D (see Table A.3 in the Appendix). Nevertheless, relatively low levels of R&D spending also contribute to the high growth rates of R&D expenditure in these countries.

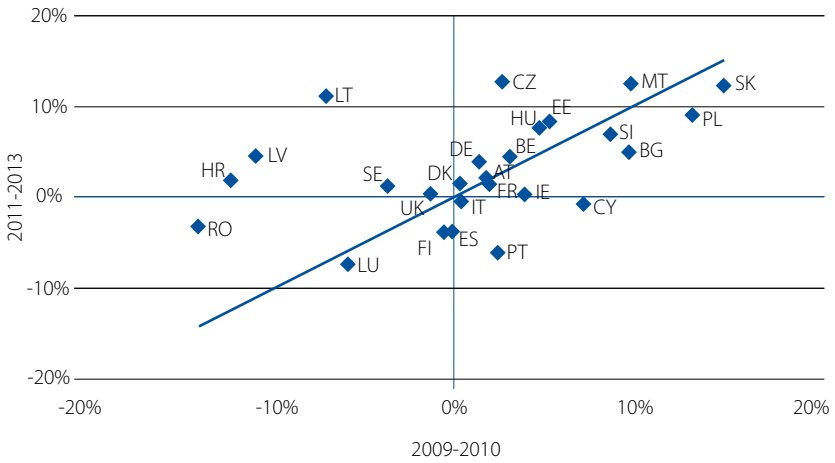
Figure 9 **Average annual growth rates of total R&D expenditure across the EU-28 countries during 2009-2013**



Source: Eurostat

Figure 10 provides a more detailed look at developments during the post-crisis period by plotting the country-specific average annual R&D growth rates for the periods 2009-2010 and 2011-2013. Points on the 45-degree line have the same average annual growth rate in the two periods. For countries above the line the growth rate was higher during the most recent period and for countries below the line the opposite was true. Clearly there are more countries above the 45-degree line, suggesting a temporary effect of the crisis on R&D expenditure during 2009-2010 and recovery thereafter. However, the figure also points to weaknesses in the recovery process. During 2011-2013 there were still eight countries with zero or negative average annual R&D growth – compared to nine during 2009-2010 – and five of those had negative or zero average annual growth during both periods (Luxembourg, the UK, Finland, Spain and Romania).

Figure 10 **Average annual growth rate of total R&D expenditure in 2009-2010 and 2011-2013 across EU-28 countries**



Source: Eurostat

3.2.3. Funding sources for business R&D expenditure

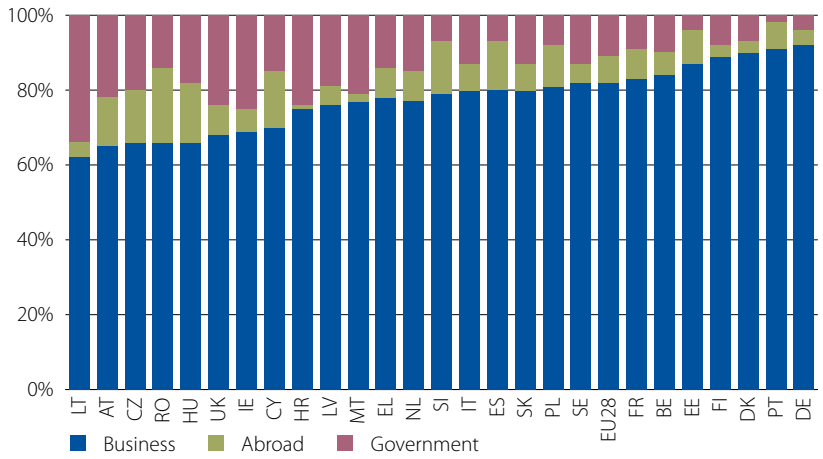
The funding of business sector R&D comes from various sources. Usually statistics cover financing from abroad (Abroad), from the domestic business sector (Business), from the government (Government), from the higher education sector and from private non-profit institutions. In general, the role of the last two is marginal; in 2012, the combined share of these two sectors was less than 0.3 percentage points in the EU. Therefore the focus here is on the other three sectors. "Business" covers funding from the enterprise sector in the country in question, "Government" consists of funding from all bodies, departments and agencies of government, and "Abroad" refers to R&D carried out domestically but financed by public and private sources from abroad.[14] Government funding consists of direct funding of business R&D via public procurement and grants but excludes indirect funding such as tax incentives.

The vast majority of R&D carried out in the business sector is also funded by the domestic business enterprise sector. Figure 11 shows the shares of business R&D funded by Business, Government and Abroad for the EU countries in 2012 (excluding Bulgaria and Luxembourg, for which complete data were not available). The share of business R&D financed by the domestic business sector varies from 62 per cent in Latvia to over 90 per cent in Germany and Portugal.

The largest shares of funding from Abroad can be found in the cohesion countries such as Lithuania, the Czech Republic, Croatia, Latvia, Malta and Hungary. This is due to the important role EU funds play in financing business R&D in these countries, but also the relatively high share of business R&D conducted by foreign-owned firms (Czech Republic, Croatia, Malta, Hungary). Also some core countries have relatively high shares of funding from abroad, in particular Austria, Ireland and the UK. According to OECD statistics, all of them have at least half of their business R&D carried out by foreign affiliates.

The highest shares of government-funded business R&D can also be found in the cohesion countries, but this is at least partly explained by relatively low levels of business R&D in general. Of the core countries, Austria and Spain are to some extent outliers, with their roughly 13 per cent share of business R&D funded by the government. In Austria, the share has been constantly increasing over the last decade, even during the crisis years, while in Spain the fiscal consolidation measures have pushed the share down from the 18 per cent peak in 2008. However, it is worth bearing in mind that indirect government support for business R&D, such as tax incentives, is not included in the figures for government-funded business R&D.[15]

Figure 11 Distribution of business R&D expenditure across different funding sources in 2012[16]



Source: Eurostat

14 For more details see Frascati Manual (OECD, 2002).

15 The majority of EU countries have some sort of tax incentives in place and in some countries, such as France, Belgium, Ireland, the Netherlands and Portugal, they play a larger role than direct government funding.

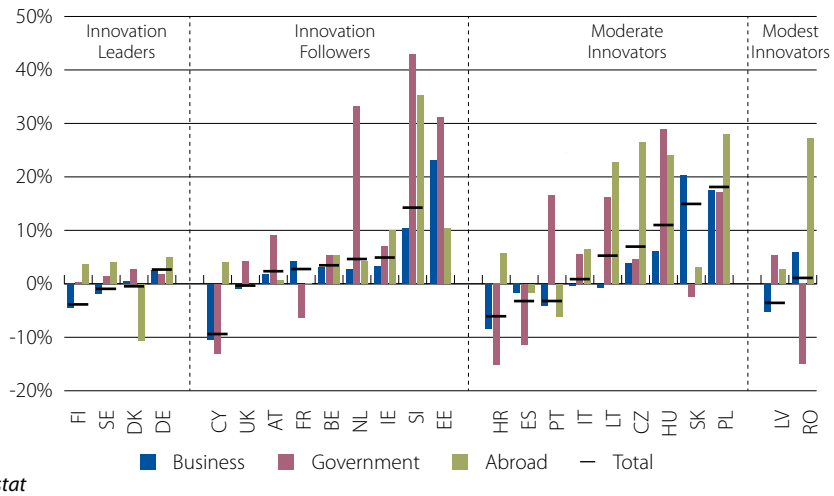
16 Data for Austria, Belgium and Sweden refer to 2011.

The average annual growth rates of business R&D by different sources of finance indicate that financing from abroad continued to grow in all but four countries (Denmark, the UK, Spain and Portugal) during the period covered (Figure 12). This trend was particularly strong among the cohesion countries, a development that is again explained by foreign multinationals' R&D activities in the country and/or the high reliance of R&D activities on EU funds. Of the crisis-hit countries, Ireland has experienced a relatively rapid growth of R&D funding from abroad. This is the result of policies to attract R&D-intensive FDI. Unfortunately the data coverage is not wide enough to differentiate between different sources of funding from abroad.

Government funding of business R&D continued to be a priority in a number of countries. In 18 countries out of the 24 covered in Figure 12, government funding of business R&D increased during the crisis years. The highest growth took place in some of the cohesion countries (again partly due to low levels), but also several other countries experienced positive growth rates for government-funded business R&D. Of the crisis-hit countries, Ireland and Portugal increased direct government support for business R&D. Among the core countries this applied to the Netherlands and Austria in particular. France seems to be an exception in this respect, as government-funded business R&D declined significantly during the crisis. However, France uses fiscal incentives extensively to support business R&D, which is not included in the figures. According to OECD (2013), the tax incentive share of government funds for R&D was close to 70 per cent in France in 2011, compared to some 38 per cent in 2006. During 2006-2011, tax incentive support in France grew by over 20 per cent annually. Also in Belgium and Ireland tax incentive support for business R&D increased significantly during 2006-2011 and accounted for close to 70 per cent and 75 per cent respectively of government funds for business R&D in 2011.

Given that the large majority of business R&D is also financed by domestic businesses, it is not surprising that the overall development of business R&D is in general driven by domestic business-financed R&D. Latvia and Italy are the only countries where funding from the government and from abroad has managed to offset declining business sector funding, resulting in an overall increase in R&D carried out in the business sector. However, the decline in domestic business sector funding has been modest in both countries. In general, it seems that for the majority of countries with positive business R&D growth rates, increased financing from the domestic business sector is backed up by increased funding from government and from abroad. This suggests potential complementarities between the different sources of finance.

Figure 12 Average annual growth rate of different sources of finance for business R&D during 2009-2012. Countries are sorted according to the average annual growth rate of total business sector R&D.[17]



Source: Eurostat

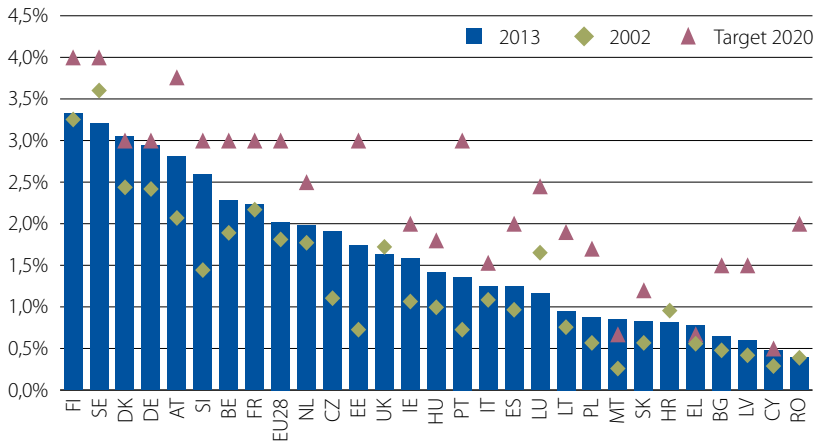
17 Malta is excluded from the figure as an outlier (annual growth rate of government funding was 85 per cent). For the Netherlands and Poland the data refer to 2008-2012, for Austria and Sweden to 2008-2011 and for Belgium to 2009-2011.

3.2.4. Progress towards EU2020 targets

To conclude, this sub-section looks at progress made towards the EU2020 R&D targets. The EU's Europe 2020 strategy put forward the goal of a smart, sustainable and inclusive EU economy. In order to achieve this, one of the five objectives to be met by 2020 is to invest 3 per cent of GDP in R&D. As Figure 3 above indicates, the overall progress towards the target has been slow. Achieving the objective relies to a large extent on efforts made at the country level. Accordingly, each country has adopted its own targets that together would enable the EU as a whole to meet the objective.

Overall, for the majority of EU countries there is a considerable gap between 2012 levels and the 2020 targets. This is documented in Figure 13, which presents the national R&D intensity targets and the situation in 2013. That said, there are significant differences between the EU countries, and some of them have already met or are very close to meeting the target. This includes countries with fairly low targets (Cyprus, Greece, Malta) but also those that had relatively high R&D intensities to start with (Germany, Denmark). It is also clear that to reach the 2020 targets there would need to be a significant step change from the pace of progress over the past ten years. For 18 countries (out of the 25 that have set a target), the remaining gap between current R&D intensity and the target is greater than the increase in R&D intensity during 2002-2012. According to the European Commission (2014), only four countries (Estonia, Ireland, Hungary and Finland) on top of the ones mentioned above are likely to meet their 2020 R&D target if the progress made over 2000-2011 is repeated over 2011-2020.

Figure 13 R&D intensity in 2013 and in 2002 and the national EU2020 R&D targets across the EU-28 countries[18]

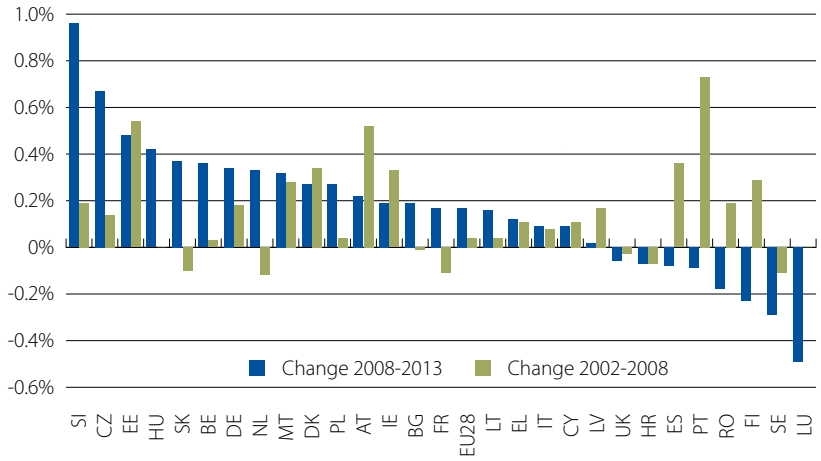


Source: Eurostat

Furthermore, it seems that weak GDP developments during 2008-2013 played a non-trivial role in explaining progress in R&D intensities until 2013. Figure 14 shows the changes in R&D intensity during a pre-crisis period of 2002-2008 and a post-crisis period of 2008-2013. Although the pre-crisis period is one year longer than the post-crisis one, the figure demonstrates that in many countries the progress intensified during the post-crisis period. For the EU as a whole the modest progress towards the target occurred almost entirely during the latter period – even though the growth in R&D expenditure slowed down. The positive side to this development is that in general R&D expenditure reacted less to the crisis than GDP. Nevertheless, it also raises the question of what will happen to R&D intensities when GDP growth starts to pick up again. There might be some downward correction in R&D intensities in the coming years. This underlines the need to try to boost EU R&D expenditure – particularly business R&D expenditure – if the EU2020 target is to be achieved.

18 Data for Ireland refer to 2012 instead of 2013, data for Greece, Sweden, Ireland and Luxembourg refer to 2003 instead of 2002, and data for Lithuania refer to 2004 instead of 2002.

Figure 14 Change in R&D intensity in two periods[19]



Source: Eurostat

19 Data for Ireland refer to 2012 instead of 2013, data for Greece, Sweden, Ireland and Luxembourg refer to 2003 instead of 2002, and data for Lithuania refer to 2004 instead of 2002.

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Appendix

Table A.1. The share of R&D expenditure by different sectors in selected countries in 2000, 2007 and 2012, in per cent

		Business	Government	Higher education	Private non-profit
China	2000	60	31	9	
	2007	72	19	8	
	2012	76	16	8	
EU-28	2000	64	14	21	1
	2007	63	13	23	1
	2012	63	13	24	1
Japan	2000	71	10	15	5
	2007	78	8	13	2
	2012	77	9	13	1
South Korea	2000	74	13	11	1
	2007	76	12	11	1
	2012	78	11	10	1
USA	2000	74	11	11	4
	2007	71	12	13	4
	2012	70	12	14	4

Source: OECD, Main Science and Technology Indicators

Table A.2. Average annual compound growth rate in business R&D expenditure (constant PPP dollars) in selected countries across sectors during 2008-2011 for the US and the EU, during 2008-2012 for Japan and South Korea and during 2009-2012 for China, corresponding NACE Rev. 2 codes in parenthesis, in per cent

	US	EU	JP	KR	CH
Food, textiles, wood, paper (10-18)	1.8	1.8	-2.4	9.4	24.7
Rubber, plastics, mineral products, fuel products, metals (19, 22-25)	-1.8	3.6	-1.3	10.8	20.1
Chemicals (20)	3.1	-1.3	-0.6	9.6	19.6
Pharmaceuticals (21)	-2.4	1.8	2.2	9.1	24.0
Computer, electronic and optical products (26)	0.2	-0.7	-4.3	11.5	15.4
Electrical equipment (27)	5.8	1.5	-3.1	10.4	17.3
Machinery (28)	8.9	2.8	-0.1	9.9	17.8
Motor vehicles, transport equipment (29, 30)	-0.7	2.7	0.4	2.7	18.9
Other (31-33)	5.7	4.5	4.6	13.5	31.5

Source: OECD, Structural Analysis (STAN) Databases

Table A.3. Average annual compound growth rate of R&D expenditure (constant 2005 prices in national currency) by performer in the EU countries during 2009-2013, in per cent

	Total	Business	Higher education	Government
AT	2.0	1.9	2.5	1.2
BE	3.9	4.2	3.8	3.6
BG	6.8	22.3	4.6	-6.7
CY	2.4	-5.3	8.1	-6.7
CZ	8.6	6.9	17.7	4.0
DE	2.9	2.5	3.9	3.8
DK	1.1	-0.3	4.3	-0.6
EE	7.1	9.2	6.8	1.4
ES	-2.5	-3.1	-1.7	-2.0
FI	-2.4	-3.9	2.1	-0.3
FR	1.7	2.3	2.4	-2.2
HR	-4.2	-1.8	-8.3	-4.0
HU	6.5	12.6	-2.2	-2.7
IE	2.2	4.9	-2.5	-4.6
IT	-0.1	0.0	-1.6	3.1
LT	3.5	4.9	4.1	0.3
LU	-6.8	-11.2	12.0	0.5
LV	-2.0	0.5	-4.0	-1.0
MT	11.5	7.3	15.1	34.2
NL	3.0	5.9	-0.6	0.6
PL	10.8	18.7	7.7	4.8
PT	-2.8	-3.8	-0.9	-7.1
RO	-7.8	-7.4	-14.6	-4.3
SE	-0.8	-2.4	4.6	-3.9
SI	7.7	11.4	2.4	-3.0
SK	13.5	15.2	20.7	3.3
UK	-0.4	0.4	-0.6	-4.8
EA-18	1.7	1.9	1.5	1.2
EU-15	1.3	1.4	1.5	0.6
EU-28	1.6	1.7	1.7	0.6

Source: Eurostat

Part II

Investment finance

Chapter 4

Recent developments in investment finance

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Recent developments in investment finance

Chapter at a glance

After falling between 2007 and 2009, gross savings have been increasing in the EU as gross investment has declined. As a result in 2011 the EU became a net exporter of capital for the first time since 2005. Governments, especially in the core countries, and corporates in the VMS and cohesion countries were the largest contributors to rising gross savings. Increasing net capital outflows from the EU and declining investment signal lower risk-adjusted returns relative to the rest of the world.

Non-financial corporations (NFCs) in most EU members have been net lenders since 2009. Except in some cohesion countries, NFCs have, on average, reduced leverage consistently over the past five years. Long-term financing as a share of total debt has increased in the core countries and in the VMS over the past five years. At the same time, bank credit to NFCs has been very weak and has, to a certain extent, been substituted by debt-market financing, especially in the core countries. Spreads in lending rates between the core and vulnerable countries in the euro area have remained persistently high. These spreads reflect an environment of higher credit risk in the VMS but also of more restricted access to finance.

Project finance has been on a downward path since 2011, with the largest declines incurred by the cohesion countries. In public-private partnerships some signs of breaking away from this path became evident in 2013, as volumes increased for the first time since the beginning of the financial crisis and financing conditions marginally improved.

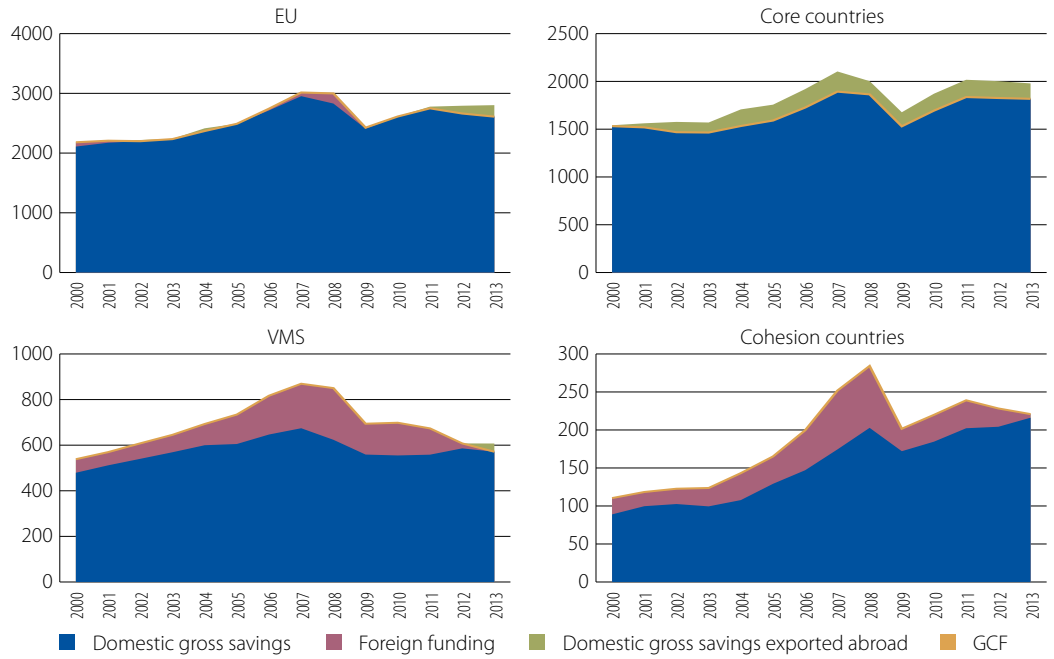
The aim of this chapter is to review the recent developments in investment finance. Investment finance is made available by savers – households, corporates and governments – both domestic and foreign. Savings reach investors typically through the financial system, i.e. through banks, capital markets, private equity, etc. Financial systems play an important role in allocating savings to investment projects by transforming maturities, evaluating and pricing risks, screening investment projects and channelling funds from regions with excess savings to those with a shortage. The first part of this chapter examines the sources of savings, whether domestic or foreign, and by institutional sector. The second part looks at the uses of savings for non-residential investment by non-financial corporations and project companies.

4.1. Domestic versus foreign funding

In a closed economy, investment must be equal to domestic savings. In open economies, such as those in the EU, investment equals the sum of domestic savings and net foreign funding.[2] The inflow of foreign funds is the result of resource relocation from countries with relatively low returns on investment to countries with relatively high returns on investment. This removes the constraints that domestic savings impose on investment in closed economies.

Figure 1 plots domestic savings, gross capital formation (GCF) and net foreign funding for the EU and three groups of countries in the EU. The core countries group consists of ten developed EU economies, the cohesion countries[3] group consists of eleven lower-income EU economies characterised by investment and financing patterns that are different from those of the core countries. Finally, the vulnerable Member States (VMS) group is composed of both high and lower-income EU members that have been affected far more by the recent financial and economic crises than the other economies in the EU.

Figure 1 Gross savings and net foreign funding, EUR bn, EU



Source: AMECO.
Notes: "Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.

2 Investment here is taken to be gross capital formation, which is the sum of gross fixed capital formation (GFCF), changes in inventories and the net acquisition of valuables. Inventories can be stocks of materials, work in progress or finished goods.

3 The name of the group derives from the fact that all countries in this group are eligible for funding from the EU's Cohesion Fund in the programme period 2014-2020.

After being a borrower of foreign funds to finance investment between 2006 and 2010, the EU turned into a net exporter of savings (see Figure 1). In 2013 gross savings exceeded GCF in the EU countries by nearly 7 per cent, i.e. 7 per cent of gross domestic savings were exported abroad. Both increased savings and declining investment after 2010 contributed to this reversal.[4] The increase in aggregate EU savings was the result of two opposing developments after 2010 – a marginal decline in gross savings in the core countries, offset by a steeper increase in gross savings in the VMS and cohesion countries. In the core countries, domestic funds exported abroad have remained constant as a share of total gross savings over the past three years due to the simultaneous and similar decline in both savings and investment. In the VMS, after 2010 nominal investment accelerated its decline, while gross savings accelerated their increase. As a result, in 2013 the VMS exported 6 per cent of domestic savings abroad, having been a net borrower from abroad during the preceding decade. In that period, the VMS attracted foreign funding that amounted, on average, to 21 per cent of domestic savings per year. In the cohesion countries, developments that were qualitatively similar to those in the VMS – falling investment in 2012-13 and a rapid increase in gross savings – reduced implicit demand for foreign funding to 2 per cent of gross domestic savings. This is in contrast to the average foreign funding in the preceding decade of 27 per cent of gross domestic savings per year.

In this way the rapid increase in foreign capital inflows before the economic and financial crisis was more than offset by the fall in the wake of the twin crises – the banking and sovereign debt crises. The bulk of the adjustment in the cohesion countries was carried out over a much shorter period and was more marked than in the VMS group. As argued by Gros and Alcidi (2013), this was due to three important factors. First, the financing channel through the Eurosystem provided a buffer for the banking systems in the VMS that mitigated the blow from the sudden decline in foreign capital inflows. Second, fiscal policy in the cohesion countries was much more contractionary and therefore government finances adjusted much more quickly than in the VMS group. Finally, significant foreign ownership of banks in the cohesion countries acted as a loss absorber and, consequently, as an indispensable buffer to the legacy problems of previous excesses in the cohesion countries. In contrast, in the VMS the costs associated with the banking crisis continue to delay full adjustment.

4.1.1. Decomposition of foreign capital flows

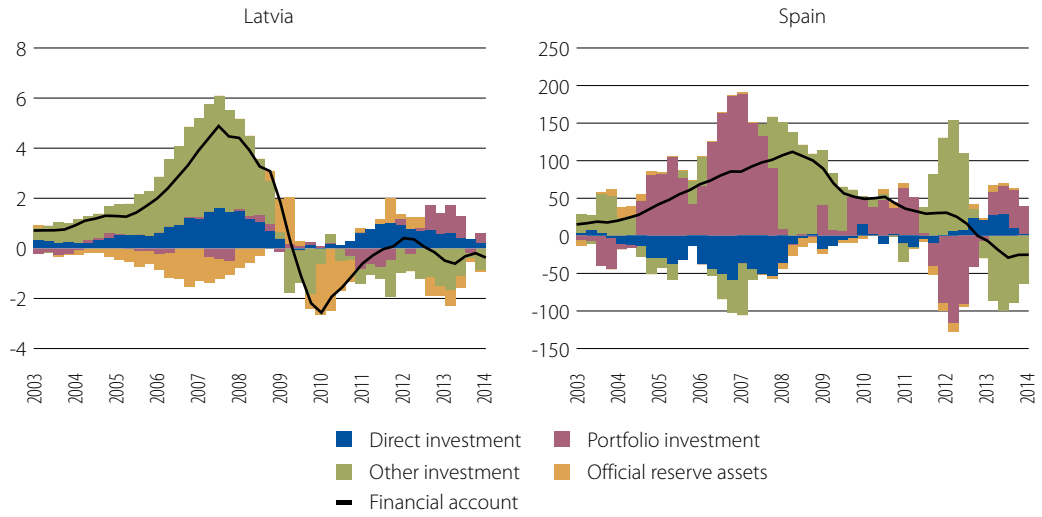
In several cohesion countries the large financial account surplus shrank rapidly in 2008 and 2009, declining to the levels of 2005 and earlier. This group includes Latvia (see left-hand panel of Figure 2), Bulgaria, Estonia, Lithuania, Hungary, Croatia, Romania and Slovenia. All of them had surges of net inflows of "other investment" (mostly bank loans) and direct investment (FDI) before 2008. After 2008, net "other investment" turned negative as foreign-owned banks began to withdraw funds from the region. According to an EIB survey of foreign banks operating in Central, Eastern and South Eastern Europe (CESEE), foreign banks with subsidiaries in the region have consistently decreased intra-group funding and direct cross-border bank loans since the beginning of the crisis (see further, European Investment Bank, 2014a).[5] FDI also fell significantly after 2008, leading to disappearing financial account surpluses and, in the case of the Baltic countries, large financial account deficits. Overall, financial account surpluses disappeared within a year and a half of the beginning of the financial crisis.

Inflows of FDI resumed in most of these countries after 2010, but tailed off again at the end of 2013. Financial account deficits persisted in 2013 and into 2014, reflecting continued overall net capital outflows. These outflows were mostly due to net increases in bank assets abroad, which were partly offset by net portfolio investment and net FDI inflows.

4 The decline in investment is documented in Chapter 1 of this publication.

5 The survey also finds, however, that foreign banks did not reduce their equity in CESEE subsidiaries.

Figure 2 Decomposition of foreign funding of EU economies, EUR bn



Source: Eurostat.
Notes: Plotted series are four-quarter moving sums of quarterly components of the balance of payments, in EUR bn.

In countries in the VMS group, which had also sustained large surpluses in their financial accounts before 2008, the adjustment took much longer, as discussed in Gros and Alcidi (2013). Large private net capital outflows were offset by even larger inflows of "other investment", consisting mostly of financing through the Eurosystem and official loans. In 2013 net portfolio investment turned positive in Spain (right-hand panel of Figure 2), Slovenia and Italy, but not in Greece, Ireland or Portugal. At the same time, net inflows through the Eurosystem declined in Spain, Italy and Slovenia. Spain, Ireland and Greece have received small net inflows of FDI since 2013.

An in-depth analysis of the impact of the financial crisis on capital flows requires consideration of gross capital flows too. As emphasised by Lane (2013), gross rather than net flows affect the allocation of funds and the diversification of risks across borders. Thus, coincident large capital inflows and outflows may be the outcome of economic dynamism and efficient allocation of capital across borders. They may, however, be a sign of heightened financial risks if resulting in domestic credit booms, over-indebtedness and a mismatch between cross-border assets and liabilities, as we were forcefully reminded during the financial crisis in 2007 and 2008.

Gross capital flows fell dramatically in all European countries in the wake of the financial crisis. In 2009, in many European countries both domestic and foreign investors repatriated assets, resulting in an outflow of foreign capital and the return of domestic capital invested abroad. Since 2009, gross capital flows have recovered to their pre-crisis levels in only four countries – the Czech Republic, Luxembourg, Slovakia and Sweden (Figure 3, top left-hand panel).

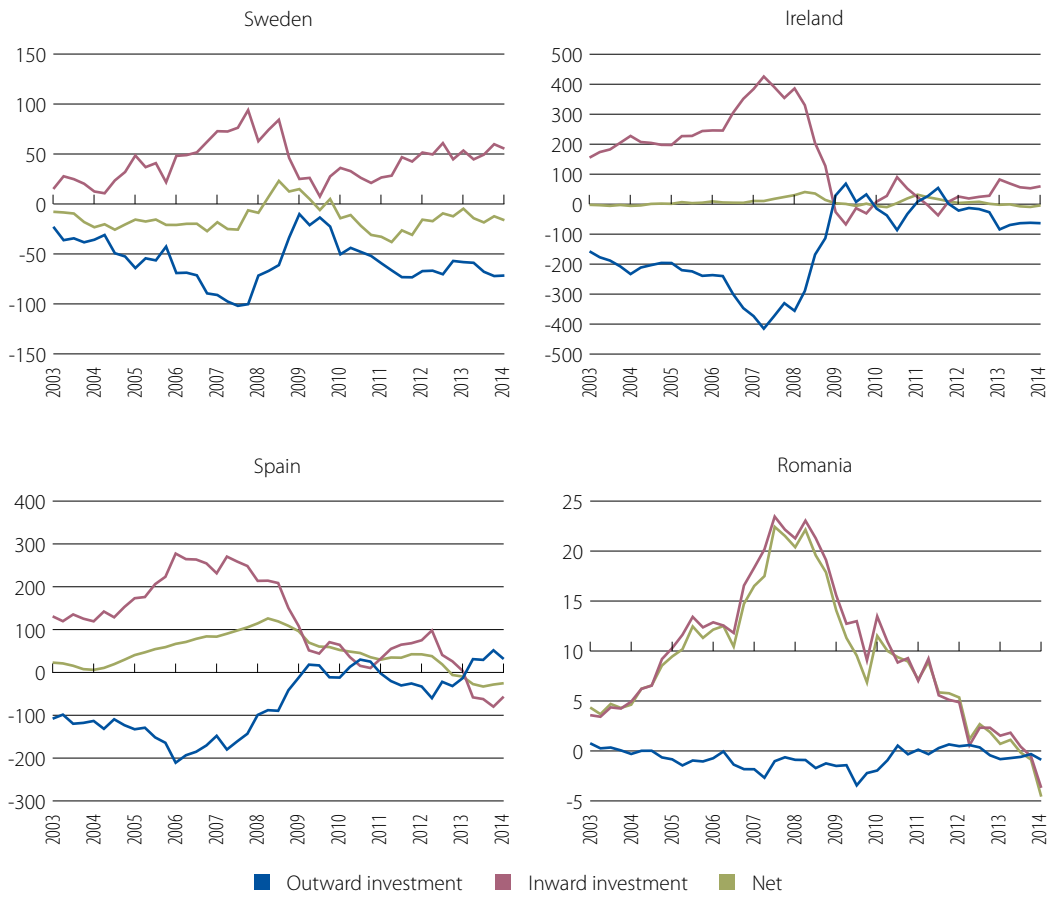
In the remaining EU members gross capital flows continue to be only a fraction of their pre-crisis levels, reflecting several different problems – the banking crisis in some countries, the sovereign debt crisis in the euro area, or longer-term problems that have been exposed by the twin crises. Depending on the main reason for the weakness of gross capital flows in a country, there have been several different patterns since 2009. In some countries gross capital flows stabilised at very low levels after the initial decline. In Ireland (top right-hand panel of Figure 3), for example, gross capital flows fell considerably when the financial crisis erupted and stayed very low for more than five years. Since early 2013 they have increased slightly but are still much lower than before the crisis. Gross capital flows in Estonia, Latvia and Bulgaria have followed a similar pattern.

In another group of countries gross capital flows picked up in 2010, as in Spain (Figure 3, bottom left-hand panel). This development was reversed, however, in 2012, and by early 2013 inward and outward

flows switched signs, indicating net repatriation of assets by both domestic and foreign investors. Gross capital flows in several other countries – Belgium, Germany, Italy, the Netherlands, Portugal and the UK – have followed a similar pattern.

Finally, in Hungary, Poland and Romania (bottom right-hand panel of Figure 3), inward capital flows have been declining since 2009 while net outward investment has been stable around zero, thereby resulting in a disappearing financial account surplus. There has been little sign of a recovery of inward capital flows.

Figure 3 Gross and net cross-border capital flows, EUR bn



Source: Eurostat.
Notes: Plotted series are four-quarter moving sums of quarterly components of the balance of payments, in EUR bn.

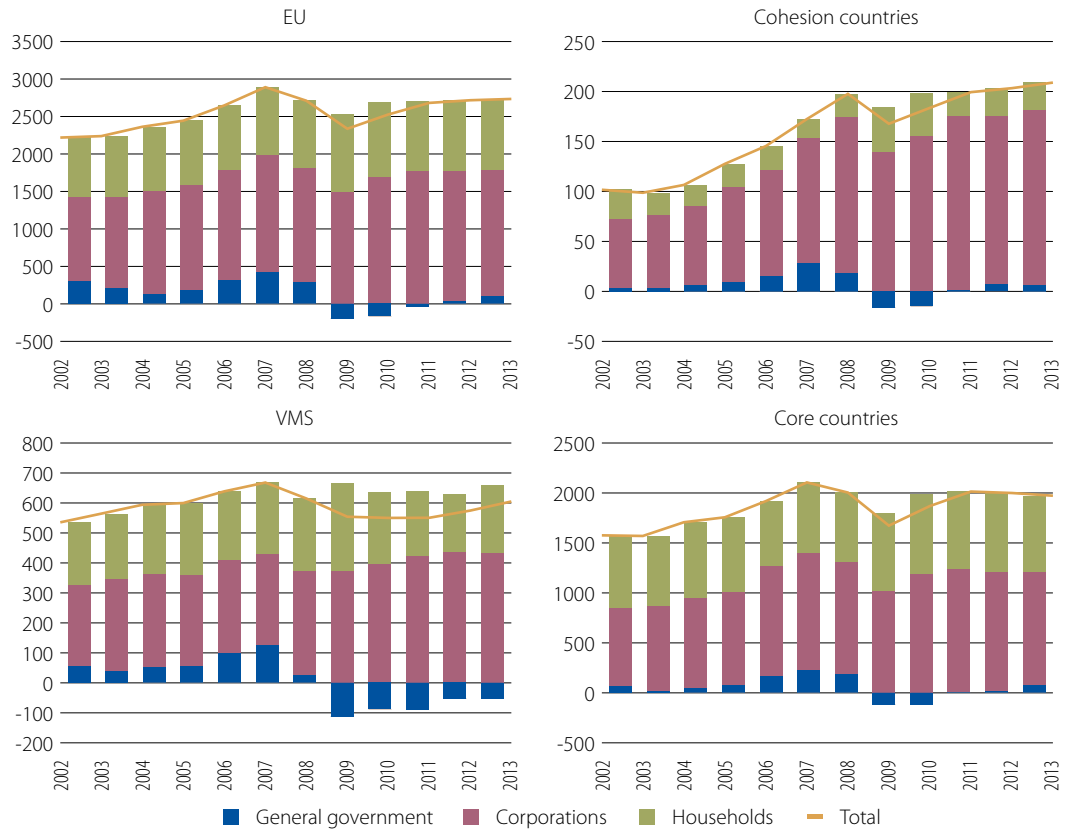
4.1.2. Decomposition of domestic savings

Figure 4 plots the decomposition of domestic savings by institutional sector and shows that the corporate sector is the largest saver in the EU, accounting for about two-thirds of total gross savings over the past five years. Among country groups there are substantial differences in the size of the corporate sector's share of total gross savings. In the cohesion countries the average share over the past five years is 84 per cent, while in the VMS it is 72 per cent and in the core countries 60 per cent.

As discussed in the preceding section, domestic savings in the EU have been increasing since 2010, after falling substantially between 2007 and 2009. At the end of 2013 they were near the 20-year average, as a share of GDP. Between 2010 and 2013, EU governments switched from being users of savings from the other sectors of the economy to generating positive gross savings, as a result of fiscal consolidation efforts.

As regards the change in total domestic savings in the EU over this period, governments made the largest contribution to this increase. By country groups, the largest contributors to increasing government savings were governments in the core countries. Households have reduced savings in all country groups since 2010. An important factor in this reduction has been the high and persistent level of unemployment over the period in question.

Figure 4 Decomposition of domestic savings by institutional sector, EUR bn



Source: AMECO.
Notes: "Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.

Gross savings of corporations have increased since 2009 in the VMS by 17 per cent and in the cohesion countries by 25 per cent. In the core countries they increased in 2010 by 17 per cent relative to 2009, but have since decreased by 5 per cent. These developments will be discussed in more detail in the following section, which focuses on non-financial corporations.

Overall, gross savings in the core and cohesion countries have stabilised at levels that are similar to those experienced in the recent past, given the level of income. In the VMS, they have been somewhat lower and the difference is almost entirely due to the household and government sector.

4.2. Financing of non-financial corporations

This section first takes a look at the decomposition of investment financing of NFCs into gross savings and net borrowing or lending. It then moves on to the flow of different financial market instruments such as debt securities, loans and equity transactions, as well as the composition of NFCs' outstanding liabilities. Focusing further on debt, this section analyses recent developments in the structure of debt and in bank lending to NFCs.

4.2.1. Internal finance, lending and borrowing, and capital transfers

In the EU, NFCs cover a substantial part of their investment financing needs with gross savings, while net capital transfers cover about 5 to 10 per cent of those needs (Figure 5). The remaining investment needs are financed externally.

Figure 5 Investment and savings by non-financial corporations, EUR bn

Source: Eurostat.
Notes: "Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.

Across the EU the use of external finance by NFCs is, on aggregate, closely related to foreign borrowing at the country level, with the notable exception of Italy.[6] Thus NFCs in the core countries have been net lenders in all years since 2002, except 2008, and the core countries have been net exporters of capital throughout this period (see Figure 1). On the other hand, NFCs from the VMS group borrowed heavily in the run-up to the financial crisis, at a time when the same countries attracted large net capital inflows. At the peak in 2008, NFCs from the VMS group financed more than 40 per cent of gross investment with borrowed funds. On average, NFCs in the core and cohesion countries have been net lenders since 2009, while NFCs from the VMS turned into net lenders in 2012, as external positions in those countries showed signs of improvement.[7]

6 This can be broadly explained by the fact that in Figure 4 the corporate sector makes up the largest share of domestic gross savings.
7 In Ireland and Spain NFCs have been net lenders since 2010.

Gross savings of NFCs in the EU started to increase again in 2013 in most of the EU economies, after two years of decline driven entirely by reductions in NFC savings in the core countries.[8] As explained in Wagenvoort and Torfs (2013), the increase in gross savings over this period could be the result of lower interest rate expenses, cost-cutting and reductions in dividends, the last two most likely being driven by concerns about access to finance, as companies are willing to hold more liquid assets as insurance against insufficient external finance. As pointed out in Chapter 1, debt reduction can be another legitimate reason for higher savings. This is particularly true for companies that have difficulties accessing external finance if their leverage ratio is perceived to be too high.

Increased savings in the VMS and the cohesion countries are probably the consequence of reduced availability of external finance and the focus on repairing balance sheets, whereas the decline in the core countries has been associated with the return to normal after the spike in savings during the years of heightened economic and policy uncertainty. The relative importance of access to finance, balance sheets and uncertainty, however, is difficult to assess from aggregate data and a greater focus on firm-level studies is needed.

Finally, it should be pointed out that increases in gross savings are not necessarily a negative development. High gross savings were observed in a number of core countries and in the US well before 2007. These savings were associated with acquisitions of productive assets abroad by NFCs and as such can be viewed as a sign of reallocation of capital to countries and regions where it is more productive.

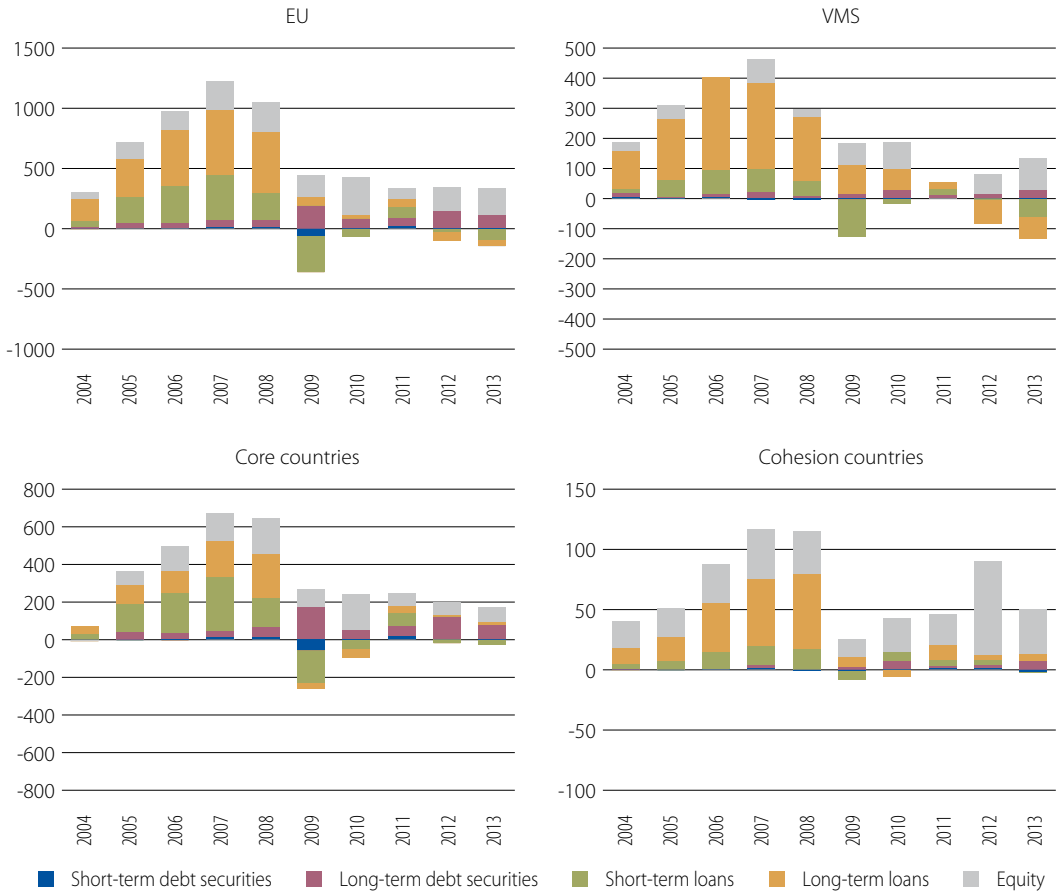
4.2.2. Debt versus equity

The preceding section described the external financing needs of NFCs on aggregate. In this section, we look at the instruments used to address those needs.[9] The liability structure of companies is important for a variety of reasons, including the structure of corporate taxation, riskiness of firms and problems of asymmetric information. For instance, for younger and more innovative firms, whose investments are typically perceived as riskier, the share of equity financing is higher than in older companies with well-established products and markets. Smaller firms have a more restricted direct access to capital markets due to relatively high fixed costs, leading them to rely largely on bank finance.

8 NFCs in Belgium, Denmark, Finland, France, the Netherlands, Slovakia and the UK decreased gross savings in 2013.

9 Of course it is not possible to identify each of these instruments' share of investment, as funds available to NFCs are fungible.

Figure 6 **Loan, securities and equity transactions of NFCs, EUR bn**



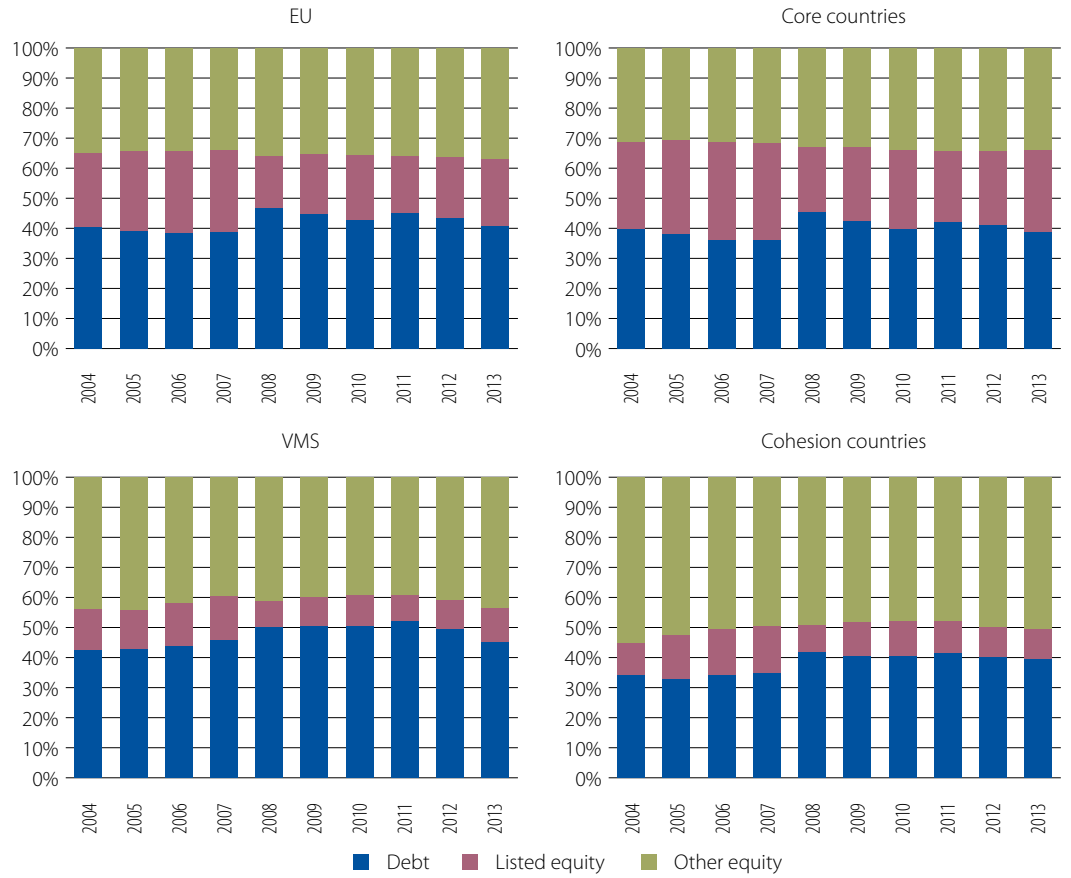
Source: *Eurostat.*
Notes: *"Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.*

Figure 6 plots the loan, securities and equity transactions of NFCs for the EU, as well as for the three groups of countries. While in the years before the financial crisis short and long-term loans dominated other sources of external finance in the EU, the composition changed substantially after 2009. Short-term loans declined every year, except in 2011. The weight of long-term loans declined significantly, and in 2012 and 2013 the amount of repaid long-term loans exceeded the amount of NFCs' new long-term loans. Increases in equity and long-term debt securities became more important during these years, offsetting the declines in outstanding loans.

