

INVESTMENT REPORT
2017/2018



European
Investment
Bank

The EU bank

from recovery
to sustainable growth

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About the Report

The Investment Report is designed to serve as a monitoring tool providing a comprehensive overview of the developments and drivers of investment and its finance in the EU. It combines an analysis and understanding of key market trends and developments with a more in-depth thematic focus, which this year is devoted to the impact of financial constraints on investment dynamics. A new addition to the report this year is the new annual EIB Investment Survey (EIBIS). The report is a flagship product of the EIB, produced by its Economic Department. It complements internal EIB analysis with contributions of leading experts in the field.

About the Economics Department of the EIB

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 40 economists, is headed by Debora Revoltella, Director of Economics.

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Executive summary

The investment recovery in Europe continues to strengthen and become more broad-based, across countries, sectors and asset classes. Since the recovery began in 2013, the growth rate of investment in the EU has reached an average of 3.2%, clearly exceeding the 1995-2005 average of 2.75%. The rate of corporate investment, in particular, has recovered to pre-crisis levels, led by investment in machinery and equipment and intellectual property.

Yet this is no time for complacency. On the one hand, we see many areas in which investment is still being held back; on the other, we see long-term, structural challenges facing Europe that require an acceleration in far-sighted investment. As a flagship annual publication of the EIB, produced by its Economics Department, this report provides a detailed examination and analysis of these trends and gaps. It incorporates and builds on the new 2017 release of the EIB Investment Survey of businesses in the EU, which this year also includes a Europe-wide survey of municipal authorities.

Business investment is being driven by the improving outlook and efforts to keep pace with competitors. EIBIS data show corporate investment on an upward trend, with firms focusing on investment in new equipment and products, to raise productivity and competitiveness.

The recovery is now turning a spotlight on structural investment needs: innovation, skills, infrastructure and sustainability. The EU continues to fall behind global peers in terms of R&D spending, while other types of intangibles – software, training, organisational capital, etc. – prove to be just as important. “Lack of staff with the right skills” is now the most frequently cited deterrent to investment, mentioned by 72% of firms, with professional training and higher education being firms’ first priority for public investment, closely followed by investment in transport and digital infrastructure. Meanwhile, estimates suggest that investment in climate change mitigation in the EU should accelerate to respond to the challenge of meeting envisaged emissions reductions after 2020.

There is no recovery yet in infrastructure investment – undermining Europe’s long-term potential. Infrastructure investment appears to have stabilised at 1.8% of EU GDP, down from 2.2% in 2009. The decline is strongest in countries with the lowest infrastructure quality, pointing to a slow-down in the convergence process. The main driver of the slow-down has been fiscal policy choices that have been biased against long-term capital expenditure, while corporate infrastructure has also struggled to keep up with pre-crisis rates, in part due to regulatory pressure on allowed returns. Municipalities report a significant infrastructure gap and see fiscal constraints, rather than access to finance, as the main obstacle. Overall, there is a need for better planning and prioritisation of infrastructure investment: only 38% of municipalities both carry out some kind of ex ante assessment and consider it an important or critical factor in decision-making.

There is still a need to improve the business environment: a majority of European firms consider business and labour market regulations to be a barrier to investment, while uncertainty remains one of the foremost barriers. Our analysis suggests that more open and flexible markets would improve the efficiency of resource allocation, encourage innovation and investment in intangibles, and help firms cope with uncertainty. Digital, transport and energy infrastructure also emerge as important to realising the efficiency benefits of the single market.

Persistent financial fragmentation could slow convergence and reduce capacity to absorb shocks. Gross financial flows remain substantially reduced relative to pre-crisis levels. Net flows reveal strong re-balancing trends with current account surpluses emerging in all EU regions, but at the expense of investment. While a shift from debt to equity flows is positive for financial stability, remaining fragmentation implies sub-optimal risk-sharing across the EU, a situation that will be tested by monetary policy normalisation.

Financing conditions for firms are generally supportive, but deleveraging remains a drag. EU firms continue to be net savers overall, suggesting that many firms are unwilling to invest despite a liquid financial position. Nonetheless, many corporates and banks are still on a deleveraging path, helping to explain the modesty of the recovery, and bank lending to firms continues to stagnate. Access to finance is not a major concern of most firms, but there are localised constraints. Financing is more difficult for firms that are young, small or innovative, or with high investment in intangibles.

There is a window of opportunity to address structural investment needs through both public and private investment, with targeted policy intervention to ease specific constraints:

- **There is a need to re-prioritise public infrastructure investment, supported by better planning and prioritisation among alternative investment opportunities.** This is key at all levels, from overcoming issues of single market fragmentation at the EU level to improving capacity for planning and prioritisation at the sub-national level, something which would go hand-in-hand with stronger re-prioritisation of infrastructure investment in public financing.
- **Enhancing the productivity and competitiveness of the EU economy requires attention to be paid to innovation, including investment in intangibles, particularly skills,** as the EU is falling behind peer economies in this regard. Skills are an important priority, relevant across Europe, as is R&D spending, but policy should also target all types of intangibles.

- **Climate change mitigation investment needs to accelerate if Europe is to stay on-track**, with a much higher rate of investment almost certainly needed to meet targets in 2030 and beyond, particularly given the fall in the rate of mitigation investment since 2012.
- **Reforms to improve the business environment will help firms cope with uncertainty, improve resource allocation efficiency and promote innovation.** This should involve lighter-touch and smarter regulation of labour, product and services markets, as well as reforms that facilitate the creation of new firms and the orderly exit of others from the market where necessary.
- **Completing the Banking Union and advancing the Capital Markets Union is needed to enhance stability and spur faster convergence.** With fragmentation persisting in the EU financial system, progress is needed to ensure resilience as monetary stimulus is gradually withdrawn.
- **A more diversified mix of business finance needs to be encouraged to foster innovation and stability.** More use of equity finance would support young innovative firms and investment in intangibles, as well as improving resilience to banking sector stress. But this requires a focus on changing incentives for firms. Private equity and venture capital can play a role. Measures to ease financial constraints for young, small and innovative firms, including credit guarantees, can facilitate adjustment processes and promote greater productivity growth and competitiveness.



Debora Revoltella
Director, Economics Department
European Investment Bank

Introduction

From recovery to sustainable growth

Following a weak start, the investment recovery has accelerated in lockstep with the overall economy. Average annual growth over the past two years has exceeded the long-term average growth rate and the investment recovery has spread throughout the EU.

Investment in machinery and equipment and intellectual property products has been driving the recovery, as firms have updated their capital stock following nearly five years of subdued investment between 2008 and 2013. This modernisation is crucial for firms' competitiveness given the potential productivity gains from digitalisation and modernisation of equipment and production processes.

While the gap versus pre-crisis levels remains significant, since early 2016 there has been some recovery of investment in dwellings and other buildings and structures, too. As the economic recovery progresses, housing markets should further improve. Commercial real estate is also expected to gain from the upturn, but its full recovery may be limited by structural changes in European economies (Chapter 1 of this report).

The current recovery has been supported by major policy initiatives on European and national levels. The multifaceted and extraordinary policy response of the ECB calmed financial markets and brought financing conditions back to investment-friendly levels. The fiscal stance of most EU economies turned to neutral or slightly positive, following years of fiscal retrenchment. The Investment Plan for Europe has added to the investment impetus, providing funds to a wide range of priority investment projects across the EU. The current recovery is also partly based on the building of the Banking Union and the plans to implement a Capital Markets Union (CMU). Reforms implemented by national governments are likewise paying off.

Targeted policy interventions are key to this transition

As economic activity gathers pace and investment accelerates, the need for general economic stimulus shifts towards action to address structural investment needs through both public and private investment, with targeted policy intervention to ease specific constraints and deficiencies resulting from structural economic problems.

This report identifies four main areas of policy intervention. First, policymakers should prioritise infrastructure investment at the national and sub-national levels, combining a complex process of good planning, rigorous project appraisal and adequate investment financing. Second, policy efforts should focus on enhancing the competitiveness of European business, by improving the business environment and incentivising investments in intangible assets, skills and innovation. Third, incentivising investment in climate-change mitigation should again become a policy priority, as addressing climate change remains to the top of policy agendas. Finally, with normalisation of monetary policy looming ahead, policymakers should accelerate European financial market integration and diversification.

Infrastructure and public investment: prioritisation and good planning

Fiscal consolidation became a policy priority in Europe as the euro area sovereign debt crisis intensified in 2010-2011. Both fiscally constrained governments and those with certain fiscal space reduced capital expenditures, in some cases quite dramatically so. As a result, gross investment of the general government, as a share of GDP, reached a 20-year low in 2016 for the overall EU economy (Chapter 1). Despite the fiscal stance in the past two years has turned from contractionary to broadly neutral, (as for ECB and EC assessment) government investment failed to increase. While it may not return to long-term averages any time soon, new unaddressed government investment needs appear, at both the national and sub-national levels.

Government infrastructure investment has been particularly affected by the decline in government capital spending (Chapter 2). It declined the most in countries which had the strongest quality gaps, thus further slowing down convergence of infrastructure quality across the EU. The low investment in modernisation and maintenance led to the perception of increasing infrastructure gaps, in almost all countries. This perception is further strengthened by the needs for new infrastructure assets arising from the demographic and technological transformation of European economies. Infrastructure investment has declined at both the national and sub-national levels. It has also declined across institutional sectors – both government and corporate investment fell after 2008. Low prioritisation in the public sector, reduced regulated returns for corporates, and stricter rules for accounting PPP risk have all contributed to the observed decline.

About 50% of infrastructure investment in Europe happens at the sub-national level, where fiscal constraints and administrative capacity are the key problems (Chapter 2). The new 2017 EIB survey of some 600 European municipalities shows that only about half of them undertake effective strategic analysis for investment decisions and only 40% effectively take the results into account when approving projects. These results indicate an overall inadequate level of administrative capacity to plan and implement infrastructure projects.

Overall, there is evidence that planning and coordination of infrastructure investment at the EU, national and sub-national levels should be improved. Infrastructure investment should be prioritised, with adequate financing, along with good long-term planning and improved administrative capacity.

Business competitiveness and investment in intangibles

The European corporate sector has fallen behind global peers in terms of investment in new equipment, R&D expenditure and innovation, and this reduces competitiveness in the medium term (Chapters 3 and 9). After a long period of underinvestment, the quality of business capital stock remains a concern and explains a large part of the firms' perceived investment gaps. Closing these gaps might require between four and ten years, assuming that the most affected firms start investing. Incentivising the adoption of best available technology is the key to closing these gaps (Chapter 1).