These developments were broadly the same across country groups, although some differences do exist. The decline in loans was very pronounced in the VMS, while it was very small or non-existent in the cohesion and core countries. Equity transactions were dominant in the cohesion countries, whereas long-term debt securities had the largest share of transactions in the core countries.

Figure 7 plots the liability structure of NFCs. Debt accounted for about 40 per cent of liabilities of the EU's non-financial corporate sector before 2008. Its share increased in the crisis years and, six years on, it is still slightly higher than the pre-crisis levels. The decline in the share of debt started in 2009 in the core countries, while in the VMS it started only in 2011. Leverage in the cohesion countries in 2013 was somewhat lower than in 2008 and roughly on a par with 2009. The deleveraging was more pronounced in the core countries and the VMS than in the cohesion countries, but this reflects the fact that debt was already less important in those countries during the years preceding the crisis.

Figure 7 **Liability structure of NFCs, outstanding amounts**



Source: *Eurostat.*

Notes: *"Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.*

4.2.3. Decomposition of debt

Given the widespread deleveraging in the EU's non-financial corporate sector evident from the preceding chart, we further examine the structure of NFC debt.[10] Figure 8 plots the components of NFC debt in the EU and the three groups of countries examined in this chapter. The bottom two bars denote the two components of long-term debt – securities and loans – followed by the two bars denoting the two corresponding components of short-term debt, while the last bar denotes other accounts payable, representing mostly trade credit.

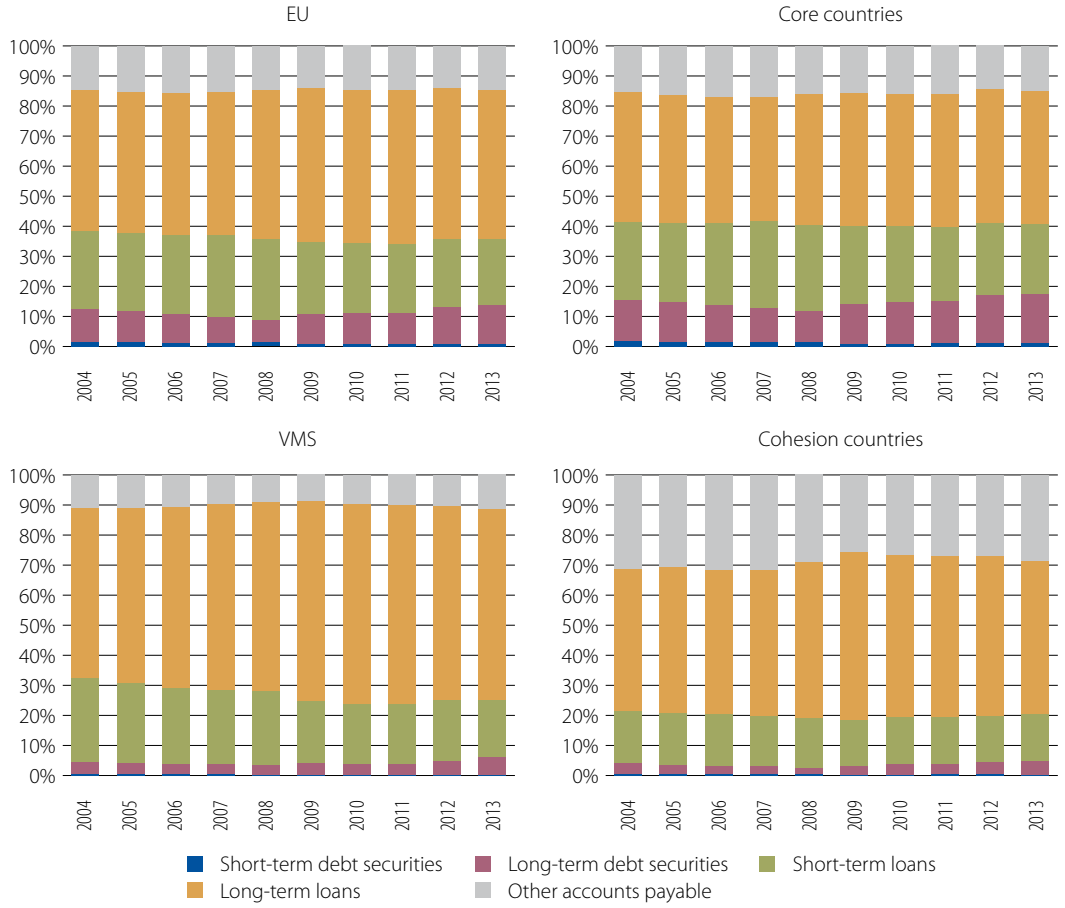
Loans represent the largest share of NFC debt in the EU – about three-quarters on average. This share is about 70 per cent in the core countries and is even lower (67 per cent) in the cohesion countries. In the VMS, loans' average share of total debt over the past ten years is 85 per cent.

The share of debt securities is about 10 per cent in the EU on average. This figure is heavily influenced by the share of debt securities in the core countries (14 per cent). In the cohesion countries and the VMS this share is around 4 per cent. Over the past ten years, debt market financing has increased only marginally in the EU – by 1½ per cent. The increase has been slightly larger in the core countries and smaller in the VMS and cohesion countries.

10 "Deleveraging" here means that the ratio of debt to equity has declined.

The share of EU NFCs' long-term debt has averaged about 60 per cent over the past ten years. Since 2009 this share has been rising, gaining 5 percentage points. Behind this trend has been the rising share of long-term debt in the core countries. In the VMS the share has been broadly constant, albeit at high levels, while it has declined in the cohesion countries. Low borrowing costs, especially in the core countries, may have been the reason for this increase, as companies tried to lock in debt at low interest rates for longer. A desire to secure liquidity in times of uncertain access to external financing may have been another reason for this development.

Figure 8 Debt structure of non-financial corporations, outstanding amounts



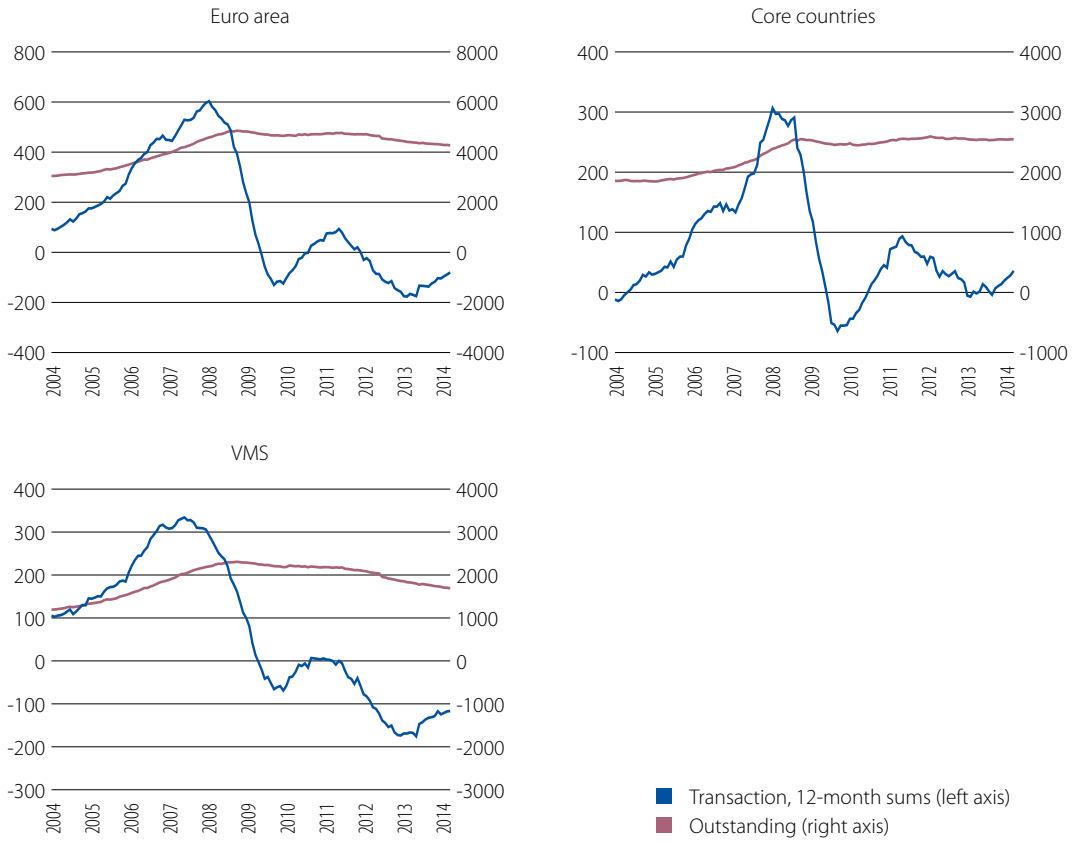
Source: *Eurostat.*
Notes: *"Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.*

4.2.4. Bank loans

As noted in the preceding chart, bank loans are the most important source of external debt finance for NFCs in the EU. Figure 9 plots loans from euro area monetary financial institutions (MFIs) to NFCs. The blue line traces the 12-month rolling sum of net loan transactions (measured on the left-hand axis) and the red line traces stocks of loans (right-hand axis). Net loan transactions in the euro area fell steeply after peaking at the beginning of 2008. Two years later they turned negative. After a brief recovery in 2011, net loan transactions fell again and have been negative ever since. Outstanding stocks by October 2014 were therefore nearly EUR 600bn below their early-2009 peak.

In the core countries the dynamics of loan transactions were similar until late 2011. Since then net loan transactions have fallen but remained mostly positive. They picked up again in the second quarter (Q2) of 2014. In the VMS, net loan transactions turned negative in 2009 Q2 and have been falling ever since, resulting in a decline in outstanding loan amounts of nearly 27 per cent, or about EUR 620bn.

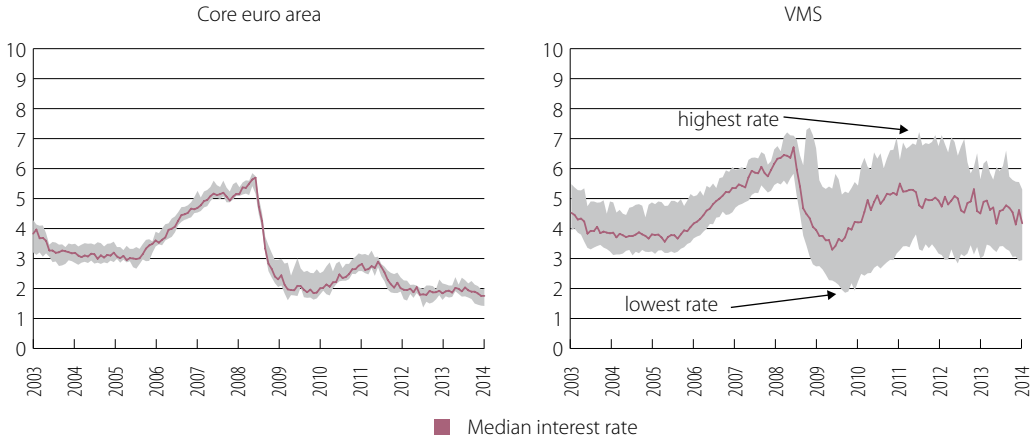
Figure 9 Loans from euro area monetary financial institutions to NFCs, EUR bn



Source: *ECB.*
Notes: *Data on the chart are rolling twelve-month sums of monthly data. "Euro area" denotes euro area, changing composition; "Core countries" include Austria, Belgium, Germany, Finland, France, Luxembourg and the Netherlands; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal.*

Interest rates on new loans in the euro area differ substantially between the core euro area countries and the VMS. Figure 10 plots median (across countries) interest rates on new loans, with rates initially fixed for up to 1 year, together with the range across countries, for the VMS and core euro area countries groups. At the beginning of 2014 Q4, these rates in the core countries were about twice as low as the median rate in the VMS – a spread of nearly 2½ percentage points. This spread widened between 2009 and late 2012 and has stabilised since then at this level. The range (spread) within the VMS is also very wide, from a minimum in Italy of 2.95 per cent to a maximum in Cyprus of 5.3 per cent.

Figure 10 Interest rates on new loans, with rates initially fixed for up to 1 year, at annual rates



Source: *ECB*
Notes: *The shaded area shows the range of interest rates within a group of countries, while the red line traces the median interest rate. "VMS" includes Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain. "Core euro area" includes Austria, Germany, Finland, France, Luxembourg and the Netherlands.*

The causes of weak lending are difficult to identify and disentangle. A recent EIB study (European Investment Bank, 2014b) argues that both demand and supply constraints are responsible for the falling lending volumes. On the demand side, weak growth and domestic demand have lowered NFCs' expected returns on their investments. These expectations have made debt levels look unsustainable and have prompted firms to reduce leverage. Lower leverage has also been essential for some firms to be able to borrow again.

Banks' risk-taking capacity is identified as a major supply-side constraint in European Investment Bank (2014b). Euro area banks have reduced their balance sheets substantially and about a third of the reduction is accounted for by the decline in loans to NFCs. In addition, banks shifted exposure from lending to NFCs to sovereign bonds, which are considered as lower-risk. Soaring levels of non-performing loans (NPLs), especially in the VMS, may further tighten constraints on banks' risk-taking capacity. European Investment Bank (2014b) presents evidence of NPLs' significant impact on credit growth.

4.3. Project finance

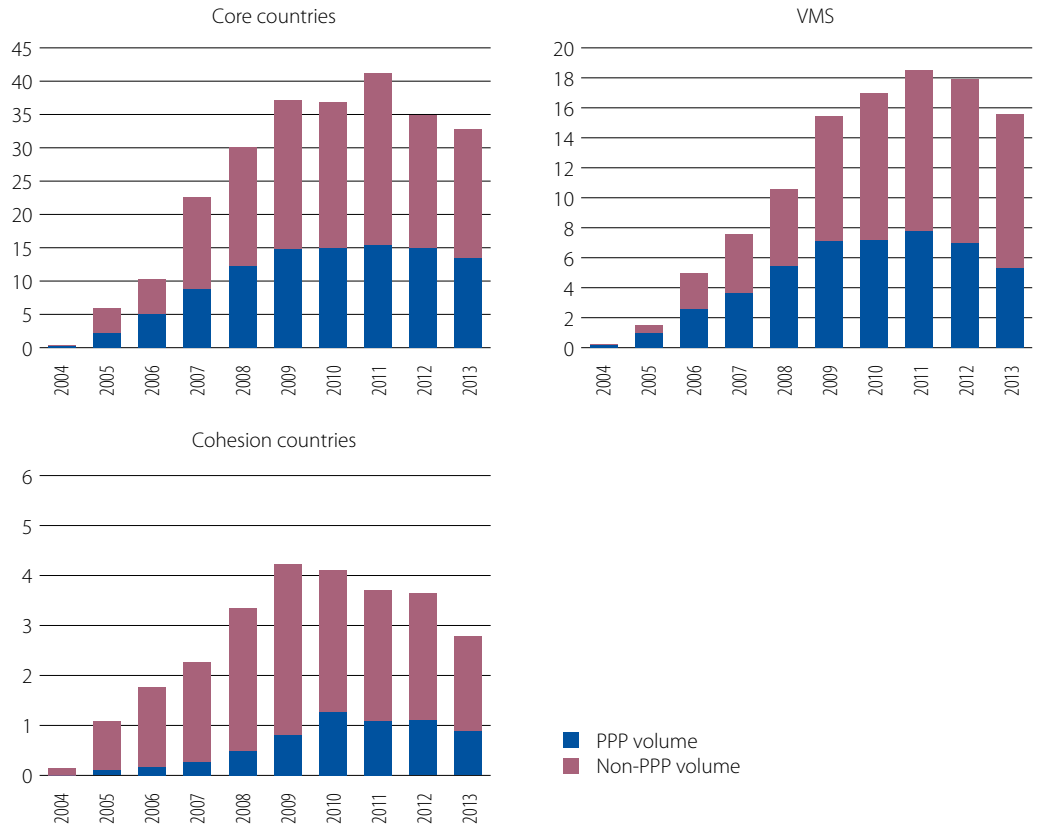
When deciding on an investment project, investors may opt to create a project company, a special purpose vehicle (SPV) for isolating their other assets from the risks of the project. SPV funding is based on the stream of cash flow generated by the project for which the company was set up.

Data on project investment are scarce and often incomplete. The present analysis is based on data gathered from several sources and compiled in a consistent way. The methodology follows Kappeler and Nemoz (2010).

Figure 11 plots the volume of projects, public-private partnerships (PPPs) and non-PPPs for the three groups of countries: core, cohesion and VMS. Project investment volumes increased steadily between 2005 and 2009. In the core countries PPP projects were broadly stable at around 40 per cent of the total, on average, while in the cohesion countries the share of PPP projects steadily increased from very low levels to about 30 per cent. In the VMS, the PPPs' share declined from about 60 to less than 30 per cent. The economic and financial crisis had a large negative impact on project finance. Volumes fell by 20 per cent in the core countries between the peak in 2011 and 2013, while the decline for the VMS was about 16 per cent.[11] In the cohesion countries, the decline in project investment started earlier and totalled 34 per cent between 2009 and 2013.

11 Projects that had secured financing and been started just before the financial crisis continued to be implemented and were completed several years later, hence the lag in the peak of project investment.

Figure 11 Project investment, EUR bn



Source: Own calculations based on Projectware/EIB/EPEC data.
Notes: Calculations are based on the methodology described in Kappeler and Nemoz (2010). "Core countries" include Austria, Belgium, Germany, Denmark, Finland, France, Luxembourg, the Netherlands, Sweden and the UK; "VMS" includes Cyprus, Greece, Spain, Ireland, Italy, Slovenia and Portugal; "Cohesion countries" include Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania and Slovakia.

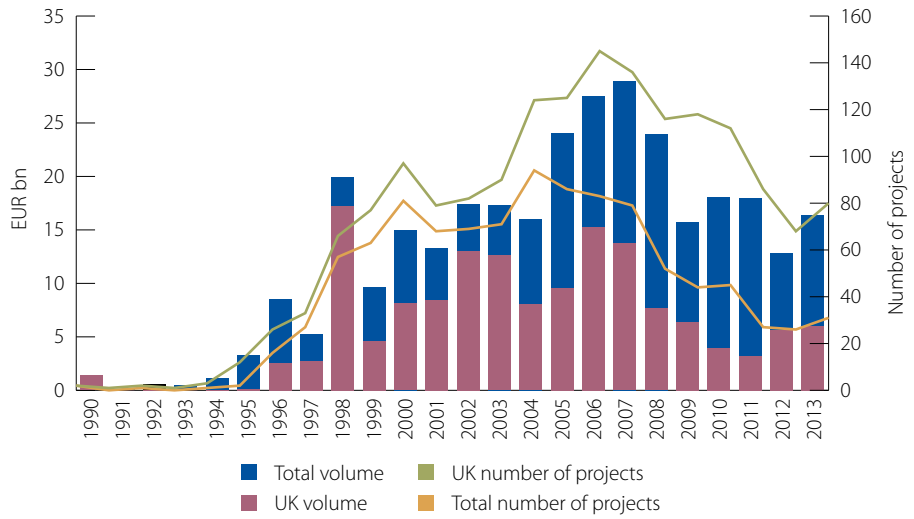
4.3.1. PPPs and how they are financed

The main idea of a PPP is to harness private sector skills in support of improved public sector services. This is achieved by moving away from the direct procurement of physical assets by the public sector towards the procurement of services from the private sector under public sector regulation and contracts.[12]

Figure 12 shows the number and aggregate value of PPP projects inside the EU over the past two decades. The green line and red bars represent the number and value of PPPs in the UK – the largest PPP market inside the EU. The PPP market in Europe has grown steadily over the past twenty years or so, reaching its historical peak in 2007. Since then it has been on a downward trend, both in terms of number of projects and aggregate value, driven mostly by the decline of the PPP market in the UK. Between 2007 and 2013 the UK's share of total PPP deals declined from 48% to 36%. 2007 also marked the beginning of a considerable decline in both the number and aggregate value of PPP projects. In 2013 the aggregate market value returned to positive growth in nominal terms for the first time after an (almost) continuous decline since 2007.[13]

12 For more details on PPPs see, for instance, European Investment Bank (2004) and (2005).
13 There was also a small rebound from 2009 to 2010.

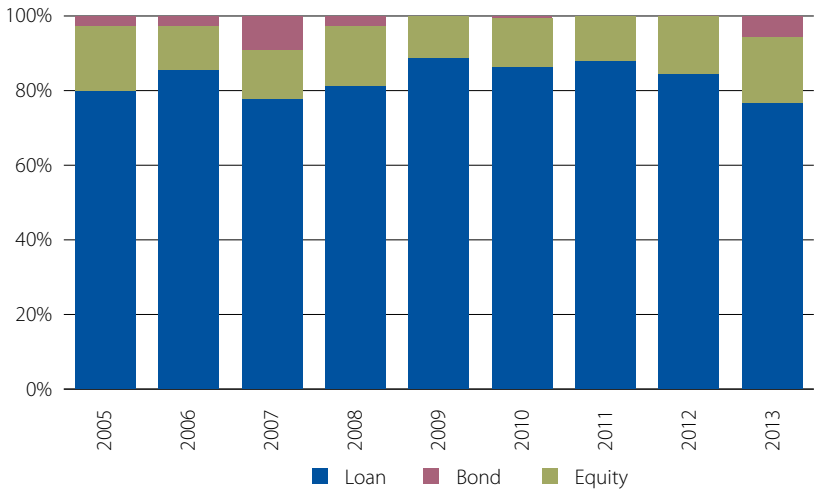
Figure 12 European PPP investments since 1990



Source: *EPEC.*
Notes: *The project values quoted refer to the projects' external funding requirements at the time of financial close (i.e. the sum of debt and equity) and exclude public capital contributions. The external funding requirement of a project may be very different from its capital investment cost.*

Figure 13 shows the composition of the PPP financing structure in terms of equity, loans and bonds from 2005 to 2013. It shows that European project finance relies heavily on debt. On average, the debt-to-equity ratio has come in at around 4:1 over the past decade. Most of this debt is made up of loans (typically provided through syndicates of lenders). While bond financing played a small role in providing funding before the crisis, it disappeared almost completely in the period 2009-2012. In 2013 bond financing made a comeback, contributing to almost 6% of total PPP financing in that year.

Figure 13 Financing structure of European PPP investments, average 2010-2013

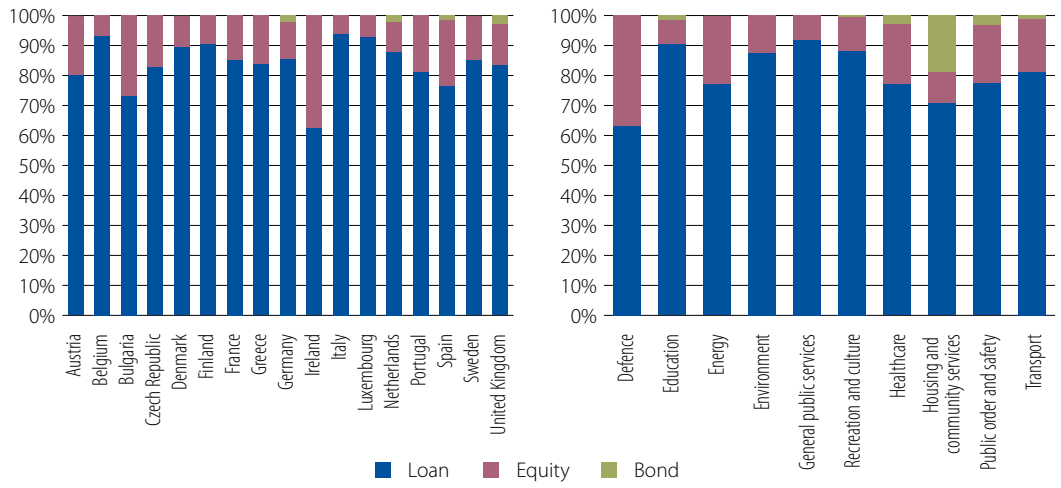


Source: *ECON/EPEC database.*
Notes: *A breakdown by source of finance is only available for roughly 80% of all PPP projects in our database.*

There are significant differences in the financing structure of PPPs across countries. Figure 14 shows that projects in the core countries tend to be more leveraged than in the cohesion countries and the VMS. Similarly, the use of project bonds is still very much limited to some of the core countries and, to a certain extent, Spain.

In terms of sectors a similar picture arises. While PPPs tend to be highly leveraged in some sectors (mostly those with relatively short maturities such as education and general public services), the opposite is true for others (such as defence, transportation and energy). Furthermore, as with the geographical distribution of project bonds, Figure 14 shows that there is an uneven distribution in the use of project bonds across sectors, with "housing and community services" accounting for the highest share of project bonds.

Figure 14 Financing structure of European PPP investments by country and sector, average 2010-2013



Source: ECON/EPEC database.

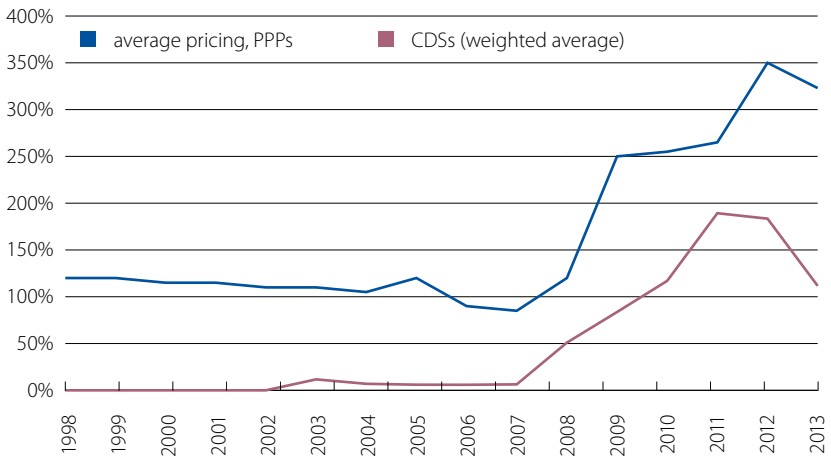
4.3.2. Pricing of PPPs

Since loans are so important for PPPs, Figure 15 below provides some insights into the pricing of private loans by plotting the average spread over Euribor/Libor of the principal loans since 1998. Spreads over Libor/Euribor declined in the run-up to the financial crisis, from 110 basis points in 2000 to 80 basis points in 2007. The financial crisis dramatically reversed this tendency: between 2007 and 2010 spreads tripled to more than 250 bps. After reaching a plateau in 2010/2011, there was another significant increase – by almost 100 basis points – as the sovereign debt crisis hit in 2011/2012. 2013 marked the first year since 2007 that prices weakened somewhat.

For comparison, Figure 15 also shows the weighted average of sovereign credit default swaps (CDSs) as a broad measure of market conditions.[14] While pricing for PPP loans broadly moved in line with CDSs in the run-up to and during the initial years of the crisis, there has been a notable divergence of the two measures in more recent years. Even though sovereign default swaps have fallen markedly since 2011, pricing has stayed rather elevated or increased even further since.

14 Five-year sovereign CDSs from Bloomberg are used.

Figure 15 Pricing of PPPs

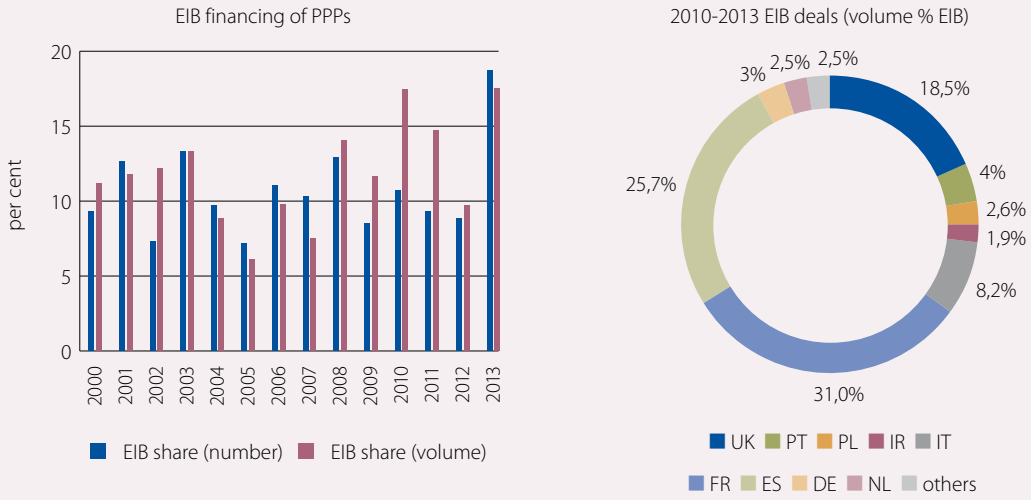


Source: *ECON/EPEC database.*
Notes: *Data on pricing refer to the principal loan of each project, as made available by Projectware and/or the Infrastructure Journal. As this information is available for a sub-sample only, the results should be taken as indicative rather than definitive. As for CDSs, we use 5-year sovereign CDSs from Bloomberg.*

Box 1 PPPs and the EIB

This box focuses on the role of the EIB in directly financing PPPs in the EU. Figure 16 shows the share of PPPs with EIB loans as well as the share of EIB loans in total PPP financing.[15]

Figure 16 EIB's PPP portfolio



Source: ECON/EPEC database.

In 2013 the provision of EIB loans for PPPs increased to its highest level in relative terms since 2000 – accounting for 17.5 per cent of PPPs' total financing requirements and 18.6 per cent of total PPP projects.

This is considerably more than in 2012 – both in absolute and relative terms. The value of EIB loans provided increased by 130 per cent from 2012 to 2013. The share of PPP projects benefiting from EIB loans increased from 6 per cent in 2012 to 15 per cent in 2013.

To give a rough idea of differences in the EIB's involvement in PPP projects across countries, Figure 16 also shows the EIB's portfolio of PPP projects by country as an average over the period 2010 to 2013. Numbers refer to the share of EIB loans relative to total PPP financing requirements in the country in question. The largest share of EIB loans for PPPs was allocated to France in 2010-2013, followed by Spain and the UK.

As the PPP market in the UK is relatively large, however, EIB loans accounted for only 8.4 per cent of total PPP financing needs in the UK. In contrast, the largest share by far of EIB loans for PPPs was allocated to Ireland in 2010-2013 (62.9 per cent). Poland, Spain and France also received a large share of EIB loans relative to their PPP market size (34.3, 34.1 and 14.6 per cent respectively).

15 When considering Figure 16, one should bear in mind that the number and volume of PPP projects and the EIB's involvement in them are volatile over time. This complicates the interpretation of observed changes from one year to the next. Furthermore, it is important to note that – in addition to its direct financing activities – the EIB contributes to the financing of PPPs in indirect ways, e.g. through its project bonds initiative.

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Part II

Investment finance

Chapter 5

SME finance in Europe

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SME finance in Europe

Chapter at a glance

Given the importance of small and medium-sized enterprises (SMEs) as the backbone of the EU economy, the financing of their activities and their access to finance is of particular relevance. In this paper, we analyse the current state of SME finance in Europe.

Access to finance remains of greater concern to SMEs than to large enterprises, mainly because SMEs depend very much on bank financing.

Most of the business indicators have started to improve in recent months and confidence has increased. Bankruptcies are expected to decrease in Europe, which sees a gradual but uneven recovery.

According to the European Commission's and ECB's latest "Survey on the Access to Finance of Enterprises" (SAFE), "access to finance" moved from third to fifth position as the most pressing problem for euro area SMEs compared to the previous survey round, although great disparities in access to finance by country persist. In distressed countries such as Greece, Ireland, Spain and Portugal, access to finance is a very pressing problem for SMEs, while in Germany and Austria less than 10% of SMEs reported "access to finance" as the most pressing problem. Hence it is necessary to distinguish weaknesses in access to finance by country/region and to carefully analyse the particular situation.

Traditional bank lending can be complemented (or sometimes even replaced) by additional instruments that help to alleviate SMEs' difficulties in accessing finance. We look at some of these instruments for SMEs in greater detail, in particular loan guarantees and securitisation, microfinance and private equity/venture capital.

Credit guarantee schemes "are used widely across economies as important tools to ease financial constraints for SMEs and start-ups" (OECD, 2013). In Europe, the volume of outstanding guarantees as a percentage of GDP is highest in Italy, Portugal, Hungary and Romania. AECM preliminary data on outstanding guarantees shows a decrease in volumes and a parallel increase in the number of guarantees for the recent past. This could be explained by an increase in guarantees involving smaller amounts, as well as in short-term guarantees.

SME securitisation (SMESec) indirectly creates a secondary market for SME loans. The benefits for banks and investors can channel through to a positive effect on SMEs' access to finance. Despite the crisis, SMESec in general performed relatively well in terms of default rates. However, it is still suffering from the economic and financial crisis. Various initiatives (including those involving the EIB Group) aim to remove current hurdles in the market and target the revival of SMESec.

Difficulties in access to finance are particularly pronounced for micro-enterprises and other microfinance target groups. The European microfinance market is still young and heterogeneous, especially with regard to the diversity of lending approaches. Nevertheless, despite the unfavourable conditions the recent EMN survey reported a remarkable growth in both the overall total value and number of microloans provided by the microfinance institutions (MFIs) surveyed. With regard to future trends, MFIs expect less public support in the coming years due to public budgetary restrictions. Microfinance is generally associated with social and economic objectives and is an important financing channel for job creation.

Following the severe crash in 2008/2009, private equity (PE) partially rebounded. After a setback in 2012, total PE investment amounts have stabilised according to EVCA figures, albeit below pre-crisis

levels. Investors' currently cautious sentiment towards venture capital (VC) is shown in the shift in the investor base, which has been going on for the past few years. Government agencies continue to support the market counter-cyclically and have accounted for a large share of total VC fundraising in the last few years. In addition, some of the gap left by the fall in VC investment has been filled by increased business angel activity. VC performance, although still disappointing, has improved slightly.

There are market imperfections for SME finance that are serious enough to warrant public support. Such support must improve SMEs' access to finance without distorting efficient market forces. On the basis of this principle, we present our concluding remarks and policy recommendations for particular market segments.

5.1. Introduction

Small and medium-sized enterprises (SMEs)[1] are commonly known as the backbone of the European economy. In the European Union (EU)'s non-financial sector, more than 21.6m of SMEs accounted for 99.8% of all non-financial enterprises, employed 88.8m people (66.9% of total employment) and generated EUR 3.666tn in value added (58.1% of total value added) (European Commission, 2014a).

Access to finance is in general of greater concern to SMEs than to larger enterprises. One reason for this is that SMEs, particularly in Europe, depend very much on bank financing. Moreover, a general market failure exists in the financing of smaller companies as the work involved in, and hence cost of, assessing a relatively small company's application for finance is disproportionate to the potential revenue. Whereas the credit assessment contains a certain fixed cost element (which is independent of the amount of finance requested), the revenue is dependent on the amount. This issue is exacerbated by the asymmetric information (in the case of debt the information gap between lender and borrower, and the availability (and quality) of information about smaller enterprises is typically not as good as for bigger companies), combined with uncertainty, which causes agency problems that affect debt providers' behaviour (see Kraemer-Eis, Lang and Gvetadze, 2014a, based on Akerlof, 1970, and Arrow, 1985).[2] This results in an insufficient supply of credit for SMEs (a similar argument applies to equity financing).

Stiglitz and Weiss (1981) argued that under certain circumstances credit rationing may be rational for banks, particularly in the case of SME financing (OECD, 2006). The real creditworthiness of an SME may be better than the perceived quality (i.e. if a financial institution's decision to lend is based on collateral and track record, rather than the economic viability of the business (BIS, 2012)). Hence it is important to stress that if an SME is rejected as a borrower, it does not necessarily mean that it is non-bankable – the company may be viable, but without access to bank lending.

Information asymmetries can be reduced in three ways: through a firm's ability to signal its creditworthiness (by, for instance, an institutional assessment or rating by an independent agency and the provision of collateral), through a strong relationship between lender and borrower, and through due diligence/lender scrutiny (screening). However, this means that new or young firms, with a lack of collateral and by definition without a track record, are those that encounter the greatest difficulty in securing access to debt capital (Kraemer-Eis, 2014).

Apart from such structural difficulties, the financial, debt and economic crisis has made it even harder for SMEs to access funds in recent years. Access to finance is vital for the creation, growth and survival of SMEs. In times of crisis, access to finance is even more difficult for SMEs (Pelly and Kraemer-Eis, 2012). The past few years have been no exception. Before the crisis, the OECD (2006) concluded that "in the major OECD countries […] no generalised financing gap can be identified" but since then the financing landscape has changed significantly for SMEs, and the conditions SMEs must satisfy to secure external finance have worsened. Although global economic prospects have gradually improved since 2009, the recovery has lagged for small enterprises, and access to finance remains a pressing problem for European SMEs, in particular for micro-enterprises.

1 As defined in European Commission Recommendation 2003/361, SMEs are companies that have fewer than 250 employees and either a turnover not exceeding EUR 50m or a balance sheet total not exceeding EUR 43m. See the dedicated website of the European Commission, Directorate-General Enterprise and Industry, for more details: http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/index_en.htm.

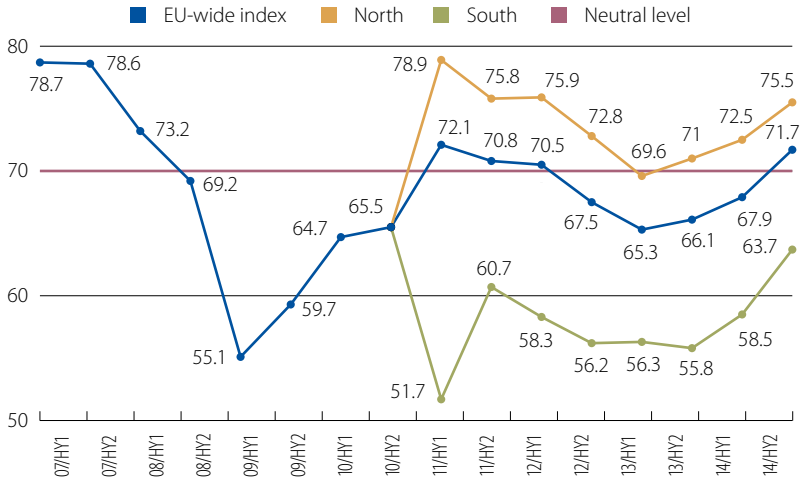
2 Agency theory/the principal-agent approach is often applied in economic literature for analysing relationships between lenders and borrowers (e.g. contract design, selection process, credit constraints).

In section 2 of this paper, we analyse in more detail the current situation of SMEs' access to finance in Europe and lending to SMEs. Section 3 looks at the main aspects of guarantees and SME securitisation (SMESec), before we briefly discuss microfinance in Europe in section 4. In section 5, we focus on private equity finance[3]. Finally, section 6 provides concluding remarks and policy recommendations.[4]

5.2. Business environment and SMEs' access to finance

The financial, debt and economic crisis dramatically worsened the business environment for European SMEs from 2008 onwards, particularly in those countries that had suffered most from the crisis. However, in the recent past some changes for the better have become visible, and the business climate for SMEs has improved again. Significant progress has been observed in the southern and peripheral countries (Croatia, Cyprus, Greece, Ireland, Italy, Malta, Portugal, Slovenia and Spain). The SME Business Climate Index for those countries increased by 5.2 percentage points in the second half of 2014 (see Figure 1), which is higher than the 3 percentage point increase in the northern and central countries (Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Romania, Slovakia, Sweden and UK). As a result, the imbalance between the two diverse country groups has diminished, with the current gap equal to 11.8 percentage points, compared to 14 percentage points in the first half of 2014. Moreover, the EU-wide index has risen above the neutral level for the first time since 2012, which indicates that the EU is seeing the beginning of a recovery (UEAPME Study Unit, 2014).

Figure 1 **SME Business Climate Index[5]**



Source: Based on UEAPME Study Unit (2014).

The improvement in business conditions also affects the expected incidence of business insolvencies. Although the Euler Hermes Insolvency Index for the euro area registered a 6% increase in bankruptcies in 2013, the projection for 2014 has recently been updated to a more optimistic level of -13% (compared to +1% projected in December 2013).

3 We use the term "private equity finance" to combine linguistically the areas of venture capital (VC) and other private equity (such as business angel financing). However, if we refer here to the EIF's equity activities, we mean only its investment-focused activities, which exclude both leveraged buyouts (LBOs) and public equity activities.

4 The EIF regularly describes the current situation in SME financing markets in its publication "European Small Business Finance Outlook" (ESBFO), which is published twice a year (usually in June and December) and provides the framework for this paper. See Kraemer-Eis, Lang and Gvetadze (2014b).

5 The UEAPME SME Business Climate Index is calculated as the average of the current situation and expectations for the next period resulting from the sum of positive and neutral (meaning: no change) answers as regards the overall situation for the business. For example, for "semester A", with 25% positive, 55% neutral and 20% negative answers, the Index would be 80 (25 + 55), and for "semester B", with 40% positive, 30% neutral and 30% negative answers, it would fall to 70 (40 + 30). However, the respective balances of positive minus negative answers would show the opposite, from 5% (25 – 20) for "semester A" to 10% (40 – 30) for "semester B". Therefore these balances should also be examined and they are reported in UEAPME's EU Craft and SME Barometer.

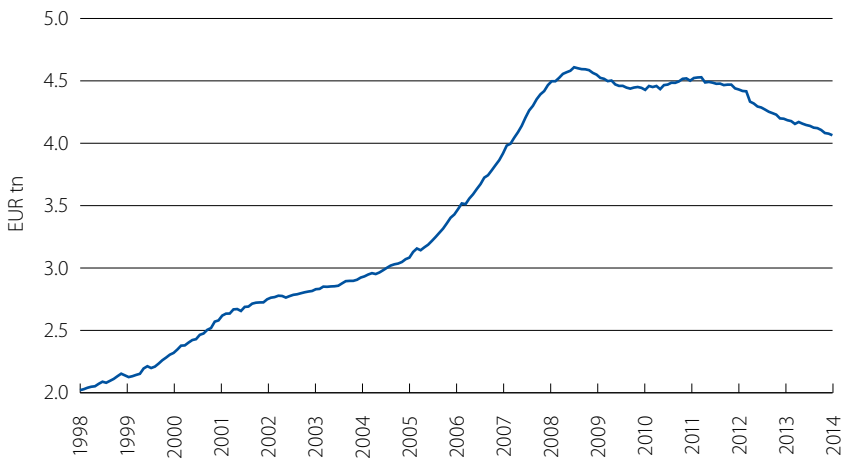
However, at the same time the regional disparities have remained prevalent (Euler Hermes, 2014). In 2013, the insolvency indices increased at a record rate of +57% in the Czech Republic, while double-digit increases were also recorded in Slovakia (+25%), Norway (+20%), Italy (+12%) and Spain (+12%). On the other hand, the biggest falls in the European insolvency indices were recorded in Hungary (-40%), Ireland (-19%) and the UK (-15%).

Hence, although the economic environment is improving for SMEs, significant difficulties remain. Moreover, the disparities between different European countries are still considerable. This is also true when we look at the financing situation of SMEs. According to the European Commission's and ECB's latest Survey on the Access to Finance of Enterprises (SAFE), covering April 2014 to September 2014 (European Commission, 2014c and ECB, 2014c), "access to finance" moved from the third to fifth most pressing problem for euro area SMEs compared to the previous survey round. Unsurprisingly, the divergence across countries remained large. On the high side, 32% of SMEs in Greece, 18% in Ireland and 17% in Spain and Portugal mentioned "access to finance" as the most pressing problem, compared with around 9% of SMEs in Germany and 7% in Austria on the low side (ECB, 2014c).

Moreover, it appears to still be of greater concern to SMEs than to large firms. One potential reason for this structural weakness is that SMEs are more dependent on bank finance,[6] such as loans and credit lines, than large firms, which can launch public offerings for debt and equity (OECD, 2014; ECB, 2013). During the crisis a combination of balance sheet concerns, increased risk aversion and higher credit risks in the SME business made banks reluctant to lend to SMEs (Kraemer-Eis, Lang and Gvetadze, 2013). Furthermore, the difficulty of securitising loans contributed to this reluctance. Hence SMEs, in particular unlisted companies, are more affected by changes in bank lending due to bank deleveraging than other firms.

According to ECB data, the trend in lending to non-financial corporations (NFCs) in Europe has been declining since 2009 and has yet to bottom out (see Figure 2). From the peak of EUR 4.6tn reached at the beginning of 2009, the volume of outstanding loans decreased by 11.8% to EUR 4.1tn in the euro area in October 2014. As we have argued in a previous study (see Kraemer-Eis, Lang and Gvetadze, 2013), "the deleveraging of NFCs was to some extent a necessary process", following the steep and potentially unsustainable increase of the years before.

Figure 2 Outstanding loans to non-financial corporations in the euro area



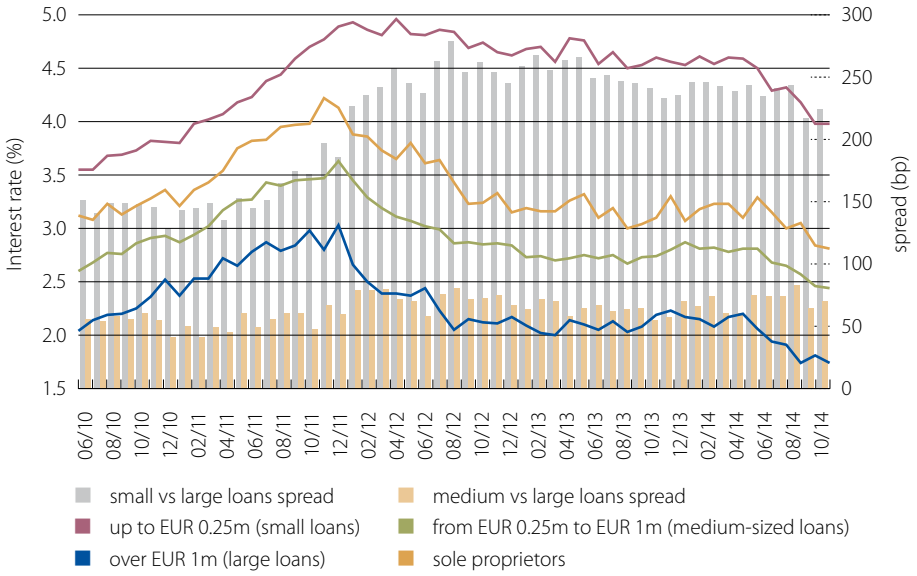
Source: Based on ECB data.

6 However, the importance of non-bank lending is growing. So far only a few of the existing initiatives to strengthen alternative financing channels seem to focus on SMEs and small midcaps, while most of them are targeting larger companies (bigger midcaps to large caps) and/or mezzanine instruments. There are numerous calls from market participants and policymakers to support alternative sources of finance for SMEs and small midcaps to fill the bank financing gap.

However, some positive signs have also been observed in the area of bank lending. According to the reporting banks of the ECB's Bank Lending Survey, net demand for loans to NFCs continued to be positive and recovered further in Q4/2014 (18% compared to 6% in Q3/2014) and remained above its historical average. This was mainly driven by financing needs related to debt restructuring, mergers and acquisitions and fixed investment. Concerning the conditions for the supply, banks continued to ease credit standards in net terms on loans to enterprises in the fourth quarter of 2014. This was the third time in a row that banks reported, on balance, a net easing in credit standards, following the continuous net tightening that had been observed since 2007 (ECB, 2014d).

However, interest rates for SMEs are still at a relatively high level (based on a comparison of interest rates charged for small loans with those charged for large loans). The ECB MFI (Monetary Financial Institution) Interest Rate Statistics reveal that, although the interest rate level for small loans (up to EUR 0.25m) has decreased, the interest rate spread between small loans and large loans (more than EUR 1m) has remained wide and amounted to 214 basis points in October 2014 (see Figure 3).

Figure 3 **Evolution of monetary financial institutions' interest rates on new loans to non-financial corporations**[7]



Sources: EIF, based on Huerga et al. (2012), ECB (2014b), ECB SDW and own calculations.

Another useful instrument for tracking the situation of SMEs' access to financial resources is the European Commission's SME Access to Finance (SMAF) index.[8] The SMAF index provides an indication of the change in the situation of SMEs' access to finance over time for the EU and its Member States.

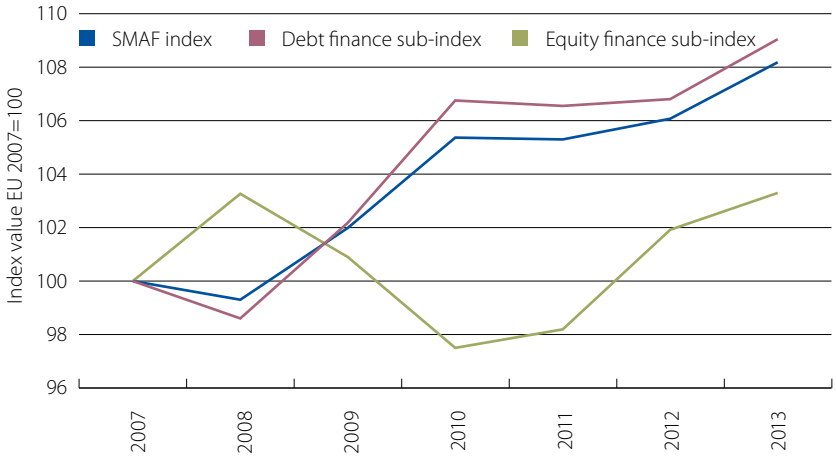
Based on figures for 2013, the aggregated SMAF index for the EU has increased since 2008 (see Figure 4). The key factor in this improvement is the debt finance sub-index, which has itself increased due to the fall in interest rates on loans and overdrafts since 2009 for many EU countries. At the same time the performance of the equity finance sub-index is still weighing on the overall SMAF index.

7 New loans to non-financial corporations, with a floating rate and up to three-month initial rate fix by loan size, and new loans to sole proprietors (percentages per annum, excluding charges, period averages). The series new loans to "sole proprietors" has an initial rate fix of up to one year and not three months, unlike the other series used in the graph, because data for shorter periods are not collected.

8 The SMAF index is a weighted mean of two sub-indices: the access to debt finance index (85%) and the access to equity finance index (15%). High values in the overall index and its sub-indices indicate better performance of the access to finance indicators relative to the EU level in 2007.

However, it has to be borne in mind that the aggregate view hides significant inter-country differences. France, Austria, Finland and Luxembourg recorded the highest SMAF index values (126, 123, 122 and 121, respectively), whereas Greece, Cyprus and Romania scored the lowest values (78, 82 and 85, respectively).

Figure 4 **SME Access to Finance (SMAF) Index and its sub-indices for the EU**



Source: *European Commission (2014b).*

In this section, we have described the current state of "traditional" SME finance in Europe. Access to finance is of greater concern to SMEs than to large enterprises, mainly because SMEs are highly dependent on bank financing. Apart from such structural difficulties, the financial crisis made it even harder for SMEs to access funds, and corporate *demand* for loans had been falling for several years. In addition, banks' balance sheet and risk considerations had also led to more restrictive lending behaviour on the *supply* side. Although some improvements have been observed recently, these problems are still more pronounced in those countries that were most affected by the financial and sovereign debt crisis. It is therefore necessary to distinguish weaknesses in access to finance by country/region and to carefully analyse the particular situation.

There are additional instruments that can supplement (or sometimes even replace) traditional bank lending, thereby alleviating SMEs' difficulties in securing access to finance. In the following sections, we shall look at some of these instruments for SMEs. We shall cover loan guarantees, loan securitisation, microfinance and private equity. Loan guarantees can replace missing collateral and hence enable banks to grant more loans. SME loan securitisation aims to enhance the lending capacity of financial intermediaries such as banks and can thus help to improve the availability and terms of debt for SMEs. Microfinance provides access to funds typically for micro-enterprises and those who would like to become self-employed, i.e. for target groups that find it very difficult to secure access to finance. Private equity, especially the venture capital part of the market, aims to improve the availability of risk capital, particularly for high-growth and innovative SMEs. While equity instruments typically reach an important but limited share of SMEs, guarantees and securitisation target the "traditional" debt instruments that are important for the majority of SMEs. Microfinance is typically aimed at micro and small enterprises. However, the availability of all these instruments depends very much on the current state of the respective markets. We shall discuss this in the following sections.

5.3. SME loan guarantees and securitisation

5.3.1. SME loan guarantees

Guarantee mechanisms, "whereby should the borrower default the guarantor compensates a pre-defined share of the outstanding loan" (OECD, 2014), are a commonly used response to market failures in SME lending, as guarantees reduce the risk for lenders and encourage the provision of finance to viable businesses that are constrained in their access to finance. Credit guarantee schemes "are used widely across economies as important tools to ease financial constraints for SMEs and start-ups" (OECD, 2013), and in order to alleviate market failures in SME financing. Loan guarantee programmes expanded substantially between 2007 and 2011 as a government policy response to the financial crisis. In addition, "new elements were added to some of these programmes, such as reduced red tape and more rapid provision (i.e. 'express guarantees' [in Belgium]), and new instruments were created outside traditional guarantee programmes". Therefore loan guarantee programmes have continued to be "the most widely used instrument at goverments' disposal to ease SME access to finance" (OECD, 2015).

With particular reference to the countries of Central, Eastern and South-Eastern Europe (CESEE), in 2014 the Working Group on Credit Guarantee Schemes (CGSs) in CESEE, established under the European Bank Coordination Initiative (Vienna Initiative 2), undertook an analysis of the role of SME Credit Guarantee Schemes in the region in question (VIWGCGS, 2014). The findings and conclusions are in line with other studies (e.g. OECD, 2013) and emphasise the importance of and strong demand for SME CGSs in the region. Moreover, best practices for the design and operational characteristics of schemes have been identified that can be generalised to other parts of Europe as well. In the context of this work a sub-project on measuring the economic additionality of CGSs has been carried out, using a specific guarantee programme (MAP, the Multi Annual Programme for Enterprise and Entrepreneurship) financed by the European Commission and implemented by the EIF. This sub-project found, inter alia, that there were positive effects on the number of employees (at the level of the companies, benefitting from the guarantees) as well as on total factor productivity. It will be presented in detail in a forthcoming joint European Commission/EIF working paper.

In general, however, data on the provision of guarantees for SMEs in Europe are scarce. Some market information is collected by AECM, the European Association of Mutual Guarantee Societies.[9] These data cover SME loan guarantees provided by AECM members. We provide information below about countries with at least one AECM member.

In addition to their guarantee activities some AECM members also offer counter-guarantees, whereby the (typically public) counter-guarantor takes over the risk from the guarantor, up to a predefined share of the guarantee (see Kraemer-Eis, Lang and Gvetadze, 2013, and OECD, 2013b). In terms of total amounts of guarantee and counter-guarantee activities (see Table 1), the core countries are Italy (EUR 32.9bn), France (EUR 16.5bn), Germany (EUR 5.8bn) and Spain (EUR 4.7bn). Italy also has the highest total number of outstanding guarantees (781 635), followed by France (596 660), Turkey (283 231), Poland (150 314), Portugal (80 892) and Spain (73 200).

9 AECM currently has 42 members in 20 EU Member States, Bosnia and Herzegovina, Kyrgyzstan, Montenegro, Russia and Turkey. EU countries without an AECM member are Cyprus, Denmark, Finland, Ireland, Malta, Slovakia, Sweden and the UK, even if guarantee activities exist in those countries. In the AECM member countries, the AECM members cover all or almost all SME guarantee activity. Some members are national associations or networks and thus have their own member organisations. AECM has purely private, mutual, public and mixed public-private members. Source: AECM.

Table 1 Outstanding guarantees and counter-guarantees[10] on SME[11] loan portfolios[12] and resulting average guarantee size in 2013[13] by country

	Guarantee and counter-guarantee activity			Guarantee activity			Counter-guarantee activity		
Country	Volume [EUR '000]	Number	Average guarantee size [EUR '000]	Volume [EUR '000]	Number	Average guarantee size [EUR '000]	Volume [EUR '000]	Number	Average guarantee size [EUR '000]
Austria	373 336	5 759	64.8	373 336	5 759	64.8			
Belgium	737 780	9 643	76.5	712 409	8 002	89.0	25 371	1 641	15.5
Bulgaria	30 028	1 041	28.8	28 944	1 023	28.3	1 084	18	60.2
Czech Rep.	661 039	6 060	109.1	661 039	6 060	109.1			
Croatia	149 356	1 384	107.9	149 356	1 384	107.9			
Estonia	102 300	1 366	74.9	102 300	1 366	74.9			
France	16 548 860	596 660	27.7	15 748 860	587 960	26.8	800 000	8 700	92.0
Germany	5 794 999	48 431	119.7	5 794 999	48 431	119.7			
Greece	585 298	23 374	25.0	585 298	23 374	25.0			
Hungary	1 327 863	42 045	31.6	1 281 953	41 706	30.7	45 910	339	135.4
Italy	32 915 057	781 635	42.1	20 276 000	658 380	30.8	12 639 057	123 255	102.5
Latvia	86 104	386	223.1	86 104	386	223.1			
Lithuania	192 799	3 711	52.0	102 222	2 314	44.2	90 577	1 397	64.8
Luxembourg	1 563	61	25.6	1 563	61	25.6			
Netherlands	2 166 000	19 830	109.2	2 166 000	19 830	109.2			
Poland	1 540 905	*	*	1 540 905	*	*			
Portugal	3 039 368	80 892	37.6	3 039 368	80 892	37.6			
Romania	1 623 948	36 737	44.2	1 369 233	29 955	45.7	254 715	6 782	37.6
Russia	265 706	1 812	146.6	265 706	1 812	146.6			
Spain	4 704 049	73 200	64.3	4 704 049	73 200	64.3			
Slovenia	194 195	1 841	105.5	193 705	1 781	108.8	490	60	8.2
Turkey	3 911 411	283 231	13.8	3 911 411	283 231	13.8			
Total	76 951 964	2 169 413	35.5	63 094 760	2 027 221	31.1	13 857 204	142 192	97.5

*For Poland, the number of guarantees and the average guarantee size are available for one AECM member only. For this member, AECM statistics report a number of guarantees of 150 314 and an average guarantee size of EUR 0.5k. Most recent figures for all Polish AECM members are from 2011, when the average guarantee size amounted to EUR 6.8k.

General Note: Missing values mean that the AECM member(s) in the respective country has (have) no counter-guarantee activities, according to AECM information.

Source: AECM.

10 In Romania and Slovenia some AECM members provide counter-guarantees to other AECM members. In those cases, the aggregation of guarantee and counter-guarantee activities leads to double-counting of the underlying guaranteed loans. However, for consistency of the data shown in the table, these were not cleaned accordingly.

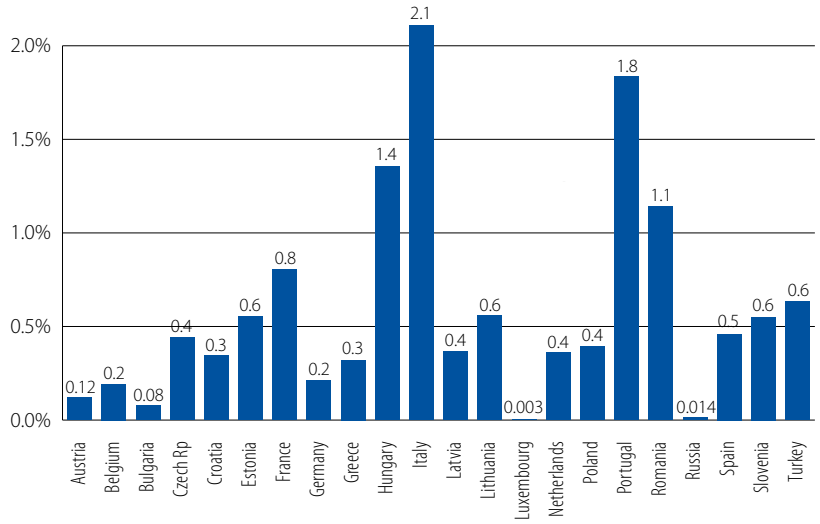
11 In the case of France, the counter-guarantee data include co-guarantees. These can also cover non-SME related areas such as regional infrastructure and municipality financing.

12 In the case of some AECM members, guarantees or counter-guarantees cover portfolios of loans or guarantees. However, in most cases, they cover single/individual loans/guarantees.

13 For data availability reasons, AECM statistics include the business figures of the largest Italian AECM member with a time lag of one year. For the same reason, 2012 figures were used for AECM members from Greece, Luxembourg and Poland and for one Slovenian member. No 2013 data were included for some smaller Belgian AECM members. These disclaimers apply to the whole subsection.

Compared to the value of economic activity, guarantees are relatively important (measured by volume of outstanding guarantees in the portfolio as a percentage of GDP) in Italy (2.1%), Portugal (1.8%), Hungary (1.4%) and Romania (1.1%), as shown in Figure 5. According to the OECD (2013), guarantees are particularly relevant "in those countries where a network of local or sectoral guarantee institutions is well established".

Figure 5 Volumes of outstanding guarantees on SME loans scaled by GDP, 2013 data



Source: AECM (provisional figures).

In 2013, according to the preliminary AECM data the total *volume* of outstanding guarantees in the portfolio decreased by 0.7% compared to the previous year. Within the EU, the largest decreases were recorded in Bulgaria (–47.7%), the Czech Republic (–22.8%), Spain (–14.9%) and the Netherlands (–11.6%). Only five countries exhibited a positive growth rate, the strongest being recorded for one Polish AECM member (+295.3%) following the launch of a new guarantee product. Increases were also reported for Lithuania (+11.2%), Turkey (+9.3%), France (+3.4%) and Portugal (+2.4%).

At the same time the *number* of outstanding guarantees reported by AECM increased by 3.8%. Within the EU, by far the largest increase was recorded in France (+31.0%), followed by Portugal (+12.4%) and the Czech Republic (+11.2%). The most substantial decreases were reported for Romania (–38.7%) and Bulgaria (–36.7%). For the Czech Republic, the decrease in the guarantee volume (in EUR), with a parallel increase in the number of outstanding guarantees, can to a large extent be explained by the devaluation of the Czech koruna between end-2012 and end-2013.

The observed decrease in values, with a parallel increase in the number of guarantees, is reflected in changes in the average size of the guarantee, for which the AECM statistics show an increase from EUR 34.1k in 2008 to EUR 40.2k in 2011, while the value dropped backed again in 2012 (to EUR 37.4k), i.e. towards the average size reached in previous years. In 2013, the average size of the guarantee decreased further to EUR 35.8k, based on the preliminary AECM statistics.

These developments can be explained by an increase in guarantees of smaller amounts, due to smaller underlying loan sizes because of lower investment, as well as in short-term guarantees (i.e. working capital loan guarantees, which generally involve smaller amounts, and bridge-financing guarantees, e.g. for the extension of a guarantee that has already been provided). Short-term guarantees generally (for the AECM members) cover less than 12 months. According to AECM, its members have been faced with growing requests to increase the guarantee period for existing guarantee commitments because of SMEs' financing constraints, which have led to requests to reschedule loan repayments. These reschedulings of SME loan repayments and of the related guarantee commitments often imply lower guarantee values.

The volume of new guarantees provided per year was reported to be EUR 25.7bn in 2013 (EUR 23.3bn of guarantee activity, plus EUR 2.4bn of counter-guarantee activity). For those AECM members that consistently reported data for 2012 and 2013, the volume of new guarantees (including counter-guarantees) increased by 2.0%. No further explanation is given as to why the stock of guarantees fell in 2013 while new business increased. A possible reason could be that the value of maturing guarantees in 2013 was higher than that of new guarantees issued.

As for developments in new guarantee business by country (for those countries for which 2012 and 2013 data are available), the strongest value increases in new guarantees granted per year were recorded for Poland (+914.3%), the Czech Republic (+68.1%), Lithuania (+34.9%), Portugal (+33.0%), Slovenia (+13.9%) and Austria (+6.8%). Due to their relatively large business size, the increases in France (+2.7%) and Germany (+2.4%) also contributed strongly to the overall growth in the European guarantee business. The biggest decreases were observed in Bulgaria (–97.9%), the Netherlands (–29.2%), Turkey (–24.0%), Romania (–18.2%) and Spain (–13.4%). The large drop in activity recorded for Bulgaria is due to the termination of a major guarantee product (a newly developed product was started only this year). In addition, setbacks in demand and cuts in the budgets allocated to purely public guarantee schemes led to decreases in guarantee activity in some countries.

In terms of numbers, 681 347 new guarantees were issued in the course of 2013. For those AECM members that consistently reported data for 2012 and 2013, the number of new guarantees issued increased by 20.9% compared to the previous year. This seemed to reflect a bottoming out of the negative trend after big falls in the number of new guarantees in 2010 and 2011.

According to the most recent AECM data for the first half of 2014 (but only based on a subset of AECM members[14]), the *total amount* of *new* guarantees increased slightly (+1.0%) compared to the same period a year before, while the *number* of *new* guarantees remained fairly stable (+0.1%). In some countries, particularly Bulgaria and Poland, remarkable increases in the new guarantee business were observed, due to the launch of new guarantee product lines.

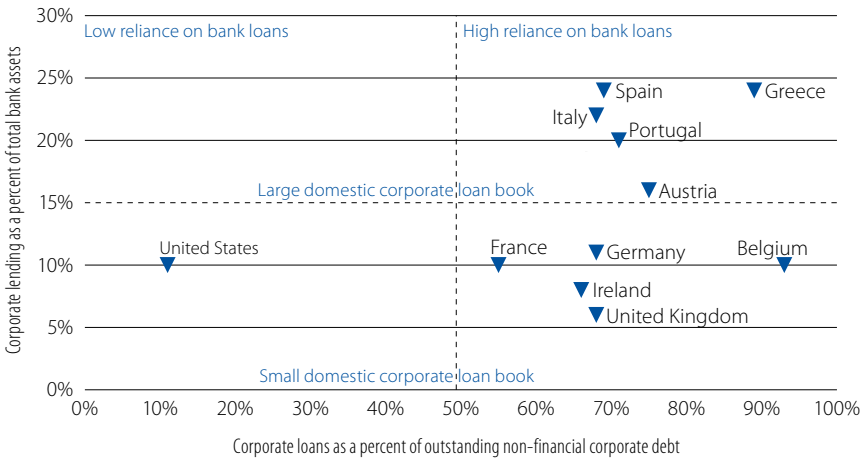
The growth of SME guarantee transactions is, on the one hand, caused by special factors in particular countries, while, on the other, it seems to mirror the specific macro and microeconomic situation in the different economies. Those countries that suffered most from the sovereign debt crisis and experienced weak economic growth – or even a decline in economic activity – also showed lacklustre growth in guarantee transactions. This was driven by both demand and supply side factors. In times of weak economic output growth, the business activity of SMEs, their investment, their related need for finance, and hence their implied demand for guarantees, are all low. At the same time public budgetary constraints and high financial risk perceptions weighed on the supply of guarantees. Consequently, public support can improve the situation, if only on the supply side. In some countries, such as Germany, the weak growth of guarantees has also been explained by relatively favourable financing conditions, and a reduced need for guarantees following the strong increases in demand for guarantees observed during the crisis years of 2009-10 (VDB, 2012). Hence in some countries, the downturn in guarantee business reflects a reversion to the pre-crisis levels.

14 The AECM (2014) Scoreboard for the first half of 2014 covers the data of 23 AECM members, as currently not all members "are able to provide their figures on a semester basis".

5.3.2 SME loan securitisation

As shown above, European SMEs depend very much on bank financing (see Figure 6). ECB President Mario Draghi mentioned in an often-quoted statement that "in the United States 80% of credit intermediation goes via the capital markets. … In the European situation it is the other way round. 80% of financial intermediation goes through the banking system" (Draghi, 2013). This ratio is only slowly moving towards more capital market action, and such a substitution is easier for large corporations than for small and medium-sized firms (see Kraemer-Eis, 2014 for more details). Moreover, banks in peripheral countries are facing the highest deleveraging pressure and these banks typically have large corporate and SME loan portfolios (IMF, 2012). Against this background, a well-functioning securitisation market could be a way to ease supply problems by helping banks to diversify their funding and achieve capital relief (see Kraemer-Eis, Passaris and Tappi (2013), IMF (2014a), or ECB and BoE (2014) for details).

Figure 6 **Reliance on bank financing by non-financial corporations (in %)**



Source: IMF (2012), based on data from the ECB, Eurostat, Federal Reserve and Haver Analytics.

However, SME securitisation (SMESec)[15] placed with investors currently represents only a tiny portion of total placed asset-backed securities (ABS) issuance. In 2014 (Q1 to Q3), only 7% of total SME issuance was placed in the primary market (see also Figure 7), with the bulk of SME ABS being retained for ECB refinancing purposes (Kraemer-Eis, Lang, Gvetadze, 2014b).

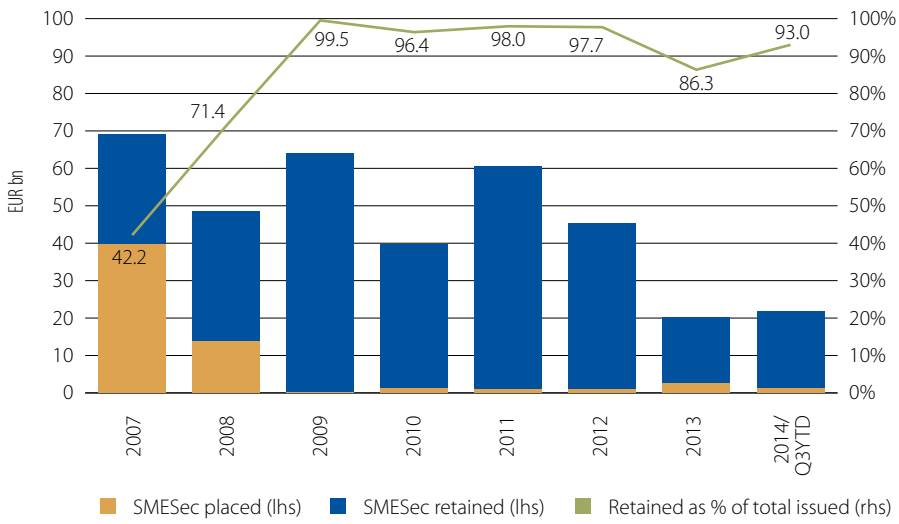
The important role of securitisation in financing, in particular SMESec, has been publicly reiterated for several months now. In a working paper on SMESec (Kraemer-Eis, Passaris and Tappi, 2013), various statements in favour of SMESec by the ECB, European Commission, IMF, AFME, UEAPME, European Council and others were quoted. Yves Mersch, Member of the Executive Board of the ECB, has memorably stated that "connecting SME financing needs with the funds of bank and non-bank investors via securitisation of SME loans can assist banks' ability to fund and distribute risk … We have seen that SME ABS can play a key role in bridging the gap between deleveraging banks and investors seeking to diversify their portfolio." (Mersch, 2014).

15 The term SME securitisation (SMESec) comprises transactions based on SME loans, leases, etc. It is important to look not only at banks/lending when analysing SMESec, but equally at leasing companies, which form part of the securitisation market. Given that bank financing is and will be less available for leasing companies post-crisis, it can be expected that SMESec will be particularly relevant in the leasing area. For more information on the importance of leasing for SME finance, see Kraemer-Eis and Lang (2014).

Market activity[16]

The European securitisation market had grown steadily from the beginning of the previous decade until the outbreak of the crisis. During the crisis, issuance remained at high levels, but these high volumes were almost exclusively driven by the eligibility of ABSs as collateral for ECB liquidity operations. After having peaked in three successive years over 2008-2010, the overall market activity decreased to the levels just before the crisis due to regulatory uncertainties[17] and tighter euro system collateral rules (see Figure 7).[18] Also the large volumes of synthetic SMESec transactions in evidence pre-2007 on SME portfolios, dominated primarily by German SMEs on the back of KfW's PROMISE programme, virtually disappeared. Rating downgrades, based on revised rating agency criteria (i.e. counterparty and country ceiling criteria, without grandfathering[19]), on downgrades of counterparties involved in the transactions and on negative credit trends, contributed to the negative market sentiment. The most active markets in the first three quarters of 2014 in terms of overall securitisation activities were France (market share: 29%), the UK (19%), the Netherlands (13%), Italy (9%) and Germany (9%).

Figure 7 **European total securitisation issuance by retention (EUR bn)**



Source: EIF, based on Wehinger/Nassr (forthcoming) and updated data from AFME/SIFMA.

SMESec issuance is still suffering from the crisis. However, the issued volume of SME deals in the first three quarters of 2014 was already slightly higher than the overall volume in 2013 (see Figure 8). The market share of SMESec rose (with some volatility) from 6% in 2001 to 18% (of total yearly issuance) in 2012, the highest value ever registered in Europe. This, however, came about due to the base effect, as overall activity went down while SMESec activity decreased slightly less. In Q1-Q3 2014, the share of SMESec was 14%.

SME-related issuance in Q1-Q3 2014 occurred only in the Netherlands (42%), Italy (20%), Belgium (19%), Spain (11%) and Portugal (8%). As already mentioned, it is important to note that only a tiny fraction of the issuance was placed with investors: the nature of the SMESec market changed from a developing

16 Unless otherwise flagged, the data source is AFME, the Association for Financial Markets in Europe (AFME, 2014).

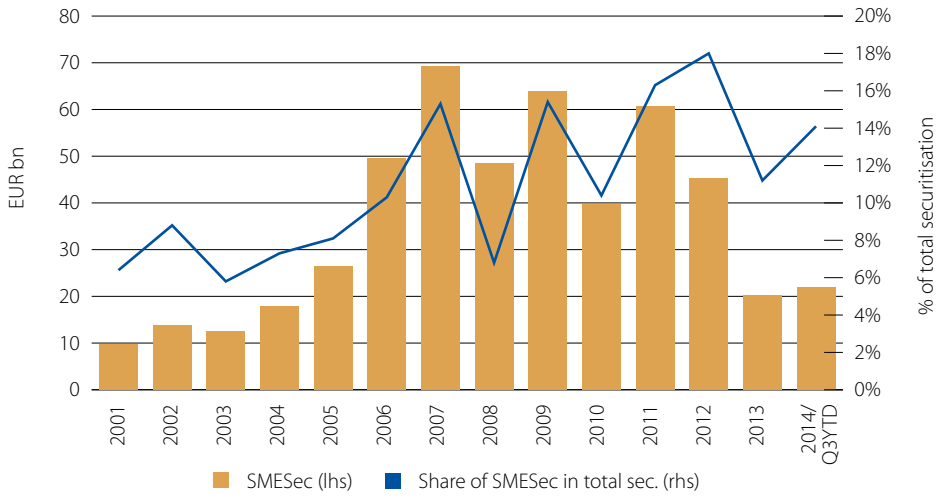
17 There are many ongoing regulatory developments that may affect the securitisation market (with an impact on originators and investors). We could even speak of a regulatory wave. The main ones are the proposed Basel (III) securitisation framework and the Solvency II treatment proposed by the European Insurance and Occupational Pension Authority (EIOPA). In October, the European Commission published the respective Delegated Acts under the EU capital requirements framework (http://eur-lex.europa.eu/ LexUriServ/LexUriServ.do?uri=OJ:L:2013:176:0001:0337:EN:PDF) and the Solvency II regime (http://ec.europa.eu/internal_market/insurance/docs/solvency/solvency2/delegated/141010-delegated-act-solvency-2_en.pdf), providing further details on the treatment of securitisation. For a discussion of regulatory reforms, see, for instance, EBA (2014) or Wehinger and Nassr (forthcoming).

18 The ECB's asset repurchase or "repo" facility allows (among other assets) asset-backed securities to be used as collateral for funding.

19 I.e. the new criteria had to be applied retroactively to existing transactions.

market (pre-crisis, with most transactions placed in the primary market) to a purely retained/ECB repo-driven market (see previous footnote) during the crisis (with almost no placements on the primary market). This shift led to liquidity drying up and originators accepting higher all-in costs as, in addition to the credit enhancement, the repos envisage considerable haircuts to the face value of the notes.

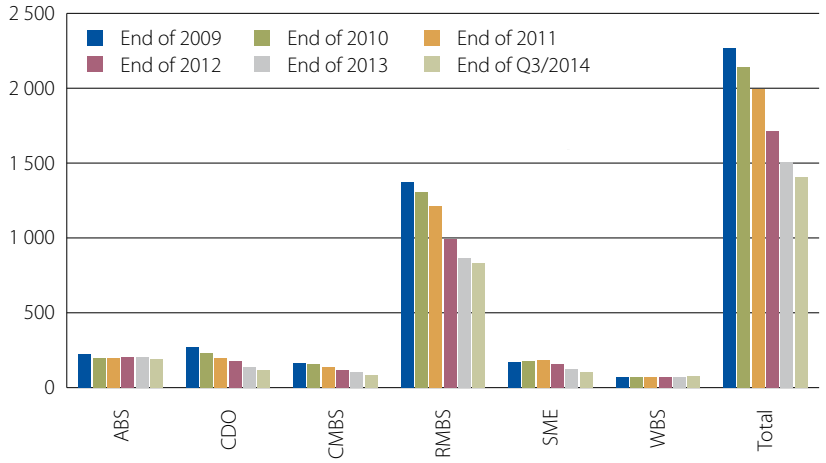
Figure 8 **SMESec transaction volumes in Europe and share of SMESec in total securitisation**



Source: EIF, based on data from AFME and own calculations.

Due to low new activity levels, the volume of *outstanding securitisation transactions* is on a downward trend (see Figure 9) compared to the end of 2013. By the end of Q3/2014, the total outstanding had decreased by another 7%. Since the end of 2011, the volume of outstanding SMESec transactions had decreased by 43%, from EUR 182bn to EUR 159bn (end of 2012) and EUR 104.6bn (end of Q3/2014). If the SMESec volumes at the end of Q3/2014 are broken down by country, the Spanish (25.7%) and Italian (25%) markets together account for around half of the overall outstanding, followed by Belgium (18.7%) and Greece (6.7%).

Figure 9 **European outstanding securitisation transactions (by collateral, EUR bn)**



Source: EIF, based on data from AFME.

Despite the financial and sovereign debt crisis the European securitisation market in general has performed relatively well, with comparatively low default rates.[20] The low losses are not only based on the typically high granularity, diversification and seasoning of these transactions but also on the structural features (such as large credit enhancement), which helped counterbalance the negative effects of the deteriorating European economy (i.e. increased SME default rates).

Prospects

As shown above, the track record of SMESec in Europe is relatively short. The market started only towards the end of the 1990s. At the time, this segment was relatively unknown to investors and rating agencies (owing to the novelty of the tools applied but also to the heterogeneity of SMEs/SME loans), the technique of securitisation was also new to most of the originators and many banks were not in a position to securitise SME loans (to take a simple example, the originators' IT infrastructure has to be able to cover securitisation transactions). Consequently, before the crisis started overall SMESec volumes were small compared to the overall securitisation market and the market had not had much time to develop. The uncertainty was one of the reasons for generally conservative structures in the general SMESec segment, and this led to good SMESec performance in Europe compared to other segments of the securitisation market (and compared to the US). According to Standard & Poor's (2014), only 1.58% of European structured finance notes (rated by Standard & Poor's) outstanding in mid-2007 had defaulted by mid-2014. The cumulative default rate for SMESec transactions was 0.55%, compared with 19.3% for US structured finance notes and 41.08% for CDOs.

There are many advantages of SMESec – for banks, for investors and, most importantly, for SMEs (see Kraemer-Eis et al., 2010 for a detailed discussion). At first sight the advantages are mainly for banks and investors, but these benefits can have a positive effect on SMEs' access to finance and hence the SMEs themselves. A recovery and development of the primary securitisation markets could play a role in unlocking the supply of credit and encouraging economic recovery. However, this will only benefit SMEs if the freed-up capital/fresh liquidity is used to finance the real economy (i.e. for new SME lending) and not for regulatory arbitrage, for instance.

A compelling case can be made for public intervention to enhance SMEs' access to finance (market failure based on information asymmetries, high transaction costs and spillovers, exacerbated by the credit crunch associated with the financial crisis in many economies; see Kraemer-Eis, Passaris and Tappi, 2013, for details)[21], especially if public support can contribute to the re-emergence of the primary European SME securitisation market. In this context, not only the volumes of the intervention matter, but also the positive signalling effect of public involvement and support can be important.

If the basic conditions for securitisation improve, there is significant potential, also for SMESec transactions. Altomonte and Bussoli (2014), for example, estimate, on the basis of the current outstanding loan volumes and applying several haircuts based on different eligibility parameters, a potential securitisation volume of EUR 325bn of SME ABSs, spread mainly over the main markets, namely Spain (19%), France and Germany (14% each), Italy (14%), Portugal (7%), Ireland (6%) and the rest of Europe (22%).

What can be done to revitalise the securitisation market? A first important step towards restoring investors' confidence in European ABSs is to remove misalignments of interests and information asymmetries between issuers and investors, encouraging greater transparency to ensure accurate pricing of credit risks. This also includes harmonisation of information and the basic conditions (e.g. regarding information on credit quality and national insolvency frameworks). A number of financial regulations as well as public and private sector initiatives in the EU have been implemented recently to address this concern.[22] However, some structural roadblocks remain that should be addressed.

20 With some exceptions, i.e. non-granular hybrid transactions (German mezzanine CDOs). For more details see Kraemer-Eis, Passaris and Tappi (2013).

21 The authors also discuss the justification for intervention at EU level (EU added value).

22 There are many initiatives to improve transparency, such as the DataWarehouse/Loan Level Initiative, Prime Collateral Securities (PCS) Initiative and new disclosure requirements (from ESMA, for instance).

In this context it is crucial that public development banks, the European Commission and European agencies engage in a close dialogue with regulators, both in response to public consultations and on a bilateral basis, to ensure that the capital requirements framework is consistent with the quality of the assets to which it applies. A particular focus should be placed on the promotion of simple structures and well-identified, transparent underlying asset pools with predictable performance ("high-quality securitisation") in order to revitalise the securitisation market – and SMESec transactions should be included.[23]

Also the Ecofin Council meeting of 9 December 2014 (Ecofin, 2014) highlighted the importance of revitalising the market for simple and transparent securitisation, including those products suitable for SMEs, based on a dedicated European securitisation framework addressing the inherent risks associated with securitisation, and encouraged the Commission to develop such a framework by summer 2015.

Current disclosure and bankruptcy laws across Europe have created an uneven playing field and although it is acknowledged that a huge effort will be required to standardise reporting and improve data availability, this effort must continue unhindered. Moreover, the dissemination of best market practice and knowledge about SMESec among (potential) market participants is important to develop this market. Here, public support can also play a significant role.

One initiative which the EIB Group has launched recently to contribute to the revitalisation of the securitisation market is the EIB Group Risk Enhancement Mandate (EREM), which aims to further enhance access to finance for SMEs and small midcaps by providing, inter alia, a range of targeted capital market instruments, including ABS credit enhancement. Under the umbrella of these instruments, the EIB Group provides credit enhancement for senior and mezzanine tranches of securitisation backed by SME loans, including guarantees. The European Council (2013a), (2013b) conclusions of June and October 2013 required an increase in the EIF's credit-enhancement capacity with the purpose of supporting the impaired financing of European SMEs. The response was to increase the EIF's capital, together with the EIB Group Risk Enhancement Mandate (EREM, which involved EUR 4bn from the EIB, plus EUR 2bn from the EIF). EREM will raise the EIF's credit enhancement capacity and leverage its catalogue of existing products, systems and procedures. An important element is the ABS credit enhancement window, which enables the EIF to increase its capacity as a credit enhancer of ABS tranches, in terms of both a larger ticket size and broader scope in each individual SME securitisation.[24] This can be seen as an important additional contribution of the EIB Group to a revitalisation of the European SMESec market.

In October this year, the ECB (2014a) announced operational details of its ABS purchase programme (ABS PP). The overall objective is to enhance the transmission of monetary policy, support the provision of credit to the euro area economy and, as a result, provide further monetary policy accommodation. The ECB's support of the ABS market in general and the SMESec market in particular is a positive step. The ABS PP can play an important role as a buyer and in driving investors into mezzanine tranches. However, so far the details revealed remain vague. The programme has started, but in particular the eligibility criteria for guaranteed mezzanine tranches have not yet been disclosed. Hence at this stage it is not possible to judge the overall impact of these measures on the revival of a sustainable SMESec market, and in particular on the involvement of the EIB Group, but constructive discussions between the Group and the ECB are under way.

23 In Kraemer-Eis, Lang and Gvetadze (2014a), we outlined what high-quality SMESec might look like. See also in this context the ongoing EBA consultation on simple, standard and transparent securitisation (EBA, 2014).

24 For more details see Kraemer-Eis, Lang and Gvetadze (2014a).

5.4. Microfinance

"Microcredit is generally recognised […] as an effective financing channel for job creation and social inclusion, which can attenuate the adverse effects of the current financial crisis while contributing to entrepreneurship and economic growth in the EU" (European Commission, 2012). In Europe, microfinance consists mainly of microloans (less than EUR 25 000) tailored to micro-enterprises (92% of all European businesses) and people who would like to become self-employed but are facing difficulties in accessing the traditional banking services. Throughout the EU, 99% of all start-ups are micro or small enterprises and one third of those were launched by unemployed people.

According to the recent EMN (European Microfinance Network) survey (Bendig et al., 2014), microcredit provision in Europe showed a positive trend in terms of the overall total value and number of microloans. More precisely, the European microfinance institutions (MFIs) surveyed disbursed a total of 207 335 microloans with a total volume of EUR 1.26bn in 2013 (compared to 122 370 microloans disbursed with a volume of EUR 872m in 2011). Compared to the 2011 survey data, this shows an increase of 45% in the total value of microloans and 69% in the number of loans reported in 2013 by the MFIs surveyed. The average loan size also increased from EUR 7 129 in 2011 to EUR 9 234 in 2013, on a par with 2009 (EUR 9 641). With regard to future trends, MFIs expect less public support in the coming years due to public budgetary constraints. Other challenges that MFIs face are new competitors such as crowdfunding and crowdlending platforms.

Despite the recent positive trends reported by EMN member MFIs, the overall situation of microcredit provision in Europe remains complex. Microfinance institutions have been affected by the adverse macroeconomic conditions during the global financial and economic crisis, generally through significantly higher bad debt rates among their clients and in some cases through increased difficulties in accessing external sources of funding. With ongoing problems in the banking sector, the target groups for microfinance are faced with a tightening of the credit supply by mainstream banks due to their higher risk aversion and growing need to deleverage their balance sheets. In an increasingly risk-averse credit allocation environment, lending may be diverted away from small and young firms, as they are riskier than their larger peers. This applies to the microfinance segment in particular.

The European microfinance market is still young and heterogeneous due to the diversity of legal frameworks, institutional environments and microfinance providers in European countries. In addition to commercial banks, which target micro-enterprises as part of their general SME lending activity, the spectrum of European microcredit developers includes many profit-oriented and non-profit associations. They range from microfinance associations to credit unions, cooperatives, community development financial institutions, non-bank financial institutions, government bodies, religious institutions and non-governmental organisations or foundations.

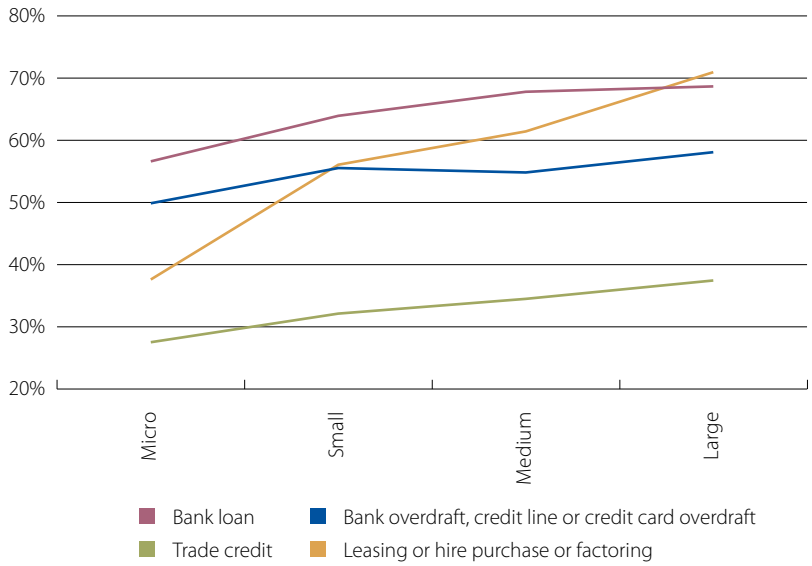
In addition to the diversity of institutional environments and microfinance providers, the characteristics of microloans are also very diversified across countries. According to Bendig et al. (2014), the average interest rate among the microfinance providers surveyed was 10% in 2013 (11% in 2011) but ranged from 5% in France, Italy, Austria and Switzerland to 27% in the UK, and even higher in non-EU Balkan states. The differences in average interest rates are typically related to differences in the legal framework, MFI business models, pricing policies, refinancing cost, cost structure and the level of subsidies. Without usury laws or interest rate ceilings in place, the interest rate usually decreases with the loan size (Bendig et al., 2012, 2014). Microloans are normally offered with a special focus on social inclusion. Higher interest rates for microloans ("high" compared to "standard" lending rates) typically reflect the non-subsidised, cost-covering business models (often MFIs in the eastern part of the EU), while the lower interest rates reflect a higher prevalence of social microfinance, corporate social responsibility initiatives and MFIs with subsidised, partly grant-dependent business models (often in the western part of the EU). For-profit institutions typically charge higher interest rates (cost coverage) and grant larger loans (economies of scale). However, it is important to note that a profit orientation is not inconsistent with a socially-oriented investment strategy. In fact the microloan business model, if operated on sustainable terms in the long run, inherently requires relatively high interest rates on the microloans (Bruhn-Leon,

Eriksson and Kraemer-Eis, 2012). Similarly, the spread of average loan durations varies across countries. Long loan terms can be found in Hungary (77 months), Portugal (72) and Austria (60). Typically, shorter loan terms are observed in countries with high average interest rates and low average loan volumes (except Germany), i.e. mainly in the Balkan states.

According to the data from the latest ECB survey on access to finance of enterprises in the euro area (ECB, 2014c), the share of enterprises which see access to finance as their most pressing problem is larger among micro-enterprises than among other SMEs. Micro-enterprises reported "access to finance" as their second most pressing problems (while it was the sixth "most pressing problem" for small, medium and large enterprises). "Finding customers" remained the most frequently mentioned concern. The ECB (2014c) also reported a rise in bank loan rejection rates for micro and small enterprises, and a fall for medium-sized ones. The rejection rate is still highest for micro firms (18%), compared to 12% for small firms and 5% for medium-sized firms.

Difficult access to finance, in particular bank loans, might be one key reason why micro-enterprises in Europe use bank loans and other external financing sources considerably less than other SME size classes. However, on balance micro-enterprises reported a greater need for bank loans. Figure 10 shows that, with the exception of "bank overdraft, credit line or credit card overdraft", the use of different financing sources on average typically increases with the size of the SME.

Figure 10 Different financing sources for enterprises (by enterprise size class)



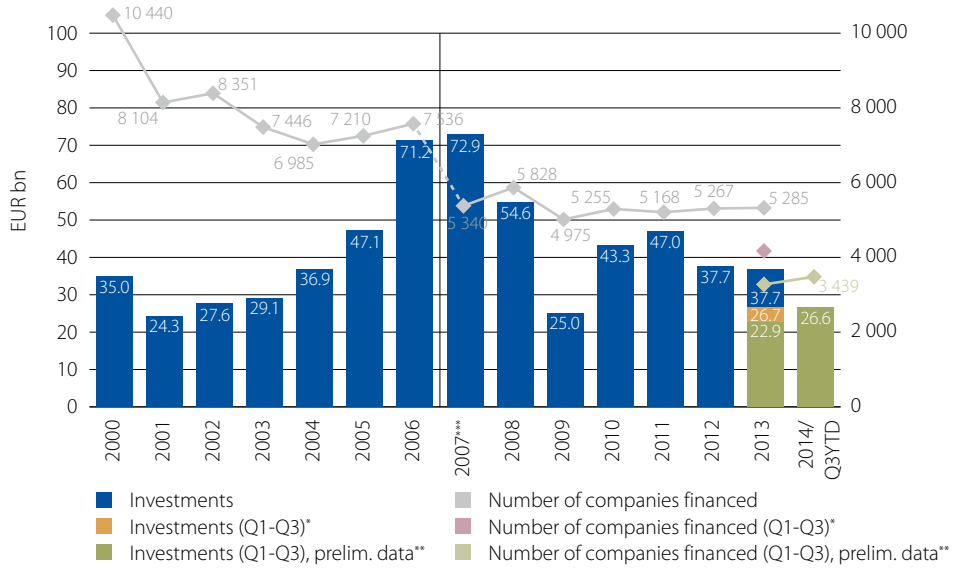
Source: EIF, based on ECB (2014c) data.

The EMN (Bendig et al., 2014) survey showed a high diversity with regard to targeted social groups and societal policy goals. Two-thirds of the MFIs surveyed reported that they included social impact in their mission, followed by job creation (58%), and social (56%) and financial (50%) inclusion. 85% of the MFIs surveyed reported that they include at least one dedicated employment goal as part of their mission.

5.5. Private equity and venture capital

Following the severe crash in 2008/2009, European private equity (PE) investment partially rebounded in 2010 and 2011. However, the recovery then suffered a setback in 2012, but stayed well above the 2009 crisis low (see Figure 11). In 2013, PE investment stabilised at EUR 37.7bn, according to EVCA figures.[25] The number of companies benefiting from PE investment in 2013 remained almost unchanged at nearly 5 300. In the first three quarters of 2014 PE, investment amounted to EUR 26.6bn, according to the preliminary EVCA data, an increase of 19% compared to the EUR 22.9bn reported for the same period of the previous year (preliminary data as at Nov. 2013).[26] These EVCA data also indicate a considerable increase in the number of companies financed in the first three quarters of 2014.