While investment in intangible capital, and R&D in particular, recovered following the financial and economic crisis in Europe, other global peers have done much better. R&D intensity in China has surpassed EU R&D intensity; at the same time, the US has maintained its R&D intensity lead over the EU and South Korea has increased it. The EU mostly lags in business R&D, having far fewer leading innovators in high-technology industries (Chapter 3). This deficiency can be explained by different business conditions, including access to finance, and a regulatory environment that does not support young firms undertaking risky and innovative investments (Chapter 9).

The whole range of intangible investments should be the target of supportive policies. Capitalised R&D expenditures constitute a substantial share of intangible capital, but there are other intangible assets that play very important roles in improving competitiveness. Investment in software and databases, original designs, organisational capital and training improves a firm's position in the market and its productivity (Chapter 3). Many of these investments are not included in national accounts and are more difficult to measure than R&D expenditure, but nevertheless some of them create positive externalities, just like R&D expenditures, and should thus benefit from public support.

The 2017 wave of the EIBIS identified the lack of availability of staff with right skills as the most cited impediment to corporate investment activity, shared by 72% of European firms. Moreover, a majority of respondents see public investment in training and higher education as a top priority. While most investment in skills is undertaken by individuals and its returns are mostly private, the fact that lack of relevant skills impedes aggregate investment introduces a public policy dimension. The short-term response can be rather limited. Boosting training with the close involvement of the business sector, standardisation and constant reviews of curricula in the light of changing skills requirements should go some way towards addressing the problem. The longer-term response necessarily involves reforming the education and training systems to refocus them away from preparing people to spend their career in one or two workplaces. In addition to national policies, coordinated policies at the EU level are also needed, given the free movement of people across the EU. This is because education and training are still planned and paid for at the national level, while people may employ their skills and human capital in any other country in the EU.

Creating a business environment that is conducive to innovation and investment in intangible capital, and ensures efficient reallocation of resources, should be another key policy priority, given the crucial importance of intangible capital for overall productivity and competitiveness and the costs associated with the inefficient use of resources (Chapter 3 and Chapter 10). In addition to improving competitiveness and productivity, overall higher shares of intangible capital are also associated with a weaker impact of uncertainty on investment (Chapter 8). Improving the business environment is easier said than done, but it should involve less and smarter regulation of labour, product and services markets, lower barriers to entry and exit, and enhanced access to diversified sources of finance (Chapters 7 and 9).

An improved business environment is crucial not only for innovation. More flexibility and lower barriers to entry and exit reduce costs related to irreversibility of investment and sunk costs, thereby reducing the negative impact of heightened uncertainty on investment (Chapter 8). They also improve the reallocation of resources from less profitable to more profitable business activities.

Resource misallocation is an important source of inefficiency in the EU. It has been increasing over time and varies across the EU (Chapter 10). Labour market regulation and heavy business regulation are found to have a strong negative impact on the efficiency of resource allocation. Higher energy costs also have a negative contribution, suggesting that in addition to reducing regulation more efforts are needed to create a single energy market in the EU.

Investment in climate mitigation

Europe will most likely meet the 2020 targets for greenhouse gas emissions reduction, but substantial effort and investment are still needed for the transition to a low carbon economy to succeed. Before the eruption of the financial crisis, addressing climate change was among the highest policy priorities, especially in the EU. The financial crisis shifted the focus away from climate change for many years as more pressing problems, like financial stability and the preservation of the common currency, had to be urgently addressed. Lower economic activity also helped to reduce greenhouse gas (GHG) emissions, moving the EU closer to its 2020 GHG emissions reduction targets. Investment in climate change mitigation is estimated at 1.2% of EU GDP, and has declined from 1.6% in 2012 due to factors including the reduction in capital costs for renewable energy and changes in incentives that saw the cooling of the “solar boom”. The EU is on target to reduce CO₂ emissions to 20% below 1990 levels by 2020, but dramatic increases in the rate of emissions reduction will be needed to meet envisaged reductions for 2030, 2040 and 2050 under the Paris accord and the European Commission’s roadmap (Chapter 4). This implies an overhaul of policies to incentivise more investment, but also to improve energy efficiency and change behaviour.

Accelerating European financial integration and diversifying financial instruments

The financial crisis resulted in substantial financial market fragmentation in the EU. Since 2012 financial market integration has gradually regained ground, but indicators, albeit imperfect, are still far from pre-crisis levels (Chapter 5). Incomplete integration also means limited risk-sharing among euro area members and more generally among EU Member States, although some positive signals about risk-sharing capacity are seen in the changing composition of cross-border capital flows from debt to equity. Completion of the Banking Union and designing and implementing CMU is crucial to accelerate financial integration and to foster private risk-sharing capacity.

Despite incomplete reintegration, EU financial systems have stabilised and financing conditions are supportive (Chapter 6). Problems with access to finance remain limited to smaller companies in certain sectors and countries. A particularly important problem is the lack of growth capital for young innovative companies (Chapters 5 and 9).

Corporate investment has strengthened, despite continuing corporate deleveraging. Nevertheless, corporates maintain a preference for debt over equity, due to the fear of losing control, tax incentives, etc. As discussed in this report, firms will benefit substantially from a more diversified financing mix and from increasing the share of equity in particular, suggesting that more is needed to diversify the financing options of firms and to incentivise equity finance (Chapter 7). These benefits include more stable financing over the financial cycle, but also the ability to invest more in intangibles.

ECB extraordinary policy has provided critical support for financial-market stabilisation and the improvement in financing conditions, so that looming monetary policy normalisation will be a serious test. In this context, acceleration of the implementation of the Banking Union and the CMU will provide a strong signal that policymakers are firmly committed.

About this report

The Investment Report is designed to by the EIB Economics Department to serve as a monitoring tool providing a comprehensive overview of the developments and drivers of investment and investment financing in the EU. It combines an analysis and understanding of key market trends and developments with a more in-depth thematic focus, which this year is devoted to the impact of uncertainty, innovation and resource allocation on business investment. The report brings together internal EIB analysis and collaborations with leading experts in the field. It is structured in three parts covering recent developments in investment in tangible and intangible capital (Part I), investment finance (Part II) and business investment: uncertainty, innovation and resource allocation (Part III).

The report incorporates the latest results from the annual EIB Investment Survey (EIBIS). The survey covers some 12,000 firms across the EU and a wide spectrum of questions on corporate investment and investment finance. It thus provides a wealth of unique firm-level information about investment decisions and investment finance choices, complementing standard macroeconomic data.

The add-on module of the EIBIS this year was a survey of 555 large municipalities across the EU inquiring about infrastructure needs, planning and financing. The survey thus follows a bottom-up approach to evaluate infrastructure needs and the administrative capacity to plan and implement infrastructure projects. The answers to this survey shed light on the relationship between infrastructure investment activities and infrastructure investment needs and gaps and the bottlenecks for infrastructure investment activities from planning to actual implementation.

Country grouping in this report

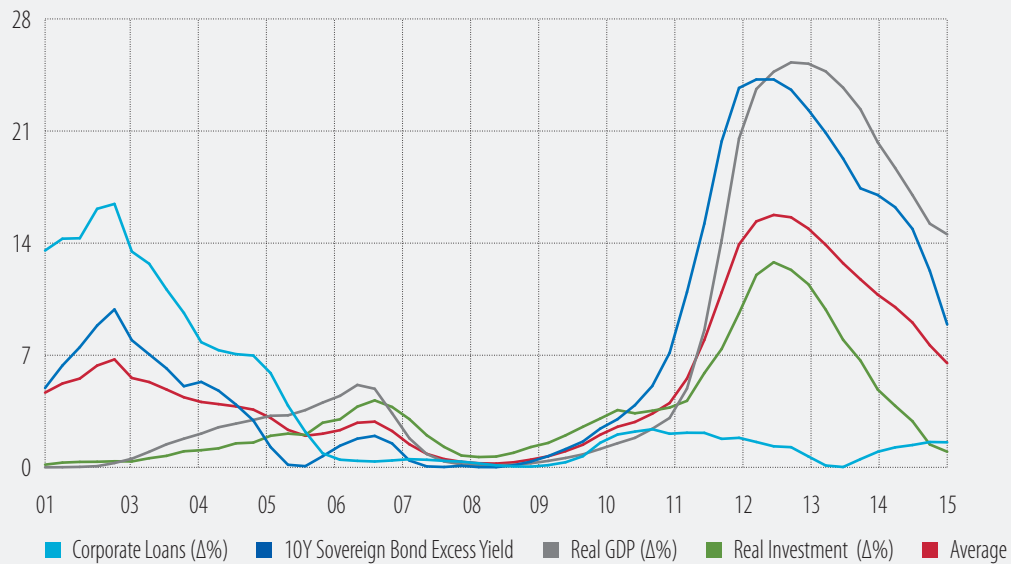
As in previous years, this report often uses a breakdown of EU Member States into “Cohesion”, “Periphery” and “Other EU” countries. While such classification is always arbitrary, here we provide a brief note on the relevance of this country breakdown by looking at the differences in the key macroeconomic variables for the three country groups.

The countries in the Cohesion group are all those that joined the EU in 2004 and later. All these countries have embarked on a path of convergence with more advanced EU economies and are recipients of EU Structural and Cohesion Funds. Periphery countries are EU Member States that were affected by the economic and financial crisis more than the other countries. They include Cyprus, Greece, Ireland, Italy, Portugal, and Spain. While some of these economies have become much more dynamic, the similarities in their recent economic histories are still relevant. The group of Other EU members comprises the remaining ten EU Member States: Austria, Belgium, Denmark, Finland, France, Germany, Luxembourg, the Netherlands, Sweden, and the United Kingdom. In 2016, the Periphery countries accounted for 23% of total EU GDP while the Cohesion group accounted for 8% and the Other EU countries accounted for the remaining 69%.

To evaluate the relevance of the country groupings we analyse the behaviour of several macroeconomic variables including real GDP, long-term government bond yields, real investment and corporate loans over the 2000-2016 period. For each of the macroeconomic variables we estimate the following regression equation over four-year (16-quarter) rolling windows, and plot the evolution of the explained variance (R²) over the sample period:

$$Y_{i,t} = \alpha + \beta_0 D_{periphery} + \varepsilon_{i,t} , (1)$$

where $Y_{i,t}$ is the macroeconomic variable and $D_{periphery}$ is a dummy variable that takes the value of one if a country belongs to the Periphery group, and zero otherwise.