Figure 11 Investment activity by private equity firms located in Europe[27]



Notes: **As reported at November 2014.*
***As reported at November of the respective year.*
****EVCA had changed the data provider with effect from 2007 on. Since then, EVCA PE activity statistics are based on data from PEREP Analytics.*

Source: *EIF, based on EVCA data.*

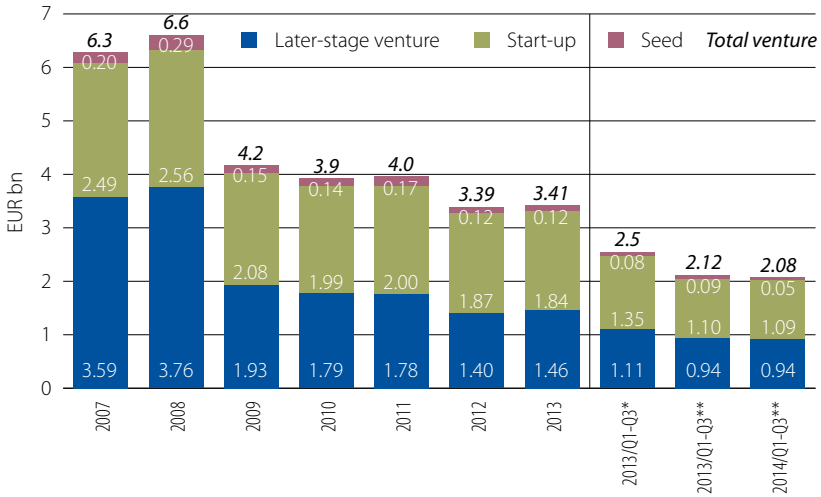
25 We should like to thank our colleagues from the European Private Equity & Venture Capital Association (EVCA) research team for their support. Please note that EVCA PE statistics do not include infrastructure funds, real estate funds, distressed debt funds, primary funds of funds, secondary funds of funds or PE/VC-type activities not conducted by PE funds. This means that business angel, hedge fund and corporate venture capital activity not conducted by a corporate VC fund is not included in the statistics. Please note that the EVCA investment figures show investment activity by PE firms located in Europe ("industry approach" or "office approach"). EVCA statistics can differ from the numbers reported by other data providers for the reasons just mentioned and due to different definitions and interpretations of the PE fund and investment stages and geographical definitions (e.g. of "Europe"). For more details see also EVCA (2014b), (2014c), the EVCA website (www.evca.eu) and Kraemer-Eis, Lang and Gvetadze (2014b).
Please note that all EVCA figures for 2014 are based on the first three quarters of 2014 ("2014/Q1-Q3"). It has to be noted, however, that conclusions from EVCA data for less than a full year should be drawn much more cautiously than when interpreting annual data, as a significant number of funds do not report their figures to EVCA until the fourth quarter. Thus annual data may differ to a relatively large extent from the data for the first few quarters of a year, and figures for less than a full year should be regarded as preliminary. In addition, in order to make reasonable assessments for the recent past, we have often compared the 2014/Q1-Q3 data with 2013/Q1-Q3 data reported at a comparable time (i.e. in November 2013). These data may differ from the 2013/Q1-Q3 figures reported today (which we also occasionally mention in footnotes) due to data revisions carried out in the meantime.

26 Based on data available at Nov. 2014, PE investments amounted to EUR 26.7bn in the first three quarters of 2013.

27 All investment figures are equity value, i.e. excluding leverage.

Since its pronounced slump of 37% in 2009 compared to the year before, investments related to the venture capital (VC) stage of the European PE market declined further, albeit at a much slower pace, to EUR 3.4bn in 2013 (see Figure 12).[28] In the first three quarters of 2014 total VC investments amounted to EUR 2.08bn. They thus remained fairly stable compared to the figures reported for the same period of the previous year.[29] Life sciences, computer/consumer electronics and communications have remained the most relevant industries for VC investment since 2007 (Kraemer-Eis, Lang and Gvetadze, 2014b).

Figure 12 Venture capital investment activity in Europe



Notes: **As reported in November 2014.*
***Preliminary data as reported in November of the year in question.*
Source: *Based on EVCA data.*

Some of the gap created by the decline in VC investment since the beginning of the crisis has been filled by increased business angel activity. Business angels represent an important class of private equity investors, primarily consisting of high net worth individuals. They tend to invest their own money, either individually or in formal or informal syndicates, in businesses that are not publicly traded. Their proximity to the market has been beneficial during this difficult period. For more information on business angels' recent activity see Kraemer-Eis, Lang and Gvetadze (2014b). For a general description of business angel financing we refer to Kraemer-Eis and Schillo (2011) and to OECD (2011).

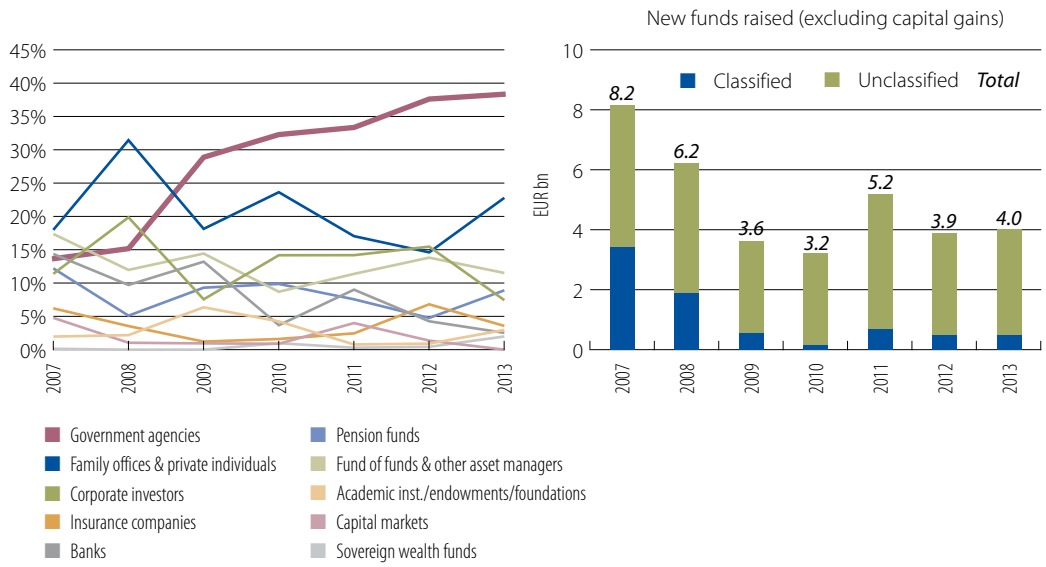
Total PE *fundraising* improved substantially in 2013. EVCA figures report a 118% increase (compared to the year before) in funds raised by private equity firms located in Europe, to EUR 53.6bn. However, this is still a long way off the amounts reached during the pre-crisis years, and preliminary EVCA figures for the first three quarters of 2014 have so far not shown a continuation of the positive development (see Kraemer-Eis, Lang and Gvetadze, 2014b, for details).

The recent changes in PE fundraising were mainly driven by the buyout sector, which forms the largest part of the market by far. Total European *VC* fundraising stabilised at EUR 4.0bn in 2013 but still does not substantially exceed the levels of the crisis years 2009, 2010 and 2012. A sign of investors' still cautious sentiment for venture capital is the shift in the investor base that has been taking place in recent years (see Figure 13). According to EVCA figures, government agencies accounted for 38% of total investors in venture capital funds in 2013 (Kraemer-Eis, Lang and Gvetadze, 2014b).

28 Venture capital focuses on non-mature companies. Three VC stages can be distinguished: seed, start-up and later-stage venture. Venture capital funds often back entrepreneurs who have just the germ of a business idea (source: http://evca.eu/what-is-private-equity/).

29 Preliminary data as at November 2013. Based on data available at November 2014, VC investments amounted to EUR 2.5bn in the first three quarters of 2013.

Figure 13 Investor base: share of government agencies in VC fundraising[30]



Source: Based on data from EVCA.

In order to put public investors' activity in context, we can take the EIF as an example. In 2013, EIF investment represented 15% of all VC fund investment in Europe. If we assume that the average stake in each fund ranges from 25 to 30%, the EIF invested in more than two-thirds of all VC funds launched in 2013. Not even 30% of VC funds in which the EIF invested from 2011 onwards managed to close with their full target size until mid-2014, and nearly 60% of the EIF-backed funds would not have had a first closing at a viable fund size without EIF support. This indicates the EIF's catalytic role, rather than a crowding-out effect, in times of an ongoing severe crisis for European VC. This view was confirmed in a recent Unquote Intelligence (2014) survey among General Partners (GPs) and Limited Partners (LPs), which found that "the overriding benefit of [public funding bodies'] (PFB) money is the crucial role it plays in attracting other investors". Moreover, "[h]aving PFB money in a fund does not deter other LPs from committing". However, even though the EIF strives to stimulate market activity by its investments, it would not invest in funds that are not majority-financed by private investors (Kraemer-Eis, Lang and Gvetadze, 2014a).

Divestments have increased substantially since the crisis lows in 2009. In 2013, total divestments by PE firms located in Europe amounted to EUR 33.6bn (please note that EVCA divestment figures show only the equity amount initially invested, i.e. excluding any profit on the investment). VC divestments have increased as well, amounting to EUR 2.4bn in 2013. In 2014, the exit markets seem to have remained remarkably strong, according to the preliminary EVCA data. In the venture capital segment, the relative importance of write-offs as a form of divestment has decreased, while trade sales remained the most popular form of divestment. The importance of initial public offerings (IPOs) increased substantially again in 2013 and the first three quarters of 2014. Even if this is in principle a positive sign for the European VC (and PE) market, warnings are already being voiced of potential overvaluations when companies that are still a long way from being profitable go public (see, for example, Go4Venture Advisers, 2014).

According to Thomson Reuters data, European venture capital *performance (returns)* has stabilised, albeit at a low level. Following three increases in a row, the three-year rolling-horizon internal rate of return (IRR) recorded only a small setback in 2013 and amounted to 2.3% (2014 data are not yet available.) Following the long period of negative returns between 2008 and 2010, this can still be interpreted as good news. The longer-term performance figures also convey a slightly optimistic message. For the first time

30 Based on incremental amounts raised during the year (in contrast to final closings only).

since 2008, the rolling-horizon IRRs for the five-year (1.3%) and ten-year (0.8%) periods are reported to be in positive territory at the same time. However, VC performance in Europe is still below the level of returns reported for the private equity industry as a whole, which also includes the buyout and mezzanine segments of the market. Moreover, the average VC return levels are still relatively low given the riskiness of VC investments.

The current economic situation and various regulatory changes continue to make the general market environment very challenging. EVCA (2014a) provides a comprehensive overview of some 30 regulatory initiatives and changes and their potential impact on PE in Europe. We cannot go into a detailed assessment of all the different sets of rules here (AIFMD, Solvency II, EuVECA, CRD IV and CRR, to mention but a few, and various taxation rules). However, according to a Preqin (2014) survey, regulation, performance and the economic environment were still perceived as the biggest challenges currently facing investors (similar findings were reported by Unquote Intelligence, 2014). All these challenges continue to create access to funding problems, in particular for new funds, in the European VC market. Moreover, a Coller Capital (2013) study found that the majority of global Limited Partners believe that there are insufficient sources, other than VC, available to finance innovation and growth in Europe. This supports a view that public backing is especially needed for this market segment in order to strengthen the early-stage part of the market in particular. Indeed, a recent Unquote Intelligence (2014) survey found that "public money remains absolutely critical to the European venture industry and is likely to remain so for the next five years", and this has been particularly true for new funds, as most public funding bodies support first-time funds, while this applies to only around half of private investors. Apart from the additional funding volumes, public investors' participation in a PE/VC fund can also have a positive signalling effect on private investors as a result of perceived strict due diligence requirements and an assumed relatively high stability of public LPs' commitment to a fund. These advantages seem to outweigh the potential disadvantages of public investors' participation (such as a possibly negative impact on speed and responsiveness or imposed restrictions in the investment strategy of the fund). See also Unquote Intelligence (2014) for more details. According to Colombo, Cumming and Vismara (2014), the design of a public VC investment scheme is important for its impact. In particular, government VC schemes seem to have been more successful when these have acted alongside private investors, which would favour a government fund of funds set-up over direct public investment. Moreover, Brander, Du and Hellmann (2014) find that enterprises funded by both government VC and private VC obtain more investment than enterprises funded purely by private VC, and much more than those funded purely by government support. There is also a positive association between mixed government/private funding and successful exits, as measured by initial public offerings and acquisitions, attributable largely to the additional investment. These findings are in line with Bertoni and Tykvová (2012), who concluded that "that syndicates between private and governmental venture capital investors, in which the private investor takes the lead, are the most efficient form in terms of innovation production that outperforms all other forms."

Recent EIF market insight shows a number of VC-backed companies in the early-stage segment that show promising revenues, positioning them well for sustained organic growth and ultimately good returns for investors. It is of course important to support these companies in their continued growth and also help, through the support of financial intermediaries, additional and complementary businesses to maintain and strengthen the backbone of the European VC market, encouraging a strong and continued supply of new innovative companies. In addition, the VC ecosystem is developing, including the emergence of more and more successful incubators and accelerators. Should these trends continue, the potential returns on early-stage companies would have significantly positive impacts on the performance of VC investing. The medium-term perspective of the European VC market would therefore be more positive than the backward-looking statistics suggest.

5.6. Concluding remarks

We have described the current state of SME financing in Europe. The European economy is at present heading for a moderate recovery. However, large country differences remain and there are still a number of downside risks, as the legacies of the crisis (inadequate demand, high debt and unemployment) still weigh on the economy (IMF, 2014b). The nonetheless improved general economic conditions have resulted in a considerable amelioration of European SMEs' business environment and a more optimistic outlook for corporate insolvencies than in the recent past, although the imbalances between the EU Member States are still significant.

According to available information, corporate *demand* for loans improved in the course of 2014, while credit standards on average eased for the first time since 2007, implying less restrictive lending behaviour on the *supply* side. However, access to finance has remained more difficult in those countries that were most affected by the crisis.

There are instruments that can add to (or sometimes even replace) traditional bank lending, thereby alleviating SMEs' difficulties in obtaining access to finance. We have highlighted some of these instruments for SMEs, in particular loan guarantees, loan securitisation, microfinance and private equity/venture capital. All these instruments can improve SMEs' access to funds. However, while equity instruments typically reach a sizeable but limited share of SMEs, guarantees and securitisation target the more "traditional" debt instruments that are important for the majority of SMEs. Microfinance typically targets micro-enterprises and small companies. Despite their importance in broadening the financing base of SMEs, these instruments have also been affected by the financial crisis to different extents.

As outlined above, there are market imperfections as well as cyclical difficulties for SME finance, and these are serious enough to warrant intervention. SMEs need a balance of equity and debt finance, and this balance shifts across the SME life cycle. Hence, public support of SME financing has to consider the whole range of financial products needed throughout the various development stages of SMEs.

As we described in greater detail, on the basis of five key principles, in the 2013 EIB Annual Economics Conference publication (see Kraemer-Eis, Lang and Gvetadze, 2013), "this intervention to mitigate the 'bottlenecks' must be conditional upon ensuring 'additionality', i.e. not crowding out private activities, but rather serving as a catalyst for the entry of private capital in order to create self-sustainable markets in the long run."

In the field of debt instruments, such targeted policy intervention could be implemented with a wider use of risk-sharing tools, by also using EU funds to partially guarantee portfolios of SME loans, in order to generate a leverage effect in terms of the SME lending (or leasing) volume. We have also shown that public support can contribute to the re-emergence of the primary European SME securitisation market, which could be an important factor in enhancing access to finance for SMEs in Europe. In this context not only the volumes of the intervention matter, but also the positive signalling effect triggered by the public involvement and support. However, this will only benefit SMEs if the freed-up capital/fresh liquidity is going to be used by the banks to finance the real economy (i.e. for new SME lending) and not for regulatory arbitrage, for instance. Moreover, investors will only return in volume if they regain trust in the quality of the transactions and if there is satisfactory secondary market liquidity. Originators will return if transactions are economically feasible. For both, a stable and reliable regulatory framework is also a key precondition. Hence, a recovery of the European structured finance market will depend not only on the development of market fundamentals and the enhancement of investors' confidence but also to a large extent on the direct and indirect impact of regulatory priorities.

In the area of private equity/venture capital, despite some improvement in the recent past, activity levels are still very low. This applies to all segments of the market that are relevant for SMEs, but in particular to the early-stage part. Public support for this market is also needed and public actors should continue to play their countercyclical role and to catalyse private investment. The long-term objective of this support is to establish a well-functioning, liquid equity market that attracts a wide range of private sector investors. Moreover, alternative investor categories should be incentivised to invest in European VC.

Microfinance can play an important role in overcoming the effects of the crisis for some specific groups and in particular in supporting inclusive growth. However, the outlook for the sector in terms of growth and self-sufficiency are limited if microfinance providers do not have access to stable funding. The MFIs have paved the way for developing more efficient and lean processes, for reducing the cost of providing microloans and for seeking additional funding sources (Bendig et al., 2012). Against the background of the current difficult environment, support at European level has become even more important – via funding, guarantees and technical assistance for a broad range of financial intermediaries, from small non-bank financial institutions to well-established microfinance banks – in order to make microfinance a fully-fledged segment of the European financial sector.

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List of acronyms

ABS: asset-backed security

ABS PP: Asset-Backed Securities Purchase Programme

AECM: European Association of Mutual Guarantee Societies

AFME: Association for Financial Markets in Europe

bn: billion

BIS: Department for Business, Innovation & Skills

BoE: Bank of England

CDO: collateralised debt obligation

CGS: credit guarantee scheme

CESEE: Central, Eastern and South-Eastern Europe

CMBS: commercial mortgage-backed security

ECB: European Central Bank

EIB: European Investment Bank

EIF: European Investment Fund

EIOPA: European Insurance and Occupational Pension Authority

EMN: European Microfinance Network

EREM: EIB Group Risk Enhancement Mandate

ESBFO: European Small Business Finance Outlook

ESMA: European Securities and Markets Authority

EU: European Union

EUR: euro

EVCA: European Private Equity & Venture Capital Association

GDP: gross domestic product

GP: General Partner

HY: half-year

IMF: International Monetary Fund

IPO: initial public offering

IRR: internal rate of return

k: thousand

LBO: leveraged buyout

LP: Limited Partner

LTRO: long-term refinancing operation

m: million

MAP: Multi Annual Programme for Enterprise and Entrepreneurship

MFI (in context of microfinance): microfinance institution

MFI (in context of ECB): monetary financial institution

NFC: non-financial corporation

OECD: Organisation for Economic Co-operation and Development

PCS: prime collateralised security

PE: private equity

PFB: public funding body

pp.: pages

Q: quarter

RMA: Research & Market Analysis

RMBS: residential mortgage-backed security

SAFE: Survey on the access to finance of enterprises

SMAF (Index): SME Access to Finance (Index)

SME: small and medium-sized enterprise

SMESec: SME securitisation

tn: trillion

UEAPME: European Association of Craft, Small and Medium-sized Enterprises

UK: United Kingdom

US: United States

VC: venture capital

VDB: Verband Deutscher Bürgschaftsbanken

VIWGCGS: Vienna Initiative Working Group on Credit Guarantee Schemes

WBS: Whole Business Securitisation

Part III

Investing in competitiveness

Chapter 6

In search of competitiveness[1]

Philippe Aghion[2]

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In search of competitiveness

Chapter at a glance

This chapter builds on modern trade economics and in particular on the idea that a country's competitiveness boils down to the competitiveness of its individual enterprises. Recent empirical work in turn shows that firm-level competitiveness is related to a firm's productivity and ability to grow.

A useful framework for thinking about firm-level productivity growth and the determinants of that growth is the so-called Schumpeterian paradigm, which revolves around four main ideas:

1) Productivity growth relies on profit-motivated innovations. As such, policies and/or institutions that increase innovators' expected benefits from innovation should induce more innovation and thus faster productivity growth.

2) Different forms of innovation, such as "frontier innovations" and "imitative innovations" require different types of policies and institutions. In particular, "frontier innovations" require labour and product market flexibility, research education and universities that perform well, and financing that compensates investors for the fact that they are taking on higher risk than if they are financing an established activity.

3) Creative destruction and the importance of reallocation for productivity growth. Efficient entry of new firms, exit of old technologies or products and firm-level growth require properly functioning product market competition and also labour market flexibility.

4) Schumpeterian waves and the ability of countries to quickly benefit from new technological waves corresponding to the diffusion of new "general-purpose technologies".

Enhancing firm-level productivity growth calls first for horizontal policies (product and labour market liberalisation, trade liberalisation, investment in higher education, etc.), though there may be a case for vertically targeted policies, provided these are properly designed and governed. Such an industrial policy would target activities with high growth potential (not particular firms), provide horizontal support within those sectors based on clear and verifiable criteria, and should be governed in a way that preserves or even enhances product market competition in the sectors in question and also guarantees an exit from non-performing activities.

To support horizontal policies, structural funds could be partly reoriented towards facilitating the implementation of structural reforms in areas such as labour markets, product markets and education. They should aim to facilitate changes in the functioning of those areas and help to finance the related transition costs. Funds should be allocated on an individual basis and to specified deliverables.

6.1. Introduction

After decades during which governments in developed countries focused on domestic demand as the main driver of economic growth, the advent of globalisation has forced them to increasingly turn their attention to the competitiveness of the domestic economy, i.e. the extent to which a country can export its production abroad and thereby "exchange goods and services in which it is abundant for goods and services that it lacks" (Altomonte et al., 2012).[3]

Meanwhile, trade economists have themselves reconsidered how the issue of competitiveness should be approached. Thus, as clearly explained by Bernard et al. (2011), while theories of international trade used to emphasise inter-industry trade and therefore the view that international competition is between countries, with each country playing on the industries where it has a comparative advantage, recent theories emphasise firm-level competition worldwide and intra-industry trade. As Altomonte et al. (2012) put it so well, "it is not really the country that exchanges (...) goods and services, but rather its firms". According to that view, what makes a country competitive is primarily what makes its individual firms competitive. And what makes an individual firm competitive on the world market is its productivity and also to some extent its size: here the seminal theoretical contribution is by Melitz (2003),[4] which develops a model of intra-firm trade with heterogeneous firms, where only firms that are sufficiently productive can become exporters, as being more productive allows firms to secure a market share that covers the fixed cost of exporting.

This prediction is confirmed by cross-country firm-level evidence (see, for instance, Altomonte et al., 2012), and it has at least two important implications. First, one can widen the idea of competitiveness to include also domestic business activities (in particular local services sectors). Thus we shall define competitiveness as the general fitness of a firm to compete in foreign markets, i.e. whether the firm is sufficiently productive and large to operate profitably in a foreign market if it were to relocate and start exporting to that market. This does not mean that the firm actually needs to compete in a foreign market to be regarded as being competitive. That said, the focus on exporters is justified by the fact that they serve as a good proxy for measuring "competitiveness", as exporters are more likely to pass the required productivity/size threshold than non-exporters.

Second, linking competitiveness to productivity has important policy implications for how to enhance the competitiveness of the domestic economy: in particular, departing from "vertical" or "top-down" policies that emphasise the national comparative advantage based on current national factor endowment, the new theories call for more horizontal policies to favour productivity growth and size growth of individual firms in the country.

This paper will be organised as follows. In section 2, we summarise the main arguments in the recent trade literature in favour of a firm-level approach to competitiveness. In section 3, we link firm-level competitiveness to productivity. In section 4, we discuss potential determinants of firm-level productivity and productivity growth. In section 5, we look at so-called technological waves. In section 6, we consider potential barriers to growth in firm size. In section 7, we revisit the role for vertical targeting (or sectoral policies). In section 8, we draw on our discussion to propose some elements of a new growth strategy for Europe. And section 9 concludes this chapter. Finally, in the Appendix, we develop a simple model in which trade liberalisation fosters productivity growth.

3 The recent fiscal devaluation in France through the introduction of the CICE (Crédit d'Impôt Compétitivité) gave rise to a heated debate between the advocates of demand-driven policies and those who emphasise the need to increase the country's competitiveness.

4 See also Hopenhayn (1992).

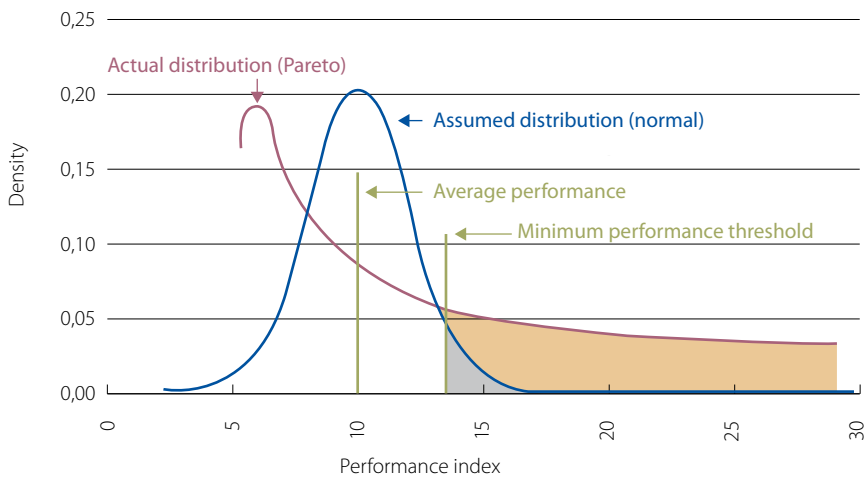
6.2. From industry-level to firm-level competitiveness

Until Melitz's (2003) seminal contribution to trade economics,[5] mainstream theories of international trade commonly relied on the assumption of a representative firm in each domestic economy. These theories include both the Heckscher-Ohlin model, which emphasises comparative advantage under perfect competition as the main driver of international trade, and the more recent theories of Krugman (1980) and Helpman (1981), which focus instead on increasing returns and consumers' preference for variety as drivers of trade. However, recent evidence shows a high degree of heterogeneity across firms in the same domestic industry and also that this heterogeneity is reflected in firm-level productivity, firm size, firm-level skills and wages, and capital intensity. Moreover, as predicted by Melitz (2003), this heterogeneity, particularly with regard to productivity, is a key determinant of whether and to what extent firms are involved in international trade and of how well they perform as exporters.

First, the extent of intra-industry differences is shown by Syverson (2004), for example. Thus within an average US sector, the top 10 per cent of most productive firms are twice as productive as the bottom 10 per cent. More recently, Hsieh and Klenow (2009) show that intra-industry differences are even bigger in emerging economies: in China and India the top 10 per cent produce more than five times as much as the bottom 10 per cent in the average industry.

Moreover, the actual distribution of firm-level performance, whether it is measured by productivity or firm size, tends to be more highly skewed (typically Pareto distributed) than the symmetric normal distribution people assume (see Figure 1 below from Altomonte et al., 2012). This in turn gives rise to an «aggregation bias». In other words people tend to underestimate the share of low-performing firms, and therefore ignoring firm heterogeneity within industries and instead looking directly at industry-level or country-level averages may lead to inappropriate policy prescriptions.

Figure 1 **Actual (Pareto) vs. assumed (normal) distributions of firms' performances**



Source: *Altomonte et al. (2011).*

For example, suppose, as in Melitz (2003), that only firms beyond a given cut-off performance level are able to export. Then, as explained by Altomonte et al. (2012), any policy aimed simply at increasing average industry-level productivity without affecting the distribution of firm performance within the

5 Here we also ought to mention the precursor contribution by Hopenhayn (1992).

industry and, in particular, without affecting the number of firms that pass the export threshold, will have no effect on the industry's overall exports, and therefore on its competitiveness. And indeed, as we will see in the next section, there is evidence of a "happy few" phenomenon, i.e. that only few firms above a given performance threshold make it to be exporters or more generally "internationalised". Hence the importance of looking directly at firm-level differences and of understanding how firm-level characteristics affect firms' ability to export, i.e. not only their individual productivity level but also whether that level gets to pass the export threshold.

Antras et al. (2010) appeal to the aggregation bias to explain the so-called "Spanish paradox", namely the fact that Spain increased its overall degree of competitiveness (as measured by its share of world exports) over the decade 2000-2009, even though average productivity (as measured by unit labour costs) deteriorated over that period. What happened is that productivity improved for firms already beyond the export threshold, whereas it underwent a significant deterioration for firms below that threshold. Thus the same number of firms kept exporting and they exported more due to their increased productivity.

One remark to conclude this section. Here we have tried to explain why more productive firms are more likely to engage in international activities. But there is the reverse causality from trade openness to firm-level productivity growth. For example, using new firm-level panel data across twelve European countries over the period 1996-2007, Bloom et al. (2011) show that increased competition from Chinese imports spurred technical change within firms in those countries (whether technical change is measured by IT diffusion, R&D expenses, total factor productivity (TFP) growth or improvements in management practices). In the online Appendix[6], we develop a simple model that rationalises these effects of trade on productivity growth.

6.3. Productivity and other key characteristics of exporting firms

Table 1 below from Bernard et al. (2011) is based on 2002 data from the US Census of Manufactures. It regresses the various firm characteristics (size, productivity, skills, etc.) on a dummy variable indicating whether the firm is an exporter or not. Results in the second column control for differences across industries that do not change over time, and the third column also controls for log firm employment. Overall, the results point to an "exporter premium", i.e. to a comparative advantage of exporters over non-exporters with regard to performance variables such as: (i) firm size measured by log employment: log employment in exporting firms is equal to log employment in non-exporting firms plus one times the corresponding coefficient in the Table; similarly, firm size measured by the log of shipments: log of shipments for exporting firms is equal to log of shipments for non exporting firms plus one times the coefficient in the corresponding row and column in the Table: (ii) productivity measured by log value added per worker or by the log of TFP is again higher in exporting than in non-exporting firms; (iii) skill, measured directly by log skill per worker or indirectly by log wages, is higher in exporting firms; (iv) capital intensity measured by log capital per worker is higher in exporting firms.

6 http://www.eib.org/infocentre/publications/economics/index.htm

Table 1 Exporter premia in US manufacturing

	(1)	(2)	(3)
Log Employment	1.19	0.97	.
Log Shipments	1.48	1.08	0.08
Log Value Added per Worker	0.26	0.11	0.10
Log TFP	0.02	0.03	0.05
Log Wage	0.17	0.06	0.06
Log Capital per Worker	0.32	0.12	0.04
Log Skill per Worker	0.19	0.11	0.19
Additional Covariates	None	Industry Fixed Effects	Industry Fixed Effects, Log Employment

Source: Bernard et al. (2011).

More recently, Altomonte et al. (2012) went somewhat further by looking at the relationship between firm characteristics (skills intensity, capital intensity, productivity, etc.) and firm-level openness over multiple countries and considering several dimensions of openness. In order to perform reliable comparative analysis, with the support of the Bruegel think tank the authors carried out a large cross-country firm-level survey known as EFIGE. To construct the EFIGE dataset, the authors selected seven countries (Germany, France, Italy, Spain, the UK, Austria and Hungary) and for each of them they selected a large number of firms to which they sent a survey questionnaire. All these firms had more than 10 employees; and the overall sample included 3 000 firms from each of the first four countries, more than 2 000 in the UK and around 500 firms in Austria and Hungary. Based on the answers to the questionnaire, the authors constructed "openness" indicators reflecting the nature or extent of firms' international involvement. Thus a firm would be called "an exporter" if it provided a positive answer when asked if it sold abroad. Similarly, binary indicators were constructed for importing versus non-importing firms or for distinguishing between firms that were involved in foreign direct investment (FDI) or outsourcing and firms that were not.

Table 2 from Altomonte et al. (2012) provides interesting descriptive statistics on the mapping between various dimensions of firm performance and various indicators of firms' degree of openness. In particular, we see that larger or more capital-intensive firms tend to be "more open" along the various openness scales. Moreover, the export performance threshold appears to be lower than the FDI threshold. Table 3 shows that the same conclusion applies when looking at firm-level productivity (whether measured by TFP, unit labour costs, or labour productivity), i.e. more productive firms tend to be more open, and again the export performance threshold appears to be smaller than the FDI threshold. One potential explanation is that FDI requires additional collateral to be put up by the local firm in order to mitigate the potential expropriation risk faced by foreign investors (see Aghion, Comin, Howitt and Tuncer, 2009d).

Table 2 International categories of firms – descriptive statistics (full sample), 2008

	No. of firms	Avg. turnover per firm (in € '000s)	Avg. no. of employees	Avg. capital stock per employee (in € '000s)
Non-active abroad	3 402	4 443.33	31.44	152.16
Active abroad of which	11 357	19 273.46	139.85	196.40
Exporter	9 849	20 494.21	151.42	199.03
Importer of services	3 449	38 659.98	332.12	223.57
Importer of materials	7 298	21 976.44	191.17	200.36
Global exporter	4 016	24 777.71	103.43	222.93
Passive outsourcer	5 799	17 052.42	83.96	204.98
Active outsourcer	590	24 657.11	119.55	225.28
FDI	719	77 637.20	334.13	239.55
Whole sample	14 759	15 589.29	114.52	186.59

Source: Altomonte et al. (2012).

Table 3 International categories of firms – descriptive statistics (restricted sample), 2008

	No. of firms	Avg. turnover (in € '000s)	Avg. no. of employees	Avg. capital stock per employee (in € '000s)	Total factor productivity	Unit labour cost (in € per unit of added value)	Labour productivity (added value per employee in € '000s)
Non-active abroad	1 514	5 298.51	31.67	156.14	0.872	0.77	50.71
Active abroad of which	5 921	24 623.51	152	200.01	1.024	0.78	57.55
Exporter	5 201	26 104.12	164.41	203.19	1.033	0.77	58.09
Importer of services	1 900	50 004.76	372.81	230.61	1.159	0.84	61.81
Importer of materials	3 939	31 647.82	208.25	203.31	1.058	0.79	58.43
Global exporter	2 211	28 345.27	104.42	224.77	1.094	0.79	62.56
Passive outsourcer	2 965	20 763.66	84.31	208.06	1.060	0.79	59.86
Active outsourcer	306	32 991.62	127.39	224.94	1.066	0.76	56.03
FDI	387	98 554.23	359.7	238.08	1.293	1.05	63.35
Whole sample	7 435	20 303.82	125.6	190.39	0.991	0.78	56.05

Source: Altomonte et al. (2012).

The fact that the more open firms tend to perform better appears even more clearly when looking at performance deciles. Thus Altomonte et al. (2012) show that around 85 per cent of firms within the top TFP decile in the corresponding industry are exporters, around 45 per cent of firms in the same decile are global importers, less than 15 per cent are involved in FDI and around 5 per cent are involved in outsourcing.

Next, Table 4 from Altomonte et al. (2012) reports the results from the OLS regression of TFP on the various openness dummies. First, we see that the correlations between TFP and the various openness

indicators are all positive and significant. Second, being involved in FDI commands a higher TFP premium than being an exporter, which is again consistent with the notion that the fixed cost of FDI involvement is higher than that of exporting.

Table 4 International status and TFP premium

	(1)	(2)	(3)	
Dep. variable: TFP	OLS	OLS	O.Probit	N
Active abroad	0.0906***	0.0353***	0.261***	7 259
	(0.0132)	(0.0128)	(0.0290)	
Exporter	0.0999***	0.0399***	0.272***	6 563
	(0.0136)	(0.0131)	(0.0298)	
Importer of services	0.171***	0.0626***	0.620***	3 334
	(0.0171)	(0.0171)	(0.0531)	
Importer of materials	0.118***	0.0449***	0.394***	5 320
	(0.0142)	(0.0138)	(0.0332)	
FDI	0.257***	0.0980***	0.750***	1 862
	(0.0329)	(0.0357)	(0.0750)	
Passive outsourcer	0.122***	0.0558***	0.329***	4 372
	(0.0151)	(0.0150)	(0.0342)	
Active outsourcer	0.134***	0.0477	0.364***	1 777
	(0.0309)	(0.0306)	(0.0755)	
Global exporter	0.156***	0.0699***	0.425***	3 652
	(0.0168)	(0.0167)	(0.0368)	
Country fixed effects	Yes	Yes	Yes	-
Sector fixed effects	Yes	Yes	Yes	-
Firm size	No	Yes	No	-

*Note: Standard errors in parentheses. *** Denotes statistical significance at the 1 percent level. One cross-sectional regression for each internationalisation characteristic, with sector and country dummies. Column 2 also controls for the size class of firms (10-19; 20-49; 50-249; >=250 employees). The number of observations is given by the number of inactive firms plus the number of firms active in the selected international activity. All regressions control for country and fixed effects.*

Source: Altomonte et al. (2012).

A key issue raised by the above tables is of course that of the direction of causality. In particular, do the above correlations reflect the impact of firm-level performance on firms' ability to become more "open", or do they reflect the fact that increased openness raises firms' productivity growth? Melitz (2003) models the performance-to-openness causality, whereas the model we develop in the Appendix captures the reverse causality from openness to productivity growth, as this model has both a reallocation effect (towards more productive firms) and an escape-competition-through-innovation effect, both of which contribute to increasing average productivity in the domestic economy. That both causalities should be at work comes out clearly from the recent empirical literature on trade, reallocation and firm heterogeneity.[7]

7 See, in particular, sections 2.3 and 2.4 in Bernard et al. (2011).

6.4. Enhancing productivity

The next two sections look at the determinants of productivity growth on the basis of the following two questions. First, how can we enhance productivity growth in advanced versus emerging market economies? Second, is there something to learn from observing the big technological waves and their diffusion patterns across different countries? This section presents a simple framework for considering the sources of productivity growth. We next look at the sources of productivity growth in advanced countries and then turn our attention to the sources of productivity growth in emerging market economies.

6.4.1. A framework for considering the sources of productivity growth

In 1956, Robert Solow developed a model to show that, in the absence of technical progress, there can be no long-run growth in per capita GDP. On the other hand, historical evidence suggests that productivity growth is an increasingly important component of growth (see, for instance, Helpman, 2004). But what are the sources of productivity growth?

A useful framework for thinking about productivity growth and its determinants is the so-called "Schumpeterian" paradigm. The paradigm revolves around four main ideas.

First idea: Productivity growth relies on profit-motivated innovations. These can be process innovations, namely to increase the productivity of production factors (e.g. labour or capital); or product innovations (introducing new products); or organisational innovations (to make the combination of production factors more efficient). Policies and/or institutions that increase the expected benefits from innovation should induce more innovation and thus faster productivity growth. In particular, better (intellectual) property rights protection, research and development (R&D) tax credits, more intense competition, better-performing schools and universities are all policies that foster productivity growth.

Second idea: Creative destruction, i.e. the fact that new innovations tend to make old innovations, old technologies and old skills obsolete. This in turn underlies the importance of reallocation in the growth process: everything that facilitates the entry of new firms, exit of old technologies or products and firms' growth helps foster innovation-led growth. Hence the importance of enhancing product market competition (to facilitate the entry and exit of firms) and also labour market flexibility (to make it easier for a new firm to hire workers or for an existing firm to close down an old activity and start up a new one).

Third idea: Innovations may be either "frontier innovations", which push the frontier technology forward in a particular sector, or "imitative" or "adaptive" innovations, which enable the firm or sector to catch up with the existing technological frontier. And the two forms of innovation require different types of policies and institutions. In particular, to a greater extent than imitation, frontier innovation requires: (i) labour and product market flexibility (competition enhances frontier innovation more than it enhances catch-up growth, see Aghion et al., 2005); (ii) research education and universities that perform well (see Aghion et al., 2009b); and (iii) equity financing, as investors in such innovation need to be compensated for the fact that they are taking on higher risk than when they are financing an established activity.

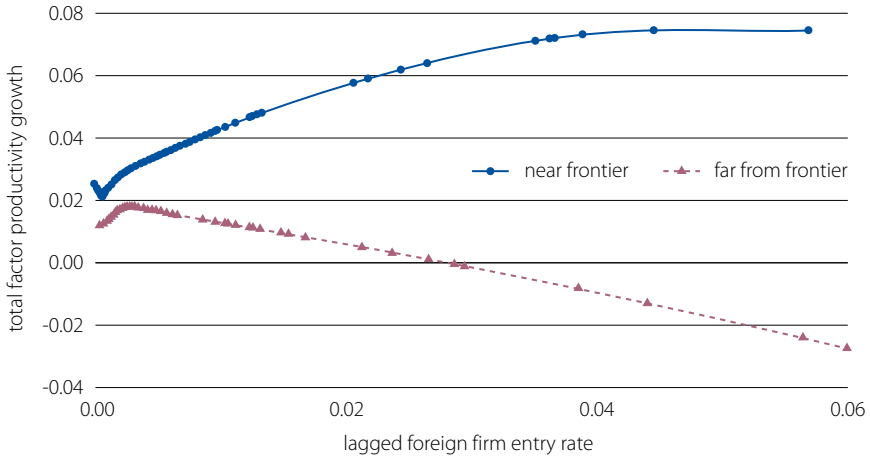
Fourth idea: Schumpeterian waves. Technological history is shaped by the big technological waves that correspond to the diffusion of new "general purpose technologies" (the steam engine, electricity, information and communication technologies (ICT), etc.) to the various sectors of the economy. A country's ability to (quickly) benefit from a new wave is directly related to its ability to generate frontier innovation.

6.4.2. Enhancing productivity growth in advanced countries

To enhance productivity growth in advanced countries, where growth relies more on frontier innovations, it helps to invest more in (autonomous) universities, to make product and labour markets as flexible as possible and to develop financial systems that rely in particular on equity financing.

Figure 2 below (from Aghion et al., 2009a) shows how competition (here measured by the lagged foreign entry rate) affects productivity growth in domestic incumbent firms. The upper curve averages among domestic firms that are closer to the technological frontier in their sector worldwide, compared to the median. We see that on average productivity growth in those firms responds positively to more intense competition. This reflects an "escape competition effect", i.e. the fact that such firms innovate more to escape the more intense competition. In contrast, productivity growth in firms that are further than the median from the technological frontier in their sector worldwide reacts negatively to more intense competition. This reflects a discouragement effect: firms further from the frontier know that they have little chance of winning against a potential entrant; thus the higher the entry rate, the more discouraged such firms are from investing in innovation and productivity growth. However, the closer a country is to the world-leading productivity level, the higher the proportion of firms that are close to the corresponding technological frontier, and therefore the more productivity-enhancing is product market competition.

Figure 2 **The effect of competition on productivity growth in firms that are near the technological frontier and far from the frontier**



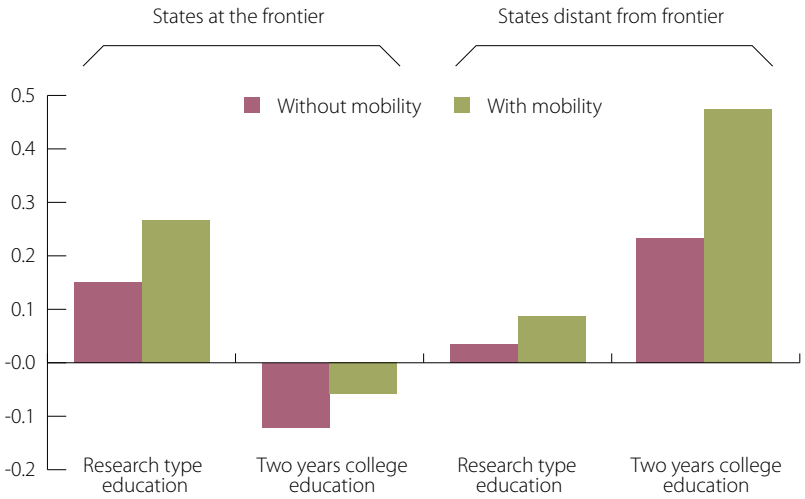
Source: Aghion et al. (2009a).

Similarly, Aghion et al. (2009c) show that more flexible labour markets (which facilitate the process of creative destruction) foster productivity growth more in more advanced countries. This is quite intuitive: the more advanced a country, the more productivity growth relies on frontier innovation. But frontier innovation in turn entails more creative destruction, and thus more job turnover, than technological catch-up.

A third lever of productivity growth in advanced countries is graduate education: indeed frontier innovation requires frontier researchers and therefore good universities and research centres, whereas good undergraduate education is sufficient for imitation. Figure 3, drawn from Aghion et al. (2009b), shows that research education enhances productivity growth more in more frontier US states, i.e. in states with a higher per capita GDP (such as California and Massachusetts): these are states where a higher proportion of firms are "frontier-firms", i.e. firms with levels of productivity that are close to the best practice in the corresponding sector. On the other hand, two-year college education is what enhances productivity growth more in less advanced states (such as Alabama and Mississippi): in those states, imitation (i.e. catch-up growth) is the main source of technological progress, and good

undergraduate education enhances imitation. The same is true across countries: higher (and especially graduate) education enhances productivity growth more in countries with higher per capita GDP (see Vandenbussche et al., 2006).

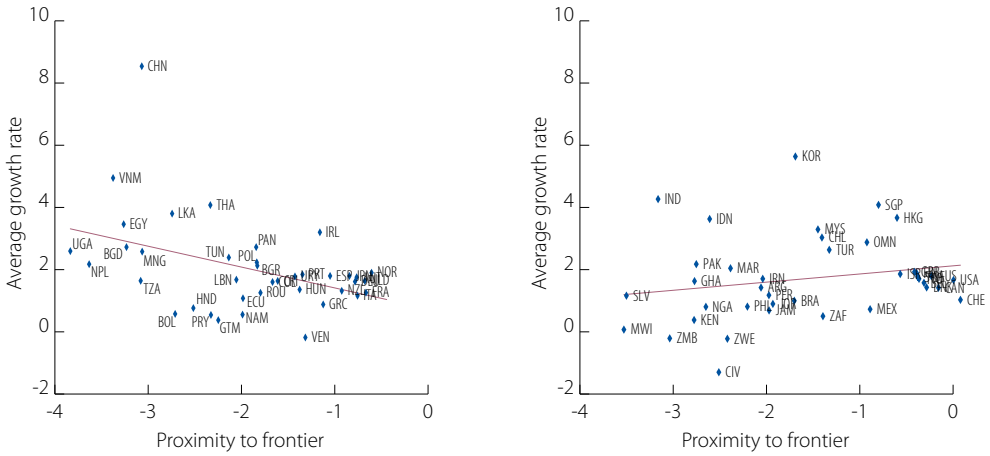
Figure 3 **Long-term growth effects of $1 000 per person spending on education, US states**



Source: *Aghion et al. (2009b).*

A fourth lever of productivity growth is the organisation of the financial sector. As shown by Figure 4 below (drawn from Koch, 2014), choosing a bank-based financial system enhances productivity growth more for less advanced countries, whereas choosing a more market-based financial system enhances productivity growth more in more frontier countries. The intuition is as follows: frontier innovation, which breaks new ground, entails a higher level of risk than imitation activities, which are already well defined. But this in turn implies that outside financiers involved in frontier innovation will ask for a higher share of upside revenues and also for higher control rights: hence the role of equity in financing frontier innovation.

Figure 4 **Average growth rate and proximity to the frontier for bank-based (left) and market-based (right) countries (per capita GDP growth rate)**



Source: *Koch (2014).*

Aghion et al. (2009c) performed cross-country panel regressions of productivity growth on the share of ICT in total value added and found a positive significant coefficient on ICT (see Table 5 below, first three columns). In other words, all other things being equal, productivity growth appears to be positively correlated to ICT diffusion. But interestingly, once the authors control for product market regulation, the coefficient on ICT becomes non-significant. This in turn suggests that the positive ICT coefficient mentioned above reflects something more fundamental than ICT, namely the effect of liberalising product or labour markets and of investing in research education: these policies enhance productivity growth in developed economies, in part because they facilitate the diffusion of information technologies (ICT). We shall come back to this point below when looking at the diffusion of technological waves across countries.

Table 5 Regressions of productivity growth on the share of ICT in total value added.

Dependent variable: hourly labour productivity growth (instrumental variables method)

	(1)	(2)	(3)	(4)	(5)
Changes in capacity utilisation rate	0.00200***	0.00190***	0.00161***	0.000908	0.000634
	(0.000622)	(0.000499)	(0.000475)	(0.000648)	(0.000702)
Growth in working time	-0.583***	-0.787***	-0.797***	-0.784***	-0.698***
	(0.170)	(0.138)	(0.138)	(0.157)	(0.172)
Changes in the employment rate	-0.529***	-0.641***	-0.653***	-0.878***	-0.809***
	(0.177)	(0.165)	(0.160)	(0.203)	(0.217)
Share of ICT production in total VA	0.930***	0.344*	0.372**	0.0614	0.170
	(0.261)	(0.195)	(0.179)	(0.164)	(0.178)
Share of pop. (>15) w/ some higher educ.		0.0808**			
		(0.0348)			
EPL			-0.00726**		
			(0.00307)		
PMR(t-2)				-0.0103**	
				(0.00486)	
EMPL*PMR(t-2)					-0.00368***
					(0.00130)
Constant	-0.0376**	-0.0199	0.0107	0.0296**	0.0197*
	(0.0160)	(0.0153)	(0.0118)	(0.0137)	(0.0113)
Observations	163	149	142	95	95
P-value of the Durbin-Wu-Hausman endogeneity test	0.00066	0.02912	0.03388	0.02966	0.01112
P-value of Basmann test of overidentifying restrictions	0.6354	0.2581	0.4140	0.2075	0.7716

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Panel: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Korea, the Netherlands, Norway, Portugal, Spain, Sweden, the United Kingdom and the United States.