Figure 1 Evolution of R² in regression (1)

Source: Eurostat, ECB, author's calculations.

Figure 1 plots the evolution of the R² series for the four macroeconomic variables as well the average of the four R² series. The R² peaks around 2012, suggesting that the Periphery countries' divergence from the Cohesion and the Other EU members was strongest over the period 2010-2014. This is especially due to the differences in the real GDP changes and the long-term government bond yield. The peak is followed by a decline in proportion of the variance explained by the Periphery dummy in the last few years. This suggests that the differences in macroeconomic variables of the Periphery countries and the rest have diminished in the last few years of our sample.

To conclude, while grouping countries within the EU is useful for presentation purposes, country specificities are today significant and divergence in behavior of countries classified within the same groups is increasing.

3.2%

average annual **investment growth**
since 2013

**EU infrastructure
investment is**

20%

below pre-crisis levels

Firms
rate

45%

of their machinery and
equipment as
state of the art

72%

of firms consider **lack
of skills** an obstacle
to investment

34%

of **municipalities** say
infrastructure investment
is below needs

Only

40%

of **municipalities** make
infrastructure investment
decisions based on **proper
ex-ante quality
assessment**

EUR

45bn

**reduction in climate
change mitigation
investment** since 2012

PART I

Investment in tangible and intangible capital

Chapter 1

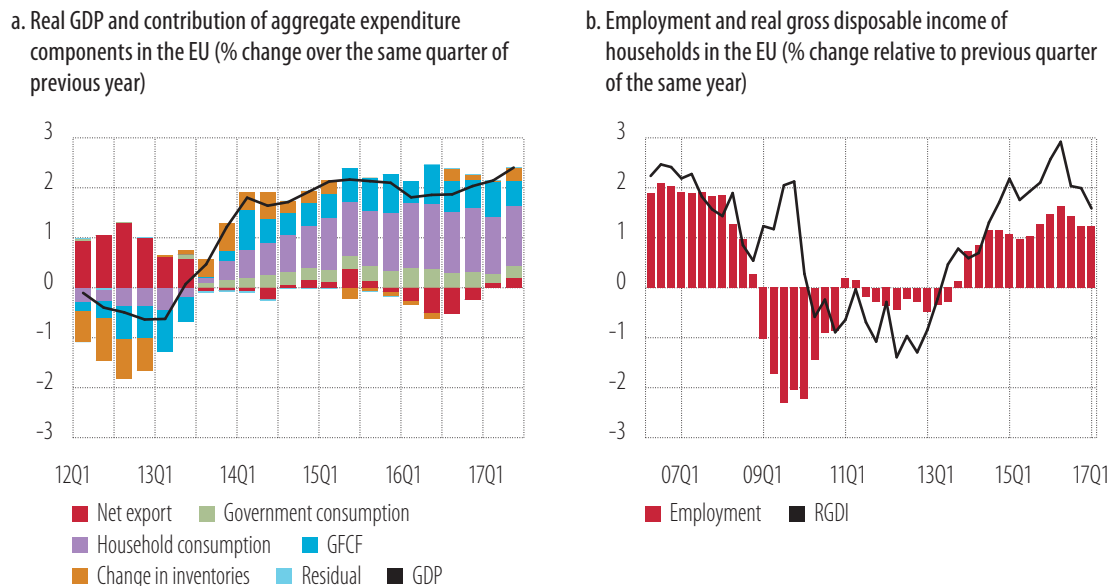
Gross fixed capital formation in the European Union

Chapter at a glance

- *Four years after the end of the last recession, the economic recovery has consolidated and investment is growing gradually but steadily, driven by the corporate sector.*
- *Investment rates are still below historical averages due to weak investment in dwellings and other buildings and structures. This has started to change with the improving economy, but no return to historical rates are to be expected due to structural changes in the economy and in demographics.*
- *In 2016, general government investment in the European Union (EU) reached a 20-year low as a share of GDP. The decline is offset by current expenditure, so there is little change in total government expenditure. Governments do not envisage a significant change in their investment policies in the foreseeable future, despite low borrowing costs and a long period of relatively low investment. This policy may lead to a further decline in the perceived quality of the infrastructure in many EU countries and may constrain growth and cohesion in the EU.*
- *Despite heightened political and economic uncertainty, and low government investment, business investment outperformed expectations in 2016. For 2017, firms expect a further expansion of investment activities. Perceived investment gaps, however, remain broadly unchanged despite increased investment, as they are a function of the economic and business outlook.*
- *Years of weak investment in a period of digitalisation and technological change led to a perceived low quality of the capital stock. The corporate sector is catching up by investing mostly in machinery and equipment, intellectual property products, and capacity replacement. Capacity constraints are unlikely to become binding in 2017 at the aggregate level, except in a few countries.*
- *Lack of skilled staff overtook uncertainty as the key barrier to investment last year. Concerns about finding staff with the right skills are also reflected in firms' view of what should be the main public investment priority in the coming years, with investment in professional training and higher education being cited most frequently.*
- *The share of firms seeing business and labour market regulation as an impediment to their investment activity has increased across the EU, underlining the clearly recognised need to make labour markets more flexible, reduce product and service market regulations, cut barriers to entry and exit, and optimise regulation to become more transparent and business-friendly.*

The economic environment has been gradually improving

The economic recovery in the EU consolidated over 2016 and the first half of 2017 (EIB, 2016a). Growth of real GDP has been driven by private consumption and, to a lesser extent, real investment (Figure 1, panel a). Government consumption also contributed positively to growth, while net exports contributed negatively, throughout 2016. All EU economies have improved over the past year and a half, despite a large variation in economic conditions across countries. Growth of private consumption was the most important contributor to GDP growth in most members of the EU. The balance sheet adjustment of all institutional sectors of economies has progressed despite low inflation, supported by low interest rates, improving cash flow in the corporate sector, increasing household disposable income, and rigorous fiscal adjustment.

Figure 1 Evolution of GDP and the labour market

Source: National Accounts, Eurostat and EIB staff calculations.

Note: GDP and expenditure component series in 2010 chain-linked volumes in euros. GFCF: gross fixed capital formation; RGDI: real gross disposable income.

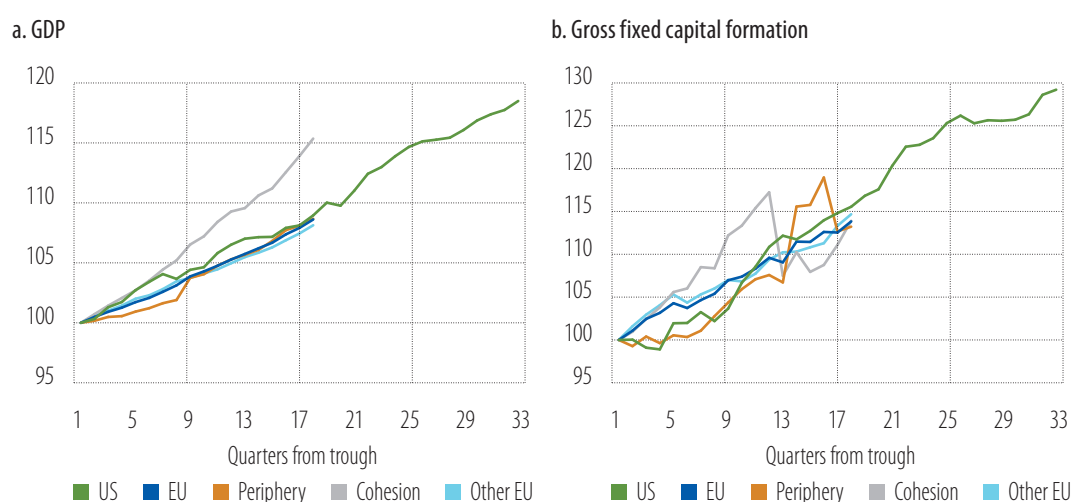
Strengthened demand has had a positive influence on labour markets and disposable income, creating a positive feedback loop for demand (Figure 1, panel b). European labour markets continued to improve throughout 2016 and the first half of 2017, and unemployment rates have steadily declined across the EU. The aggregate rate of unemployment in the EU is less than a percentage point away from the low before the global financial crisis, although significant differences remain across EU economies. Declining jobless rates have been accompanied by increasing employment rates. These rates have risen in all EU economies, bringing the aggregate employment rate in the EU to above its peak before the financial crisis. At the end of the first half of 2017, employment rates exceeded pre-crisis peaks in half of the EU economies. Aggregate annual employment growth rates in the EU and in 18 EU economies have remained positive for more than three consecutive years.

Improving labour markets and low inflation led to a steady increase in real gross disposable income of households in the EU. This improvement underpinned growth of private consumption, which reached a 10-year high in 2016. The growth rate of household real gross disposable income per capita over the past four years has also remained positive, enhancing purchasing power and strengthening private demand.

The overall economic environment in the EU provides favourable conditions for an investment expansion that could be stronger than what is currently observed. Chapter 6 provides a detailed analysis of the macro-financial environment in the EU. It outlines a gradually improving economy and outlook, with favourable financial conditions and strengthening corporate balance sheets. European banks also appear stronger and able to finance corporate investment.

EIB (2016a) argues that this recovery has been relatively weak, but this weakness is not unique to European countries. Weak investment is not unusual given the financial crisis, the ensuing sovereign debt crisis, and the accompanying deep economic recessions. Slow and gradual as it is, the recovery in most EU countries is comparable to the US recovery that started in 2009:Q2 after the Great Recession. Figure 2 plots the evolution of GDP (left panel) and gross fixed capital formation (right panel) for the US, EU, and the three EU country groups as indices normalised to equal 100 in the trough of the recession: 2009:Q2 for the US and 2013:Q1 for the EU. This comparison confirms that European economies do not underperform relative to peer economies after the recovery.

Figure 2 Real GDP and gross fixed capital formation in the EU and the US: Evolution since the last trough (index = 100 at the time of the last economic trough)



Source: Eurostat, OECD National Accounts and EIB staff calculations.

Note: Indices normalised to 100 in the quarter when the latest expansion began: 2009:Q2 for the US and 2013:Q1 for the EU.

Gross fixed capital formation in the EU increased due to the corporate and household sectors

Gross fixed capital formation has increased steadily since early 2013 in most countries in the EU. The average annual rate of growth of gross fixed capital formation in the EU since 2013 has been 3.2%, which is above the average annual growth rate of 2.75% for the period 1995–2005.¹ The improving outlook and gradually strengthening private consumption encouraged investment throughout the EU, in line with earlier findings that weak demand and outlook are the main factors behind the investment weakness in the post-crisis period (EIB, 2016a; Barkbu et al., 2015; Bussière, Ferrara and Milovich, 2017). The improving economy and outlook are also reflected in survey-based measures compiled by the European Commission. These show that consumer confidence and economic sentiment have been improving since 2013 and are at near 20-year highs.

¹ The 1995–2005 period is taken to be the reference long-term average, which excludes the investment boom and subsequent bust of the late 2000s.

Investments in machinery and equipment have been a strong driver of total investment in the countries in the Periphery and Other EU groups (Figure 3). Investments in machinery and equipment and intellectual property products have accounted for about a half of the total investment increase since 2016:Q1. This has not changed much since 2013. EIB (2016a) found that investments in machinery and equipment have been the main contributor to overall investment growth since the start of the recovery. In cohesion countries, however, such investments made a negative contribution to investment growth throughout 2016 and only a small positive contribution in the first half of 2017. The decline was the result of a high base effect in 2015. At the end of 2015, the deadline expired for payments related to European Structural and Investment Funds (ESIF) for the previous programming period. Governments and corporations concentrated investments in 2014–15 to meet the deadline, thereby producing a surge in investment in 2015 and a subsequent drop in 2016.

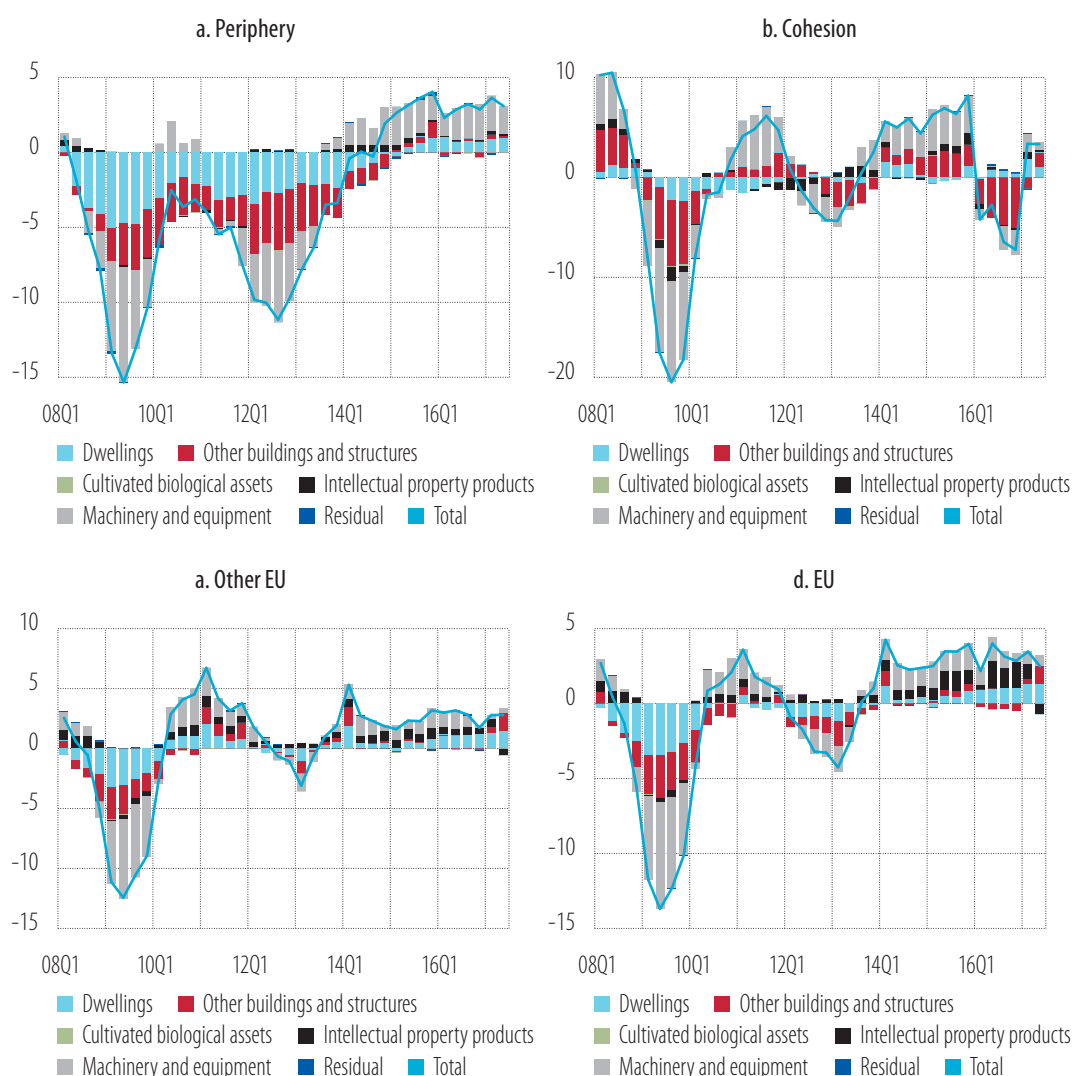
Investment in intellectual property products has positively contributed to total investment in all EU countries (Figure 3). Contributions were relatively large in the Cohesion and Other EU groups – about 20% of total gross fixed capital formation growth. They were even larger in the periphery countries, contributing 33% of investment growth since 2016:Q1. This impressive figure is influenced by investment in intellectual property products in Ireland, which dramatically increased and influenced investment aggregates for the entire group of periphery countries.² Total investment in intellectual property products in 2016 in Ireland doubled from already high levels in 2015. This increase, however, is related more to shifts of intellectual property product assets from other countries to Ireland by large firms.³

Since the beginning of 2016, investment in dwellings has also become a major contributor to the growth of total real gross fixed capital formation, after lagging behind since 2008 (Figure 3). It accounted for a third of the growth of total fixed assets between 2015:Q1 and 2017:Q2. Half of the EU economies have recorded some increase in investment in dwellings. The aggregate EU numbers, however, are mostly influenced by only a few countries: Germany, the Netherlands, and Sweden account for 52% of the total increase in investment in dwellings since the beginning of 2015. In absolute terms, the largest increases were in Malta, Sweden, the Netherlands, Cyprus, Denmark and Sweden, where investment in dwellings increased by more than 20% in 2017:Q2 relative to 2015:Q1.

2 For this reason, Figure 3 plots the aggregate for the group of periphery countries without Ireland.

3 The Central Bank of Ireland provides an estimate of the impact of these activities on investment in Ireland in its Quarterly Bulletin.

Figure 3 Real gross fixed capital formation contributions by asset type
(% change over the same quarter of previous year)



Source: National Accounts, Eurostat and EIB staff calculations.

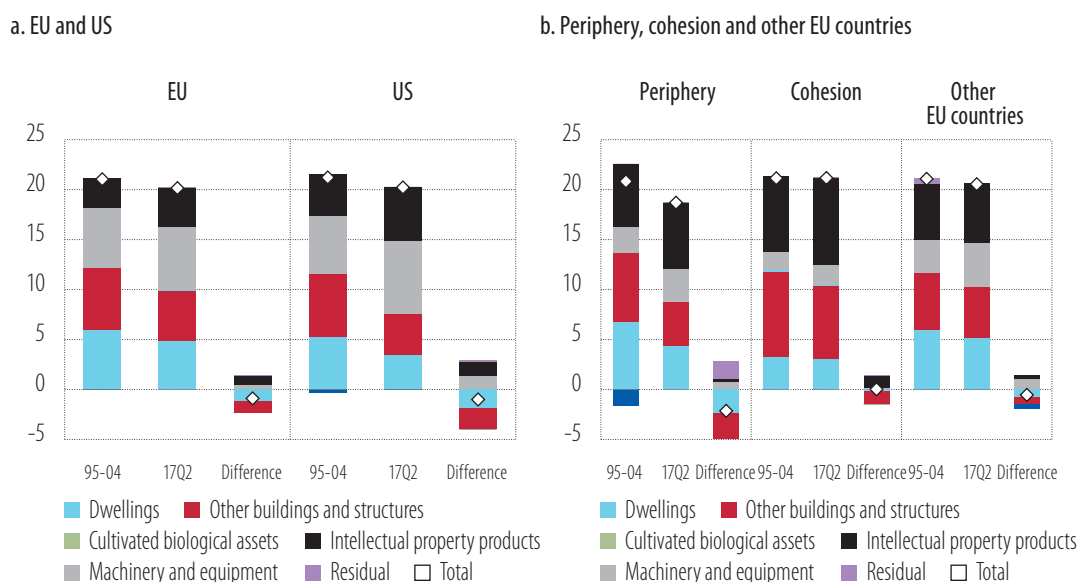
Note: Periphery without Ireland.

Investment in other buildings and structures showed a noticeable improvement in the first half of 2017. The increase is visible in most countries in the Cohesion and Other EU groups. In the periphery countries this asset type made a small (10%) contribution to the growth of investment in total fixed assets. In cohesion countries, the increase in 2017:Q2 marked a rebound after the collapse at the end of 2015: for the cohesion group as a whole, investment in this asset type fell by 14% in the course of 2016. As noted in EIB (2016a), this collapse was expected because the deadline for payments related to the ESIF for the previous programming period expired at the end of 2015. At the aggregate EU level, investments in other buildings and structures added about 17% to growth in total fixed assets in 2017:Q2 relative to a year earlier.

The recent acceleration of investment in the EU has not been sufficient to bring investment rates up to historical averages. Investment rates in most EU countries are still 1 percentage point of GDP short of the average level for the period 1995–2004 (Figure 4) and well below the pre-crisis peak in 2005–08. The exception here is the cohesion countries, most of which have exceeded the average levels of 1995–2004 because investment was still relatively low in the second half of the 1990s in many of them (Figure 4, panel b). The shortfalls, relative to historical averages, are due to lower investment in dwellings and other buildings and structures. Box 1 argues that, potentially, a part of the decline in investment rates in other buildings and structures may be permanent, while the analysis in Annex B suggests that investment in dwellings may rebound following the stronger economy. The structural decline in investment rates in dwellings due to demographics is estimated to have a relatively small share.