Time period: 1995-2007

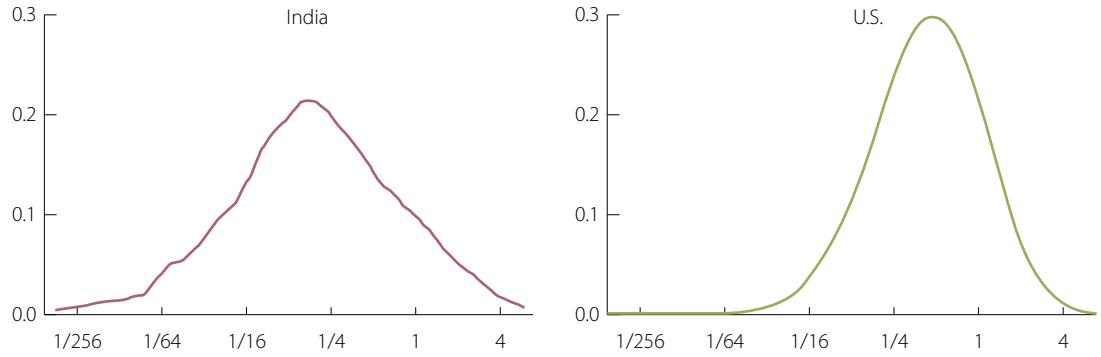
Source: Aghion et al. (2009c).

Most recently, Cette, Lopez and Mairesse (2013) analysed the impact of anticompetitive regulations in upstream (service industry) sectors on productivity growth in downstream industries that use inputs from those upstream sectors. Using an unbalanced country-industry panel dataset covering fifteen OECD countries over the period 1987-2007, the authors find that anticompetitive upstream regulations have a significantly detrimental effect on productivity growth downstream, and that this effect operates in part (but not entirely) through R&D and ICT investments in downstream industries.

6.4.3. Productivity growth in emerging market economies

If we now turn to the sources of productivity growth in emerging market economies, where adaptive innovation and factor accumulation are the main sources of growth, Hsieh and Klenow (2009) emphasised the importance of input reallocation effects. In particular, if we compare the distribution of firms' productivity in India versus the United States, we see in Figure 5 that the US has a thinner tail of less productive plants and a fatter tail of more productive plants than India: in other words, it is harder for a more productive firm to grow but also easier for a less productive firm to survive in India than in the US. In other words, the creative destruction process operates more efficiently in the US.

Figure 5 **Distribution of plant TFP differences in US vs. India. Higher US TFP due to reallocation – thinner "tail" of less productive plants (US mean=1)**



Source: Hsieh and Klenow (2009).

This difference is in turn attributable to various potential factors: in particular, more rigid capital markets and labour/product markets in India; also the lower supply of skills in India compared to the US; the poorer quality of infrastructure in India; and finally the lower quality of institutions to protect property rights and enforce contracts in India compared to the US. These factors in turn operate on productivity growth through several potential channels. One particularly interesting channel is that of management practices: recent work (see, for instance, Bloom and Van Reenen (2010) for a review) shows in particular that management practices are far worse in India than in the US, and that the average management scores across countries are strongly correlated with the countries' levels of per capita GDP.

6.5. Technological waves

"General-purpose technologies" (GPTs)[8] are defined as generic technologies which diffuse to most sectors of the economy. Obvious examples include steam energy in the early and mid-19th century, electricity and chemistry in the early 20th century, and the information and communication technology revolution in the 1980s. While innovation-led productivity growth goes beyond the diffusion of these generic technologies, the speed at which a country adopts and diffuses a new general-purpose technology reflects the country's ability to innovate more generally. In particular, this is what Table 5 above told us. It is therefore of interest to compare the diffusion patterns of general-purpose technologies across countries, especially when it is shown that lags in such diffusion reflect market or institutional rigidities which hamper innovation-led growth more generally.

6.5.1. Two productivity growth waves

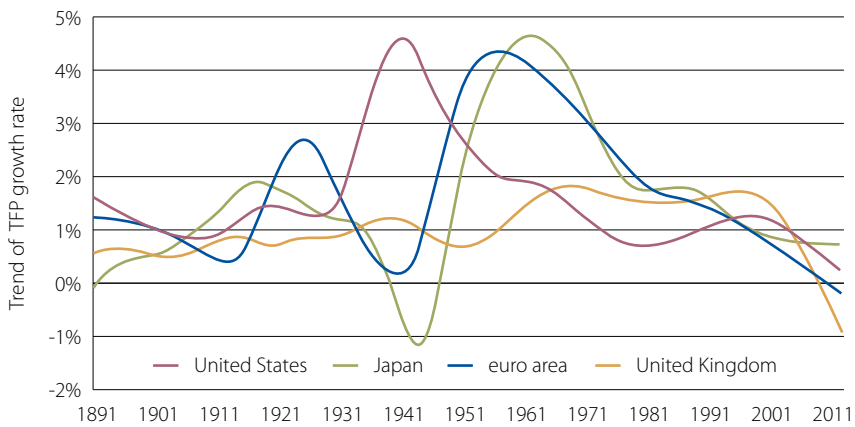
Using annual and quarterly data over the period 1890-2012 on labour productivity and TFP for 13 advanced countries (the G7 plus Spain, the Netherlands, Finland, Australia, Sweden and Norway), plus the reconstituted euro area, Bergeaud, Cette and Lecat, 2014 (hereafter BCL), show the existence of two big productivity growth waves during this period.

The first wave culminates in 1941, the second in 2001. The first wave corresponds to the second industrial revolution: that of electricity, internal combustion and chemistry. The second wave is the ICT wave. It was of smaller magnitude than the first, and the big question is whether that second wave has ended in the US.

6.5.2. Diffusion patterns

Figure 6 from Cette and Lopez (2012) shows that the euro area[9] and Japan suffer from a lag in the diffusion of technological waves compared to the US. Thus the first wave did not fully diffuse to the current euro area, Japan and the UK until after World War II. As for the second productivity wave, so far it has not shown up in the euro area or Japan. Market rigidities contribute to explaining such delays.

Figure 6 **Delayed productivity growth waves in the euro area, the UK and Japan.**



Source: *Cette and Lopez (2012).*

8 See Bresnahan and Trajtenberg (1995).

9 The euro area is here the aggregation of Germany, France, Italy, Spain, the Netherlands, Austria and Finland. These seven countries represented together, in 2012, 88.5 per cent of the total GDP of the euro area.

Through an econometric analysis, Cette and Lopez show that this lag of ICT diffusion in Europe and Japan, compared to the US, is explained by institutional aspects: a lower educational level, on average, of the working-age population and more regulations on labour and product markets. This result means that by implementing structural reforms, these countries could benefit from a productivity acceleration linked to a catch-up with the US ICT diffusion level. The lower quality of research and higher education in the euro area and Japan compared to the US also appears to matter in explaining the diffusion lag. These findings mirror those in Table 5.

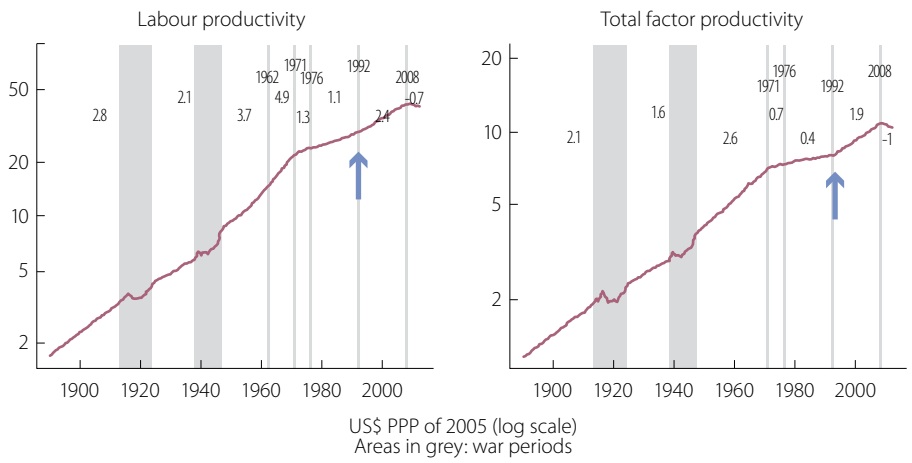
6.5.3. Country-specific shocks and the role of reforms

Figure 7 from BCL (2014) shows a positive break in labour productivity and TFP growth in Sweden after 1990. This stands in contrast to the case of Japan, shown in Figure 8, where we see no such break but instead decelerating labour productivity and TFP growth since 1980. Our explanation is that Sweden implemented sweeping structural reforms in the early 1990s, in particular a reform of the public spending system to reduce public deficits and a tax reform to encourage labour supply and entrepreneurship. No significant reform has taken place in Japan over the past thirty years.

Consider from the BCL (2014) study the four countries that are commonly presented as lead reformers over the past three decades. The reforms initiated in Sweden in the early 1990s increased the rate of TFP growth from an average of 0.4 per cent over the period 1976-1992 to an average of 1.9 per cent over the period 1992-2008. Similarly, the 1982 reform in the Netherlands (Wassenaard agreement) is associated with a break from an average TFP growth rate of 0.5 per cent over the period 1977-1983 to an average TFP growth rate of 1.5 per cent over the period 1983-2002. The reforms initiated in the early 1990s in Canada are associated with a break from an average TFP growth rate of 0.3 per cent over the period 1974-1990 to an average rate of 1.1 per cent over the period 1990-2000. Finally, the reforms initiated in the early 1990s in Australia are associated with a break from an average TFP growth rate over the period 1971-1990 of 0.4 per cent to an average growth rate of 1.4 per cent over the period 1990-2002.

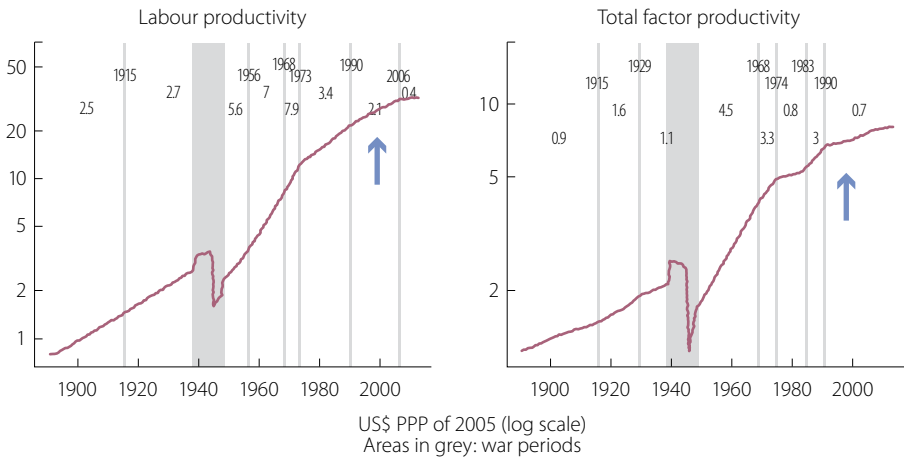
These findings are in line with cross-country panel regressions suggesting that structural reforms play a key role in speeding up the diffusion of technological waves.

Figure 7 Productivity breaks: country-specific shocks, Sweden



Source: Bergeaud, Cette and Lecat (2014).

Figure 8 **Productivity breaks: country-specific shock, Japan**



Source: *Bergeaud, Cette and Lecat (2014).*

6.6. Obstacles to firm dynamics

In section 3 we reported on recent theoretical and empirical work pointing at the importance of firm size for competitiveness. More precisely, we are looking for policies that emphasise productivity growth to an extent that should allow firms to eventually achieve and pass the threshold scales required to become "open" (i.e. first to become an exporter and then to become involved in FDI and/or outsourcing activities).

Recent developments in the growth literature have looked at the determinants of entry, growth and exit of productive firms.[10] This literature builds on the Schumpeterian growth paradigm (see Aghion, Akcigit and Howitt (2013) for a survey) to model firms as multi-line producers and innovators. A new innovator enters the market as a single product line firm. Then the innovator tries to innovate on another product line. If it succeeds, it grows in scope to become a two product line firm. But it may fail and another potential innovator may successfully improve on the first innovator's initial product, in which case the first innovator exits the market. More generally, successful innovation by an outsider on a product line currently covered by an incumbent firm eliminates that line from the incumbent firm's range of products, thereby shrinking the number of product lines covered by that firm.

This theoretical model explains how the observed firm size distribution in a country depends upon the innovation technology but also upon government policies with regard to exit and entry (e.g. subsidies to incumbent firms versus potential entrants) and upon regulatory or credit market characteristics, which will also affect firm entry and firm growth.

In particular this framework can account for various stylised facts about firm dynamics and firm size distribution. Some of these facts are: (i) the firm size distribution is highly skewed; (ii) firm size and firm age are highly correlated (in this framework new firms are single-line firms, and to become large with a sufficient number of lines a firm needs to have innovated on all those lines and also to have survived creative destruction on a sufficient number of the lines with which it used to operate); (iii) small firms exit more frequently (it takes only one outside innovation to eliminate a single-line firm whereas it takes several successful outside innovations to eliminate an initially multi-line firm), but the ones that survive tend to grow faster than average (they are more likely to be an efficient innovator, and also they can exploit R&D synergies across their multiple lines); (iv) a large proportion of R&D in the US is done by incumbents; (v) reallocation of inputs between entrants and incumbents is an important source of productivity growth.

10 Primary references include Klette and Kortum (2004), Acemoglu et al. (2013) and Akcigit et al. (2014).

The framework can also explain why factors that inhibit firm size growth in developing countries also inhibit aggregate productivity growth. For example Akcigit et al. (2014) argue that in developing countries contractual frictions become more dramatic as firms grow in size: it becomes increasingly hard to avoid hold-ups by firm managers as the number of product lines controlled by the firm increases. This in turn inhibits the growth of the most efficient firms (those with higher innovation capabilities), as such firms have lower incentives to grow as firm owners want to mitigate the hold-up problem with their manager. But this in turn enables less efficient firms to remain active for a longer period before being replaced by more efficient firms.

While contractual incompleteness and lack of trust are obvious obstacles to firm growth, previous studies have also emphasised: (a) adjustment costs induced by the R&D and/or advertising of incumbent firms; (b) the administrative costs of creating a new firm; and (c) labour market regulations.

Thus Aghion, Fally and Scarpetta, 2007 (hereafter AFS), present empirical evidence on the effect of financial development on the entry of new firms of different size and on the post-entry growth of successful entrants. They use harmonised firm-level data on entry and post-entry growth by industry, size classes and over time for a sample of industrialised, transition and Latin American countries (see Bartelsman et al., 2004). And they consider two main indicators of financial development, namely the ratio of private credit to stock market capitalisation.

The main results in AFS are as follows. First, higher financial development enhances new firm entry in sectors that depend more heavily upon external finance. Second, the entry of smallest size firms benefits the most from higher financial development, whereas financial development has either no effect or a negative effect on entry by larger firms. Third, financial development enhances post-entry growth of firms in sectors that depend more upon external finance, even when controlling for labour market regulations.

The effect of regulations on firm dynamics and firm size is itself a fascinating topic that has barely been touched upon. An interesting paper by Garicano, Lelarge and Van Reenen (2013) analyses the static allocative efficiency effects of having imposed a 50-employee regulatory threshold[11]. In particular, they show that this threshold leads to an inefficient concentration of firm size just below the threshold. Yet the question of how such a threshold or other types of regulations more generally affect the size distribution of firms and aggregate productivity growth remains unanswered.

Overall, this nascent literature on firm dynamics and reallocation points to the importance of creating a proper regulatory environment and of implementing adequate tax/subsidy policies to favour well-functioning firm growth and firm dynamics. Subsidising incumbent firms may come at the expense of delaying efficient exit by low-performing incumbent firms while deterring or delaying entry by new innovators. On the other hand, it may help them grow in an environment where firm growth is hampered by credit or regulatory constraints.

11 Above 50 employees, French firms are obliged to introduce a whole new set of rules (setting up employer-employee committees, etc.) which imply both substantial fixed costs and more bargaining power for employees.

6.7. Do we still need vertically targeted policies?

6.7.1. The debate

In our discussion so far we have emphasised the role of "horizontally targeted" policies to enhance firm-level productivity and hence competitiveness: the word "horizontal" refers to policies that apply to all activities (or sectors) of the economy: competition policy, higher education policy, labour market policy, patent protection, R&D subsidies, etc. In this section, we discuss whether one should also advocate "vertical targeting", i.e. government policies (subsidies, tariffs, etc.) that target particular activities.

Vertical targeting used to be popular in the aftermath of World War II. Thus, the World Bank and other IFIs welcomed import substitution policies aimed at particular sectors or activities in Latin American countries, which meant that the local industries in question benefited to a greater extent from domestic demand. Similarly, nobody objected to East Asian countries such as Korea or Japan engaging in selective export promotion through tariffs and non-tariff barriers, for instance, and partly through maintaining undervalued exchange rates. For at least two or three decades after WWII, these vertical targeting policies, also commonly referred to as "industrial policy," remained fairly non-controversial as both groups of countries were growing at fast rates.

However, from the early 1980s onwards vertical targeting came under increasing criticism among academics and policy advisers in international financial institutions. In particular, it was criticised for allowing governments to pick winners and losers in a discretionary fashion and consequently for increasing the scope for capture of governments by local vested interests. Empirical studies by Frankel and Romer (1999) and Wacziarg (2001) pointing at a positive effect of trade liberalisation on growth of course reinforce the case against vertical targeting, as does Schumpeterian growth theory on competition and growth (see, for instance, Aghion et al., 2013).

However, three phenomena that have occurred recently invite us to rethink the issue. First, climate change and the increasing awareness of the fact that, without government intervention aimed at encouraging clean production and clean innovation, global warming will intensify and generate all kinds of negative externalities worldwide (droughts, deforestation, migration, conflicts). Second, the recent financial crisis, which revealed the extent to which laissez-faire policies have led several countries, particularly in Southern Europe, to allow the uncontrolled development of non-tradable sectors (especially real estate) at the expense of tradable sectors, which are more conducive to long-term convergence and innovation. Third, China, which has become so prominent on the world economic stage in large part thanks to its constant pursuit of industrial policy. Also, we now see an increasing number of scholars (particularly in the US) denouncing the danger of laissez-faire policies that lead developed countries to specialise in upstream R&D and services, while outsourcing all manufacturing tasks to developing countries where unskilled labour costs are lower. They point to the fact that countries like Germany or Japan have managed better to maintain intermediate manufacturing segments of their value chain through pursuing more active industrial policies, and that this in turn has enabled them to benefit more from outsourcing the other segments.

But, more fundamentally, the most recurrent counter-argument to industrial interventionism, namely the "pick winner" argument, has never been properly addressed. While industrial policy is to some extent always about "picking winners", as Vince Cable, the current UK Business Secretary points out, "the 'winners' in this sense are the skills we judge we will need for the future, and the sectors they support." However, we shall argue below that the "pick winner" argument loses out when vertical targeting is properly designed and governed: in particular, when: (i) *the government chooses to pick activities, not particular firms*: indeed, while governments and policymakers do not have all the knowledge and wisdom needed for proper vertical selection, identifying activities with high growth potential is presumably easier than selecting individual firms[12]; (ii) *the criteria underlying the selection of activities*

12 Activities that come to mind when talking about vertical targeting most often involve the same four or five sectors, e.g. energy, biotech, ICT and transportation.

are clear and verifiable: in particular, as we shall explain below, recent research points at skills intensity and the degree of product market competition as relevant selection criteria for vertical targeting; and (iii) *the vertical interventions are properly governed:* in particular, as we shall argue below, they should be governed in a way that preserves or even enhances product market competition in the corresponding sectors and also guarantees an exit from non-performing activities.

A second criticism of traditional industrial policy is the risk of capture and rent-seeking behaviour that it involves. Here again, setting clear principles for the selection of activities and the governance of support for those activities should help to address this criticism. In particular, exit devices need to be introduced which minimise the risk that unprofitable or non-performing vertically targeted investments will be maintained or renewed in the longer term. One such device is co-financing with the private sector: if an activity becomes clearly unprofitable, then the private partner is likely to withdraw, which in turn should lead the public partner to also withdraw. Another exit device is simply to enhance product market competition.

But this does not address the issue of why vertical targeting would be needed. A main theoretical argument in support of vertical targeting is the existence of knowledge spillovers.[13] For example, firms that choose to innovate in dirty technologies do not internalise the fact that current advances in such technologies also tend to make future innovations in dirty technologies more profitable. More generally, when choosing where to produce and innovate, firms do not internalise the positive or negative externalities this might have on other firms and activities. A reinforcing factor is the existence of credit constraints, which may further limit or slow down the reallocation of firms towards new (more growth-enhancing) activities. While it can be argued that the existence of market failures is not in itself sufficient to justify vertical intervention, there are activities – typically high-tech activities – which generate knowledge spillovers for the rest of the economy, and where assets are highly intangible, which in turn makes it more difficult for firms to borrow from the private capital markets to finance their growth.

6.7.2. Rethinking the design and governance of industrial policy

To our knowledge, the first convincing empirical study in support of a properly designed industrial policy is by Nunn and Trefler (2009). These authors use micro data on a set of countries to analyse whether, as suggested by the "infant industry" argument, productivity growth in a country is positively affected by the extent to which tariff protection is biased in favour of activities and sectors that are "skills-intensive", i.e. that use more highly skilled workers. They find a significant positive correlation between productivity growth and the "skills bias" due to tariff protection. Of course such a correlation does not necessarily mean there is causality between skills bias due to protection and productivity growth: the two variables may themselves be the result of a third factor, such as the quality of the institutions in the countries considered. However, Nunn and Trefler show that at least 25 per cent of the correlation corresponds to a causal effect. Overall, their analysis suggests that adequately designed (i.e. skills-intensive) targeting may actually enhance growth, not only in the sector that is being subsidised but also in the country as a whole.

More recently, Aghion, Dewatripont, Du, Harrison and Legros, 2012 (henceforth ADDHL), argue that sectoral policy should not be systematically opposed to competition policy. First, they develop a simple model showing that targeted subsidies can be used to induce several firms to operate in the same sector and that the more competitive the sector, the more this will induce firms to innovate in order to "escape competition" (see Aghion et al., 2005). Of course a lot depends upon the design of industrial policy. It should target sectors, not particular firms (or "national champions"). This in turn suggests new empirical analyses in which productivity growth, patenting or other measures of innovativeness and entrepreneurship would be regressed over some measures of sectoral intervention interacted with the

13 In particular, with the emergence and splitting up of global value chains, companies increasingly compete for high-value added activities, which in turn can be enhanced by vertical targeting.

degree of competition in the sector, and also with the extent to which intervention in each sector is not concentrated on a single firm but rather distributed over a larger number of firms.

Data showing how much state aid each sector receives are unfortunately not available for EU countries. Thus, to look at the interaction between state subsidies to a sector and the level of product market competition in that sector, ADDHL use Chinese firm-level panel data. To be more precise, they look at all industrial firms from the Chinese National Business Survey. This is an annual survey of all firms with more than RMB 5 million in sales. The sample period is 1988-2007, and the survey contains information on inputs and outputs, firm-level state subsidies, etc. Product market competition is measured by 1 minus the Lerner index, which in turn is calculated as the ratio of operating profits minus capital costs over sales. ADDHL show that TFP, TFP growth and product innovation (defined as the ratio of output value generated by new products to total output value) are all positively correlated with the interaction between state aid to the sector and market competition in the sector. Thus the more competitive the recipient sector, the more positive the effects of targeted state subsidies to that sector on TFP, TFP growth and product innovation in that sector. In fact ADDHL show that for sectors with a low degree of competition the effects are negative, whereas they become positive in sectors with a sufficiently high degree of competition. Finally, ADDHL show that the interaction between state aid and product market competition in the sector is more positive when state aid is less concentrated. In fact, if one focuses on the second quartile in terms of degree of concentration of state aid (this refers to sectors where state aid is not very concentrated), then state aid has a positive effect on TFP and product innovation in all sectors with more than a median level of product market competition.

6.7.3. Climate

Firms in a laissez-faire economy may innovate in "the wrong direction", for example in polluting energy activities, just because they have acquired expertise in such activities, without taking into account the environmental or knowledge externalities that their choice entails. Thus Aghion et al. (2013b) explore a cross-country panel data set of patents in the automotive industry. They distinguish between "dirty innovations" that affect combustion engines and clean innovations such as those affecting electric cars. They show that the larger a given entrepreneur's stock of past "dirty" innovations, the "dirtier" that entrepreneur's current innovations. This "path dependence" phenomenon, together with the fact that innovations have so far been mostly dirty, implies that in the absence of government intervention our economies would generate too many dirty innovations. Hence a role for government intervention is to "redirect technical change" towards clean innovations.

As argued in Acemoglu et al. (2012), delaying such directed intervention not only leads to further deterioration of the environment. The dirty innovation machine also continues to strengthen its lead, making the dirty technologies more productive and widening the productivity gap between dirty and clean technologies even further. This widened gap in turn requires a longer period for clean technologies to catch up and replace the dirty ones. As this catching-up period is characterised by slower growth, the cost of delaying intervention, in terms of foregone growth, will be higher. In other words, delaying action is costly.

Not surprisingly, the shorter the delay and the higher the discount rate (i.e. the lower the value put on the future), the lower the cost will be. This is because the gains from delaying intervention are realised at the start in the form of higher consumption, while the loss occurs in the future through more environmental degradation and lower future consumption. Moreover, because there are basically two problems to deal with, namely the environmental one and the innovation one, using two instruments proves to be better than using one. The optimal policy involves using (i) a carbon price to deal with the environmental externality and, at the same time, (ii) direct subsidies for clean R&D (or a profit tax on dirty technologies) to deal with the knowledge externality. This again calls for vertical targeting.[14]

14 Of course it could always be argued that the carbon price could on its own deal with both the environmental and knowledge externalities at the same time (discouraging the use of dirty technologies also discourages innovation in dirty technologies). However, relying on the carbon price alone leads to excessive reduction in consumption in the short run. And because the two-instrument policy reduces the short-run cost in terms of forgone short-run consumption, it reinforces the case for immediate implementation, even for values of the discount rate under which standard models would suggest delaying implementation.

6.7.4. Summarising

Overall, our discussion in this section suggests that adequate vertical targeting, e.g. towards more skills-intensive sectors or towards sectors with a higher degree of product market competition, can be growth-enhancing. Also, we have argued in favour of not concentrating subsidies on particular firms, but instead spreading vertical support towards all firms and all potential entrants in an activity or sector. The research underlying these recommendations is just the starting point in what we see as a much broader research programme on how to govern industrial policy so as to make it more competition-friendly and more innovation-enhancing. In particular, how can industrial policy be designed to ensure that projects that turn out to be non-performing will not be refinanced? How should governments update their doctrine and practice of competition policy so as to factor in renewed thinking on how to design and implement industrial policy? The conjunction of the debate on climate change, the recent financial crisis and the new dominance of China on the world market reinforces our conviction that while market competition is certainly a main engine of growth, specialisation cannot be left entirely to the dynamics of laissez-faire. Also, one increasingly realises that the specialisation model whereby the most advanced countries focus on upstream R&D and services and outsource everything else to emerging market economies may not be sustainable in the long run.

6.8. Implications for the design of a European growth package

The above discussion suggests some directions for a new growth package for the EU and in particular countries in the euro area: (i) structural reforms starting with the liberalisation of product and labour markets: here we would argue that an important role can be played by structural funds, provided the targeting and governance of these funds is suitably modified; (ii) industrial investments along the lines suggested by our above discussion on vertical targeting.

6.8.1. Structural reforms and the role of structural funds

There is a broad consensus among European leaders regarding the importance of structural reforms, in particular product and labour market liberalisation and higher education reform, to foster long-run growth in Europe. In this section, we first assess the potential increase in growth potential from having all eurozone countries converge fully or partly to the best standards with regard to product or labour market liberalisation and also higher education. In the second part of the section, we discuss the role that structural funds might play in encouraging such reforms.

Assessing the growth effects of structural reforms

As in Aghion et al. (2009c), one can look at the effect of structural policies using cross-country panel regressions across 21 European countries. Our structural indicators are as follows: for the higher education system, the share of 25-64 year olds having completed tertiary education (SUP); for the product market, an OECD index assessing product market regulation (PMR); for the labour market, an OECD index assessing the strictness of employment protection (LPE). In fact we focus on the interaction between these two rigidities, namely the variable PMR*LPE, in the analysis of labour and product market reforms. Indeed, there are good reasons to believe that the effects of liberalising product markets are complementary to those of liberalising labour markets: for example, making entry into a new activity easier is of less value to entrepreneurs if they cannot hire new employees to work on that activity.

We can look at the short and long-run growth effects of converging towards the performance levels of "target countries". The target groups include those countries which are found to be the "best performers" in terms of education, product and labour market regulations. In order to determine those groups, we

rank countries according to the variables SUP and PMR*LPE and come up with two target groups: a non-European target group (US and Canada); and a European target group the (UK, Ireland and Denmark). The advantage of these two target groups is that they allow comparisons between countries within the European Union as well as with non-European counterparts. Interestingly, we found the same target groups for both the higher education and labour and product market regulation. Then we can assess the average effect of converging towards best practice for the eurozone (EMU) as a whole. Our results show that converging towards best practice in terms of product and labour market liberalisation generates a growth gain of between 0.3 and 0.4 in the short run. Converging towards best practice in terms of higher education enrolment generates a growth gain which is initially smaller (if we take the UK, Ireland and Denmark as the reference countries) but grows to 0.6 by 2050. Altogether, a full percentage point in growth can be gained through structural convergence towards those three countries.

Rethinking the role and design of structural funds

Here we argue that structural funds can be partly reoriented towards facilitating the implementation of structural reforms. So far these funds have been used mainly to finance medium-term investment projects and to foster socioeconomic cohesion within the EU. Moreover, these funds are allocated ex ante, based on recipient countries' GDP relative to the EU average, population and area.

We argue in favour of an alternative approach to the goals, targeting and governance of structural funds. With regard to the goals of structural funds: these funds should become transformative, in other words they should help achieve structural reforms in the sectors they target. In our discussion above, we identified some main areas where structural reforms are needed (labour markets, product markets and education). Structural funds should aim to facilitate changes in the functioning of these sectors in the various countries. Funds should generally be allocated on an individual basis: in other words, they should mainly target schools, employment agencies and individual workers, rather than countries, and would help finance transition costs. The funds should be allocated to specified deliverables (provision of better tutorship in education, improvements in the organisation of employment agencies, transition to portable pension rights across two or more countries, setting up of diploma equivalence for service jobs, etc.) and should also be conditional upon the country or region not having put in place a general policy that contradicts the purpose for which the funds were allocated.

With regard to the governance of structural funds, the allocation of funds by European agencies should be modelled on European Research Council practice, i.e. a bottom-up approach with peer evaluation ex ante and ex post.

6.8.2. Rethinking industrial policy in the EU

Growth in the EU also requires adequate vertical targeting, both by Member States and at EU level. In the previous sections, we have emphasised the view that horizontal targeting (basic and applied research, higher education, labour mobility) should be given priority. But, in light of our discussion in the previous sections, we also believe that properly governed vertical targeting by Member States and at EU level can help to further foster growth within the EU.

At EU level, infrastructure investments in transportation, energy and broadband networks should greatly contribute to increasing product market competition in local markets. In other words, proper vertical targeting at EU level can help enhance horizontal policies in Member States. Another justification for favouring vertical targeting at EU level is that it is more likely to preserve product market competition when the targeted activities involve high fixed costs. What we mean here is that subsidising activities with high fixed costs at local level (i.e. at the level of one particular country) often boils down to subsidising one particular firm, which in turn defeats the purpose of reconciling industrial policy with the need to enhance product market competition. This is less of a constraint if vertical targeting is done at EU level, since at that level it is easier to find more than one potential recipient of vertical subsidies, even for activities involving high fixed costs.

But EU policy with regard to vertical targeting goes beyond EU level investments: it also concerns the attitude of the European Commission with regard to Member States' sectoral policies. These are currently perceived by European authorities as a threat to European integration, which in turn explains the demanding checks by European competition authorities of all devices used to support industrial activities. Here, let us mention a remarkable work on state aid in Europe, Japan and the United States by Pierre-André Buigues and Khalid Sekkat, which identifies false debates and arguments against industrial policy. These authors find a general tendency in Europe towards reducing state aid (Germany being an exception, although mainly over the past ten years, with the integration of the Eastern Länder). This in turn suggests that the Commission has been remarkably effective in limiting the scope of state aid. What we recommend is that the Commission should become less biased as a matter of principle against the use of state aid, while at the same time setting new and clear guidelines for the allocation and governance of that aid. In other words, the Commission should move from an "ex ante" legalistic approach to sectoral state aid to an "ex post" pragmatic approach, where state aid is sanctioned only if it can be proved that it has resulted in lowering product market competition in the corresponding activity.

Whether at EU or Member State level, vertical targeting should be adequately designed and governed. In the previous section we mentioned the recent paper by Nunn and Trefler (2009), which suggests that sectoral aid is more likely to be growth-enhancing if it targets sectors with higher growth potential, one measure of it being the extent to which various industries are skills-biased. We also mentioned the work by Aghion et al. (2013), which suggests that vertical targeting is more growth-enhancing if it targets activities with a higher degree of product market competition and enhanced product market competition within the sector.[15]

6.9. Conclusion

In this paper we have taken on board modern trade economics, in particular the idea that a country's competitiveness boils down to the competitiveness of its individual enterprises. We reported on recent empirical work showing that firm-level competitiveness is related to a firm's productivity and ability to grow. Then we looked at the determinants of firm-level productivity and also at potential obstacles that may inhibit firm size growth. Finally, we argued that while enhancing firm-level productivity growth calls first for horizontal policies (product and labour market liberalisation, trade liberalisation, investment in higher education, etc.), there may be a case for vertically targeted (sectoral) policies, provided these are properly designed and governed.

To conclude our discussion, we would like to push the idea of a European Growth Pact, whereby the Member States' commitment to undertaking serious structural reforms (product and labour market liberalisation, public debt and deficit reduction, restructuring of the state, etc.) would be "traded" for greater macroeconomic flexibility in the euro area.

Recent studies (see Aghion, Hemous and Kharroubi, 2009; Aghion, Farhi and Kharroubi, 2012) carried out at cross-country/cross-industry level show that more countercyclical fiscal and monetary policies enhance growth. Fiscal policy countercyclicality refers to countries increasing their public deficits and debt during recessions but reducing them during upturns. Monetary policy countercyclicality refers to central banks letting real short-term interest rates go down during recessions, while having them increase again during upturns. Such policies can help credit-constrained or liquidity-constrained firms to pursue innovative investments (R&D, skills and training, etc.) over the cycle in spite of credit tightening during recessions, and also help maintain aggregate consumption and therefore firms' market size over the cycle, as argued in the previous section (see Aghion and Howitt, 2009, Chap. 13).

15 While it is part of the EU's remit to promote product market competition, at the same time natural monopolies are prevalent in network sectors, and having too many networks may result in Europe becoming underequipped in the field of fibre optic broadband and more generally disadvantaged in digital industry activities. This consideration should of course also be taken into account when designing vertical targeting at EU level.

This in turn suggests that the euro area would benefit from more countercyclical macroeconomic policies: lower interest rates and more quantitative easing by the ECB in low growth phases, accompanied by a more generous wage policy in more productive countries like Germany, so that the euro area as a whole can get closer to the desirable 2 per cent inflation target. Moreover, all the debt and deficit targets (both in the short and the long term) should be corrected for cyclical variations, in other words they should always be stated in structural terms. Thus, for example, if a country's current growth rate is significantly below trend, then the short-run budgetary targets should be relaxed to enable that country to maintain its growth-enhancing investments.

However, while the increased macroeconomic flexibility at European level should reward Member States' efforts to implement structural reforms, it should not serve as a pretext for the countries in question not to reform. That is the essence of the Growth Pact we are calling for.

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Part III

Investing in competitiveness

Chapter 7

Assessing competitiveness in an increasingly borderless world

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Assessing competitiveness in an increasingly borderless world

Chapter at a glance

Persistent losses in competitiveness have generally been identified as one of the fundamental problems behind the recent EU crisis. How to accurately assess the drivers behind the competitive position of European nations, however, remains a moot point, particularly at a time when the extensive internationalisation of production processes has blurred country borders, thus evidently limiting the influence of certain factors, such as price/cost. Indeed globalisation – through the removal of barriers to trade, the enhancement of flows of services and finance, and the intensification of cross-border movements of people and knowledge – has dramatically changed the structure of global production.

Against this background –since it is well established that no single measure can be judged as adequate in the assessment and measurement of competitiveness – a holistic approach is needed. That is the approach of CompNet, the competitiveness research network of the European System of Central Banks, which brings together macro, firm-level and cross-border considerations.

Drawing on the work of the network, this chapter will examine how the creation of complex global value chains (GVCs) has drastically changed the way we should address EU countries' competitiveness losses. The bottom line is that nowadays, to assess a country's degree of competitiveness, it is fundamental to take into account the cross-border dimension of the production processes. To do so, the chapter provides alternative statistical indicators to measure the impact of GVC integration on European countries' main economic aggregates, as well as to define how the increasing global fragmentation of production is challenging the prevailing policy thinking on competitiveness.

7.1. Introduction

Competitiveness gaps are increasingly seen as the main cause of divergent economic development patterns. They are also identified as the principal reason for some of the most disruptive downturns, such as the latest EU crisis. Therefore, restoring competitiveness is broadly acknowledged as the critical building block for achieving sustainable growth. At the same time, when asked what competitiveness is all about, scholars and policymakers will respond rather differently, reflecting an unresolved debate that has been going on for several decades. This chapter does not enter into the debate, but rather takes an eclectic approach, making two practical and empirically grounded points. First, the assessment of competitiveness must be holistic, using simultaneously a number of complementary indicators, since it is well established that no single measure can be judged as adequate. Second, when choosing the indicators, it is essential to rely on those with a proven explanatory capacity with respect to well-defined policy objectives.

After briefly reviewing the two major strands of literature on competitiveness, this chapter underlines the contribution of CompNet, the competitiveness research network of the European System of Central Banks, in assessing and measuring competitiveness. More specifically, this chapter will focus on how the process of globalisation has influenced the way we should look at competitiveness. In particular, we shall first describe how production processes have been globalised with the creation of complex global value chains (GVCs), and then we shall see how such phenomena have affected statistical measurements of trade. In particular, as traditional gross trade statistics have become less informative with the increased import content of exports, we shall investigate alternative tools aimed at measuring the impact of GVC integration on traditional statistics as well as on main economic aggregates. In doing so, we shall present a number of important stylised facts gathered by CompNet researchers, specifically for EU countries. The chapter closes with the general policy implications of such crucial developments.

7.2. Brief review of the literature on competitiveness

Without endeavouring to be exhaustive, we broadly divide the literature on competitiveness into two main strands. First, the one concentrating on a narrow definition of competitiveness that explains export behaviour through price competitiveness or foreign demand and is mostly related to trade results. Second, the more holistic literature, which takes a much broader perspective on the definition of competitiveness and considers other factors, from institutional to micro, but is mostly based on survey results. Both approaches tend to be affected by pitfalls, as we shall briefly indicate below.

7.2.1. One-dimensional studies

In the first category, we find studies that tend to focus on only one dimension of competitiveness, most notably macro aggregate indicators such as unit labour costs, and tend to give large weight to trade results as the predominant policy objective.

On the positive side, macro indicators are both easy to measure in aggregate and are well understood by the public. Moreover, they relate to macroeconomic variables that policymakers can partly control. On the other hand, however, such macro indicators have a number of drawbacks. First, they fail to acknowledge that there is considerable heterogeneity in firms' behaviour, which undermines the relevance of indicators based on average measures; as firm-level data are currently more readily available for policy use[2], maintaining the hypothesis of the "representative agent" is increasingly untenable and

2 To assess the importance of firm-level data for policy use see, for example, Altomonte, C., Barba Navaretti, G., Di Mauro, F. and Ottaviano, G. I.P. (2011), "Assessing competitiveness: how firm-level data can help", Bruegel Policy Contribution 2011/16. See also CompNet Task Force, (2014), "Micro-based evidence of EU competitiveness: the CompNet database", Working Paper Series No 1634, to get an idea of the availability of firm-level data within the CompNet database.

bound to result in faulty policy advice[3]. Second, they fail to acknowledge that over the past few decades national borders have become increasingly less relevant, given the extent of the fragmentation of production processes at the global level. One of the main consequences has been that some traditional policy objectives, such as maximising exports, have become much more difficult to hold on to unless a serious attempt is made to distinguish the various contributions – foreign and domestic – to the gross export results aggregate.

7.2.2. Holistic approach

The second major strand of the literature takes a much broader view of competitiveness, seeing it as "the set of institutions, policies and factors that determine the level of productivity of a country"[4]. Examples of this approach are the WEF and IMD competitiveness reports, as well as the World Bank's "Doing business report", where – mostly via surveys – an assessment is made of the overall business conditions of countries, which are then ranked accordingly.

On the positive side, these kinds of studies have the advantage of considering a much broader set of variables in addition to just macro indicators of trade; on the other hand, however, such studies fail in general to provide systematic links between the competitiveness criteria selected and the ultimate objectives of policy, whether they be per capita income or employment. Therefore, even if these reports are very comprehensive in their assessment of national competitiveness worldwide, they tend to be quantitatively very imprecise when it comes to determining how a specific set of indicators relates to ultimate policy variables.

7.3. CompNet approach to competitiveness

Against this background, at the end of 2011 the European System of Central banks (ESCB) established CompNet, a research network on competitiveness issues with two specific aims: (i) to develop a wider range of competitiveness indicators, and (ii) to provide a precise link between indicators and ultimate policy outcomes (such as trade or welfare). Conceptually, the mandate and activity of the network are consistent with a more comprehensive definition of competitiveness, such as the one stated by ECB President Mario Draghi (2012): "a competitive economy, in essence, is one in which institutional and macroeconomic conditions allow productive firms to thrive. In turn, the development of these firms supports the expansion of employment, investment and trade". Relevant in this definition is the explicit acknowledgement that competitiveness is not limited to price/cost advantages, but incorporates at least three other important elements: firm-level factors, with an emphasis on productivity, structural/macroeconomic factors, and the cross-border dimension. In this context, two main features distinguish the network from previous research endeavours. First, CompNet research is intended to systematically bridge the gap between the three above-mentioned relevant levels of competitiveness analysis, i.e. macro, firm-level and cross-border. Second, CompNet research attempts to provide a solid quantitative nexus between drivers of competitiveness and well-defined policy outcomes (such as per capita income, productivity and employment).

Operationally, the network functions on the basis of three work streams related to: (i) aggregate measures of competitiveness (country, sector and product-level); (ii) firm-level studies; and (iii) global value chains. As mentioned, however, in CompNet these three levels, which so far have been mostly considered separately, are linked together, as suggested by economic theory.

For example, (i) the macro level markedly affects the micro one, as it determines the institutional and overall macroeconomic environment in which firms operate; (ii) the micro level is crucial to

3 As Paul Krugman (1996) stressed, countries do not compete, firms do. Aggregate performance depends strongly on firm-level factors such as size, ownership and technological capacity.

4 World Economic Forum definition, see http://www.weforum.org/issues/global-competitiveness.

understanding the drivers and implications of cross-border activity; and (iii) the increased integration in GVCs impacts the macro level, as it causes changes in the spillovers across countries and gives rise to vulnerabilities to shocks and possible co-movements of macro variables.

This holistic approach is of fundamental importance for supporting the design of adequate competitiveness policies because the three levels of analysis are not only intertwined but also clearly relate to the final goal of welfare. In this context, the network invariably claims that traditional aggregate indicators, such as the real effective exchange rate, can be most effectively used for policy-making when complemented by sectoral and firm level-based indicators, as well as by new measures of competitiveness in global trade. Conceptually, such indicators offer a more complete view of the factors that drive productivity at the firm and international level and hence competitiveness at the country level[5].

7.4. Structural changes in global production: a brief historical digression

Globalisation, through the removal of barriers to trade, the enhancement of flows of services and finance, and the intensification of cross-border movements of people and knowledge, has dramatically changed the structure of global production.

There is plenty of literature detailing how and why production has become more and more integrated across the world. In this section we shall simply summarise the historical facts that have made possible and accelerated the integration process we now refer to as globalisation[6].

Globalisation is often considered to be a process that has taken place gradually over the past few centuries and involved a regular and steady fall in trade costs. However, before the 1830s the production of goods was very much a local affair, with inputs, factors of productions and markets being at only a marginal distance from one another, and there are two main historical events that precipitated the rise of the phenomenon now known as globalisation.

It was only after the "steam revolution" that railroads and steamships started to be used for the transportation of goods, making the sale of excess production to other geographical areas feasible and profitable thanks to the exploitation of economies of scale. This is what R. Baldwin refers to as the first "unbundling", i.e. the process that enabled production to be separated from consumption. The transport revolution did not affect all regions of the world in the same way. On the one hand, it had a positive impact on northern countries (Europe, North America and Japan), triggering a self-sustaining cycle of production and growth; on the other, developing nations experienced a process of de-industrialisation, as they were unable to use to their advantage the changes in global production brought about by the "steam revolution". Therefore, one of the major effects of the "first unbundling" was the great divergence in incomes between the North and the South and the fact that the transport revolution, while making trade cheaper but at the same time favouring large-scale production, led to the local clustering of production in factories and industrial areas. The geographical proximity of various stages of production made it easier to coordinate increasingly complex production processes and to minimise the associated coordination costs.

Due to coordination costs, proximity became more important during the "first unbundling", and globalisation occurred at the level of firms or sectors up until the mid-1980s. It was only then that the ICT revolution, the "second unbundling" in international trade, made it possible to reduce those costs by

5 See Altomonte, C., Di Mauro, F., Osbat, C. (2013). "Going beyond labour costs: how and why "structural" and micro-based factors can help explaining export performance?" CompNet Policy Brief 01/2013. The brief – drawing from ongoing work within CompNet – presents some concrete examples of how a broader assessment of competitiveness can enhance policy analysis, design and evaluation.

6 For more detailed information, see Elms, D. K. and Low, P. (eds.) (2013). "Global value chains in a changing world", Fung Global Institute, Nanyang Technological University, and World Trade Organization.

enabling complexity to be coordinated at a distance. Thanks to the development of telecommunications, computers and software, not only could consumption be separated from production, but production could also be broken up. The possibility of relocating the different stages of production theoretically enabled different tasks within a production process to be performed by geographically dispersed production units; this in turn led, from the mid-1980s onwards, to the sharing of production between North and South.

The main reason for the offshoring of certain stages of production was obviously the large wage differences between developed and developing countries. Thanks to production sharing, from the mid-1980s onwards developing nations had a wider choice of options available for diversification, industrialisation, growth and development. Whereas previously only countries with a well-functioning infrastructure and efficiently integrated production processes could participate in the global economy, developing countries could now join the existing global supply chains by specialising in certain stages of the production process, typically the most labour-intensive ones. The relocation of the labour-intensive stages of manufacturing to developing countries fostered tremendous growth rates in emerging markets and was further accelerated by domestic policies aimed at attracting foreign capital and expanding the offshoring of production stages onto national soil. As a consequence, the "second unbundling" reversed the previous industrialisation/de-industrialisation pattern prevalent in developed and developing countries. Over the past 50 years the North has been de-industrialising, while the South has been industrialising (even though much of this reversal has been driven by a small minority of nations, most of them located in Asia). In addition, another important consequence of the "second unbundling", which is linked to the previous one, was the reversal of the large income divergence between North and South: from 1988 onwards the G7 nations' share of world income steadily decreased. There is no doubt that this reversal of fortunes represents one of the biggest economic changes of the last century and that it reshaped and will continue to reshape the balance of power in both international and economic relations.

7.5. The rise of global value chains: definition, impact on firms and standard indicators

7.5.1. Definition of GVCs and their impact on firms' locational decisions

Global value chains – a term coined by Gereffi (2001) – are one of the main expressions of globalisation. Their emergence has resulted in a complete reconfiguration of world trade in terms of participants and comparative advantages. Therefore nowadays, to assess a country's degree of competitiveness it is fundamental to take into account the cross-border dimension of its production processes.