The negative contributions of investment in construction have been partly offset by above-average rates of investment in intellectual property products and machinery and equipment. If the EU had matched US investment rates in machinery and equipment and intellectual property products, it would have outperformed US investment growth overall. Despite their strength in most EU countries relative to investment in other asset types, European investment levels in 2017 in these areas still fall short of those in the US, where investment rates in machinery and equipment and intellectual property products were still 0.6 and 1.2 percentage points of GDP higher, respectively, than in the EU. Annex A looks at the industry composition of this gap. When it comes to investment in intellectual property products, however, the US economy is not the only comparator. The competitiveness challenge for Europe today is global and also comes from emerging markets such as China. Chapter 2 discusses this in more detail.

Figure 4 Investment rates by asset types in 2017:Q2 compared to historical levels in the EU and US (% of GDP)



Source: OECD National Accounts and EIB staff calculations.

Note: The investment rate is calculated as the ratio of gross fixed capital formation to GDP, both in national currency, 2009 chain-linked volumes for the US in US dollars and 2005 chain-linked volumes for the EU in euros.

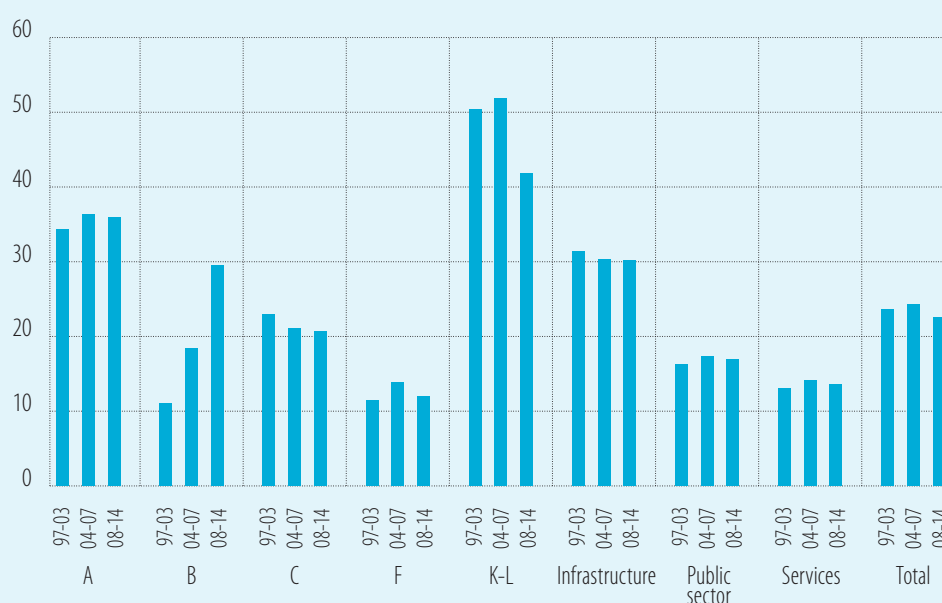
Box 1 Decomposing the change in investment intensity: an industry-level analysis

This box analyses changes in industry-level investment rates in the post-crisis period compared to their historical averages, and links these changes to structural changes in the European economy. The basis for comparison is the period preceding the investment upswing in 2004–07. This is because comparisons with the years immediately preceding the crisis can be misleading, as argued in EIB (2016a), since investment rates surged during this period in most sectors of the EU economy to well above their historical averages.

Figure 1 plots average investment rates by broad sectors of the EU economy for three periods: before the investment boom (1997–2003), during the investment boom (2004–07), and after the financial crisis (2008–14). The period between 2004 and 2007 saw surging investment rates throughout European industries relative to the late 1990s, resulting in an increase in the aggregate investment rate by 1 percentage point of GDP on average in the boom period. This average increase masks substantial cross-country variation. During 2004–07, average investment rates increased by 3 percentage points of GDP in the periphery countries and by 2.5 percentage points in the cohesion countries, driven by increases in the real estate, construction, public, and infrastructure sectors. At the same time investment rates fell by 0.5 of a percentage point in the rest of the EU, mostly driven by declines in the manufacturing and infrastructure sectors.

The dramatic decline of investment following the financial crisis in 2007 and the sovereign debt crisis in 2011–12 led to falling investment rates in most sectors of the EU economy, with the finance, insurance, and real estate sectors (industries K-L in the figure) declining by nearly 10 percentage points of gross value added relative to the preceding five-year period. While this decline was most acute in the periphery countries, it was also observed in the other EU economies despite the fact that these sectors did not experience an investment boom in the pre-crisis period.

Figure 1 Investment rates by sectors in the EU-20 (% of sector gross value added)



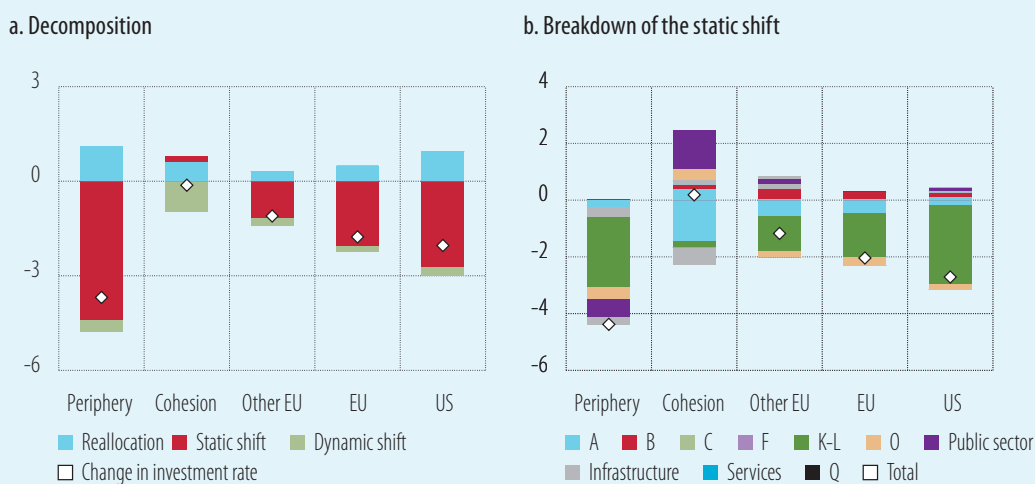
Source: Eurostat and National Accounts.

Note: Belgium, Cyprus, Denmark, Ireland, Lithuania, Malta, Poland, and Romania are not included in the EU-20 due to incomplete data. The investment rate is calculated as the ratio of real gross fixed capital formation to real gross value added. A = Agriculture; B = Mining; C = Manufacturing; F = Construction; K-L = Finance, insurance and real estate. Infrastructure = Electricity and gas (D); Water and waste management (E); Transport (H); Communication (J). Public sector = Public administration and defence (O); Education (P); Health and social work (Q). Services include the remaining private services (G, I, M, N, R, S).

The European experience is not unique. The dynamics of the total investment rate in the US have been quite similar to those in the EU. Some of the underlying drivers, however, were different there. The pre-crisis surge in investment rates was mostly due to mining, real estate, the public sector, and services, while the post-crisis decline has been mostly associated with the real estate sector.

In order to better understand these developments and disentangle structural from cyclical changes, we decompose the change in the aggregate investment rate into three components: within-industry changes in investment intensity (static shift), changes in the economic weight of the various sectors of the economy (reallocation), and a dynamic component (dynamic shift) capturing the interaction between industries' investment rates and their shares in the total economy's value added (see Annex A for details).

Figure 2 Decomposition of the change in economy-wide investment rates by sector, total fixed assets (% of sector gross value added)



Source: Eurostat and National Accounts.

Note: Periphery = Greece, Italy, Portugal, Slovenia, Spain. Cohesion = Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Slovakia. Other EU = Finland, France, Germany, Luxembourg, the Netherlands, Sweden, the UK. The investment rate is calculated as the ratio of gross fixed capital formation to gross value added, both in euros, 2010 chain-linked volumes for the EU in euros, and 2009 chain-linked volumes in US dollars for the US. A = Agriculture; B = Mining; C = Manufacturing; F = Construction; K-L = Finance, insurance and real estate. Infrastructure = Electricity and gas (D); Water and waste management (E); Transport (H); Communication (J). Public sector = Public administration and defence (O); Education (P); Health and social work (Q). Services include the remaining private services (G, I, M, N, R, S).

Average investment rates fell in 2010–14 relative to 1998–2002, and the main contribution to this fall came from the within-industry decline (static shift) of investment rates. Figure 2 plots the change in the average economy-wide investment rate in 2010–14 relative to 1998–2002, along with the contribution to this change for each of the three components from the decomposition described in Annex A for the EU, the three country groups within the EU, and the US. With the exception of the cohesion countries, the downward static shift drove investment rates in the second period below those in the first.

The downward static shift was partly offset by positive reallocation contributions that were due to high-capital-intensive sectors gaining a higher share of total economy gross value added between the late 1990s and the most recent years. In cohesion countries, the manufacturing sector increased substantially following the growth of European and global supply chains. In the periphery and other EU countries, as well as for the US, these contributions came from the finance, insurance and real estate industries and from infrastructure industries.

Part of the positive reallocation contribution of these sectors was offset by a dynamic shift in them. The reason is that some of the industries that drove the positive reallocation described in the preceding paragraph reduced their investment intensity as they expanded their shares of total gross value added. This was the case with manufacturing in the cohesion countries, and for the financial, insurance and real estate sectors in the countries of the periphery and the US. The negative contribution of the dynamic shift in the group of other EU countries came from the mining industry, which dramatically increased its investment intensity while its share in the aggregate economy shrank between the late 1990s and the most recent years.

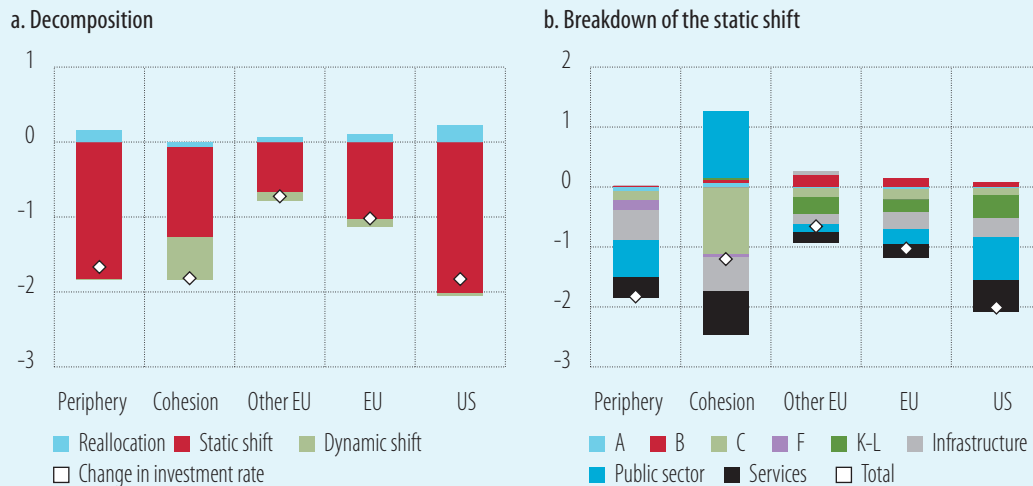
Excluding the group of cohesion countries, the largest contribution to the decline of the within-industry component (static shift) and of overall investment intensity comes from the finance, insurance and real estate industries. The static shift component is plotted in Figure 2 (panel a). The finance, insurance, and real estate industries (K-L) account for two-thirds of the change in investment intensity in the group of periphery countries, for 90% of the decline in other EU countries, and for more than the total change in the investment rate in the US. For the cohesion countries, the declines in investment intensity in the manufacturing and services industries largely exceed the decline in the aggregate investment rate. These declines were offset by large positive contributions of the public sector and infrastructure industries, possibly supported by EU structural funds, as part of EU convergence policies.

The significant decline of within-industry investment intensity in the finance, insurance and real estate industries is largely due to the decline of investment in dwellings. On average for the EU, investment in dwellings in the real estate sector constitutes about two-thirds of investment in total fixed assets.⁴ Investment in dwellings can thus account for roughly half of the decline in the total investment rate (-1.8) between 1998–2002 and 2010–14. With improvements in the housing market, some of this decline should be offset (see Annex B).

In line with the findings of the first part of this chapter, investment in other buildings and structures is the other large contributor to the decline of the rate of investment in total fixed assets. This investment accounts for 45% of the total in the periphery, 65% in the group of other EU countries, and 89% in the US. In the cohesion group it exceeds the total change multiple times over. Some of this decline is likely to remain permanent, driven by technological progress and globalisation.

⁴ This share varies across countries and over time, from 38% in Latvia to 94% in Cyprus in the post-crisis period.

Figure 3 Contribution of sectors to the within-industry component: other buildings and structures (% of sector gross value added)



Source: Eurostat, National Accounts and EIB staff calculations.

Note: Periphery = Greece, Italy, Spain, Portugal and Slovenia; Cohesion = Estonia, Bulgaria, Latvia, Slovakia, the Czech Republic, and Hungary; Other EU = Germany, Finland, France, Luxembourg, the Netherlands, Sweden, and the UK. The investment rate is calculated as the ratio of gross fixed capital formation to gross value added, both in euros, 2010 chain-linked volumes for the EU in euros, and 2009 chain-linked volumes, for the US in US dollars. A = Agriculture; B = Mining; C = Manufacturing; F = Construction; K-L = Finance, insurance and real estate. Infrastructure = Electricity and gas (D); Water and waste management (E); Transport (H); Communication (J). Public sector = Public administration and defence (O); Education (P); Health and social work (Q). Services include the remaining private services (G, I, M, N, R, S).

In the case of other buildings and structures, the static shift component accounts for virtually all the decline in investment rates. The decomposition of investment intensity for this asset type between the late 1990s and the most recent years is plotted on panel a of Figure 3. Only the group of cohesion countries differs from the others with a non-negligible negative dynamic shift. This is due to developments in the manufacturing industry and the public sector. Manufacturing reduced its investment intensity but increased its share of total gross value added, whereas the public sector increased intensity but decreased its relative share in economic activity.

The observed declines in the public sector and the infrastructure sectors (Figure 3) are another way to describe the decline in infrastructure investment documented in Chapter 2 of this report. The static shifts in these industries account for 30% of the total decline of the investment rate across the EU. For the US this number is 50%.

Despite lower investment rates, the infrastructure sector does not seem like a sector in decline, as it has increased its size relative to the total economy. All industries in this sector – electricity, water, communications, and transport – were subject to reforms, deregulation and privatisation in many EU countries in the late 1980s and early 1990s. This wave of reforms resulted in increased investment in the 1990s, so the decline in the post-crisis period may to some extent be the result of a high base effect.⁵ Another reason for this decline is the post-crisis tightening of allowed rates of return across countries and industries due to declining sovereign yields (Perrin, 2013; Grayburn and Haug, 2015). This regulatory shift and the anticipation of it have likely induced a reduction in investment by regulated industries in the post-crisis period.

⁵ Nicoletti and Scarpetta (2003) analyse the impact of reforms on productivity, growth and investment and conclude that deregulation and privatisation in the 1980s and 1990s increased productivity and growth in the sectors concerned. Alesina, et al. (2005) focus on the infrastructure industries and find that deregulation and privatisation in the sector since the 1970s have increased investment.

The downward static shifts of investment intensity in other buildings and structures in the manufacturing and services industries account for about one-quarter of the decline in the total investment rate in the EU and about a third in the US. The declines observed in services and manufacturing are unlikely to be caused only by the crisis, because investment rates in these industries had already fallen before 2008. New technology and digitalisation have had a substantial impact on these industries, reducing demand for permanent office space and the size of office space per worker. Technological progress also generated and consolidated online retailers for both goods and services, including finance, reducing the need for retail space and downtown front offices. These changes have been substantial. For instance, the share of online retail trade in total retail trade increased from 13.5% to 16.8% in the UK in just two years (from 2014 to 2016). For Germany these figures are 10% and 13.5%, respectively, while for the US they are 11.6% and 13.9%. These trends affect demand for commercial real estate and lead to the decline of investment in other buildings and structures in the real estate industry.

In addition to technology and digitalisation, the manufacturing sector has been transformed by globalisation. Global and regional supply chains have led to outsourcing and the shift in advanced countries to manufacturing pre-production and post-sales services such as product design, R&D, and customer support. The large decline in cohesion countries is the result of a base effect combined with expectations of low demand growth and the gradual catch-up of labour costs in these economies to the EU average. The base effect stems from significant investments in the 1990s and early 2000s that increased the investment rate in other buildings and structures in manufacturing in the cohesion countries. Szent-Iványi (2017) argues that the economic crisis and the changing competitiveness of cohesion countries have had structural impacts on foreign direct investment in the region. These led to a structural shift that makes focusing on cheap labour as a competitive advantage a losing strategy for the countries in the region. In order to escape this trap, countries have to create conditions for more innovative industries that capture a larger part of the value added and spur investment in the region. This change cannot be made overnight, however, and it may take some time before investment rebounds.

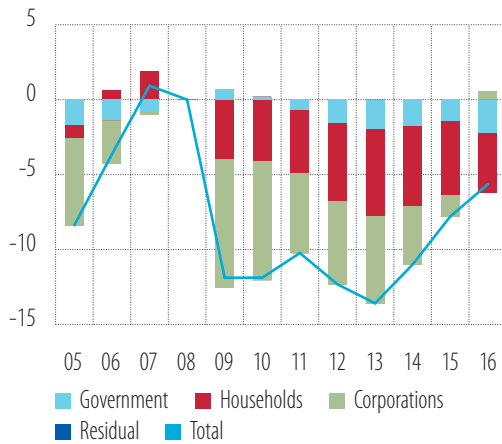
The decline in the investment rates in other buildings and structures of around 1 percentage point of GDP could remain for a long time. Assuming that the public sector and infrastructure industries do not fully reverse the declines, and taking into account the structural shifts in advanced economies brought about by digitalisation and globalisation, implies that investment rates in other buildings and structures may remain at current lower levels permanently. Even if the public sector and infrastructure industries fully recover, the decline in investment rates in other buildings and structures would still exceed 0.5 percentage points of GDP.

Focusing on the contribution of institutional sectors to total gross fixed capital formation, the corporate sector emerges as the main driver of the investment recovery (Figure 5). Real gross fixed capital formation by companies exceeded its pre-crisis level in 2016, contributing about 95% of total investment growth in 2016, while household investment contributed about 40%. These two large contributions were offset by government investment that had a negative contribution of -35%. Rates of investment by the institutional sector still show the household sector to be the largest contributor to the shortfall relative to the period 1999–2004, accounting for most of the difference.

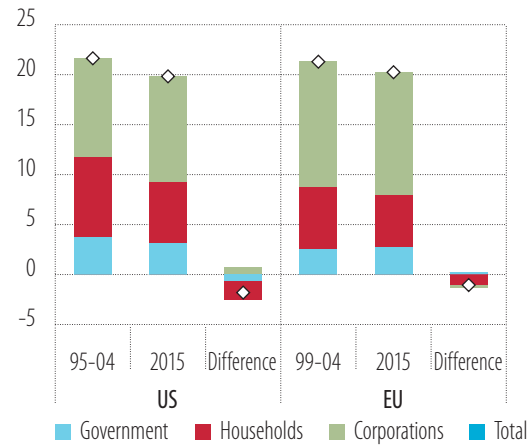
The following two sections discuss in more detail the drivers of government and corporate investment, while Annex B analyses household investment.

Figure 5 Gross fixed capital formation by institutional sector

a. Contribution of institutional sectors to investment relative to 2008 (% change)



b. Investment rates by institutional sector (% of GDP)



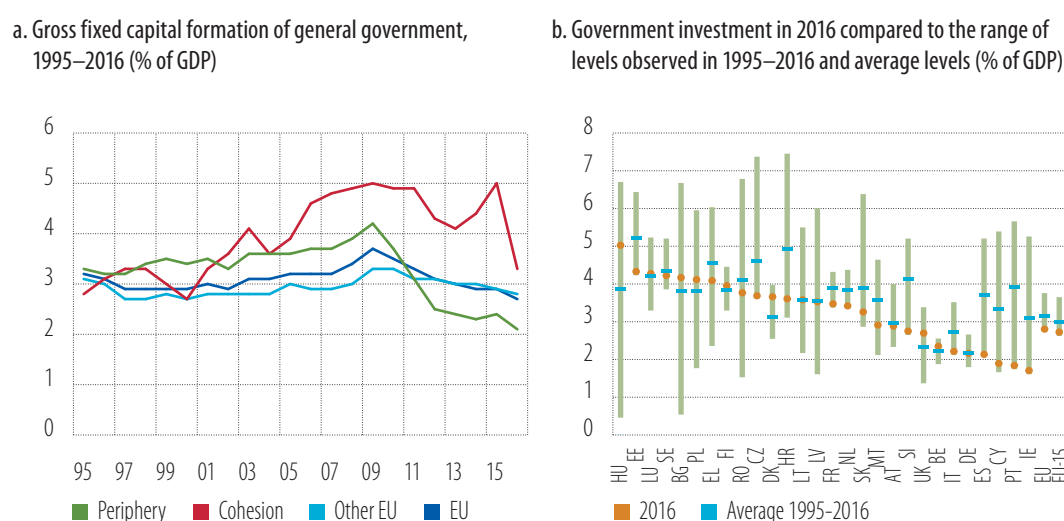
Source: Eurostat, National Accounts and EIB staff calculations.