By definition, "a value chain identifies the full range of activities that firms undertake to bring a product or a service from its conception to its end use by final consumers" (De Backer and Miroudot, 2013). Such activities range from design, production, marketing, logistics and distribution through to support for the final customer, and they have started to be shared between several different firms. Therefore, nowadays GVCs relate to everything, such as the fragmentation of production, vertical specialisation and trade in tasks. Their importance has been steadily increasing since the year 2000 and, as reported in UNCTAD's 2013 World Investment Report, about 60% of global trade consists of trade in intermediate goods and services, which are then incorporated at different stages of production.

Conceptually, the fact that different stages of the production process can be distributed between a number of countries has presented firms with an additional challenge. To enter foreign markets, firms face a choice between producing goods at home and then exporting them, or producing those goods directly abroad. Consequently, their choices of product determination, market destination and so on will depend on a vast array of variables and processes to be optimised.

From a general point of view, the dominant theory concerning international business is that propounded by Dunning (1988), who maintains that a firm's decision to operate in a foreign market depends on its ability to operate successfully in a foreign environment, its ability to coordinate its resources across national borders and, in turn, the appeal of a given location. However, the determinants of locational decisions crucially depend on the type of activity carried out by a firm and on the stage of production that is to be offshored; some determinants are similar across different types of firms because they reflect broad incentives, such as cost-saving opportunities in terms of both labour and capital costs, geographical proximity to the target markets and exploitation of physical infrastructure, while others, such as the possibility of relying on a local centre of specific specialised expertise, influence in particular firms operating in knowledge-intensive activities.

The specific factors that positively influence locational decisions in a similar way between different types of firms include:

(i) the size of the foreign target country, which in turn positively affects the availability of resources, intangible assets (such as human capital) and the strength of local demand;

(ii) labour market conditions, i.e. in particular wage differentials between the source and host country. Wage differentials are particularly relevant for the offshoring of labour-intensive activities, but this link might be reversed in the case of high-tech industries, where the quality of labour is particularly important and stages of production are therefore more likely to be moved to where wages are higher (if higher wages are believed to reflect higher productivity);

(iii) local infrastructure, such as highways, railways and airports, as well as high-quality universities, which play a crucial role when firms are deciding whether to move certain production processes abroad;

(iv) the tax regime. Since all firms aim to minimise their worldwide tax liability, the host country's tax regime will also affect firms' locational decisions (the host country may, for example, levy corporate income tax on local foreign companies, while the parent country may decide to impose corporate income tax on resident multinational's foreign-source income) [7].

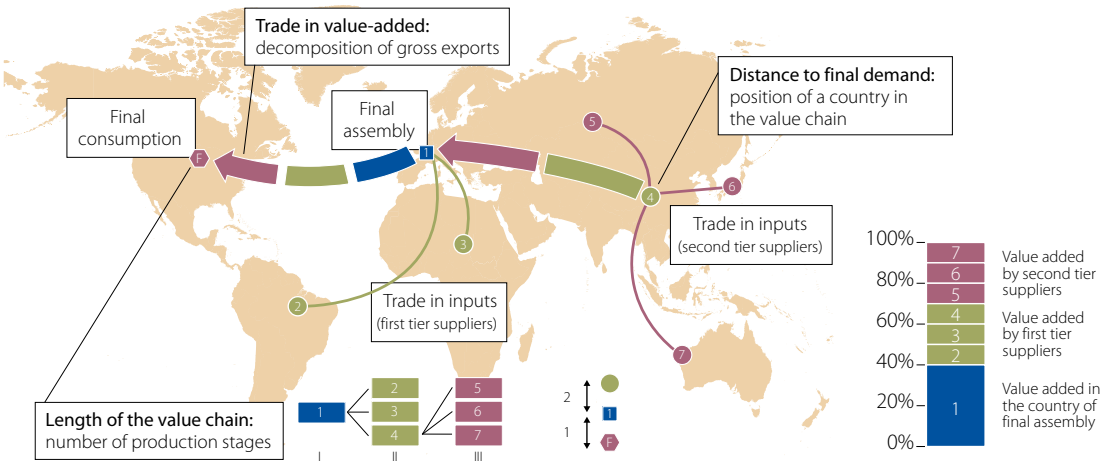
To conclude, although the determinants of firms' locational decisions differ according to the type of activity carried out by the firms and the stage of the production process being offshored, much of the literature on firms' locational decisions is based on the analysis of agglomerational effects resulting from the rising number of interrelated activities in a given place, which potentially creates a number of advantages for firms that decide to offshore stages of their production process to such areas; indeed the existence of increasing returns to scale and trade costs encourages firms to locate close to large markets. Over time a greater proportion of firms will tend to move there and this, in turn, creates pecuniary positive externalities, further triggering the agglomeration of economic activities[8].

To clarify what a GVC is in practical terms and the effects it has on locational decisions, let us start with an example taken from De Backer and Miroudot (2013). The figure below shows the production process for a Porsche car assembled and sold within and outside Germany (point 1). Each car will have some parts produced by a supplier in China (point 4), using inputs produced in other East Asian countries, while other intermediates will be directly imported from South America (2) and certain African countries (3). Eventually, the car will be sold/exported to American consumers.

7 See Barrios, S., Huizinga, H., Laeven, L. and Nicodème, G. (2009), "International Taxation and Multinational Firm Location Decisions", Economic Papers 356.

8 See Ottaviano and Puga (1997) for a review of the literature focusing on the relationship between agglomeration, trade costs and locational decisions.

Figure 1 **Example of a GVC**



Source: *K. De Backer and S. Miroudot (2013).*

A number of aspects of this complex set-up need to be considered. First, the value added components of the gross exports from Germany to the US should be decomposed, with a distinction being made between the domestic and the foreign portion: the former is the share of valued added produced at home with domestic factors, while the latter is the value added that is imported from abroad. Second, the number of production stages involved in the process is very relevant in order, for instance, to evaluate the different types of tax to which the components will be liable along the chain. Finally, in order to assess the impact of the fragmentation of the production process on the individual countries, we need to consider the position of those countries along the chain; in fact, as we shall see in greater detail in section 6.5.3, whether the process is positioned more "upstream" or "downstream", as defined in the relative literature, is very relevant. In the following sub-section we shall describe how the literature has tackled these aspects.

7.5.2. Decomposing gross exports via input-output tables

The process of internationalisation and integration in global production has had a number of critical impacts on the value and use for policy purposes of traditional trade statistics. The first impact is that the identification of the actual value added generated in a particular country has become much more complex. This is because gross exports are the result of inputs that have a purely domestic origin and of other inputs that arise from the complex interactions between production of intermediates and trade originating in third countries.

The second critical impact of GVCs is that traditional measures of trade performance based on gross exports are affected by a significant amount of double-counting, which hampers their interpretation. According to estimates in UNCTAD's 2013 World Investment Report, in 2010 about 28 per cent (or $5 trillion) of the estimated $19 trillion of global gross exports represented simple double-counting due to the existence of GVCs. Therefore, in calculations of gross exports trade in intermediates is counted several times rather than being counted only once as "value added in trade".

Against this background, in order to empirically decompose gross exports and therefore be able to assess the value added embodied in the trade results, researchers rely on information from input-output tables, as detailed in Box 1. Such tables provide a breakdown of the inputs (both labour and intermediates) needed at the various stages of production for different productive sectors and therefore proxy the value added generated at the various cross-border crossings during the global production process.

Box 1 Input-output analysis applied to the study of global value chains

Although input-output analysis has had a long tradition in economics since the 17th century, in its modern form it was first developed by Leontief in the 1930s as a tool for inter-industry analysis (Miller and Blair, 2009). This framework accounts for the fact that each industry produces products (output) that may be used by other industries and also by the industry itself, as inputs, giving rise to the name input-output analysis. Part of the output will also be attributed to final consumption, as well as exports. Therefore input-output tables (IOTs) like the one shown in Figure 2 enable the distribution of each industry's product to be tracked throughout the economy.

Figure 1 Single-region input-output table

	Industry 1	Industry 2	Industry 3	Final consumption	Gross capital formation	Exports	Total
Industry 1							
Industry 2	use of intermediate inputs			final uses			total use of output
Industry 3							
Imports	use of imported inputs			imported final uses			
Value added	use of primary inputs						
Gross output	total supply of output						

Source: CompNet policy brief 03/2013, adapted from EUROSTAT (2008).

The emergence of global value chains has extended the use of IOTs, enabling the impact of interdependencies between industries to be addressed across different countries (or regions). The elements of these multi-regional input-output (MRIO) tables (also known as "inter-country input-output" (ICIO) tables) now represent flows between country-industry pairs (see Figure 3).

Figure 2 Interregional input-output table

	Inter-industry transactions/Intermediate demand							Final demand			Total
	Country 1			Country 2			…	Country 1	Country 2	…	
	Ind 1	Ind 2	…	Ind 1	Ind 2	…	…				
Industry 1 Country 1 Industry 2 …	use of domestic inputs			use of foreign inputs							
Industry 1 Country 2 Industry 2 …	use of foreign inputs			use of domestic inputs							
… …	use of foreign inputs			use of foreign inputs							
Value added	use of primary inputs			use of primary inputs							
Gross output											

Source: CompNet policy brief No. 3/2013, adapted from De Backer and Miroudot (2013).

In principle, an inter-country input-output table is therefore a tool that makes it possible to track the flows of products between sectors and countries as well as to final uses, such as household and government consumption and gross fixed capital formation.

Furthermore, it provides information on the use of and payment for primary factors. In doing so, it follows the national accounting principle in the sense that the value added (GDP) is recorded on a

regional basis and not according to the ownership principle (GNP). Thus, an IOT enables domestic rather than national value added to be tracked. Whereas most countries provide information on domestic – and, less commonly, imported – inter-industry flows in the form of supply and use tables (SUTs) and national input-output tables (IOTs), there is generally a lack of data on imports from specific country-industry pairs.

An input-output table is basically a system of linear equations of the following form:

total output = intermediate demand + final demand

or, following Miller and Blair (2009), in matrix notation:

$\mathbf{x} = \mathbf{Zi} + \mathbf{f}$,

where **Z** is the matrix of inter- and intra-industry transactions with element $\mathbf{z}_{ij}^{RS}$ denoting the input from industry ***i*** in country ***R*** to industry ***j*** in country ***S***. One can then define the input-output ratios or input coefficients as

$$\mathbf{a}_{ij}^{RS} = \frac{\mathbf{z}_{ij}^{RS}}{\mathbf{x}_j^S},$$

and, assuming that they are fixed, we can also write

$$\mathbf{X} = \mathbf{Ax} + \mathbf{f} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{f},$$

where **A** is the matrix of input coefficients $\mathbf{a}_{ij}^{RS}$. In a true interregional IOT the production structure of each industry in each region is perfectly known, but in reality the input coefficients $\mathbf{a}_{ij}^{RS}$ and in particular the international dimension of the **A** matrix always have to be estimated on account of a major shortcoming in the available data. Generally, data on imports in national SUTs or IOTs are provided only by industry aggregate without a breakdown by source country.

In order to derive flows between specific country-industry pairs, additional information from detailed trade data has to be used, allowing researchers (i) to determine the breakdown into intermediate (**Z** or **Ax**) and final uses (**f**) of these imports, and (ii) to distinguish intermediate imports in each destination country-industry pair according to the source country.

One important method of constructing the final global IOT rests on the application of the proportionality assumption to separate imports into intermediate and final uses; here it has been assumed that for each product the breakdown into intermediate and final uses is proportional to the aggregate breakdown into intermediate and final uses in the destination country. An IOT resulting from the use of the proportionality method is commonly called a multi-regional input-output (MRIO) table.

A second way to separate intermediate from final imports is to sort bilateral trade flows with the help of the UN Broad Economic Categories (BECs) or refinements of these, which make it possible to assign each imported product to one of the three end-use categories (intermediate inputs, final consumption and gross fixed capital formation) at the 6-digit HS level. This results in an individual split into intermediate and final uses for each origin industry, increasing the accuracy of estimated input coefficients.

Lastly, it has to be mentioned that for both MRIOs and ICIOs an assumption of proportionality is applied within the three end-use categories, in particular to split imported intermediates across industries. A more sophisticated approach would be to use additional information to provide a more differentiated breakdown of use patterns for imported intermediates across industries, but this data is generally unavailable.

Source: Di Mauro, F., Plamper, H., and Stehrer, R., "Global value chains: a case for Europe to cheer up", CompNet Policy Brief No 3, August 2013, Appendix II.

In reality, however, the information derived from I-O tables is far from complete. Most common I-O tables include a rather limited sectoral breakdown (accounting for more or less 40 sectors), which cannot fully account for the complexity of the real production processes. Therefore I-O tables are usually only available at the national level and are hardly interconnected at all across countries (see Appendix I for a comprehensive comparison of the main global databases). As a consequence, the use of I-O tables for regional studies has many shortcomings, and regional economists are often forced to use either national coefficients or coefficients from other regions; because of the obvious limitations of using surrogate coefficients, this methodological approach is rarely used effectively. Moreover, because I-O analysis assumes fixed technical coefficients, it does not allow for substitution between inputs and therefore assumes proportionality and constant returns to scale for all sectors.

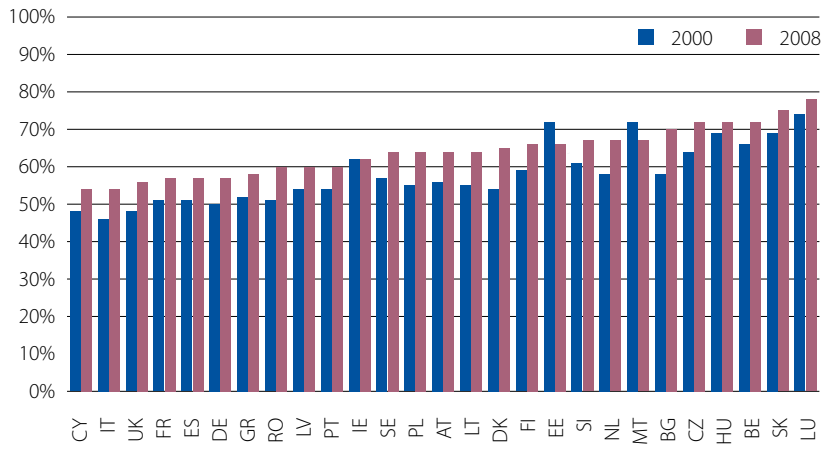
Nevertheless, the literature relying on I-O tables has flourished and two main strands have emerged. As reported by Amador and Cabral (2014), a number of papers focus on measuring the foreign content of domestic production by evaluating the amount of imported inputs over production or over the amount of total inputs, i.e. it refers to the direct imported input share of gross output. Feenstra and Hanson (1996) were the first to implement and create this measure, which has since been used extensively, with some modifications (see Horgos (2009) for a detailed analysis on this type of index). The bottom line of the analysis using this measure is that there is a constant rise in international outsourcing of material inputs over time. The second strand of the literature instead places emphasis on the direct and indirect import content of exports. This measure has been labelled "vertical specialisation" after its initial formulation by Hummels et al. (1998 and 2001). It is suitable for capturing situations where the production process is carried out in two or more countries and the goods cross international borders at least twice.

Compared with the first I-O based measure, the second is more stringent in that it adds the condition of having some of the resulting output exported. At the same time, however, it is more comprehensive since it also includes the imported inputs indirectly used in the production of exports. Hummels et al. (2001) find that vertical specialisation activities accounted for 21 per cent of the exports of ten OECD countries in 1990 and grew almost 30 per cent between 1970 and 1990. This result is in line with other studies (see, for example, Amador and Cabral (2008) for Portugal, Minondo and Rubert (2002) for Spain, and Breda et al. (2008) for Italy and six other EU countries).

7.5.3. Proxies for GVC participation

In addition to the above measures, a commonly used measure is the so-called "GVC participation index" by Koopman et al. (2011). This index measures the extent to which a country is involved in vertically fragmented production. It takes into account the following two dimensions: (i) the use of foreign inputs for its own exports; and (ii) the supply of intermediate goods or services used in other countries' exports. The higher the import content of exports and the higher the value of exported inputs that are re-exported to third countries, the higher the participation of a given country in the value chain.

Figure 4 **Degree of participation* in GVCs (2000 vs. 2008)**



Source: *ECB calculations using WIOD.*

$$*\text{Degree of participation in GVCs} = \frac{\text{Domestic VA}_{\text{reexported}}}{\text{Exports}} + \frac{\text{Foreign VA}}{\text{Exports}}$$

Figure 4 above shows that European countries appear to be highly integrated into GVCs and that this increased interconnectedness has deepened over time. The vast majority of countries record an increase in the index between 2000 and 2008, which points to a rise in the vertical specialisation of production. However, this index does not per se imply any change in welfare arising from GVCs, nor does it provide information about the position of countries within GVCs, i.e. whether they are closer to or farther away from final demand.

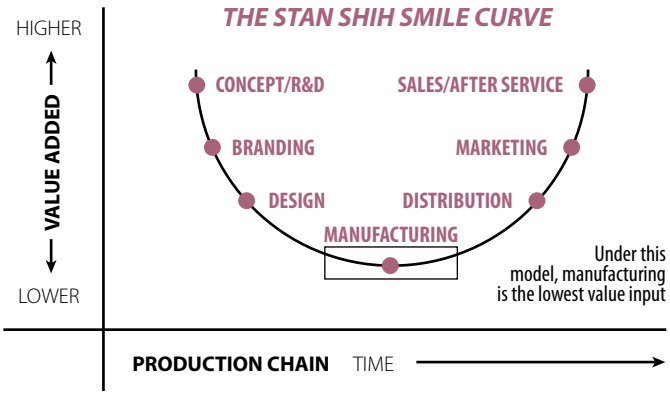
The position of countries within GVCs is indeed another very important issue when analysing the impact of the international fragmentation of production. Even though the creation of a global supply chain made it possible to offshore stages of production, not every stage has actually been moved. Also, activities seem not to be randomly distributed across the world.

Locational decisions depend on a set of different factors, starting with some basic economic considerations (such as market size, the presence and quality of infrastructure, factors of production availability) and a number of institutional ones (cost of doing business, sets of rules regulating investment decisions, trade agreements, etc.).

Some of the above-mentioned considerations are of crucial importance (such as a politically stable system, well-defined commercial laws, etc.), irrespective of the type of activity being offshored. However, in the decision on where to locate specific segments of the production process, precise locational determinants are at work.

With respect to this, it has been observed that value added along the value chain shifts away from the offshored stages. This trend is illustrated by the "smile curve", represented in Figure 5 below, which shows that the opportunities that exist in a value chain to produce higher value added components are located upstream and downstream of manufacturing and assembly.

Figure 5 The "smile curve"



Source: Based on the Stan Shih "smile curve" of value added.

As the curve indicates, the highest level of value creation in a GVC is often found in upstream activities such as new concept development, R&D or branding, as well as in certain downstream activities such as marketing or customer service. In line with this, empirical evidence suggests that fragmentation of production has so far led to a division of labour in which OECD countries have specialised in upstream activities, while emerging countries have specialised more in manufacturing and assembly activities. This should not come as a surprise, given that upstream and downstream activities are those characterised by the importance of know-how and human capital.

The bottom line here is that locational decisions depend principally on the nature of each stage of the final product or service created and, given the role they play in determining the value added generated by a given country participating in a GVC, it is crucial to account for them when analysing competitiveness.

In the light of the above, governments are in a position to selectively target GVCs and GVC segments in line with their endowments and development objectives. In the same way, companies increasingly compete for high value added activities in GVCs instead of for market share in high value added industries.

7.6. GVCs and competitiveness

7.6.1. A closer look at Europe

Using mostly results obtained by a CompNet researcher, this section highlights a number of stylised facts relating to the impact of GVCs on the euro area economy.

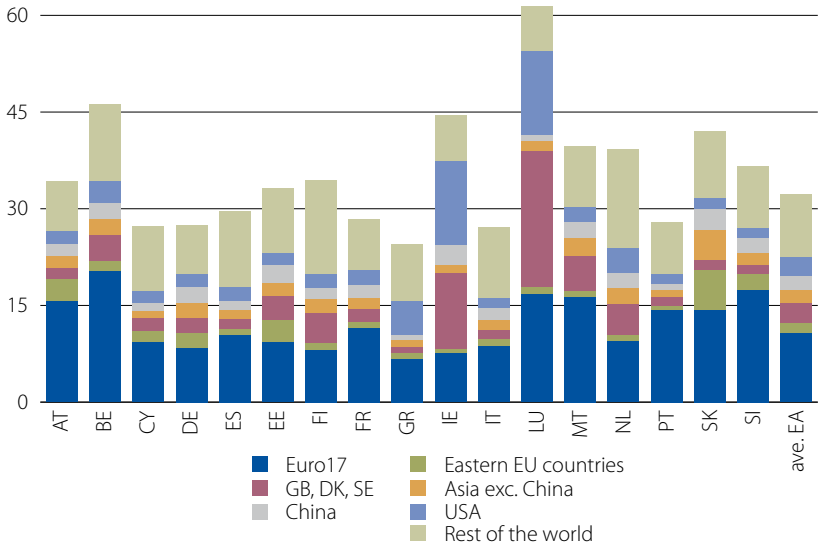
Overall, in the latest year for which figures are available (2011), the relevance of GVCs – measured as the share of foreign valued added in exports (e.g. broadly speaking, the import content of exports) – was as important in the euro area as in China and more important than in the US and Japan (see Amador et al. (2013)). GVCs in the euro area were also fairly resilient during the financial crisis, since the increase in foreign valued added stopped only temporarily in 2009 and then subsequently rebounded.

Figure 6 **Foreign value added in exports, 2000-2011**

Source: Amador et al. (2013) using WIOD.

Notwithstanding the increase in global integration, as proxied by the import content of exports, the average share of foreign value added in euro area exports still equalled just over 30% in 2011 (Figure 6). This means that there is substantial value added generated independently in Europe. Most importantly, a special feature of the euro area is that the role of GVCs rose in parallel with enhanced integration with the Eastern European countries. This increase in regional interlinkages translated into a deeper integration within a European value chain (see Figure 7 below) and allowed European firms to vertically specialise in those activities in which they have a comparative advantage.

Figure 7 **Share of foreign value added (in exports) by origin – 2011 (percentages)**



Source: Amador et al. (2013) using WIOD.

Incorporating GVC activities is also crucial when assessing specialisation patterns in Europe. Traditionally, the measure proposed to assess this pattern is the revealed comparative advantage (RCA), defined as the ratio of a country's exports in a particular commodity category divided by the proportion of world exports of that commodity. A value of this index greater than one indicates that a country has a comparative advantage in the export of that product category while, if the RCA is less than one, the country is said to have a comparative disadvantage in that commodity or industry.

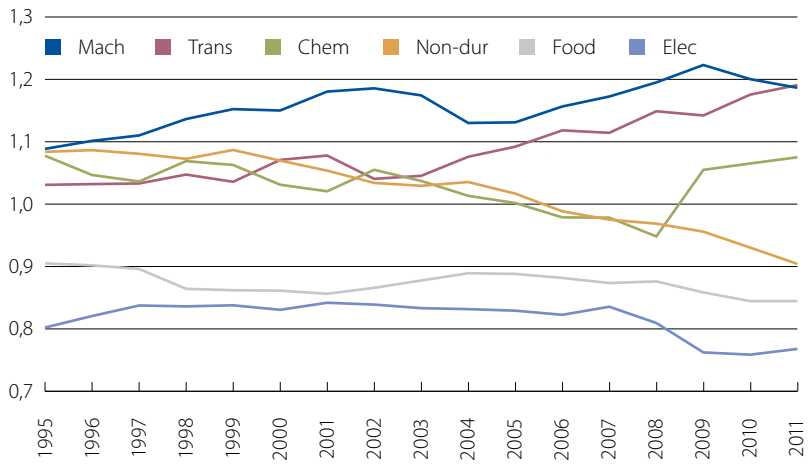
Box 2 Global value chain income

In order to proxy the impact of GVCs on exports, Timmer et al. (2013) developed a new measure known as "GVC income", defined as the sum of all value added by all labour and capital that is directly and indirectly used for the production of final manufacturing goods. There are two distinguishing characteristics of this measure. First, it indicates to what extent a country can compete internationally when global manufacturing is measured in value added terms rather than in gross exports. Second, it is a reflection of an economy's strength to compete in both domestic and global markets, since countries might gain income by serving foreign demand but at the same time lose income in producing for the domestic market.

There are two main findings from this measure: (i) Europe still has the edge in terms of its GVC income in final manufactures, mainly because of its increased comparative advantage in supporting service activities, notwithstanding the recent process of internationalisation, the rise of China, etc. and (ii) strong export performance does not automatically translate into GDP growth. Analyses using gross exports overestimate the degree of competitiveness of countries that rely heavily on imported intermediates for exporting their products. This is precisely what happens when researchers try to assess the export performance of Germany, for which real gross exports in manufacturing goods increased by 98% between 1998 and 2005, while GVC income in manufacturing increased by only 7%.

This measure is often used by industrial and trade policy makers to evaluate which national industry would gain from further global market opening and which, on the contrary, would be damaged. However, traditionally RCA analysis is performed on the basis of gross export values, which do not fully reflect the effects of international production fragmentation on a country's share of exports. For instance, studies based on gross exports found that, in contrast to other advanced economies, the euro area specialisation patterns have not changed much over the last one and a half decades; in particular, di Mauro and Forster (2008) find no evidence of either a decline in the specialisation in labour-intensive products or in the expected shift towards more skills-intensive production. On the contrary, when the RCA is calculated as the EU-27 share in world GVC income, as in Timmer et al. (2014), the comparative advantage of Europe tends to change over time. In particular, the RCA tends to rise for non-electrical machinery and transport equipment, and to decline instead for non-durables and food (see Figure 8) more in line with expectations.

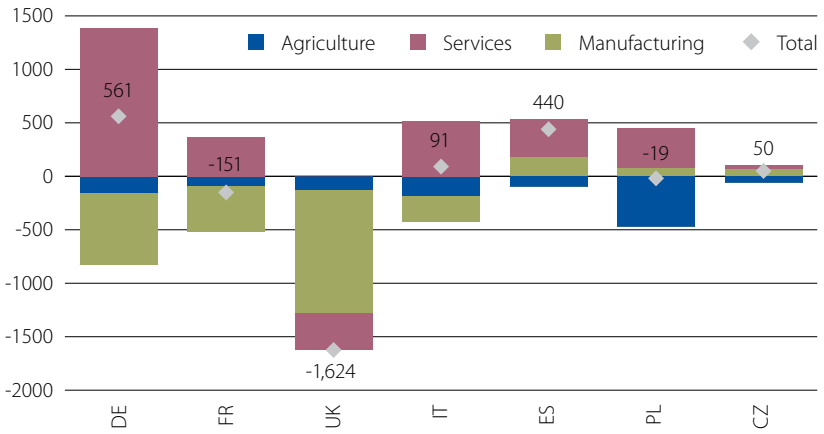
Figure 8 **Revealed comparative advantage of EU-27, by group of final manufactures (%)**



Note: *Final food manufacturing products; other non-durable products; chemical products; machinery & metal products; electrical machinery products and transport equipment.*
Source: *"Rethinking competitiveness: The global value chain revolution" by Timmer, M., Los, B., Stehrer, R., De Vries, G.*

Another issue politically relevant for the euro area is whether increasing integration into GVCs increases the risk of job shedding, as is often publicly claimed. To tackle this issue, Timmer et al. (2013) constructed an indicator labelled "manufactures GVC jobs". By strict analogy with GVC income (see Box 2), it measures the number of jobs associated with all activities that are directly or indirectly related to the production of final manufacturing goods. As shown in Figure 9, along with the increase in GVC participation, the importance of services in European countries, both directly and as embodied in final manufacturing, has grown in terms of value added and job creation (the UK is a notable exception).

Figure 9 **GVC job creation (in '000s), 1995 vs. 2008**



Source: *Timmer et al. (2013) using WIOD*

In particular, two notable cases are Germany and Spain, where, from the mid-90s onwards, job creation in service activities more than compensated for job losses in declining traditional manufacturing activities. The bottom line here is that job vacancies, rather than disappearing, are just differently (and, to be perfectly honest, more unevenly) distributed across high-skilled and low-skilled activities.

This result has some important policy implications. On the one hand, it signals Europe's ability to create employment growth within productive, relatively well-paid activities; on the other hand, it fosters an uneven wage distribution and thus provides a good argument in favour of more policies supporting a transition from low-skilled to high-skilled positions, for example via training.

In conclusion, the widespread internationalisation of production processes often has negative connotations in public discussions; economic "hollowing out", job shedding, the risk of closure of once-successful iconic firms tend to be seen as the most disturbing results, while the positive effects of greater global competition and the ensuing healthy restructuring of the "affected" economies are largely overlooked. As we have just shown, one major reason for this is inaccurate measurements. With increased fragmentation of production across borders, traditional measures of competitiveness based on gross exports become less meaningful and fail to capture the value added for the exporting country; however, when adequate measures are used, such as the ones we have presented, European countries seem capable of creating continued growth in value added while integrating into GVCs. In the next section we report how competitiveness polices should address the changes in production processes brought about by globalisation.

7.6.2. Policy implications

The increasing global fragmentation of production and the emergence of complex GVCs challenge the prevailing policy thinking on competitiveness. As we have seen, we need to complement traditional indicators with new measures incorporating GVC operations and impacts. Adding this dimension has wide-ranging policy implications.

First, policymakers should – when formulating their policies – bear in mind where their respective country mostly lies within the "smile curve". For instance, while nations such as China, which is located at the bottom of the curve, have principally focused on investment policies in order to attract offshored industries, OECD countries may focus on innovation and educational policies. This is in line with the evidence found by Timmer et al. (2013) regarding jobs shifting towards more skills-intensive activities inside the euro area.

Second, as pointed out by De Backer and Miroudot (2014), a key issue arising from firms' involvement in GVCs is the inadequacy of traditional government policies that target local jobs and value added. Because of the increasing geographical fragmentation of production processes, the contribution of national firms to the international production process is not so easy to detect. Consequently, the resumption of investment by domestic firms and, likewise, government support for such investment might partly leak to other countries through the linkages created by GVCs.

Third, and related to the above, policies should strengthen production factors that are "sticky" and less likely to cross borders. According to De Backer and Miroudot (2014), for OECD countries this includes investment in high-quality infrastructure (such as sophisticated IT services, as well as well efficient railways, highways and airports) and human capital, which are both sources of vital importance in supporting the "upgrading" of GVCs. The upgrading process should be a top priority for industries and, therefore, governments; in fact we previously showed that the stages of production entailing more value added are those located upstream or downstream of the production chain. In the US, for instance, investments in intangible assets have become even larger than those in tangible ones.

Fourth, the clear message of the GVC literature is that to be a good exporter, one also needs to be an efficient importer. "Defensive" policies are therefore not only ineffective but also harmful for domestic firms operating in an integrated world where access to cheaper, more differentiated and better-quality intermediates is key. On the contrary, open border policies, if correctly defined, become highly beneficial in the presence of GVCs and, according to OECD evidence, could enable trade costs to be reduced by about 10% in OECD countries.

Against this background, instead of promoting industrialisation through the development of vertically integrated industries, policymakers may want to foster specialisation in specific activities and tasks. This has been the case, for instance, in developing and Eastern European countries, where the integration of global production was fostered by simplifying administrative procedures at the border and reducing impediments to cross-border investment.

7.7. Conclusions

The increased trade in intermediates and further expansion of complex GVCs has resulted in a dramatic reconfiguration of world trade. Impacts are wide-ranging and extend from the redefinition of global players to the rethinking of national comparative advantages. Although some might argue that the fragmentation of production processes, and in particular the offshoring of manufacturing activities, has gone too far and might also end up eroding the competitiveness of those activities still located in the home country, the results of the research presented in this chapter suggest otherwise. Indeed in Europe there is evidence that, from the mid-90s onwards, job creation in service activities compensated for job losses in declining traditional manufacturing activities. Moreover, it should be pointed out that the average share of foreign value added in euro area exports in 2011 was still less than a third. This means that substantial value added is generated independently in Europe and that the average contribution of the extensive margin to total trade growth has been rather small over the past decade. Thus, EU countries' export growth has mainly been the result of a deepening of existing trade relationships, especially in the form of enhanced integration with the Eastern European countries, rather than the exploration of new sectoral or geographical markets.

However, this chapter has not concentrated only on the impact of the rise of GVCs on the competitiveness of the euro area but has also argued in favour of new databases and measures. For this reason CompNet has revised and updated existing indicators so that they can ultimately complement the now obsolete traditional trade statistics with others that can decompose the valued added embodied in national exports. There is a need, though, for a greater effort to be made to devise better, more precise indicators, drawing in particular on the firm-level data now increasingly available. Only by identifying appropriate measures of the international fragmentation of production processes will it be possible to measure the precise benefits of GVC integration for European countries and, in turn, to define adequate competitiveness policies.

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Appendix: Comparison of the main global databases

In complex production lines the parts and components of an individual finished good typically cross several borders many times before reaching the final consumer. In order to eliminate this double-counting of intermediates and to extract exactly how much value added is generated at each of the different stages of production, researchers rely on information from input-output tables. This is a very complex task, since reliable I-O tables are only available at the national level and are hardly interconnected at all across countries. Also, the degree of sector detail, typically ranging between 25 and 100, can only broadly mimic the complexity and variety of existing products. Notwithstanding these difficulties, there are now a number of databases available that allow for a distillation of value added from gross trade flows (see Table A.1).

Typically these databases differ in a number of dimensions, such as (i) the country, sector and time coverage, (ii) their linked satellite datasets, (iii) the methodology used for constructing them, and (iv) their public accessibility. Therefore, the choice of the preferred database will depend on the nature of the policy/research questions at hand, across the four dimensions mentioned above.

(i) With regard to the first dimension, for policymakers with a focus on Asia the database of Asian International IOTs (AIIOTs) produced by the Institute for Developing Economies of the Japan External Trade Organisation (IDE-JETRO) (Meng et al., 2013) is the most natural choice. However, if the focus is on the recent financial crisis, the World Input-Output Database (WIOD) (Dietzenbacher et al., 2013), which is currently the only database providing data up to the year 2011 in both the current and previous year's prices, is more reliable. Finally, if being able to count on periodical updates is a priority, the WTOOECD Trade in Value Added (TiVA) database (De Backer and Miroudot, 2013) is the only option.

(ii) Value added databases are used for different purposes, and this is reflected in the satellite datasets they are connected to. For instance, since it provides a set of socioeconomic satellite accounts, WIOD is well suited to exploring the interaction between GVCs and employment creation for 40 countries (incl. EU27). On the other hand, the most prominent environmentally extended (EE) input-output tables EORA (Lenzen et al., 2013) and EXIOPOL (Tukker et al., 2013) are linked to environmental accounts and emissions datasets.

(iii) With respect to the methodology used to extract the value added, there is a clear trade-off between accuracy and data availability.

In particular, a first group of researchers uses a simplifying proportionality assumption[9] to break down imports into intermediate and final uses (e.g. EORA, EXIOPOL, Johnson and Noguera (2012), Andrew and Peters (2013)). A second group instead assigns each import flow to one of the three end-use categories (intermediate inputs, final consumption and gross fixed capital formation) individually, with the help of additional data. In particular, detailed trade data and correspondences to broad end-use categories (BECs) are used, increasing the accuracy of the resulting inter-country IOTs (e.g. WIOD, Koopman et al. (2013) and Tsigas et al. (2012)). The problem is that, while the second methodology improves accuracy compared with the simple proportionality assumption, some proportionality assumptions still have to be applied within certain use categories.

(iv) Finally, with respect to accessibility, at the moment only WIOD (up to the year 2009) and parts of EORA are freely available, while GTAP and IDE-JETRO can be accessed against payment of a fee. EXIOPOL and the OECD do not publish their global input-output tables, although the OECD-WTO Trade in Value Added (TiVA) database can be accessed freely online.

9 Source: Di Mauro, F., Plamper, H. and Stehrer, R. (2013). "Global value chains: a case for Europe to cheer up", CompNet Policy Brief No 3, August 2013, Appendix I.

Table A.1 Summary of existing global databases

		Coverage	Time dimension	Features	Satellite accounts or ready-to-use indicators
Trade	IDE- JETRO (Asian IIO)	9 Asian countries and US, 76 industries	intermittent years 1975 - 2005	• ICIO	• employment statistics (2000, 2005)
	WIOD (World Input-Output Database)	40 countries (incl. all EU27) plus ROW, 35 sectors	1995-2009 annually, will be updated to 2011	• ICIO • based on SUTs and benchmarked to national accounts • available in this and last year's prices	• socio-economic accounts (employment statistics) • services • environmental accounts
	OECD - WTO TiVA (Trade in Value Added)	57 countries, 18 industries (37 in underlying tables)	1995, 2000, 2005, 2008, 2009	• OECD ICIO (not publicly available) • OECD-WTO Trade in Value Added indicators (TiVA)	• services • GVC indicators: incl. GVC participation, distance to final demand, GVC length, GVC income
	YNU - GIO (Yokohama National University - Global IO Table)	27 endogenous and 61 exogenous countries, 35 sectors	2005-2010 annually	• ICIO	• shock transmission indicators: Simultaneous Shock Transmission Index (SSTI), industry-specific Shock Transmission Index (STI)
	GTAP[1] (Global Trade Analysis Project)	129 countries, 57 sectors, 5 factors (land, skilled/ unskilled labour, natural ressources, capital)	2000, 2004, 2007	• dataset of harmonised national IOTs and social accounting matrices (SAMs) • serves as a basis for a number of ICIO projects	• energy volumes, land use, CO_2 emissions • international migration • processing trade accounts for China and Mexico constructed by Koopman *et al.* (2013) and Tsigas *et al.* (2013)

1 GTAP consists of a harmonised meta-dataset of bilateral trade, together with national IOTs as well as social accounting matrices (SAMs) for 129 countries and 57 sectors (Walmsley *et al*., 2012). Instead of harmonising data from a wide range of sources themselves, a number of authors, including Koopman *et al*. (2013) and Tsigas *et al*. (2013), take the GTAP dataset as a basis for constructing inter-country IOTs.

		Coverage	Time dimension	Features	Satellite accounts or ready-to-use indicators
Environment	EXIOPOL (Externality and IO Tools for Policy Analysis)	43 countries plus ROW, 129 sectors/products	2000, currently being updated to 2007	environmentally enhanced Supply & Use table SUT/MRIO	30 emitted substances, 80 resources by industry environmental accounts (global warming potential, acidification, total material requirement, external costs) land use and water use
	EIORA	187 countries, 25-500 sectors depending on the country	1990-2011 (based on initial MRIO estimated for the year 2000)	MRIO reliability statistics (est. standard deviations) highly disaggregated avoids transforming original raw data	35 environmental indicators (air pollution, greenhouse gas emissions, water use, ecological footprint, human appropriation of net primary etc.)

Part III

Investing in competitiveness

Chapter 8

Mapping European export performance

Tim Bending[1]

1 Tim Bending is an economist at the European Investment Bank. This chapter summarises a longer report on European export performance prepared for the European Investment Bank by Michael Landesmann and Sandra Leitner of the Vienna Institute for International Economic Studies (wiiw), which is published as an EIB working paper (forthcoming). This report can be referred to for extended tables covering both gross export and valued added data, as well as extended results of the econometric analysis.

Mapping European export performance

Chapter at a glance

This chapter examines developments in market share, export structure and revealed comparative advantage within the EU and in comparison with other regions of the world. It pays special attention to shifts in specialisation and export structure with regard to manufacturing and services, lower and higher technology industries and business services. Data are taken from the World Input-Output Database (WIOD), which provides information on international production process linkages and allows calculation of measures of "trade in value added".

The main findings of this chapter can be summarised as follows. While the EU is losing manufacturing market share like other advanced economies, it has notably gained world market share in the export of services, in contrast to the US and Japan. Trends are divergent within the EU, with manufacturing remaining strong in Germany, Austria and central-eastern Europe. France and Italy also retain a revealed comparative advantage in manufacturing. Elsewhere, there is generally a shift towards services, with the UK specialising dramatically in this regard.

Within manufacturing industries there has been a shift at the aggregate EU level from low-tech to high-tech industries, while domestic value added in manufacturing exports has decreased across the EU, in line with the global trend of increasing cross-border production integration. Germany and central-eastern Europe lead these trends. The continued relative specialisation in lower and medium-tech industries in southern Europe is a potential cause for concern as labour costs are likely to be a key factor in determining export performance in these sectors. It will be hard for European countries to maintain living standards while competing on these terms.

Exports of business services have risen in importance throughout most of the EU, as has the contribution of business services to gross manufacturing output. The latter confirms that manufacturing performs an important export "carrier function" for services, which is greatest for high-tech industries.

An exploratory regression analysis supports positive linkages between export performance and labour productivity, the share of high-skilled workers in an industry, the use of business services and the degree of integration within cross-border production networks. Labour compensation costs can be linked negatively with export performance in low-tech industries, but positively with export performance in medium and high-tech industries. This is in line with the finding that variables linked to labour costs such as labour productivity and skills are more important in medium and high-tech industries.

8.1. Introduction: From firm competitiveness to national export performance

This chapter provides an overview of European trade performance. It examines developments in market share, export structure and revealed comparative advantage to draw comparisons between the EU and the rest of the world, between different regions of Europe, and between some of Europe's largest economies. It pays special attention to shifts in specialisation and export structure between manufacturing and services and between lower and higher technology industries. It also examines the growing importance of business services for export performance, including indirectly as a contributor of value added to manufacturing firms and manufacturing exports. It can be seen as mapping out some key indicators of industry structure and export performance as impacts of firm competitiveness, to add a geographical dimension to the analyses in this volume.

To highlight the differences within Europe, the chapter distinguishes between five different groups of European economies:

- old Member States (OMS)-North (the higher-income economies of the EU);
- old Member States-South (Greece, Portugal and Spain);
- new Member States (NMS)-Central (the Czech Republic, Hungary, Poland, Slovakia and Slovenia);
- new Member States-South East Europe (SEE) (Bulgaria, Romania, Cyprus and Malta); and
- the Baltic countries (Estonia, Latvia and Lithuania).

In addition, particular attention is given to the individual performance of the four largest European economies (Germany, France, Italy and the United Kingdom), which have a very strong impact on Europe as a whole.

Data are taken from the World Input-Output Database (WIOD)[2], which provides information on international production process linkages and structures of final goods trade for 59 products across 35 industries and 40 countries over the period 1995 to 2011. The countries covered include the EU Member States (with the exception of Croatia) and 13 other major countries, plus an estimate for the rest of the world (RoW). Data for "EU" presented in this chapter always refer to the EU Member States minus Croatia.

The WIOD data set allows calculation of measures of "trade in value added" (Foster-McGregor and Stehrer, 2013) as an alternative to traditional gross measures of trade performance. Gross trade measures may be distorted by the fact that production has become more and more internationally integrated through global value chains, in which different firms in different countries add value at different stages of production. In this context, gross exports become less meaningful as a measure than the domestic value added within exports. This chapter will generally rely on domestic value added in exports rather than gross exports, although the background analysis showed that use of gross export data would make little significant difference to the specific conclusions presented here. All data presented are calculated on a value added basis unless otherwise stated. This includes calculations of revealed comparative advantage (RCA, see Box 1).

Finally, this chapter briefly summarises an econometric analysis of the links between export performance and many important factors for firm competitiveness, such as labour productivity and human capital, and linkages within global value chains.

2 See Dietzenbacher et al, 2013, Timmer, 2012.

Box 1 "Revealed comparative advantage" as an indicator of relative export specialisation

In addition to examining data on the share of world exports, this chapter also uses a simple revealed comparative advantage (RCA) indicator as evidence of the export specialisation of a country or region in comparison to the overall mix of industries in world trade. The indicator is defined as:

$$RCA_{ijt} = \frac{\frac{EXP_{ijt}}{EXP_{jt}}}{\frac{EXP_{it}}{EXP_{t}}} - 1$$

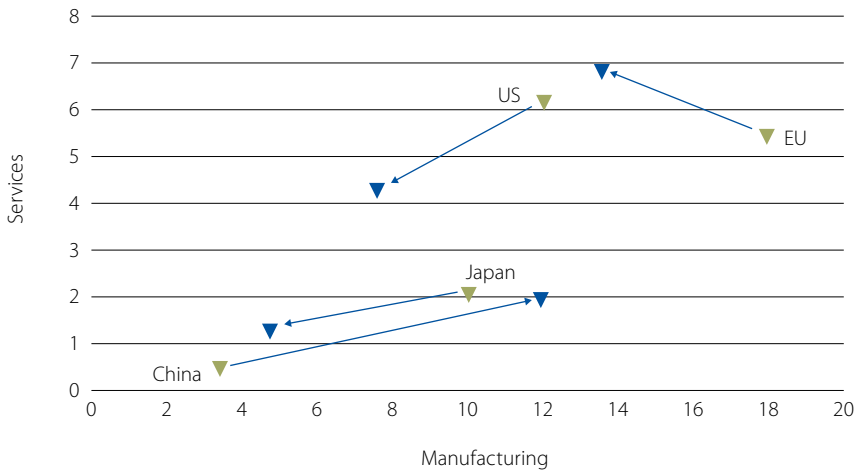
where RCA_{ijt} refers to the revealed comparative advantage of an industry i of country j, EXP_{ijt} to the exports (in gross value terms or value added terms) of industry i of country j and EXP_{it} to global exports of that industry (all at time t). Similarly, EXP_{jt} and EXP_{t} refer, respectively, to total exports of country j and total global exports at time t.

Hence the indicator compares the position of an industry in a particular country's export basket with that industry's position in global exports. An RCA value of -0.25, for example, means that a particular industry is represented 25% less in a country's total exports than it would be in global exports for the industry in question.

8.2. The changing role of manufacturing and services in EU export performance

The decline in the manufacturing sector and the growing importance of services in advanced economies is a well-known phenomenon, and the EU has not been immune to this trend. However, the export performance of the EU differs in significant ways from that of major competitors such as the US and Japan.

Figure 1 Major economies' share of global gross exports, extra-EU trade only, 1995 to 2011 (%)



Source: WIOD; wiiw calculations. Arrows indicate shift from 1995 to 2011.

To put EU export performance in a global context, the following observations can be made:

- As of 2011, the EU was still the largest single global exporter in both manufacturing and services when measured in gross export terms, even when intra-EU trade is excluded (Figure 1). The EU accounted for 13.5 per cent of global manufacturing exports in 2011 (as against 17.9 per cent in 1995). By comparison, China's share of gross world manufacturing exports increased from 3.4 per cent in 1995 to 11.9 per cent in 2011.
- The EU share of world manufacturing exports is significantly lower when measured in value added terms. According to calculations from the WIOD project, China's 2011 share of global manufacturing value added exports (11.8 per cent) already exceeded that of the EU in extra-EU trade (11.5 per cent). This suggests that international production linkages are more important in European manufacturing than in other countries and regions of the world.
- Whilst the importance of EU manufacturing exports has declined, the EU share of global services exports has actually increased, and this remains true whether or not one excludes intra-EU trade, and in both value added and gross terms. This is notably not the case for the US and Japan, which both lost export share in services. There was a sharp decline in intra-EU trade in services during the crisis period from 2009 to 2011, but this did not impact on extra-EU-27 global trade flows.
- The fact that the EU share of extra-EU exports of services is not lower in value added terms than in gross exports terms suggests that services are more characterised by domestic vertically integrated production and cross-border intra-EU trade integration than is the case for manufacturing.

While these findings point to the overall declining position of EU manufacturing in global trade, such comparisons need to be treated with caution. Firstly, it should be noted that excluding intra-EU trade from the analysis could be said to treat regions asymmetrically, as intra-East Asian trade flows or intra-NAFTA trade flows are not similarly excluded (although intra-US flows are). Secondly, it needs to be noted that the WIOD dataset uses national input-output tables to calculate the direct and indirect uses of both domestically produced and imported inputs. From this information the direct and indirect contribution of domestic and foreign suppliers to export value added is calculated. What the WIOD database cannot capture, however, is whether exporting firms are more likely to source inputs from foreign suppliers than firms producing mainly for the domestic market. Indeed, analyses based on firm-level data suggest that import intensities may be quite different for exporting firms than for firms mostly supplying the domestic market (Altomonte et al., 2012). Where exporting firms are more likely to source inputs from foreign suppliers than firms focused on domestic markets, the data can be expected to underestimate the foreign contribution to the value of gross exports.

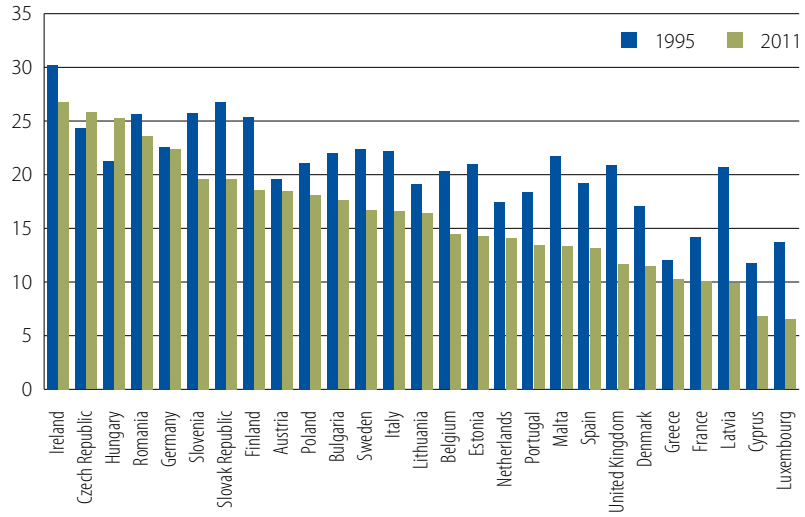
Within the EU, important differences are also evident:

- Most EU Member States experienced a significant decline in manufacturing as a share of GDP over the 1995–2011 period (Figure 2). This pattern is also reflected in shares of world exports (calculated on an extra-EU only, value added basis – see Table 1). The OMS-North and OMS-South groups showed a dramatic decline in export shares, while export shares of the OMS-SEE and Baltic States remained more stable. Manufacturing export shares fell strongly in France, Italy and, particularly, the UK.
- A clear exception to this trend is formed by what can be termed the "central European manufacturing core", comprising Germany, Austria and the NMS-Central group. While manufacturing as a share of GDP remained almost unchanged in Germany and Austria, it actually rose in the Czech Republic and Hungary, and remains relatively high in other central European countries, plus notably Romania and Ireland. Germany's share of world exports fell, though less so than other large OMS-North countries, while the share in world exports of the NMS-Central group almost doubled. These countries are all strongly connected through cross-border production networks with Germany (see also Stoellinger, 2014).
- Where manufacturing has declined in importance within the EU on aggregate, this trend has been accompanied by an increasing specialisation in services. Shares of global extra-EU exports of services, in value added terms, have increased in all EU groups, particularly in the OMS-South group, although they have fallen in France and Italy. In revealed comparative advantage terms, all regional groups apart from NMS-Central show an increased specialisation in services over the 1995–2011 period, and little change in their specialisation in manufacturing relative to the composition of global exports

(Figure 3). The NMS-Central group actually became less specialised in services and strongly specialised in manufacturing.

- Trends within the OMS-North group are very heterogeneous. France, Italy and Germany all show increased specialisation (RCA) in manufacturing exports, relative to the composition of global exports, but not in services exports, while the UK strongly increased its relative specialisation in services and lack of specialisation in manufacturing.
- In overview, it is possible to identify two distinct trends within the EU as regards export performance and specialisation in manufacturing and services. On the one hand, there is a general trend towards greater specialisation in services and a weaker global position in terms of manufacturing exports (although the EU remains perhaps the leading manufacturing exporter). On the other, a group comprising Germany and neighbouring countries to the east can be seen to be moving in the opposite direction, playing an increasingly important and even dominant role in EU manufacturing exports.

Figure 2 **Manufacturing share of GDP in EU Member States, 1995 and 2011 (%)**



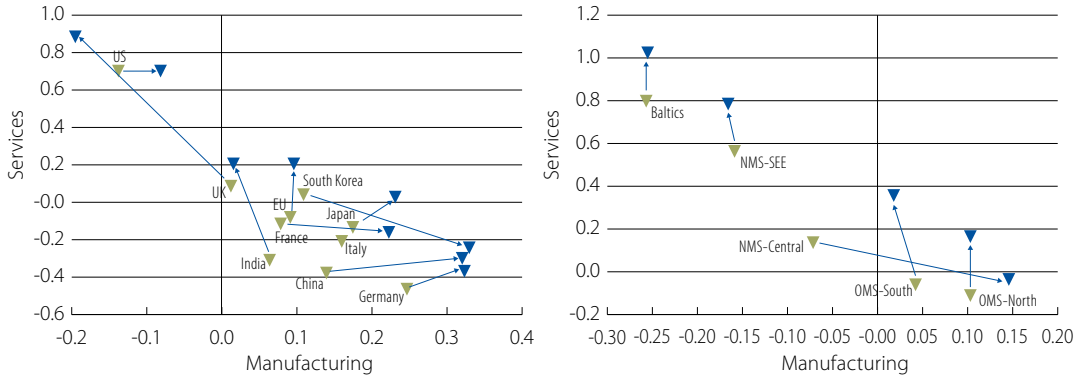
Source: WIOD; wiiw calculations.

Table 1 **Share of exports in total global exports (extra-EU trade only, value added, %)**

	Manufacturing		Services	
	1995	2011	1995	2011
EU	16.57	11.49	5.63	6.88
US	12.59	7.82	7.27	5.23
Japan	11.26	5.00	2.41	1.49
South Korea	2.64	2.66	0.73	0.54
China	3.40	11.78	0.54	2.23
India	0.85	1.47	0.16	0.62
OMS-North	15.39	10.12	4.98	5.72
OMS-South	0.76	0.69	0.30	0.55
NMS-Central	0.30	0.54	0.23	0.37
NMS-SEE	0.10	0.10	0.09	0.16
Baltics	0.03	0.04	0.03	0.09
France	2.41	1.47	1.02	0.60
Germany	5.28	4.00	0.66	1.13
Italy	2.24	1.49	0.65	0.47
United Kingdom	2.42	1.18	0.91	1.07

Source: WIOD; wiiw calculations.

Figure 3 **Revealed comparative advantage, manufacturing and services, 1995 to 2011**



Source: WIOD; wiiw calculations. Arrows indicate shift from 1995 to 2011.

8.3. Export performance and the technology intensity of industry

Within manufacturing, it is important to distinguish between different industries that have different levels of technology intensity, to identify changing patterns of specialisation and export performance (see Figures 4 and 5). In this chapter, we divide manufacturing sectors into three groups: "low-tech" (LT), "medium-low tech" (MT) and "medium-high and high-tech" (HT).[3] While this subdivision is useful in revealing broad trends based on the categories within the WIOD database, its limitations also need to be recognised. In particular, these three categories are not sensitive to specialisation within industries, such as in relatively "low-tech" assembly operations or "high-tech" R&D tasks. This is important to keep in mind given the increasing importance of cross-border production networks.

At the **global level**, the following observations can be made:

- In terms of GDP share the EU shows a shift from low-tech to high-tech industries between 1995 and 2011, on aggregate, and in this regard is similar to most major economies such as the US, with South Korea notably showing a very strong shift towards high-tech. However, the position of Japan has shifted little in GDP share terms.
- Shifts in GDP share towards high-tech in the EU and USA are not reflected in calculations of revealed comparative advantage based on value added in exports. RCA values for the different industry groups for the EU, US and Japan appear fairly stable between 1995 and 2011, with the EU and US showing no comparative specialisation in high-tech industries relative to the world trade average, while such specialisation is strong for Japan. In interpreting these results, it has to be borne in mind that the structure of total world exports has also shifted towards high-tech, so that the apparent stability of RCA values in these economies represents a shift in line with global trends.
- RCA calculations for South Korea, China and India all show very strong shifts away from low-tech and towards high-tech industries, although China and India are still comparatively specialised in low-tech.

3 Low, medium-low and medium-high and high-tech are defined according to the following NACE (Nomenclature des Activités Économiques dans la Communauté Européenne) categories: low-tech (LT): food, beverages and tobacco (15-16), textiles and textile products (17-18), leather, leather and footwear (19), wood and products of wood and cork (20), pulp, paper and paper products, printing and publishing (21-22), manufacturing, nec., recycling (36-37); medium-low tech (MT): coke, refined petroleum products and nuclear fuel (23), rubber and plastics (25), other non-metallic mineral products (26), basic metals and fabricated metal (27-28); medium-high and high-tech (MHT): chemicals and chemical products (24), machinery, nec. (29), electrical and optical equipment (30-33), transport equipment (34-35).

The shift from low-tech to high-tech is reflected across the different regions of the EU, particularly in terms of share of GDP. However, aggregate EU data obscure some strong **regional differences**:

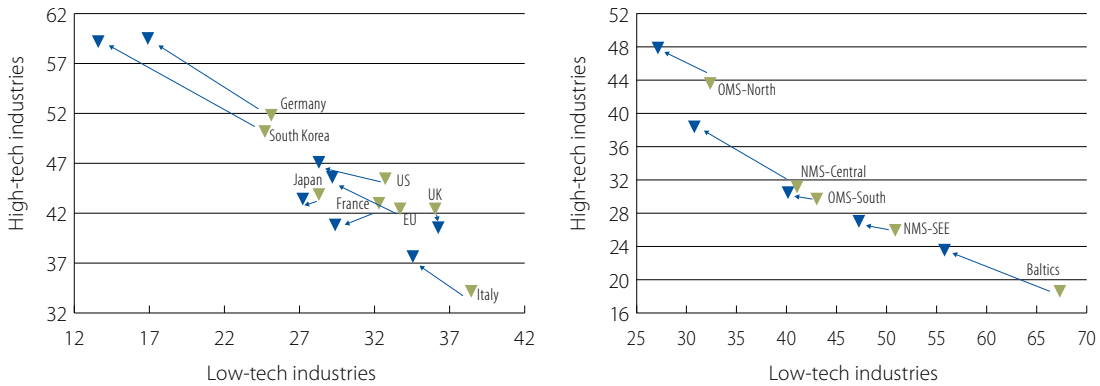
- The OMS-North countries remained the most specialised in high-tech industries in 2011, although collectively their position had not changed greatly in either share of GDP or RCA.
- The NMS-Central group countries are notable for a very strong shift from 1995 to 2011 towards high-tech, almost catching up with the OMS-North. They are now clearly more specialised in high-tech industries than other new Member States and the OMS-South.
- The OMS-South group has moved little in GDP share terms and appears to be specialising relatively in medium-tech manufacturing exports.
- The Baltic States are notable for retaining a strong relative specialisation in low-tech industries in 2011, although they too have shifted very strongly towards medium and high-tech industries since 1995.

The picture within the **OMS-North** group needs to be qualified, however, because very different trends are revealed by the largest economies within this group:

- Germany has experienced a very strong shift from low-tech to high-tech industries since 1995, in share of GDP terms almost comparable to the transformation in South Korea.
- In France, both low and high-tech industries have declined slightly as a share of GDP. RCA calculations show no clear picture, with increasing relative specialisation in both low-tech and high-tech.
- Italy has experienced a strong shift away from low-tech and towards high-tech in share of GDP terms, but starting from a point of greater comparative specialisation in low-tech. In RCA terms, Italy remains relatively specialised in low and medium-tech industries, but has expanded its export presence since 1995 in medium and high-tech.
- The UK stands out as having lost revealed comparative advantage in all manufacturing industry groups between 1995 and 2011, with negligible change in the structure of manufacturing.

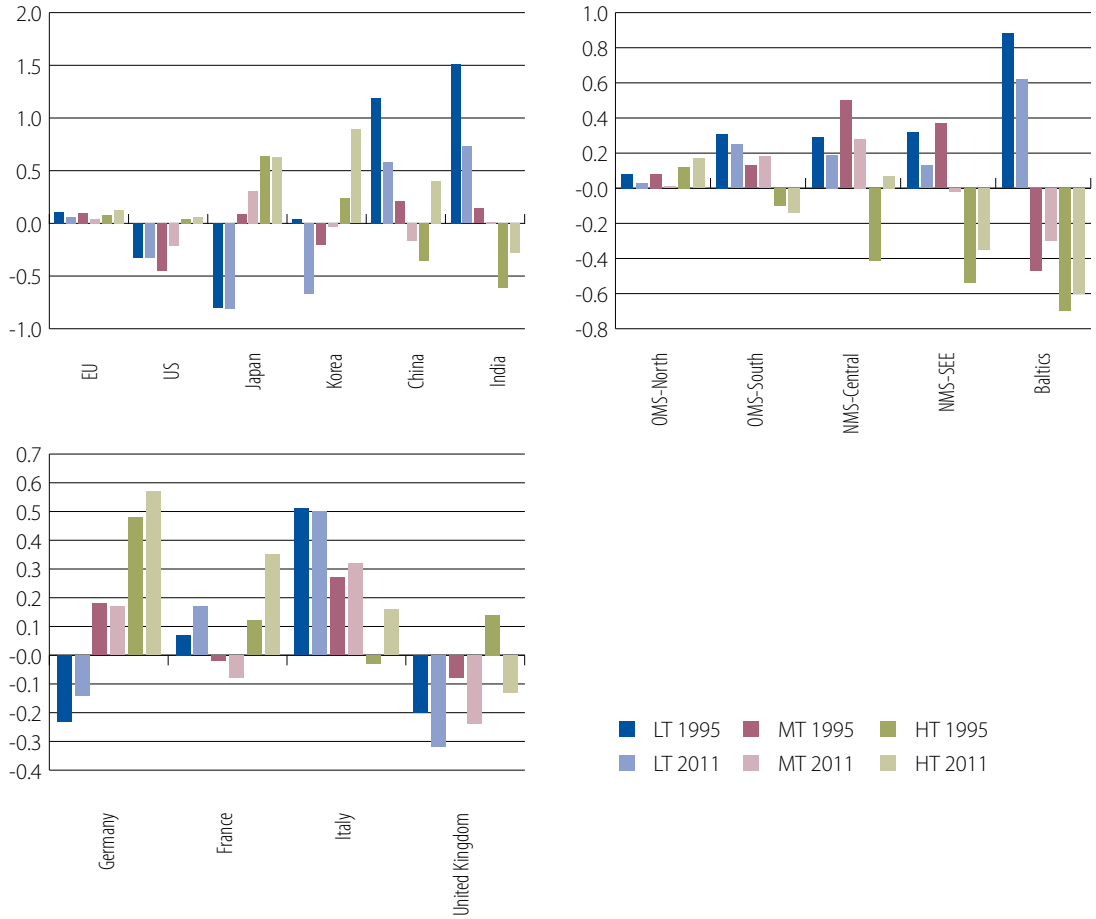
In overview, it is the shift from low and medium-technology industries to high-tech industries in Germany and the NMS-Central countries – the "central European manufacturing core" – that stands out as a key development and can be linked to the particular success of this region in manufacturing growth and export performance. The manufacturing structure and revealed comparative advantage have also shifted towards high-tech industries in most EU countries, though to a much lesser extent. In some cases, these shifts may be driven as much by declining low-tech industries as by growing high-tech ones.

Figure 4 Shares of HT and LT industries in total manufacturing GDP, 1995 to 2011 (%)



Source: WIOD; wiiw calculations. Arrows indicate shift from 1995 to 2011.

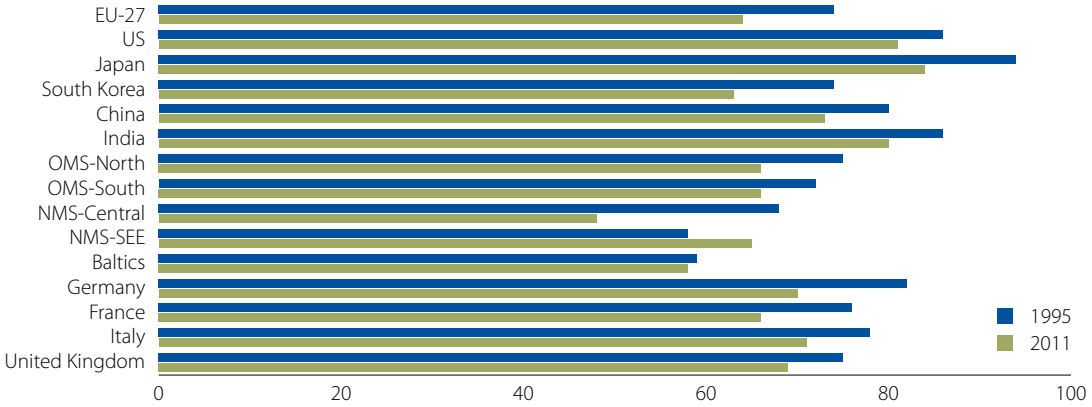
Figure 5 **Revealed comparative advantage of manufacturing industry groups, 1995 and 2011**



Source: WIOD; wiiw calculations.

An important development with regard to manufacturing and export performance is the growing significance of cross-border production networks. In this regard, it is revealing to examine the difference between domestic value added in exports (which has been used for calculating RCA values) and gross exports. Figure 6 takes medium-high and high-tech industries as an example. It shows that domestic value added as a proportion of gross exports decreased in nearly all countries and regions examined, indicating the widespread growth in importance of cross-border production chains. Unsurprisingly, domestic vertically integrated production for export appears lower in the EU (given that intra-EU trade is included in this case), in South Korea (as a relatively small country) and in the small countries represented by the new Member States regions. Interestingly, the decline in domestic value added appears strongest in the NMS-Central group. This is clear evidence of the importance of integration within cross-border production networks for that group of countries, particularly with Germany. The growth in the proportion of domestic value added in the NMS-SEE region, and very small decline in the Baltic States, may reflect the fact that these regions have a much lower level of specialisation in high-tech industries, and therefore may have a lower level of integration with industries in Germany and other leaders in high-tech industries.

Figure 6 **Domestic value added as a proportion of gross manufacturing exports, including intra-EU trade, for HT industries (%)**



Source: WIOD; wiiw calculations.

8.4. The growing importance of business services in EU export performance

Business services include sectors such as transport, distribution, communications (including activities such as call centres) and financial intermediation. One important characteristic of business services is that they are used as inputs by manufacturing firms as well as other services sector firms. This means that part of the gross exports achieved by manufacturing firms may actually be value added by service industries. Manufacturing can thus have an important "carrier function" for services, allowing value added from services to be traded because they are embodied in manufactured goods, where otherwise these services might not have been tradable.

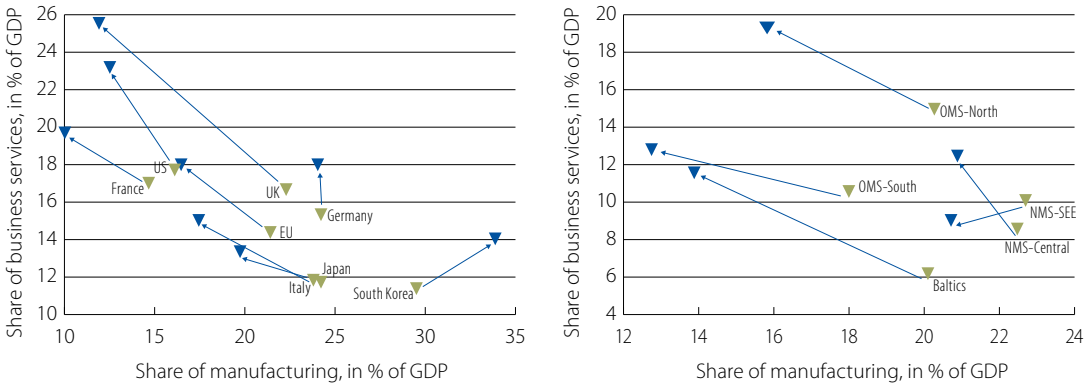
Another important issue is the increasing tradability of many services that arises both from processes of liberalisation of trade in services and from technological changes such as telecommunications, which enable call centres to be based in countries other than those of the customers they serve. For these reasons, it is interesting to examine developments in the structures of industry and exports with regard to business services.

At the global level, we see business services increasing as a share of GDP across advanced economies in the 1995 to 2011 period (Figure 7). The level of specialisation in business services is higher in the US than in the EU, and lower in Japan and South Korea. This pattern is also reflected in the share of business services value added in total (regional or national) value added exports (Table 2).

Within the EU, the growing importance of business services output as a share of GDP is evident across regions and the large northern European economies. The one exception is provided by south-eastern Europe, where the business services share of GDP declined by around 1 percentage point. In terms of business services value added in exports, however, the NMS-SEE group saw a notable 2 percentage point increase, while the only decline was registered by the NMS-Central group. A possible explanation is that the NMS-SEE group has specialised more in directly tradable services, while the NMS-Central group has specialised more in manufacturing that is highly integrated within cross-border production chains, in the context of which business services may be more likely to be foreign-sourced.

Among the large OMS-North countries, the UK stands out in terms of the exceptional GDP share and export performance of business services, and the degree to which this specialisation increased over the 1995-2011 period.

Figure 7 **Share of business services and share of manufacturing, as % of GDP, 1995 to 2011**



Source: WIOD; wiiw calculations. Arrows indicate shift from 1995 to 2011.

Table 2 **Share of business services value added in total value added exports (%)**

	1995	2011
EU	5.59	9.02
US	11.19	16.24
Japan	2.00	2.49
South Korea	3.14	2.30
China	0.70	2.84
India	1.59	13.81
OMS-North	5.75	9.75
OMS-South	4.19	8.65
NMS-Central	4.60	3.47
NMS-SEE	3.04	5.14
Baltics	2.99	3.77
Germany	2.84	4.81
France	6.49	6.63
Italy	3.49	5.17
United Kingdom	10.33	24.11

Source: WIOD; wiiw calculations. Intra-EU trade is included.

The **contribution of services to gross manufacturing output** notably increased from 1995 to 2011 across most of the countries and regions examined, with South Korea and NMS-SEE being the exceptions (Table 3). This further reinforces the view that manufacturing performs an increasingly important "carrier function" for services. In line with the overall share of business services in GDP, we see larger contributions of business services to gross manufacturing output in the more advanced economies and regions, with the US and EU ahead of Japan and Korea in this regard. Within the OMS-North group, however, the pattern is rather different, with France standing out in terms of the contribution of services to manufacturing, while the contribution in the UK is lower.

The contribution of services to gross manufacturing output is consistently different for the various technology levels of industry. As shown in Table 3, the contribution is almost always highest in high-tech industries and lowest in medium-tech industries. While it seems that inputs of business services play an important role in high-tech industries, it may be suggested that inputs from other manufacturing

industries make up a significant share of medium-tech industry gross output, so that the services share is lower, while in low-tech industries labour costs and services inputs account for a higher share. At the same time, a high share of business services inputs appears to be characteristic of high-tech industries, with the caveat that there is a broad degree of national differentiation in terms of business models in this regard, manufacturing in high-tech leader Germany using substantially less services inputs than France.

Table 3 Cost share of business services in manufacturing gross output (%)

	LT		MT		HT		All manufacturing	
	1995	2011	1995	2011	1995	2011	1995	2011
EU	6.8	9.1	6.7	6.5	9.0	10.2	7.7	8.8
US	8.0	9.6	5.5	4.9	9.9	11.3	8.3	9.0
Japan	4.2	5.5	3.8	3.7	4.7	6.3	4.3	5.3
S. Korea	4.9	4.7	4.6	3.0	5.6	4.8	5.1	4.2
OMS-North	7.2	9.9	6.9	7.0	9.2	10.9	8.0	9.5
OMS-South	5.4	8.1	6.0	5.5	7.6	8.5	6.2	7.4
NMS-Central	4.2	5.5	3.7	4.3	5.3	5.2	4.4	5.0
NMS-SEE	5.2	4.4	5.2	4.7	7.7	5.8	5.8	4.8
Baltics	1.6	3.7	1.7	2.1	1.9	4.1	1.7	3.4
Germany	8.8	10.1	7.5	7.2	8.9	9.4	8.6	8.9
France	9.3	13.9	9.2	9.8	13.0	14.6	11.0	12.9
Italy	4.2	6.7	5.5	6.5	6.3	8.2	5.3	7.2
United Kingdom	6.6	8.3	6.3	4.9	7.8	8.3	7.1	7.4

Source: WIOD; wiiw calculations. Intra-EU trade is included.

8.5. Exploring the drivers of export performance

In order to underline the link between firm-level competitiveness, industrial specialisation and trade performance at the national level, it is useful to investigate the relationship between key factors in influencing firm performance and national export performance.

Using WIOD for 1995 to 2007 (to exclude short-term crisis-related effects) for EU countries (excluding Croatia), the analysis explored the linkages between, on the one hand, labour productivity, human capital, use of business services, vertical integration, capital intensity and labour compensation costs, and gross exports and domestic value added in exports on the other. The exercise was repeated for manufacturing as a whole and for the high, medium and low-tech manufacturing industry groups identified earlier in this chapter. The methodology, specification and results are further presented in Box 2.

The main conclusions of this analysis can be stated as follows:

- Manufacturing industries with higher labour productivity are characterised by significantly better export performance, with a 1 per cent increase in labour productivity associated with around 0.6 per cent higher export levels, irrespective of the indicator of export performance considered. This conclusion holds across the different technology sub-groups, although the size of the coefficients differs, with the impact of labour productivity on export performance appearing greatest for medium-technology industries.
- The share of high-skilled and medium-skilled workers in an industry appears to enhance export performance, with the share of high-skilled workers mattering most. This relationship is shown to be significant for medium and low-technology industries, but not for high-tech industries.

- Strong backward business services linkages correlate with export performance, but significant relationships are observed only for the high and low-tech sub-groups.
- The share of foreign value added in exports is associated with an increase in both gross exports and the volume of domestic value added in exports. This holds for all three industry sub-groups, but the effect is strongest for medium-high and high-technology industries.
- There is a significant negative relationship between labour compensation costs and export performance in low-technology industries and in manufacturing overall, while the opposite effect can be observed in medium and high-technology industries. This suggests that cost-competitiveness may be particularly important in low-tech industries, while the export performance of medium and high-technology industries is more strongly affected by non-cost factors such as product quality and scope of after-sale services.

These findings are in line with, for example, Landesmann et al. (2009), who demonstrate for a sample of EU economies that a higher share of both high- and medium-skilled labour is conducive to export growth of industries, with a stronger effect noted for high-skilled workers. The evidence in relation to labour costs requires more careful interpretation. Several empirical studies have pointed to a negative relationship between external industrial competitiveness and labour costs (Liu and Shu, 2003) or unit labour costs (for example, Ito and Shimizu, 2013; Guerrieri and Cafferelli, 2012; Landesmann et al., 2009).

However, it has been suggested by Carlin et al. (1999) that, given different short-term effects, the individual components of unit labour costs (the cost of labour and labour productivity) should be analysed separately in a short-run analysis of the determinants of exports. In this context it should be noted that while labour productivity appears to be an almost uniformly important determinant of export performance, the picture as regards labour costs is rather differentiated, with a clear negative relationship only for low-technology industries.

This analysis also touches on the issues of the growing "servitisation"[4] of manufacturing and the acceleration of global production sharing. Its findings are in line with evidence that strong backward linkages of manufacturing industries with services industries are associated with significantly better export performance of manufacturing industries, with foreign service providers playing a particularly important role (Wolfmayr, 2012). Integration within global production sharing (as opposed to domestic vertical integration) is also increasingly seen as an important determinant of export performance (Guerrieri and Caffarelli, 2012; Vogiatzoglou, 2012). Thus the analysis summarised here suggests that foreign value added in exports and domestic value added in exports tend to "move in parallel", evidence that successful exporting firms have tended to be those that are engaged in global production sharing processes, rather than the more traditional vertically integrated approach.

4 'Servitisation' is a term coined by Vandermerewe and Rada (1988) and refers to the increased services component in goods production. See also Fontagné et al. (2014).

Box 2 Drivers of export performance[5]

The following econometric analysis uses the World Input-Output Database (WIOD), which is based on the NACE Rev.1 industry classification (Dietzenbacher et al., 2013; Timmer, 2012). The analysis focuses on the period 1995 to 2007 to exclude short-term crisis-related effects on the group of EU-27 member countries (no data being available for Croatia) and on the manufacturing sector.[6] A step-wise procedure is pursued to account for the potential sensitivity of results to the inclusion of log labour compensation per employee, which shows non-negligible correlation with log labour productivity. The following econometric specification is estimated:

$$ExpPerfInd_{ijt} = \alpha_0 + \beta_1 LnLabProd_{ijt} + \beta_2 SH\_HS_{ijt} + \beta_3 SH\_MS_{ijt} + \beta_4 BS\text{-}linkages_{ijt} + \beta_5 SH\_FVAiX_{ijt} + \beta_6 LnLabCompPE_{ijt} + \beta_7 CapCoef_{ijt} + \varphi_i + \upsilon_i + \varepsilon_{ijt} \quad (1)$$

where:

- $ExpPerfInd_{ijt}$ refers to either log gross exports or log domestic value added in exports of industry *i* in country *j* at time *t*;
- $LnLabProd_{ijt}$ refers to the log of labour productivity value added based on 1995 prices;
- SH_HS_{ijt} and SH_MS_{ijt} refer to the shares of high-skilled and medium-skilled labour in total employment, with the share of low-skilled labour as reference group;
- $BS\text{-}linkages_{ijt}$ captures the extent of backward linkages of manufacturing sectors with services sectors, measured by the gross output multiplier (as defined in standard input-output analysis), which shows the direct and indirect effects of a change in final demand in manufacturing on output in the respective services categories;[7]
- SH_FVAiX_{ijt} is a measure of the degree of vertical specialisation of industry *i* in country *j* at time *t*, defined as foreign value added in exports as a share of total exports;[8]
- $CapCoef_{ijt}$ denotes the capital coefficient, defined as the share of capital stock in gross output (%);
- $LnLabCompPE_{ijt}$ refers to the log of labour compensation per employee (in continuous PPP) as a measure for input cost competitiveness;[9] and
- φ_i and υ_i are country and industry fixed effects to control for time-invariant country and industry characteristics, while ε_{ijt} refers to the error term.

Selected results of the analysis are presented in Table 4. Results for the manufacturing sector as a whole are presented in columns (1) to (4) for gross exports and domestic value added in exports, both excluding and including the labour compensation measure. Results for the three technology sub-groups are presented in columns (5) to (7) for domestic value added in exports and including labour compensation (the alternative specifications showed little significant difference in results).[10]

5 See also EIB Working Paper, forthcoming.

6 Due to its particularities, the coke, refined petroleum and nuclear fuel industry (NACE-23) is also excluded.

7 Business services comprise renting services of machinery and equipment without operator etc., computer and related services, research and development services and other business services (all subsumed under category 71t74 in WIOD according to NACE Rev.1) and financial services (NACE-J).

8 See Foster-McGregor and Stehrer (2013).

9 Hence, as suggested by Carlin et al. (1999), both component parts of ULC (i.e. $LnLabProd_{ijt}$ and $LnLabCompPE_{ijt}$) are included separately to also identify their individual, and potentially different, roles for export performance. The overall effect of ULC can also be calculated as follows: the coefficient of $LnLabCompPE_{ijt}$ minus the coefficient of $LnLabProd_{ijt}$.

10 Full results are presented in Landesmann and Leitner, EIB Working Paper, forthcoming.

Table 4 Determinants of manufacturing export performance, 1995-2007

	Log exports		Log domestic value added in exports				
	All industries		All industries		Med.-high + high-tech industries	Med.-tech industries	Low-tech industries
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log labour productivity (VA-based)	0.574***	0.644***	0.569***	0.636***	0.679***	0.888***	0.503***
	(17.54)	(14.24)	(17.39)	(14.07)	(11.96)	(11.06)	(6.85)
Share high-skilled labour	0.018***	0.022***	0.019***	0.023***	0.006	0.031***	0.029***
	(3.58)	(4.06)	(3.80)	(4.24)	(0.85)	(4.55)	(3.41)
Share medium-skilled labour	0.006	0.007*	0.006	0.007	0.008	0.009*	0.012*
	(1.36)	(1.68)	(1.34)	(1.64)	(1.51)	(1.77)	(1.74)
BS-linkages, total	4.033***	4.017***	4.119***	4.104***	2.656***	-1.024	4.570***
	(10.67)	(10.63)	(10.90)	(10.86)	(6.15)	(-1.44)	(7.04)
Share foreign value added in exports	0.038***	0.039***	0.021***	0.022***	0.035***	0.010***	0.021***
	(16.80)	(16.95)	(9.28)	(9.46)	(12.79)	(2.83)	(5.10)
Capital coefficient	0.000	0.001	0.000	0.001	0.001	0.002**	0.001
	(0.61)	(1.13)	(0.78)	(1.27)	(1.22)	(2.18)	(0.86)
Log labour cost per employee		-0.150**		-0.144**	0.193**	0.389***	-0.487***
		(-2.24)		(-2.14)	(2.16)	(3.67)	(-4.67)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.277***	4.375***	4.402***	4.495***	2.385***	0.986**	5.696***
	(13.53)	(13.71)	(13.92)	(14.09)	(5.47)	(2.45)	(11.35)
No of obs.	4,357	4,357	4,357	4,357	1,329	1,014	2,014
Adjusted R^2	0.866	0.867	0.871	0.871	0.947	0.953	0.826

*Note: t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1.*

8.6. Summary and conclusions

Europe's future prosperity will depend on the ability of European firms to remain competitive in high value added sectors of the economy. This firm-level competitiveness will be reflected in the export performance of European Member States with regard to those sectors. In this context, it is revealing to examine recent trends in industrial structure and export performance in Europe. The main findings of this chapter can be summarised as follows:

- The EU remained, in 2011, the world's largest exporter of manufacturing and services in gross terms, but while the EU, like other advanced economies, is losing manufacturing market share (and China already exports more in domestic value added terms), it gained world market share in the export of services, in contrast to the US and Japan.
- Within the EU, Member States can be placed in two rather distinct groups with regard to shifts between manufacturing and services. In what can be termed the "central European manufacturing core", manufacturing as a share of GDP has remained relatively stable (Germany, Austria, Slovak Republic and Poland) or has risen (Czech Republic and Hungary). Manufacturing exports of these countries

represent relatively stable or growing shares of the world market, even excluding intra-EU trade. In the rest of the EU, manufacturing has generally declined in importance in terms of both GDP share and trade performance, this trend being countered by increasing specialisation in services. Within the largest EU economies, France and Italy, as well as Germany, have actually increased their relative specialisation in manufacturing (revealed comparative advantage), while the UK has experienced a dramatic shift in the opposite direction: from manufacturing to services.

- Within manufacturing industries there has been a shift at the aggregate EU level from low-tech to high-tech industries that is in line with the shifting composition of world trade. Within the EU, this shift has been led by Germany and the central European "new Member States", with Italy and the southern "old Member States" remaining relatively specialised in medium and low-tech industries.
- Domestic value added in manufacturing exports has decreased across the EU, in line with the global trend of increasing cross-border production integration. With regard to high-tech industries, this shift is most marked in the central European "new Member States", indicating the importance of cross-border production networks for this group of countries, particularly with Germany.
- The share of business services in GDP and in total value added exports has risen almost throughout the EU. However, the contribution of business services to exports declined in the central European "new Member States"; the importance of cross-border production linkages to manufacturing in this region may mean that there is greater foreign sourcing of business services.
- The contribution of business services to gross manufacturing output has increased across the EU (with the minor exception of south-eastern Europe) in line with global trends, confirming the "carrier function" of manufacturing. This function is greatest for high-tech industries.
- An exploratory regression analysis provides support to suggestions of positive linkages between export performance and labour productivity, the share of high-skilled workers in an industry, the use of business services and the degree of integration within cross-border production networks. Labour compensation costs can be linked negatively with export performance in low-tech industries, but positively with export performance in medium and high-tech industries. This is in line with the finding that variables linked to labour costs such as labour productivity and skills are more important in medium and high-tech industries.

In light of strong global trends towards the concentration of value creation in higher-tech manufacturing sectors and some business services, the growing strength of high-tech manufacturing sectors in central Europe is a very positive development. The continued relative specialisation in lower and medium-tech industries in some countries, particularly in southern Europe, is more worrying, particularly as labour costs are more likely to be a factor determining export performance in those sectors than in high-tech sectors, and because it will be hard for European countries to maintain living standards while competing on those terms.

This said, it is important also to note the differences within high, medium and low-tech sectors with regard to skill requirements and value added. There also needs to be a focus on high value added tasks such as R&D and design within lower or medium-tech industry value chains. Likewise, there are risks in overspecialisation in low value added tasks such as product assembly within high-tech industries.

More generally, this chapter provides further support to the argument that a strong manufacturing industry will be important to the future of Europe's economy, not just because of the value it creates directly but also because of its function as a "carrier" for otherwise non-tradable services. It also clearly reinforces the view that key determinants of positive export performance are workforce skills and high labour productivity.

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Part III

Investing in competitiveness

Chapter 9

Productivity-enhancing reallocation and the role of the financial system

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Productivity-enhancing reallocation and the role of the financial system

Chapter at a glance

Recent economic literature has increasingly emphasised the importance of firm-level resource reallocation for aggregate productivity. It is argued that misallocation of resources such as labour and capital across firms could be important in explaining differences in aggregate productivity. This chapter sheds light on the link between firm-level resource reallocation and aggregate productivity, and discusses in greater detail one channel that can create misallocation, namely finance.

Significant and persistent productivity differences across firms, even in narrowly defined industries, is an empirical fact, and the same holds for large-scale resource reallocation across firms. Together these imply that there is indeed ample scope for reallocation to affect aggregate productivity.

Empirical evidence demonstrates that reallocation makes an important contribution to aggregate productivity. At the same time, there are also significant cross-country differences. In particular, there are signs that potential weaknesses in the reallocation process in the EU might be undermining aggregate productivity performance.

Financial development spurs economic growth by altering savings incentives and relaxing the external borrowing constraint on firms. More developed and efficient financial systems allocate capital to the most productive projects, thereby raising aggregate productivity in an economy.

By the same token, inefficient and underdeveloped financial systems play a key role in inefficient allocation of finance and in generating distortions in entry and exit decisions. These can be an important drag on productivity.

The estimates of the effect of financing frictions on productivity cover a fairly large range. Some studies find that productivity losses due to misallocation of capital across existing firms are small relative to those resulting from distorted entry and exit decisions.

9.1. Introduction

As discussed in several chapters of this publication, competitiveness is largely determined by the productivity performance of the economy and more specifically by the productivity performance of firms in the economy. Productivity growth is the main channel for achieving sustained improvements in competitiveness, economic welfare and living standards. The OECD highlights the fact that in the last 15 years differences in GDP per capita growth can be mainly attributed to differences in growth in GDP per hour worked, i.e. to labour productivity.

One of the key questions in the economic literature has been the persistent productivity differences across countries. This applies to both developed and developing countries but also to countries with similar levels of development. Why does the productivity performance of even seemingly similar countries differ? In the European context, much attention has been focused on the productivity gap between the EU and the US, which has proven to be a persistent phenomenon since the mid-1990s. From the mid-1990s to early-2000s, productivity growth accelerated in the US but not in Europe. In 2004-2007, there was some narrowing of the gap but the crisis reversed that development (EC, 2013).

The recent economic literature has increasingly emphasised the importance of firm-level resource reallocation for aggregate productivity. It is argued that misallocation of resources such as labour and capital across firms could be important in explaining differences in aggregate productivity. This chapter sheds light on the link between firm-level resource reallocation and aggregate productivity, and discusses in greater detail one channel that can create misallocation – namely finance. Section 9.2 starts by explaining the link between firm-level (micro) productivity and aggregate (macro) productivity, takes a closer look at the reallocation of resources across firms within industries and finally summarises recent findings on the contribution of resource reallocation to aggregate productivity. Section 9.3 provides a brief and selective overview of the finance and growth nexus and then focuses on the literature on financial development, productivity and capital misallocation.

Box 1 Measuring productivity*

Productivity is a ratio of output to input. It measures the volume of output produced from a given volume of input(s) and aims to capture the efficiency of production. There are various measures of productivity depending on the inputs considered. The common ones are: labour productivity, capital productivity and total factor productivity (TFP). Labour and capital productivity are single-factor productivity measures because they consider only one factor of production – labour or capital. TFP (sometimes called multi-factor productivity) in turn takes into account all the observed inputs used in production. Productivity measures can be calculated at different levels of producer units such as establishment, firm, industry and country. Establishment and firm-level measures relate to micro productivity while aggregate industry and country-level measures to macro productivity.

Labour productivity is the most widely used measure of productivity due to the availability of data. It can be defined as the amount of goods and services that are produced by each unit of labour. It is a ratio of output to labour input, i.e. output per unit of labour input. In practice different measures of both output and labour input are used. The two alternatives for output are gross output and value added. Labour productivity measures based on value added have the advantage that they are less dependent on any change in the ratio between intermediate inputs and labour. Measures of quality-adjusted physical output are rare, so in practice output is often measured in deflated revenue-based terms.

Revenue-based measures such as turnover are a combination of prices and output quantities and are therefore also affected by changes in price levels. A quantity measure of output is then derived by dividing the current-price revenue-based output measure by an appropriate price index. How good a proxy for quantitative output this is depends on the deflators used. Ideally, in firm-level

analysis firm-specific deflators should be used, but unfortunately those are rarely available and industry-level deflators are used instead. This creates bias in the output measure if prices differ across firms, which in reality is often the case since differences in market power enable firms to set different mark-ups on their products. If prices differ across firms, assuming constant prices by using industry-level deflators overestimates the productivity of firms with higher than average prices. In addition, quality changes complicate the use of deflators. Any quality change that is not accounted for in the prices index creates bias in the productivity measure. Unaccounted quality improvements lead to a downward bias in productivity.

A measure of labour input is the total number of hours worked. However, such data are not always available and consequently the total number of employed persons is often used instead. The evident problem with the number of employed persons is that hours per person differ. Quality-adjusted hours worked takes into account the heterogeneity among workers in terms of their skills and capabilities. Educational attainment, years of work experience or wages are often used as a proxy for quality.

Capital productivity is also a single-factor productivity measure that gauges output per unit of capital input. As in the case of labour productivity, output can be measured by either gross output or value added. Measuring capital input is, however, more complicated. Ideally we would like to have a measure of capital services – the flow of productive services that capital delivers in production – but this is difficult to measure in practice. A fixed proportion of productive capital stock is most often used as a proxy for capital services. Productive capital stock is a weighted sum of different types of capital assets used in the production process. Weights reflect the efficiency of different capital assets in the production process, e.g. a three-year old computer has a lower weight than a brand new one in today's capital stock. Productive capital stock is in general different from balance sheet measures of net and gross capital stock, since the balance sheet measures reflect the values of different assets at a historical/acquisition price, which is not necessarily consistent with their efficiency.

Changes in the single-factor productivity measure – labour and capital productivity – are affected by changes in the use of other inputs such as capital and in the case of gross output-based measures also intermediate inputs. Changes in labour productivity therefore reflect both changes in the use of capital (and potentially intermediates) and changes in the overall efficiency of production. TFP (or multi-factor productivity) is used to disentangle these two effects.

TFP is a ratio of output to a combined measure of all the inputs (capital, labour and – depending on the output measure – intermediate materials) used in production. TFP differences reflect differences in output while keeping inputs constant. Firms with higher TFP produce more output with a given amount of inputs than firms with lower TFP. This is often described as the efficiency of production. TFP growth reflects changes in the relationship between the quantity of output produced and the quantity of inputs consumed in producing that output. It is typically calculated as a residual, i.e. the percentage increase in output that is not accounted for by changes in labour and capital inputs.

In the long term, TFP growth represents improvements in ways of doing things and is thus often used to describe the effect of technological development and innovations. However, in the short term, it also reflects a number of other factors that affect short-term productivity performance, such as cyclical variations in labour and capital utilisation, economies of scale, market power and measurement error.

*This box is based on Bartelsman & Doms (2000), OECD (2001) and Syverson (2011).

Note: This simple description of different productivity measures omits a number of complications in measuring productivity, such as output measures with non-market products and the aggregation of heterogeneous inputs and outputs into a single input and output index when calculating aggregate productivity measures.

9.2. Reallocation of resources and aggregate productivity performance

Since the beginning of the 1990s, a stream of literature based on extensive firm-level data has been analysing the importance of within-industry resource reallocation for aggregate productivity growth. This literature was spurred by a number of findings documenting 1) the large-scale ongoing reallocation of resources that happens in particular within sectors, and 2) the wide and persistent productivity differences between firms even in narrowly defined industries. These findings suggest that there may be ample scope for reallocation to matter for aggregate productivity performance.[2]

In this section, we discuss in greater detail how resource reallocation can affect aggregate productivity and to what extent this seems to be the case. We first describe the channel by which firm-level resource reallocation is linked to aggregate productivity performance. How big an impact this channel exerts on aggregate productivity performance depends on the scope for reallocation and the efficiency of reallocation. The empirical evidence suggests that there is indeed significant scope for reallocation. A considerable number of jobs are reallocated each year and productivity dispersion within sectors is large. If these job flows go from less productive producers to more productive ones, aggregate productivity improves.

Addressing the efficiency of reallocation is more difficult. There are a number of factors that shape the reallocation process and the literature on the quantitative effects of potential misallocations is in its infancy. We address the issue by looking at the contribution of reallocation to productivity. It does not tell us directly whether reallocation is efficient or not, but it does provide insights about the quantitative importance of reallocation to productivity in different countries and highlights differences across countries.

9.2.1. Relationship between macro and micro level productivity

For illustrative purposes the aggregate productivity of a country can be described as the weighted average of firm-level productivity

$$P=\Sigma\theta_j*(\Sigma\omega_{ij}*p_{ij}),$$

where P denotes aggregate country level productivity, θ_j and ω_{ij} are weights that reflect the importance of the industry j in the country and firm i in industry j respectively and p_{ij} is the productivity of firm i in industry j. The summations are over firms in an industry and over industries in the country. The term in brackets is the productivity of sector j, while the first summation is over sector-specific productivities to obtain the aggregate productivity of the country. The relative importance of industries in the country and firms in an industry is often measured by the respective input or output share such as employment, value added or market shares. The formula clearly shows that the productivity performance of an economy can improve through two different channels: productivity improvements within firms (increase in p_{ij}) and compositional changes in the economy, i.e. changes in the relative importance of sectors (changes in θ_j) and/or changes in the relative importance of firms in a sector (changes in weights ω_{ij}).

Much of the economic literature has focused on the first channel and analysed what makes individual firms productive[3]. Conceptually, a firm's productivity depends on the technology used and the efficiency with which it is used. A producer needs to have both appropriate capabilities and the right

2 See, for instance, Haltiwanger (2011).
3 See, for instance, Syverson (2011).

incentives in place in order to use productive technologies and operate them efficiently. There are a number of factors that shape those capabilities and incentives, ranging from issues related to the development of new technologies (innovation), their diffusion and adaptation, governance structures, management processes and human capital, to factors related to the wider operating environment, such as the research and education system, market structure, competition, access to finance and the regulatory environment. In Chapter 6, Philippe Aghion elaborates in greater detail on the key drivers of productivity growth.

The second channel – compositional changes – refers to the ongoing reallocation process, in which resources are constantly reallocated across producers. Some firms gain in importance while others lose. This reallocation can happen across industries or across producers within industries. If the reallocation process is efficient, it results in resources flowing from less productive units to more productive units. This means that the weight of more productive units increases relative to less productive units and the aggregate productivity of the economy improves. In essence, this is about the creative destruction associated with Schumpeter (1942), which involves new technologies, products and services replacing old ones. It manifests itself in business dynamics, with more productive firms entering the market and growing, while less productive firms contract and exit the market.

Resources can be reallocated across industries or within industries. Inter-industry reallocation relates to structural changes in the industrial composition of an economy. Some industries gain in importance while others lose. These industry-level changes are due to industry-wide technological and/or demand shocks that alter growth opportunities across industries. Shocks can be related to long-run structural shifts in technologies, endowments and demand, or short-run cyclical fluctuations (Roberts and Tybout, 1997). The technological waves discussed in Chapter 6 are an example of long-run structural shifts. The effect of inter-industry reallocation on aggregate productivity tends in general to be smaller in developed than developing economies, since productivity differences across industries are smaller and service sectors, with generally lower productivity compared to manufacturing, become more important. The ECB's Competitiveness Network (CompNet, 2014) shows that for a number of EU countries the dispersion in average sector-specific productivity across sectors is smaller than the average dispersion in firm-level productivity within sectors.[4] Lewrick et al. (2014) find that in the Swiss manufacturing sector intra-industry reallocations were the most important source of aggregate TFP growth during 1997-2007.