Note: Real investment is calculated as gross fixed capital formation in current prices deflated by the total gross fixed capital formation deflator.

Government investment remains weak in most EU countries

In the EU and in the euro area, the ratio of government investment to GDP has declined steadily in recent years, reaching 2.7% of GDP in 2016 – its lowest level in the past 20 years. The economic and financial crisis had a significant impact on government finances, with varying results across the Member States. Compared to 2009 (when the ratio of government investment to GDP was 4.2%), significant and continued contractions were recorded in periphery countries, where government investment fell to 2.1% of GDP in 2016. Cohesion countries recorded relatively high government investment levels over the last decade, but also a marked contraction in 2016 linked to the cycle of the ESIF.

Figure 6 Gross fixed capital formation of the general government



Source: European Commission Macro-economic Database (Ameco).

Note: Croatia 2001–16. The green bars in panel b are the range of levels observed in 1995–2016.

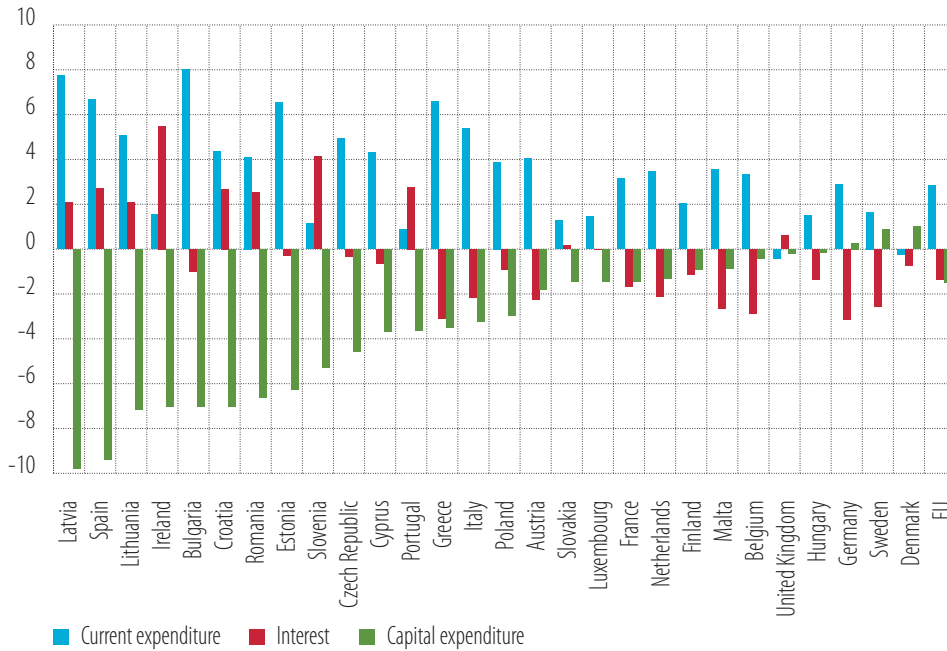
The level of government investment in the periphery and more generally in the euro area is particularly low when compared to pre-crisis and historical levels (Figure 6, panel a). This is a source of concern for the path towards sustainable growth in Europe: low government investment will inevitably be detrimental to cohesion, competitiveness and growth potential.

In 2016, government investment in Italy, Portugal, Ireland, Spain, Croatia, France and the Netherlands, was at its lowest (or close to lowest) point since 1995 (Figure 6, panel b). This is also the case for some cohesion countries, in particular the Czech Republic and Estonia, where a sizeable contraction is observable from 2015 to 2016. This is due to the end of the 2007–13 programming period of the European Cohesion Policy implementation (European Regional Development Fund and the Cohesion Fund).

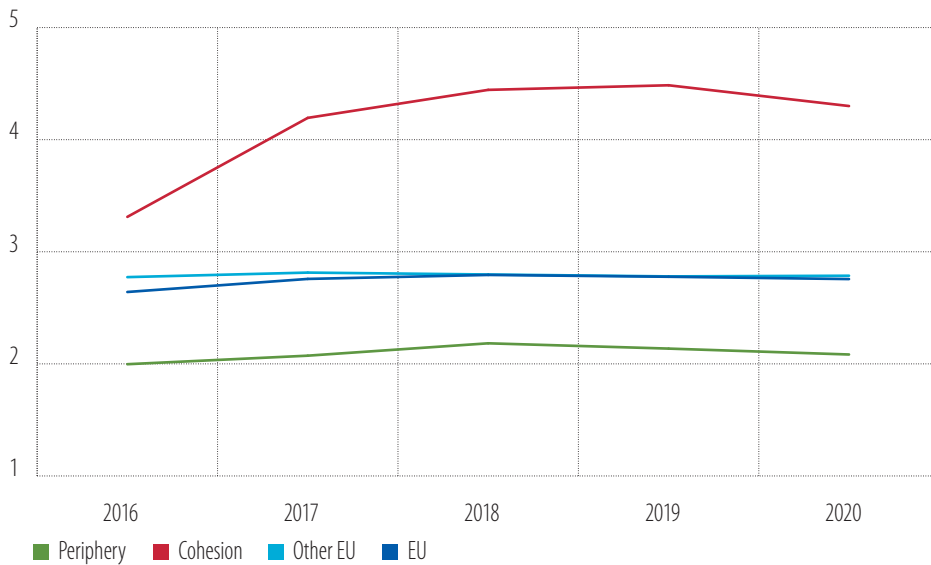
The decline in government investment was offset by increased current expenditure. This resulted in a shift in the composition of total expenditure away from capital towards current expenditure, as shown in panel a of Figure 7. In the EU, public expenditure increased from 44.7% of GDP in 2007 to 46.7% in 2016. This growth was driven mainly by social transfers, which caused an increase in current expenditure.

Figure 7 Government total expenditure and government investment (%)

a. Change of public expenditure composition 2007–16 (difference in % points)



b. Government investment (gross fixed capital formation) in 2017 Stability and Convergence Programmes (% of GDP)



Source: Eurostat, National Accounts and 2017 Stability and Convergence Programmes.

Note: The sum of the bars in panel a is zero. Greece not included.

Most EU countries slashed capital spending and financed parallel increases of current expenditure, despite an overall decline of debt-servicing expenditure (from 6% of total expenditure in 2006 to 4.7% in 2016). This resulted in large contractions of government investment financing in nominal terms (declining from 7.3% to 5.8% of the total).⁶ The shift in public spending towards current expenditure, justified mainly by the political choice to support social transfers in a context of social distress and fiscal consolidation, has contributed to the decline in capital spending.

Some structural changes in the EU economies put downward pressure on government investment. These include the narrower scope of the public sector, higher efficiency of government investment over time, lower depreciation of capital stock, saturation, and the shift from infrastructure to other growth-enhancing spending triggered by technological change. However, these changes cannot fully explain the significant fall in government investment in most countries under the current conditions, as European Commission analyses show.

Structural changes, however, do not take away important obstacles to government investment, notably (1) the relatively low political cost of downsizing/delaying government investment programmes compared to current expenditure programmes and subsidies; (2) an undervaluation of the role of government investment for growth, including its crowding-in effect in times of low growth; and (3) a set of European and national fiscal sustainability regulations that do not incentivise the prioritisation and ring-fencing of capital spending, especially at the sub-national level.

Several arguments would favour an increase in investment. For instance, according to the World Economic Forum (WEF), the quality of available infrastructure in most EU countries has declined over the past decade. The decline is particularly relevant in Germany, Belgium, Cyprus and Sweden. On the opposite side are countries where the quality of infrastructure has improved, as in many of the cohesion countries, the Netherlands, Ireland and Italy. The quality of infrastructure declined in lockstep with investment (or lack thereof) in the sector, as reported in Chapter 2, driven down primarily by the fall in government investment. EIB (2016b) argues that there are also large investment gaps in Europe in basic infrastructure. WEF-EIB (2017) argues that infrastructure is also key to simultaneously addressing competitiveness and inclusiveness issues.

Macroeconomic conditions create a good environment for government investment. From a policy perspective, given the monetary policy stance, with unusually favourable long-term financing terms, low inflation and decreasing total debt servicing costs in a number of countries, the macroeconomic impact of fiscal policy is expected to be larger than in normal times. Abiad, Furceri and Topalova (2015) show that in periods of low growth and accommodative monetary policy in advanced economies, government investment might also be supportive of debt sustainability, provided that efficient project criteria are respected, beyond having significant positive effects on economic growth. Similarly, analysis by ECB (2016) for the euro area finds large demand-side, short-run effects of increased government investment in connection with accommodative monetary policies. These benefits need to be traded off against long-term debt sustainability concerns or tax-induced output losses.

⁶ There are exceptions to this kind of expenditure shifting. Some countries, like Ireland, Slovenia and Poland, reduced capital spending in response to higher debt-servicing costs, but did not increase current expenditure. Others (France, Belgium, the Netherlands, Finland) had a lower incidence of debt-servicing in their public expenditure, but did not increase the proportion of capital spending. Germany, Sweden and Denmark remain the only EU members that increased capital spending, albeit only marginally, following the decline of the share of interest payments in total government expenditure.

The analysis of the 2017 Stability and Convergence Programmes shows that over the next few years government investment will pick up, but the increase is not sufficient to compensate for several years of subdued investment (Figure 7, panel b). This is in line with European Commission (2016) recommendations for a more positive fiscal stance in the euro area. According to current budgetary plans, general government gross fixed capital formation will increase from 2.6% in 2016 to 2.8% in 2018 and stabilise at this level until 2020, still below the average recorded from 2001–16 (3.2%). The Stability and Convergence Programmes report that total public expenditure will gradually decline from 46% of GDP in 2016–17 to 44.4% of GDP in 2020. On a positive note, some rebalancing of expenditure is expected to take place, as government investment will represent a larger share of total expenditure, reaching 6.2% in 2020 (from 5.7% in 2016). However, this is still below the 2001–16 average (6.7%).