Intra- or within-industry reallocation of resources refers to resource reallocation across firms or establishments within a narrowly defined industry. Labour and capital are constantly reallocated across firms in an industry, resulting in entry, growth, contraction and exit of producers. This process is driven by market forces and the broader business and institutional environment that shapes them. As discussed below, economists are increasingly emphasising the importance of this within-industry resource reallocation for aggregate productivity performance. The emerging economic literature suggests that resource reallocation across firms plays a major role in driving aggregate productivity growth, and the large majority of this reallocation happens within industries. Therefore in this section our main focus is on the link between within-industry resource allocation and productivity.

9.2.2. Scope for productivity-enhancing reallocation: job flows, business dynamics and productivity dispersion

Reallocation can matter for aggregate productivity performance only if there are productivity differences between firms and resources are moving fluidly between firms. Below we summarise the main findings from the literature indicating that both are indeed widely observed empirical regularities.

The large-scale intra-industry reallocation of resources is a well-established pattern in the literature. In terms of employment, Haltiwanger et al. (2013) show that in the US non-farm private sector business

4 The words "industry" and "sector" are used interchangeably throughout the section.

some 33 per cent of jobs were reallocated on average each year during 1975-2005 (the sum of job creation and destruction).[5] Roberts and Tybout (1997) find similar figures (between 25-30 per cent) for Chile, Colombia and Morocco. Haltiwanger et al. (2014) analyse 16 developed, emerging and transition economies, including 10 EU countries, during the 1990s. They find that job reallocation is large relative to net employment changes in all the countries covered and ranges from about 25 per cent of total employment on average in the OECD countries to about 30 per cent in Latin America and the transition economies. Criscuolo et al. (2014) look at a more recent period of 2001-2011, and report an average annual job reallocation rate of 23 per cent over 18 OECD countries (including 12 EU countries).

Interestingly, much of the job reallocation across firms seems to happen within industries. Davis and Haltiwanger (1999) find that as much as 90 per cent of job reallocation in the US happened within narrowly defined industries. Reallocation among continuing firms contributes to this turnover, but the importance of entering and exiting firms/establishments is emphasised in the literature. Haltiwanger et al. (2014) find that entering and exiting firms account for about 30-40 per cent of job reallocation. Young businesses, in particular startups, account for a disproportionate share of job creation (Haltiwanger et al., 2013, and Criscuolo et al., 2014). The pace of job reallocation varies across industries, but these differences seem to be systematic across countries (Davis and Haltiwanger, 1999).

The findings demonstrate that large-scale job reallocation is pervasive across countries. Nevertheless, there are also notable cross-country differences in job flows. In Haltiwanger et al. (2014) the job reallocation rates vary between 7 and 57 per cent in the OECD countries and the range is even wider for Latin American and transition countries. Differences in the size structure of firms explain some 50 per cent of the total variation in cross-country job reallocation. In particular, differences in the pace of entry and exit seem to be important in explaining the variation in job reallocation.[6] Nevertheless, even after controlling for industry/technology and size factors, there remain significant differences in job flows across countries that could reflect differences in the business environment. Moreover, the results suggest that the pace of job reallocation might be lower in the EU than in the US, thereby pointing towards potential rigidities in the reallocation process in the EU. Criscuolo et al. (2014) also document cross-country differences in the job reallocation rates among 17 OECD countries, and in general reallocation rates tend to be lower in the EU countries than in the US.

Another way to demonstrate the reallocation of resources is to look at business dynamics, namely the entry growth, contraction and exit of firms. Bravo Biosca (2010) compares business growth and contraction in Europe and the US.[7] The results show lower dynamism of European businesses compared to the US. European countries have on average a lower share of high-growth firms and much larger share of firms that neither expand nor contract, while the US has both faster-growing and faster-shrinking firms. This suggests less experimentation and a slower reallocation of resources from less to more productive businesses in Europe.

The large-scale resource reallocation coincides with persistent and wide productivity differences across firms within an industry (Bartelsman and Doms, 2000). Table 1 presents different within-industry dispersion measures for (log) labour productivity in selected EU countries during 2005-2011. In order to have a better idea of the distribution we include two different dispersion measures: standard deviation (STD) and the inter-quartile range, which is the difference between (log) productivity at the 75th and 25th percentiles. Standard deviation provides a measure of how far observations are spread out from the mean observations. The inter-quartile range describes the range of the middle 50 per cent of the data. Since our measure of labour productivity is in logarithms, an inter-quartile range of, say, 0.89 means that the ratio between labour productivity at the 75th and 25th percentiles is 2.44. In other words, the firm at the 75th percentile produces over twice as much as the firm at the 25th percentile with the same amount of labour.

5 However, more recent data indicate that during the 2000s the annual job reallocation rate in the US has been declining (Davis and Haltiwanger, 2014).

6 Industry effects explain relatively little (5.1 per cent) of the overall variation in gross job reallocation across industry, size and country classes.

7 The EU countries covered are Austria, Denmark, Finland, Italy, the Netherlands, Spain and the UK.

Table 1 Dispersion of (log) labour productivity in selected EU countries during 2005-2011

	STD of labour productivity		Inter-quartile range	
	Average over 2005-2011	Difference between 2009-2011 and 2005-2008	Average over 2005-2011	Difference between 2009-2011 and 2005-2008
AT	0.72	0.00	0.89	0.03
CZ	1.10	0.06	1.37	-0.01
DE	0.75	0.03	0.93	0.04
DK	0.79		1.04	
FI	0.78	0.01	0.89	0.03
FR	0.62	0.00	0.78	0.01
HU	0.99	0.18	1.23	0.15
IT	0.83	0.01	0.89	0.03
SE	0.75	0.05	0.92	0.06
UK	1.14	0.05	1.54	0.13

Notes: Annual figures are weighted averages of industry-level data with value added shares as weights. The data cover manufacturing industries. In order to eliminate differences due to different industrial structures, common EU15 average weights are used for all the countries. Labour productivity is the logarithm of turnover per employee, turnover is in thousands of USD, at constant prices and constant PPP, reference year 2005. Industry-level deflators are used. Our measure of labour productivity is thus a revenue-based measure. Austrian data start from 2007 and Danish data from 2009. The top and bottom 1 per cent have been excluded. The data also include small firms, but they are in general underrepresented, so we use resampling weights to improve the representativeness of the data.
Source: Own analysis based on Bureau van Dijk's Orbis data.

The figures in Table 1 indicate significant heterogeneity in labour productivity across firms within industries in all the countries covered. The highest dispersion is found in the UK and the Czech Republic, followed by Hungary and Italy. These findings are broadly consistent with those reported by Bartelsman et al. (2013). They show that large within-industry productivity dispersion also holds for a number of EU countries during 1993-2001, and that dispersion is higher in the Central and Eastern European countries than in Western Europe.[8] One notable difference between the figures reported by Bartelsman et al. and those in Table 1 is the productivity dispersion in the UK, which is significantly higher in Table 1. This may be due to differences in the samples used and/or other data problems. In general, the within-industry productivity dispersion was relatively stable throughout the period, apart from in Hungary, where the productivity dispersion increased more markedly.

Several authors show that wide within-industry productivity dispersion also applies to other countries as well. The most comparable to the figures in Table 1 are those in Bartelsman et al. (2013), which report a standard deviation of 0.58 for US labour productivity. Syverson (2004) finds that the average TFP ratio between plants at the 90th and 10th percentiles of the productivity distribution in the US manufacturing sectors is 1.92. Hsieh and Klenow (2009) document a similar ratio for the US, but even higher ones for China and India.

Just by looking at the dispersion measures it is difficult to say whether higher or smaller, or increasing or decreasing within-industry productivity dispersion is better. The point we want to highlight is that significant and persistent productivity differences across firms, even in narrowly defined industries, is an empirical fact, and the same holds for large-scale resource reallocation across firms. Together these provide ample scope for reallocation to matter for aggregate productivity developments. If resource

8 The countries covered are the United Kingdom, Germany, France, the Netherlands, Hungary, Romania and Slovenia.

reallocation is efficient and inputs flow smoothly from less productive to more productive producers, aggregate productivity improves.

However, there are also considerable differences across countries in terms of both productivity dispersion and resource reallocation. Several factors can distort the reallocation process and hamper aggregate productivity performance. Resources may end up being misallocated across producers. In particular, evidence points to potential weaknesses in the reallocation process in the EU compared to the US. Combining these observations leads to the obvious question: What is the role of resource reallocation in explaining aggregate productivity performance and productivity differences across countries?[9]

9.2.3. Contribution of reallocation to aggregate productivity

In order to gain an understanding of the contribution of reallocation to productivity, Table 2 presents figures for the static allocative efficiency for a selection of EU countries over the period 2005-2011. As described in Box 2, static allocative efficiency gives an indication of how much reallocation contributes to productivity levels at a given moment in time. Since our measure of labour productivity is in logarithms, allocative efficiency describes the percentage increase in aggregate productivity compared to a situation where labour is randomly allocated across firms. For example, an allocative efficiency of 0.20 indicates that the aggregate productivity level would be 20 per cent lower if activity was randomly allocated across firms. Therefore high allocative efficiency is associated with more efficient resource allocation.

Table 2 Static allocative efficiency for a selection of EU countries over the period 2005-2011

	Allocative efficiency	
	Average over 2005-2011	Difference between 2005-2008 and 2009-2011 averages
AT	0.20	0.00
CZ	0.33	0.15
DE	0.29	-0.02
DK	0.39	
FI	0.48	-0.09
FR	0.36	-0.03
HU	0.37	0.37
IT	0.12	0.10
SE	0.63	0.06
UK	0.21	-0.01

Notes: Annual figures are weighted averages of industry-level data with value added shares as weights. The data cover manufacturing industries. In order to eliminate differences due to different industrial structures, common EU15 average weights are used for all the countries. Labour productivity is the logarithm of turnover per employee, turnover is in thousands of USD, at constant prices and constant PPP, reference year 2005. Industry-level deflators are used. Our measure of labour productivity is thus a revenue-based measure. Austrian data start from 2007 and Danish data from 2009. The top and bottom 1 per cent have been excluded. The data also include small firms, but they are in general underrepresented, so we use resampling weights to improve the representativeness of the data.
Source: Own analysis based on Bureau van Dijk's Orbis data.

9 Another key question is of course why some firms are more productive than others. In this chapter the focus is, however, solely on the effect of resource reallocation on aggregate productivity. See, for instance, Syverson (2011) and Bartelsman and Doms (2000) for surveys on the literature analysing the determinants of firm-level productivity. Also EIB Papers Volume 16 discusses several drivers of firm-level productivity in detail.

The first column of Table 2 indicates, in line with previous findings, considerable differences in allocative efficiency across countries. Italy has the lowest allocative efficiency of the countries covered, followed by Austria and the UK. Sweden and Finland seem to be the clear leaders in terms of allocative efficiency. Interestingly, Hungary and the Czech Republic have relatively high allocative efficiency. This is at odds with Bartelsman et al. (2013), who report a negative allocative efficiency for Hungary over the period 1993-2001. However, CompNet (2014) also finds a relatively high allocative efficiency for Central Eastern EU countries for a more recent period (2003-2007) – although their numbers are generally lower than those reported in Table 1 (ranging from negative to around 0.23).[10] According to CompNet the relatively high allocative efficiency for Central Eastern EU countries could reflect the large foreign direct investments undertaken by western countries, which have created some sort of dichotomy between very large, productive foreign-owned firms and small, less productive local firms. The relatively high productivity dispersion in Table 1 for Hungary and the Czech Republic may provide some further support for this interpretation.

Apart from Hungary, the estimates of allocative efficiency in Table 1 seem to be consistent with those reported by Bartelsman et al. (2013) and also Andrews and Cingano (2014). There are some differences, but given that estimates are based on different data and different time periods that is to be expected.[11] Since we do not have data for the US, we take the estimate of 0.5 that both Bartelsman et al. and Andrews and Cingano find as a rough proxy for US allocative efficiency. Comparing our figures to that benchmark suggests that allocative efficiency continues to be lower in the EU in general than in the US. Only Sweden and Finland reach the US levels of static allocative efficiency.

Box 2 Static and dynamic productivity decompositions

The contribution of reallocation to aggregate productivity can be assessed by decomposing aggregate productivity or productivity growth into components reflecting the effects of both average firm-level productivity and resource reallocation.

Static productivity decomposition divides cross-sectional industry-level productivity into average firm-level productivity and a covariance term that reflects the extent to which more productive firms have a higher share of activity. As shown by Olley and Pakes (1996), the aggregate productivity of an industry *j* at a given point in time can be decomposed into the following two components:

$$P_j = \overline{p} + \Sigma_i (\omega_{ij} - \omega) * (p_{ij} - \overline{p}).$$

The first component, $\overline{p}$, is the unweighted average productivity of firms in industry *j*. The second term is the covariance between the "size" (activity share) and productivity. ω_{ij} is the activity share of firm *i* in industry *j* and can be measured as the labour share or market share. p_{ij} is the productivity (labour productivity or TFP) of firm *i*. Bars refer to unweighted industry averages of the firm-level measure. The covariance is often referred to as static allocative efficiency and it assesses to what extent activity (in terms of labour or output/market share) in industry *j* is concentrated on higher-productivity firms. Especially when the activity share is measured as labour share, this is the covariance between size and productivity. The higher this covariance, the more efficient resource allocation is considered to be. The intuition is that if there is dynamic allocative efficiency (i.e. resources are smoothly reallocated from less productive to more productive firms), more productive firms should gain larger shares of the activity.

Dynamic productivity decompositions assess the contribution of reallocation to aggregate productivity growth. These decomposition methods divide aggregate industry-level productivity

10 The sample used by CompNet covers only firms with more than 20 employees.

11 Andrews and Cingano (2014) also use the Orbis data, but they have an earlier version of the data, estimate allocative efficiency for 2005 only and exclude the smallest firms from their sample.

growth into contributions due to compositional shifts across production units in an industry and contributions due to productivity improvements in surviving firms. The compositional shifts can be further divided into the contribution from entry and exit, and resource reallocation across existing firms. Foster et al. (2001) provide an overview of different dynamic decomposition methods.

Dynamic allocative efficiency refers to how resources are moving across firms over time, whereas measures of static allocative efficiency provide a cross-sectional snapshot of allocative efficiency. This snapshot is the result of underlying dynamic allocative efficiency – to what extent resources have been moving away from less productive producers to the more productive ones.

Differences in static allocative efficiency suggest that there are differences across countries in the efficiency with which resources are reallocated across firms. As mentioned above, the efficiency of the resource allocation process is difficult to assess, but several papers have analysed how much of the aggregate productivity *growth* over time is accounted for by the reallocation process across firms. The papers use different methods and apply them to different and differently calculated productivity measures. Moreover, the countries, time periods and industry coverage differ. It is therefore not surprising that the results also differ. Nevertheless, a common finding is that within-industry reallocation contributes significantly to aggregate productivity growth. What differs across the studies is the magnitude of the effect.

One of the highest figures reported is that of Baldwin and Gu (2006). According to their analysis, reallocation explains some 70 per cent of aggregate labour productivity growth in Canadian manufacturing industries between 1979 and 1999. In the US, manufacturing reallocation is found to explain some 25-50 per cent of TFP growth between 1972 and 1987, depending on the decomposition method used and the time period (Foster et al., 2001 and 2008). In the UK, resource reallocation accounts for some 50 per cent of labour productivity growth and 80-90 per cent of TFP growth between 1980-1992 (Disney et al., 2003). Barnett et al. (2014) provide a similar figure for labour productivity in the UK covering a more recent period (2002-2007), but find a declining contribution of reallocation to labour productivity growth thereafter. Close to 50 per cent of TFP growth in Chilean manufacturing between 1983-1996 is explained by improved resource reallocation (Chen and Irarrazabal, 2013).

Results suggest that a large proportion of aggregate productivity improvement due to reallocation is accounted for by more productive entering producers displacing much less productive exiting producers, rather than reallocation across existing producers (Foster et al., 2006). In addition, the magnitude of the effect of resource reallocation on aggregate productivity growth depends on the length of the time period considered (Foster et al., 2001). This is explained by the importance of entry and exit. Entering firms tend to be small, and although the successful entrants grow relatively fast, it still takes time to achieve full operational size. Over a longer time period, the contribution of net entry may reflect both selection effects and post-entry "learning" effects. That is, entering businesses might be immediately more productive than the exiting ones, or it may take time for the productivity gap to widen or emerge (Foster et al., 2006).

Although a number of studies point to a significant contribution of reallocation to aggregate productivity growth, there are also exceptions. Basu et al. (2009) analyse five EU countries (Belgium, France, the UK, Italy and Spain) and find that most productivity (TFP) growth between 1995-2005 is accounted for by technology growth, in particular for the UK and France. Aggregate distortions such as the average degree of market power and various taxes are found to be quite important in Spain, Belgium and Italy, while reallocation accounts for a small proportion of productivity growth. However, the authors note that their sample consists mostly of firms that are quite large, which may explain the low significance of reallocation. As highlighted above, reallocation effects tend to be greatest when firms that are small initially grow to a large size due to their superior productivity.

CompNet (2014) reports in general smaller contributions of reallocation to aggregate labour productivity growth for eight EU countries. The contribution of resource reallocation ranges from some 30 per cent

to a negative contribution. There is considerable variation across the eight countries and across the two time periods covered (2005-2007 and 2008-2010). In this case, the short time periods could partly explain the lower importance of reallocation. In addition, the effect of reallocation on aggregate productivity tends to vary across the business cycle.

Nevertheless, it is interesting to note that both Basu et al. and CompNet find that the contribution of reallocation to productivity growth in EU countries is relatively small. Although the different data and methods used in the studies are likely to explain some of this, the question still arises of the potential misallocation of resources that may be depressing aggregate productivity growth in some EU countries. An interesting finding in this context is the one by Bloom, Sadun and Van Reenen (2013), who report a more efficient allocation of employment to better managed firms in the US than in Europe and developing countries. Furthermore, they argue that half of the TFP gap between the US and southern EU nations such as Italy and Portugal could be bridged if these countries allocated jobs to the better managed firms as well as the US does.

The results summarised above show that reallocation seems to be a significant component of aggregate productivity growth, and static allocative efficiency accounts for a significant share of productivity levels. At the same time, there are also significant cross-country differences in static allocative efficiency. Clearly, reallocation matters for aggregate productivity, and the misallocation of resources can lead to lower aggregate productivity performance. But what are the quantitative implications of resource misallocation? To what extent are, for instance, country-specific differences in the contribution of reallocation to productivity growth due to misallocation? And what are the gains if potential misallocations are removed? Research into these questions is still very much ongoing and so far the literature provides relatively few answers. In their seminal paper, Hsieh and Klenow (2009) address this issue by quantifying the potential extent of misallocation in China and India compared to the US. They report that removing misallocations would boost manufacturing TFP by 30-50 per cent in China and 40-60 per cent in India. Ongoing research will shed more light on the role of misallocation in explaining aggregate productivity differences and the importance of specific channels in generating misallocation.

The reallocation of resources across firms in an industry is ultimately determined by market conditions and (opportunity) costs related to the entry and exit of businesses. It is clear that inherent industry-specific characteristics affect both. For example, entry costs are likely to differ significantly across industries depending on the upfront investments needed in order to enter the market. Thus it is not surprising to see differences in reallocation across industries. However, market conditions and the ease of entry or exit are also shaped by a myriad of factors that together build up the overall institutional conditions and can exert a significant influence on the reallocation process.

The economic literature has identified various channels that can distort the reallocation process at either the extensive margin (entry and exit of firms) or the intensive margin (reallocation across existing firms).[12] They include: regulatory factors that can create rigidities in the labour or product market or distort firms' entry/exit decisions; distorting taxes such as firing costs; favourable treatment of inefficient firms, for example through tax incentives or subsidies; trade barriers; size-dependent policies that end up distorting the size distribution of firms; and financial frictions. A thorough discussion of the different channels is beyond the scope of this chapter and the next section focuses on one of them, namely financial frictions. For example, Bourles et al. (2010) find that the more rigid regulatory framework in the EU is hampering TFP performance compared to the US. The results of Andrews and Cingano (2013), based on a sample of 21 OECD countries, suggest that policy frictions related to employment protection legislation, product market regulation, including barriers to entry, and bankruptcy legislation and FDI restrictions have a negative effect on productivity by worsening allocative efficiency.

12 See, for instance, Restuccia and Rogerson (2013) and Andrews and Cingano (2013).

9.3. The role of financial markets

This section switches the discussion to the importance of financial systems for economic development and in particular their impact on productivity and the efficiency of resource allocation. To that end, we first review the reasons for the importance of financial systems for economic development and briefly review the empirical evidence on the topic. Finally, we focus on a particular channel through which financial systems affect economic development – the efficiency of capital allocation.

9.3.1. The role of financial systems in economic development

Financial systems emerge and develop in order to address and reduce frictions related to financing. These frictions are rooted in the asymmetric information problems that exist between borrowers and lenders. Borrowers have more and better information about their projects and what has gone into implementing them than lenders. In addition to this private information problem, the managers of borrowing firms have different goals and incentives from those of the owners of those firms and their lenders. There are also other frictions, such as transaction costs, economies of scale in providing finance, the risk aversion of lenders and coordination problems in mobilising and pooling savings. All these frictions reduce the availability of finance, increase its cost and may give rise to inefficient allocation of capital, resulting in a lower level of economic activity and lower rates of productivity and economic growth.

According to Levine (2005), financial systems have five functions in an economy that mitigate to some extent the effect of financing frictions: (i) they provide an ex ante assessment and screening of investment projects; (ii) they monitor investments and reinforce corporate governance after funds have been disbursed; (iii) they provide opportunities for diversification and risk management services; (iv) they mobilise and pool savings; and (v) they facilitate exchange. The change in the efficiency with which a financial system performs these functions may alter the incentives for saving and investment, thereby affecting the allocation of capital, productivity and economic growth.

Financial systems differ in how well they perform these functions, though. Well-functioning financial systems reduce existing frictions, thereby increasing the availability of external finance to businesses and improving the allocation of capital. For instance, the costs for individual savers to search for and assess possible investment projects are in most cases prohibitively high. As a result, insufficient savings are made available to finance potential investments and there is no guarantee that the most productive firms will be financed. Hence business opportunities will be missed due to a lack of finance and capital may be inefficiently allocated.

Financial intermediaries reduce these costs through economies of scale and specialisation in intermediation. They produce information that enables them to identify good projects that can be financed at low cost, thereby improving access to finance and the efficiency of capital allocation. Larger and more liquid stock markets also facilitate and encourage the production of information about companies and projects (see Levine, 2005).

The incentives and aims of borrowers and lenders typically differ and hence their interests easily diverge. Because borrowers have a lot of private information about their businesses, a lack of credible post-lending information about the development of the investment project reduces the willingness of savers to lend and raises the cost of capital for firms, which may lead to underinvestment. Financial systems provide post-lending monitoring of projects. Intermediaries are more efficient in monitoring investment projects than numerous small investors. This is because of economies of scale, specialisation and the benefits of gathering information over a long-term relationship with a particular borrower. Intermediaries are able to design debt contracts that discipline managers. The public trading of shares also disciplines managers, as it facilitates takeovers of poorly managed firms. Enhancing minority shareholders' rights works to further improve corporate governance. All this decreases credit rationing and facilitates the flow of savings to investment projects.

Financial intermediaries and capital markets overcome the problems involved in mobilising and pooling savings by reducing transaction, information and coordination costs. As a result, provision of savings is enhanced, savings rates increase, resource allocation is improved and access to finance, especially for large indivisible projects and higher-return projects, improves.

Corporate external financing needs are typically much greater than the average saver can provide. As people are usually risk-averse, few would like to lock up money in a single risky project. In most cases investment projects are indivisible and lenders cannot withdraw their money without disruption for the borrower. The lack of options for diversifying savings portfolios and quickly accessing savings on demand reduces the availability of savings and the savings rates in an economy.

Because financial systems enable savings to be allocated to a portfolio of investments with different risk profiles, saving rates increase and more risky, higher-return projects are financed (see Acemoglu and Zilibotti, 1997) and innovation is increased (see King and Levine, 1993b). Financial systems increase liquidity by providing a trading platform for shares and bonds and by transforming the short maturities of demand deposits to long maturities for investment loans, credit lines, etc. Liquidity is also important for businesses, as they need working capital to operate their investments. Lack of such liquidity will reduce investment and particularly innovation and long-term growth, as shown in Aghion, Angeletos, Banerjee and Manova (2005). Allen and Gale (1997) emphasise the complementarity of banks and stock markets for the efficient allocation of risk and point out that banks are better at diversifying risk over time, while stock markets are better in providing diversification across market participants at any given point in time.

Developed and well-connected financial systems also have a large geographical reach that enables savings in regions with lower-return projects to flow to regions with an abundance of higher-return projects, thereby increasing the efficiency of capital allocation and improving economy-wide productivity growth.

9.3.2. Empirical evidence on the role of financial systems in economic development

One of the most influential empirical studies on the link between finance and growth is King and Levine (1993a). They studied this nexus in a cross-country framework using a dataset of 77 countries over the period 1960-1989. The main finding of the study is that several measures of financial development are very strongly related to current and future rates of economic growth.[13] In addition, they show that the initial level of financial development in 1960 is positively and significantly related to economic growth over the following 30 years, even after controlling for country-specific characteristics. Finally, they show that financial development is positively related to both capital deepening and total factor productivity.

Numerous subsequent studies increased the sample of countries and years, used different sets of proxies for financial development and confirmed the main results of King and Levine (1993a), contributing to their robustness. A related strand of cross-country analyses that focuses on growth accounting found that financial development affects growth mainly through TFP and less through capital deepening and human capital accumulation. This finding was further qualified in that for developing countries that are further away from the technological frontier, financial development influences economic growth mostly through capital deepening, whereas in developed countries its impact is mostly through its effects on TFP.

Cross-country studies also have a number of limitations. They cannot go very far in addressing reverse causality issues between finance and growth. They cannot account for a potential heterogeneity of the effect of financial development across countries, which is further complicated by the fact that it

13 The measures of financial development that they use are the ratio of liquid liabilities of the financial system to GDP, the ratio of deposit money bank domestic assets to the sum of deposit money bank domestic assets and central bank domestic assets and the ratios of claims on the non-financial private sector to total domestic credit and GDP.

is practically impossible to control for all growth-enhancing factors due to the fact that these are very many and are highly correlated among themselves. Hence studies relying on panel data and using methods that address causality problems followed, which further confirmed the correlation between finance and growth and reinforced the evidence that there is a causal relationship running from finance to growth. Examples of this literature are Beck, Levine and Loayza (2000), Levine, Loayza and Beck (2000), Benhabib and Spiegel (2000), Beck and Levine (2004), and Rioja and Valev (2004).

Subsequent research focused on industry- and firm-level analysis in order to improve the understanding of the causality problem and the mechanisms through which financial developments affect economic growth. At the risk of oversimplifying this large body of literature, three key findings on the transmission mechanism can be singled out. First, higher financial development benefits industries and sectors with good global growth opportunities through their better ability to quickly relocate investment across sectors. Second, higher financial development has significant positive growth effects on businesses that rely a lot on external finance by relaxing the external finance constraint. Finally, these positive growth effects are mostly accounted for by the entry of new firms rather than by growth of existing firms, suggesting a beneficial impact on small and young businesses. Combining this last finding with the observation that firm entry and productivity are very highly correlated further supports the finding that financial development has a significant impact on productivity.

A number of studies have analysed particular episodes of financial deregulation and reforms, further strengthening the evidence for the existence of a causal relationship between financial development and economic growth. The subset of this literature that focuses on developed countries adds to the evidence that financial development fosters productivity growth through creative destruction by allocating capital more efficiently among firms with different productivities.[14]

To sum up, financial development increases growth and productivity mainly by increasing the pool of available resources, by altering savings incentives and relaxing the external borrowing constraint on firms, and by allocating capital to the most productive projects. This is achieved by increasing the efficiency with which the five main functions described by Levine (2005) are performed. This performance is linked to how well a financial system addresses the underlying information and incentives problems.

9.3.3. Financial systems, reallocation and productivity: the role of financing frictions in resource misallocation

The analysis of the effects of financing frictions and, more generally, financial systems on the allocation of resources and productivity has been an area of intensive research. Restuccia and Rogerson (2013) state in their editorial article for the special volume of the Review of Economic Dynamics on misallocation and productivity that "Perhaps the most studied channel in terms of generating misallocations is that of credit market imperfections." This interest is well-rooted empirically. Banerjee and Duflo (2005) present extensive evidence on the misallocation of capital in developing countries, indicating that this could be a source of productivity differences. They argue that credit constraints play a significant role in this misallocation.

Financing frictions, if not mitigated sufficiently by asset markets and markets for risk sharing, are a drag on TFP because they decrease the efficiency of capital allocations across existing heterogeneous firms (sometimes referred to as the "intensive margin" or "misallocation" effect) and the entry and exit decisions of firms (the "extensive margin" or "selection" effect). Financing frictions are difficult to measure empirically. Therefore, most of the studies are based on theoretical and quantitative analysis of models of firm dynamics that incorporate financial frictions via different modelling devices.[15]

14 See, for example, Papaioannou (2007) for more details.

15 Among the few exceptions is Gilchrist, Sim and Zakrajsek (2013), who find a way to measure the effect of financial frictions through readily observed financial market variables.

A common way of introducing financial frictions is to assume borrowing ceilings (Midrigan and Xu, 2014), collateral constraints (Banerjee and Moll, 2010, Moll, 2014, and others) or endogenous collateral constraints that arise from limited enforcement of contracts, as in Buera and Shin (2013), and Buera, Kaboski and Shin (2011). In these models, firms accumulate capital with a precautionary motive. In addition, the more productive a firm, the higher its return on capital and the greater the incentive to save and reinvest its savings so that it can eventually grow out of the external borrowing constraints. Due to this mechanism, such papers typically do not find significant productivity losses from misallocation on the intensive margin. The extensive margin, nevertheless, is typically found to be important due to fixed costs related to market entry. Because most entrants have neither sufficient collateral nor a productive technology that enables them to save and finance their entry themselves, they have to resort to external finance. In the presence of inefficient intermediaries, too few firms obtain external financing and therefore entry is inefficiently low.

Financial frictions are also more explicitly modelled as arising from limited enforcement of contracts, combined with private information of borrowers (Erosa and Hidalgo Cabrillana, 2008). The limited enforcement reduces factor mobility, because the scale of production of the most productive firms is constrained by the limited commitment of firms to repay their loans. Costly monitoring of firms and private information (Greenwood, Sanchez and Cheng, 2010, Greenwood, Sanchez and Cheng, 2013, and Cole, Greenwood and Sánchez, 2015) also give rise to incentive-compatible contracts that may underfinance productive firms and give too much finance to not so productive firms, thus misallocating capital. The reason for this to occur is that the information producing technology has diminishing returns.

In Erosa and Hidalgo Cabrillana (2008), the limited ability to enforce contracts and asymmetric information between borrowers and lenders give rise to misallocation of resources across firms with different productivities, and across industries with different needs for external financing. There are two drivers of this misallocation in their model. First, limited contract enforcement makes it difficult for lenders to penalise borrowers for not revealing truthfully private information. Second, depressed wages and high output prices create economic rents for operators of less productive technologies. The model can account for the use of less productive technologies in developing countries, for their lower aggregate TFP, for the large differences in labour productivity across industries and large employment shares in industries with low productivity. The model also provides a rationale for the persistence of these differences: entrepreneurs have a vested interest in maintaining a status quo with low contract enforcement, since they can extract economic rents.

Using costly monitoring and private information to model financial frictions, Greenwood, Sanchez and Cheng (2010) emphasise that investments differ in their risk-return profiles and producing information about these returns is costly. Given the risk-return profile of an investment, producing information is costlier in less developed financial systems. Thus, in equilibrium, capital is being misallocated, with some firms overfunded and others underfunded given their risk-return profile. Technological advance in intermediation leads to more capital accumulation and a redirection of funds away from unproductive firms toward productive ones.

As in Erosa and Hidalgo Cabrillana (2008), Banerjee and Moll (2010) also address the important question of persistence of misallocation. They point out that under a variety of specifications misallocation on the intensive margin disappears asymptotically as firms accumulate sufficient capital.[16] In the discussion of their results, Banerjee and Moll (2010) point out that the high documented persistence of misallocation remains puzzling in light of their model. One possibility to account for this persistence is to assume highly persistent shocks to productivity (entrepreneurial ability in their model), which is also supported by evidence presented in other studies. Another is that the analysis focuses on steady states. Moll (2014) finds that transitional dynamics matters for the persistence of capital misallocation. The key result in the paper is that the degree of persistence of TFP shocks and importance of financing frictions during transition interact to determine long-run productivity and the speed of transition. Thus, steady-state

16 They also show that the misallocation on the extensive margin may persist in the model under certain conditions.

analysis may miss the long transition if shocks are persistent. Big productivity losses during transitions with less persistent shocks and asymptotically disappearing financing frictions may also remain hidden.

Two interesting studies of the interaction of financing frictions and other policy-induced frictions are Buera and Shin (2013) and Caggese and Cuñat (2013). Buera and Shin (2013) study the transition to the steady state following a reform that removes firm-level distortions in a model with financing frictions. The authors quantify the role of financing frictions and the initial misallocation of resources in explaining development dynamics. In their model, financial frictions may reduce aggregate TFP by as much as 25 per cent. The paper also contributes to the argument about the importance of transition between steady states. The authors find that the speed of transition is about half that in a conventional neoclassical model with financing frictions and heterogeneous technologies. This speed reflects the dynamic process of improving resource allocation and the drag from financing frictions – it takes time for productive individuals with low net worth to accumulate sufficient collateral to become entrepreneurs and operate on an efficient scale. This process generates the persistent endogenous TFP dynamics that Banerjee and Moll (2010) emphasise is necessary to explain persistent misallocation. Some of the micro-level implications of the model, such as factor relocations and establishment size distribution, are empirically verified with evidence from five of the post-war miracle economies (China, Japan, Korea, Malaysia and Singapore).

Caggese and Cuñat (2013) study the impact of trade barriers in the presence of financial frictions, both of which are sources of resource misallocation, to better understand how financial constraints may affect the outcome of trade liberalisation. In their model, financing constraints have an impact both on the decision to enter the domestic market and to become exporters. In a quantitative study, the authors test some of their model's predictions, confronting the model with a rich dataset of Italian manufacturing firms for the period 1995–2003 and matching some of its key features. They quantify the effect of financing constraints on aggregate productivity gains induced by trade liberalisation at about 25 per cent. The main channel is the distortion of incentives of the most productive firms to self-select into exporting.

Sizable effects of financing frictions on economic development are also found by Greenwood, Sanchez and Cheng (2013), albeit by playing down the importance of self-financing. In their study, differences in financial systems can account for about 30 per cent of cross-country differences in per capita GDP. If all countries were able to adopt the best practice financial system, world GDP would be 53 per cent higher.

Buera, Kaboski and Shin (2011) and Midrigan and Xu (2014) study explicitly the productivity losses on the intensive and extensive margins that arise from credit constraints. Buera, Kaboski and Shin (2011) develop a two-sector quantitative model to explain the relationship between aggregate and sector level TFP and financial development across countries. Motivated by the argument in Rajan and Zingales (1998) and as in Erosa and Hidalgo Cabrillana (2008), there is a sector with high financing needs that is disproportionately affected by financing frictions. Key assumptions in this model are sector-specific fixed costs and the ability of individuals to save and augment their net worth. These two features create differences in firm scale across sectors. Financing frictions produce distortions through three different channels: the extensive and intensive margins, and the number of firms in each sector for a given distribution of firm-level productivity in the economy. In the quantitative part of the study, financing frictions are found to impact the sector with smaller fixed costs (and therefore less dependent on external finance) mostly on the intensive margin, while more than half of the impact of financing frictions in the more investment-intensive sector is through the extensive margin. Moreover, the impact of financing frictions is disproportionately larger in finance-intensive sectors, as shown empirically in Rajan and Zingales (1998). The model is able to explain a factor-of-two difference between output per worker across economies.

Midrigan and Xu (2014) find that the impacts of financing frictions may differ significantly on the intensive and extensive margin. They calibrate their model using data from South Korea, China and Colombia featuring well and not so well developed financial sectors. The quantitative analysis finds fairly small losses from misallocation on the intensive margin of about 5 to 10 per cent, but potentially large losses from inefficiently low levels of entry and technology adoption that may amount to

40 per cent. The small losses from misallocation on the intensive margin are largely due to the ability of firms to accumulate own funds and rely on internal finance, thereby circumventing financing frictions. Entry costs and technological choice entail large upfront costs that have a long payback period and are difficult to finance without significant reliance on external finance.

Among the very few empirical studies on the impact of financial frictions on productivity and capital misallocation are Gilchrist, Sim and Zakrajsek (2013) and Peek and Rosengren (2005). The former develop an accounting framework that enables them to exploit the difference in borrowing costs between firms subject to financing frictions and those that are less affected, such as firms with access to capital markets. This difference is measured directly from the interest rate spreads on the outstanding publicly traded debt of a panel of US manufacturing firms. The empirical study finds a modest productivity loss due to resource misallocation on the intensive margin — about 2 per cent of TFP. The authors point out, however, that the dispersion of borrowing costs that generates these losses has been on a secular increase in the US since 2000, implying an annual TFP loss of about a quarter of a percentage point. Hence financing frictions may have non-negligible aggregate effects, even in countries with very advanced financial systems.

The study of Peek and Rosengren (2005) focuses on the impact of poor regulation and supervision of banks on the misallocation of credit in Japan. The authors use data on loans between individual borrowers and lenders to show that credit misallocation arose from banks' incentives to continue lending to the weakest firms so that those firms could keep paying interest on existing loans. There were both internal and external incentives. Firms are more likely to receive additional bank credit if they are in poor financial condition because troubled Japanese banks have an (internal) incentive to allocate credit to severely impaired borrowers in order to avoid the realisation of losses on their own balance sheets. This was more prevalent among banks with low capital ratios. Strong corporate affiliation between banks and borrowers acted as an aggravating force. External to the bank was the government pressure to continue financing so as to avoid a credit crunch and decline in economic activity, as well as large government costs related to bank bailouts or failures. Box 1 discusses another instance of large misallocations of capital resulting from a lack of both appropriate monitoring and exercise of banks' corporate control over their borrowers.

Apart from these studies that provide direct evidence on financing frictions and misallocation, there exists a large body of literature that provides indirect evidence. In particular, the influential cross-industry, cross-country study of Rajan and Zingales (1998) shows that industries that rely more on external finance grow faster in more developed financial systems. Many extended this analysis, piling up more evidence that financial development does indeed have a disproportionately large impact on industries and firms that are more dependent on external finance relative to others and that it relaxes external financing constraints (see, for instance, Claesens and Laeven (2003), who show that weak property rights reduce growth by leading to a suboptimal allocation of resources). Wurgler (2000) shows that in countries with more developed financial systems, growing industries increase investment more and declining industries decrease investment more than those in countries with less developed financial systems. Beck, Demirguc-Kunt, Laeven and Levine (2008) emphasise the removal of obstacles to growth for small firms. They show that industries that are naturally composed of small firms grow faster in countries with more developed financial systems.

A number of firm-level studies provide some evidence on the allocation of capital and economic development. Demirguc-Kunt and Maksimovic (1998) show that firms in financially more developed countries are able to better exploit profitable opportunities and grow faster than their peers in less financially developed economies, while Beck, Demirguc-Kunt, Levine and Maksimovic (2001) confirm these findings using an extended sample of firms. Love (2003) and Beck, Demirguc-Kunt and Maksimovic (2005) argue that financial development reduces financial constraints, particularly for small firms.

By and large, financing frictions are found to be an important determinant of productivity differences across countries. Nevertheless, the estimates of the importance of financing frictions for capital misallocation and productivity losses are quite dispersed. Some studies find a substantial impact (to the tune of 50 per cent) and others estimate only modest effects of 1-2 per cent. The fact that some papers

focus on steady states only and do not analyse the transitional dynamics may go some way towards explaining this wide range of estimates. When analysing explicitly the effects on productivity from the extensive and intensive margins, studies find that losses on the extensive margin are potentially significant, whereas those on the intensive margin are much less so.

Box 3 Capital flows, total factor productivity and retail banking integration

The recent experience

The pre-crisis period in Greece, Ireland, Italy, Portugal and Spain was marked by massive capital inflows and deteriorating total factor productivity (Figure 1).

This co-occurrence is puzzling: it is not only at odds with developments elsewhere over the same time period (e.g. the United States) but also raises the question – from a causal point of view – of what happened to the inflowing capital so that it led not only to a stagnation but to a deterioration of total factor productivity.

One answer to this question is "misallocation of resources". It is by now widely accepted that pre-crisis inflows of resources into the non-tradable sector in the crisis countries took their toll in particular on total factor productivity in those countries (see, for instance, Lane (2013), Reis (2013), Wagenvoort and Torfs (2013) and Eichengreen (2010)).

Wholesale without retail market integration in Europe

This raises the question: If misallocation of resources mattered for the co-occurrence of massive capital inflows and falling total factor productivity, what is it that made this misallocation of resources possible in the first place?

Large differences in the composition of pre-crisis capital inflows across countries – with some countries experiencing mostly portfolio inflows, others cross-border bank capital flows, and yet others FDI inflows – suggest that several mechanisms are likely to have been at work when it comes to explaining the co-occurrence of capital inflows and the misallocation of resources in different countries.

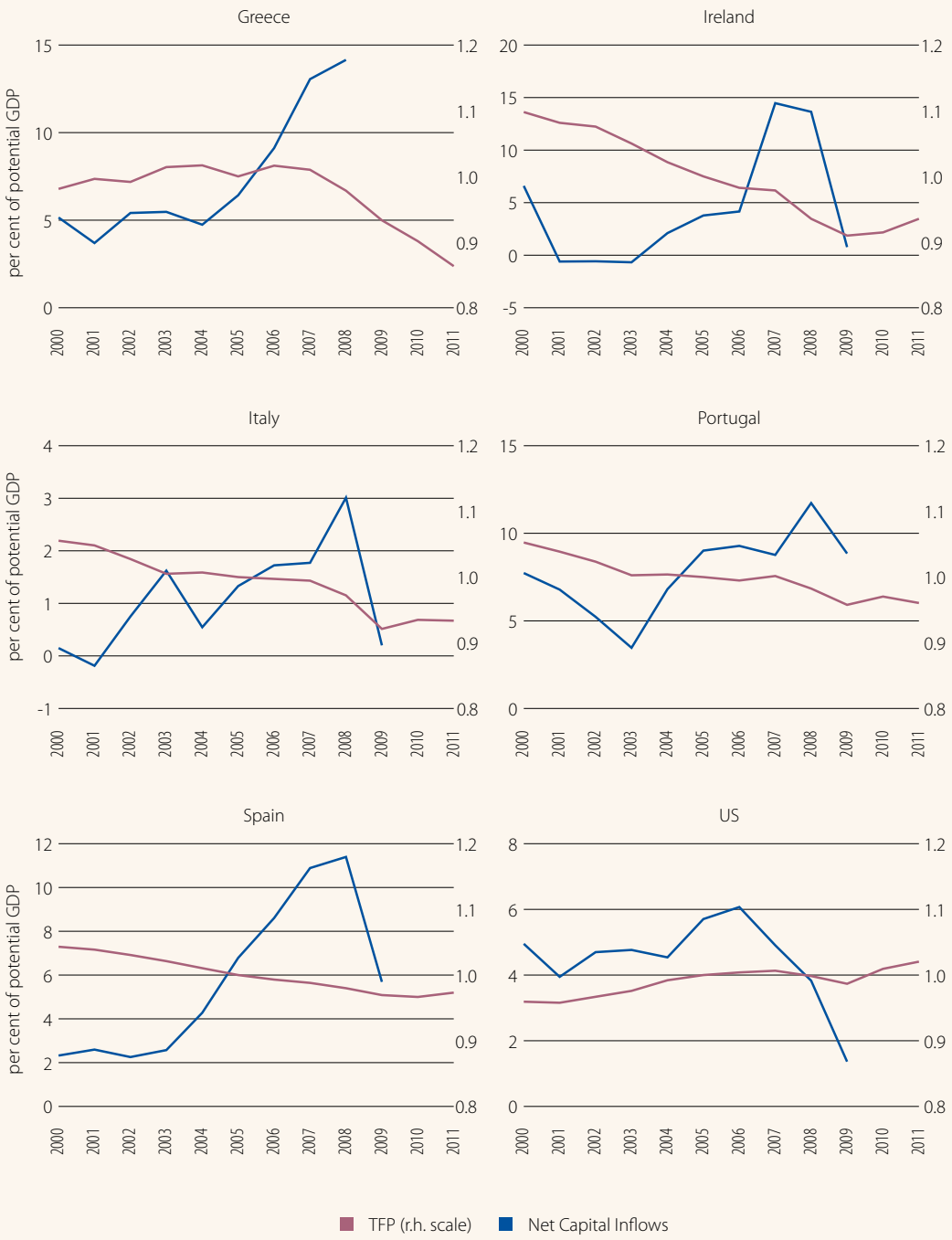
In a paper accompanying this publication (Brutscher, 2015), we explore the plausibility of one such mechanism – which is that, in the absence of an integrated retail banking sector, massive cross-border bank flows can end up in unproductive sectors, the idea being that the de facto seniority of wholesale bank financing (vis-à-vis deposits and other long-term funds) can lead to a sub-optimal incentive for banks lending to other banks abroad to monitor where their funds end up and hence can increase the risk of a misallocation of resources.[17]

While this is true both for banks lending to independent banks in other countries and banks lending to their own branches or subsidiaries abroad, the difference is that whereas the negative incentive to monitor goes unmitigated in the case of cross-border capital flows between independent banks, the equity relationship of mutually dependent banks should act as a counterforce to how much (or how little) banks follow up on where their funds end up in the receiving country.

Using a large-scale dataset (spanning 98 countries and 40 years), we test this hypothesis by examining how sustained and high cross-country inter-bank capital inflows translate into changes in total factor productivity – separately in countries with a high share of foreign-owned banks and countries with a low share of foreign-owned banks. What we find is that – in line with our hypothesis – large-scale capital inflows tend to be positively associated with total factor productivity in countries with more integrated retail banking sectors, but negatively associated with total factor productivity in countries with less integrated retail banking sectors.

17 This hypothesis was first spelled out in a theoretical model by Huang and Ratnovski (2010).

Figure 1 **Co-occurrence of net capital inflows and deteriorating total factor productivity.**



Notes: Capital inflow data come from Broner et al. (2013), data on total factor productivity from the World Penn Tables. Capital inflows are expressed as a share of potential GDP. Total factor productivity is indexed to equal 1 in 2005.

This finding is robust to a large number of control variables. We do, however, find evidence that part of the effect (about half) is due to the positive association between competition in retail banking market integration and competition in that sector and thus is not only due to differences in the incentive to monitor cross-border bank flows.

Wider implications

Our results add to the discussion of whether there is a need for more retail banking integration in Europe. The literature on this topic so far has focused primarily on two aspects of this question:

- One strand of the literature has looked at the stabilising effect of foreign banks on the credit supply in host countries during domestic banking crises. As foreign-owned banks tend to be less reliant on host country funding and more reliant on foreign sources than their domestically owned counterparts, this literature found a significantly lower cyclicality of domestic lending in more integrated markets (see, for instance De Haas and Van Lelyveld (2006) or Goldberg (2009))

- The second strand of the literature has looked at the "dark side" of retail market integration, that is, how financial crises in the home countries of parent banks tend to affect lending in host countries. The literature found (negative) contagion effects. Specifically, it found that negative shocks to the financial health of parent banks tend to impact the ability of subsidiaries to expand credit (see, for instance, Peek and Rosengren (2005), Popov and Udell (2012) and De Haas, Korniyenko, Loukoianova and Pivovarsky (2012)).

Our results add to this discussion by highlighting the potentially further positive effect of stronger retail market banking sector integration in Europe that comes about by reducing the risk of a misallocation of resources through improved incentives to monitor cross-border capital flows.

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