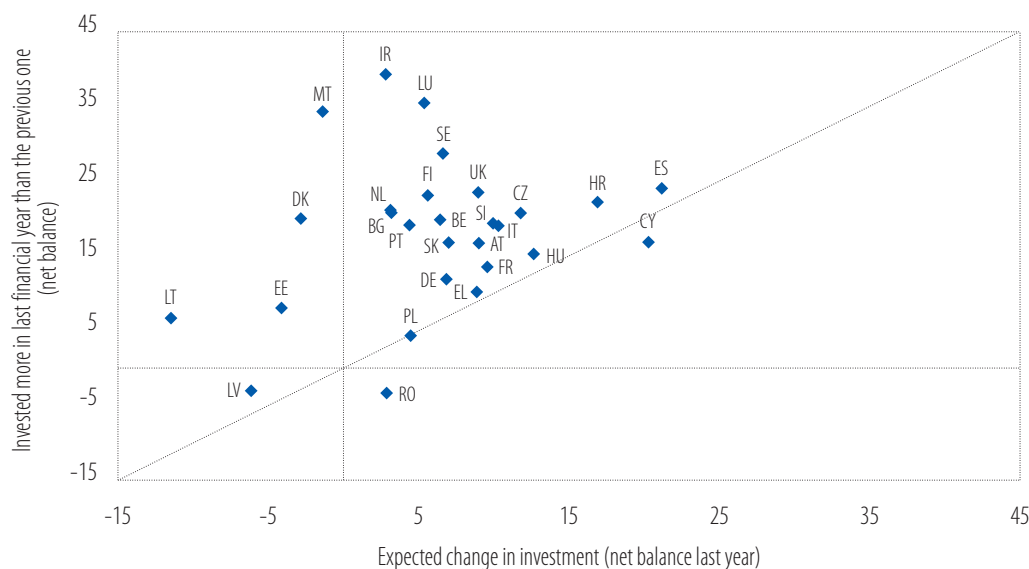
The rising share of investment in total expenditure by 2020 is largely explained by the budgetary projections of non-cohesion countries, and particularly in the periphery. In considering the euro area only, the government-investment-to-GDP ratio is expected to increase marginally in 2018 (by around 0.1 of a percentage point) before contracting again to the 2016 levels by 2020. Government investment in the periphery is expected to stabilise at around 2.1% to 2.2% of GDP, well below the long-term average (3.2% over 1995–2016). The 2017 spring forecast of the European Commission Directorate-General for Economic and Financial Affairs (ECFIN) is that the EU will register a marginal increase in government investment in 2017 compared to 2016 (by 0.1 of a percentage point, reaching 2.8% of GDP) and will be almost unchanged in 2018. In 2018, only nine Member States are projected to record a level of government investment equal to or above the level in 2007.

Corporate investment: a view from the European Investment Bank Investment Survey

Despite heightened political and economic uncertainty, business investment outperformed expectations in 2016. Figure 8 plots the net balance of firms that in mid-2015 expected to increase their investment activities in 2016 against the net balance of firms that actually did so. If realised investment had been identical to expectations, all countries would be on the 45-degree line. The figure shows that in reality – despite heightened political and economic uncertainty surrounding, for example, key referenda in Italy and the UK – realised investment in 2016 turned out generally better than anticipated.⁷

The countries that outperformed expectations the most were Luxembourg, Malta, Ireland and Sweden. Investment came in below expectations only in Romania and Cyprus, albeit in the latter case relative to very positive expectations. From a sectoral perspective, service sector firms and firms active in the infrastructure sector exceeded expectations the most – very much consistent with a largely consumption-driven recovery (see the first section of this chapter).

⁷ Data are preliminary for the Czech Republic, Slovakia, Lithuania, Romania, Poland, Sweden and Belgium.

Figure 8 Correlation of expected versus realised investment (in %)

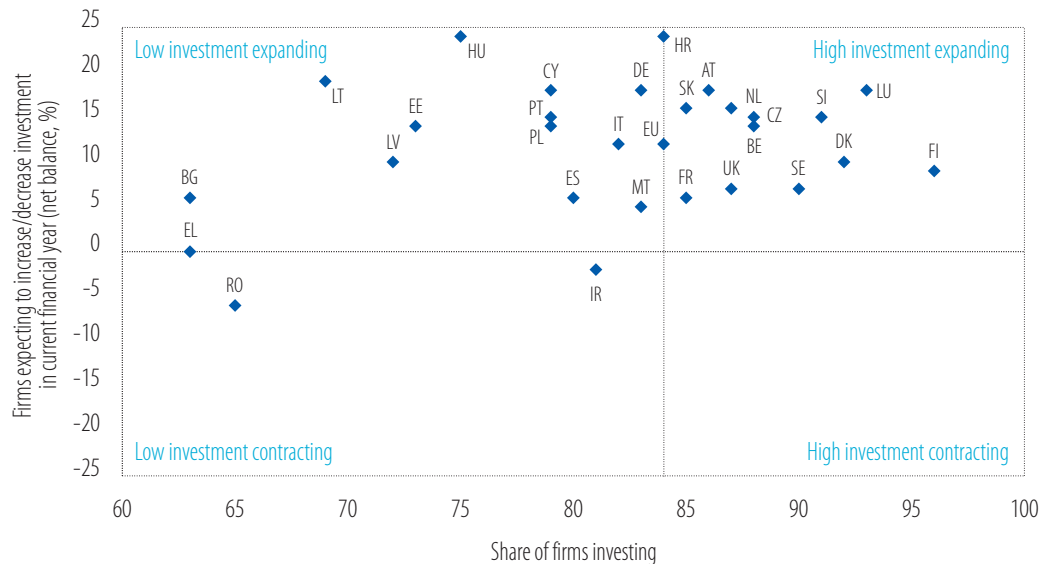
Source: EIBIS2016 and EIBIS2017.

Note: Base: All firms. Expectations are derived from two questions. Firms that had invested in the last financial year were asked if they expected to invest more, around the same amount, or less than last year. Firms that had not invested in the last financial year were asked if they expected to invest in the current financial year. Realised investment is derived from the response to the following question: "Overall was this more, less or about the same amount of investment as in the previous year?"

For 2017, firms expect a continued expansion of investment activities. The new wave of the European Investment Bank Investment Survey (EIBIS) data places the large majority of EU countries in the upper half of the investment cycle, which means that more firms expect an expansion of investment activities in 2017 than a reduction (Figure 9).

For countries located in the top left quadrant – such as the Baltic States, Cyprus, Portugal and Spain – the positive investment outlook implies a broadening of the investment recovery from still relatively low shares of investing firms. For countries in the top right quadrant – which include Slovenia, Luxembourg, Denmark and Sweden – the outlook implies further improvement of an already relatively broad-based investment upswing.

Romania and Ireland are the only countries with a somewhat less optimistic investment outlook. In both of these countries, the share of firms expecting an expansion of investment activities in 2017 is lower than the share of firms expecting a reduction. While in the case of Ireland this can be interpreted as a normalisation of investment activities after a year of stronger-than-expected investment, in Romania firms' pessimism reflects a rapidly deteriorating economic outlook.

Figure 9 Outlook for the investment cycle

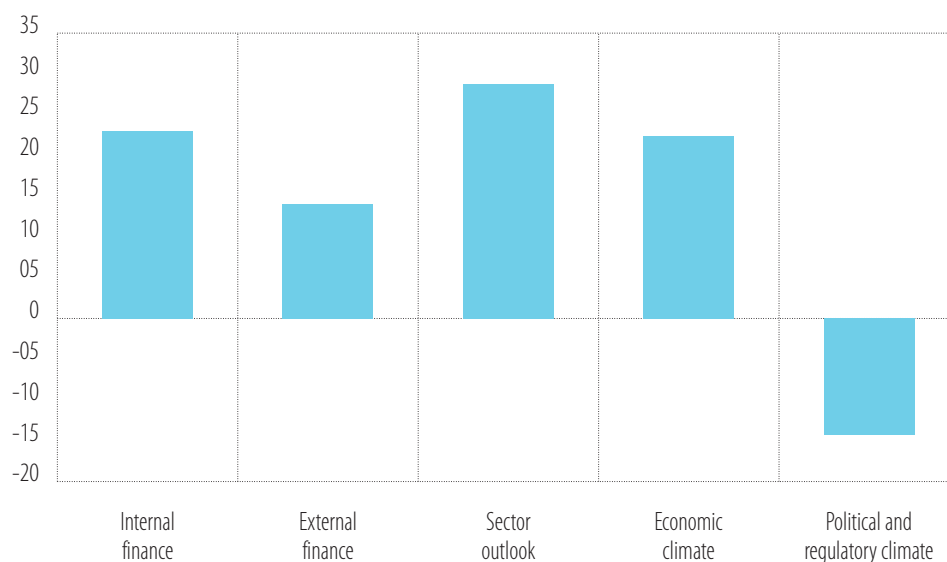
Source: EIBIS2017.

Note: Base: All firms. Share of firms investing shows the percentage of firms with investment per employee greater than EUR 500. The y-axis crosses the x-axis at the EU average. Net balances show the differences between firms expecting to increase investment activities in the current financial year and firms expecting to decrease them.

The overall positive investment outlook is supported by an optimistic business outlook, expectations of a strengthening macroeconomic situation, and continued easing of financing conditions (Figure 10). Looking at the next 12 months, firms are very positive about their sector-specific business outlook, with about 30% of firms, on net, expecting an improvement. In particular, construction sector firms and firms active in the manufacturing sector believe that their business outlook will improve in the next 12 months, whereas service sector firms are somewhat more conservative in their outlook.

Expectations about the macroeconomic situation are also largely positive, with firms in Finland leading the pack in this respect. When it comes to access to finance, firms expect both internal financing and access to external finance to improve in the coming year. Firms in Spain are most upbeat with regard to their internal financing capabilities going forward, and firms in Cyprus, Ireland, Croatia and Spain are optimistic in terms of changes in access to external finance. Greece is the only country not expecting any improvement in terms of internal or external access to finance.

The political and regulatory environment is the only factor weighing negatively on firms' investment activities. Firms believe, on net, that the political and regulatory environment will deteriorate in the next 12 months (-14%). This is true in particular for firms active in manufacturing and for larger firms. From a cross-country perspective, firms in Greece, Belgium, the UK and Poland are most concerned about imminent adverse changes to the political and regulatory environment. Only firms in France and Portugal expect an improvement in net terms in the political and regulatory environment for the coming year.

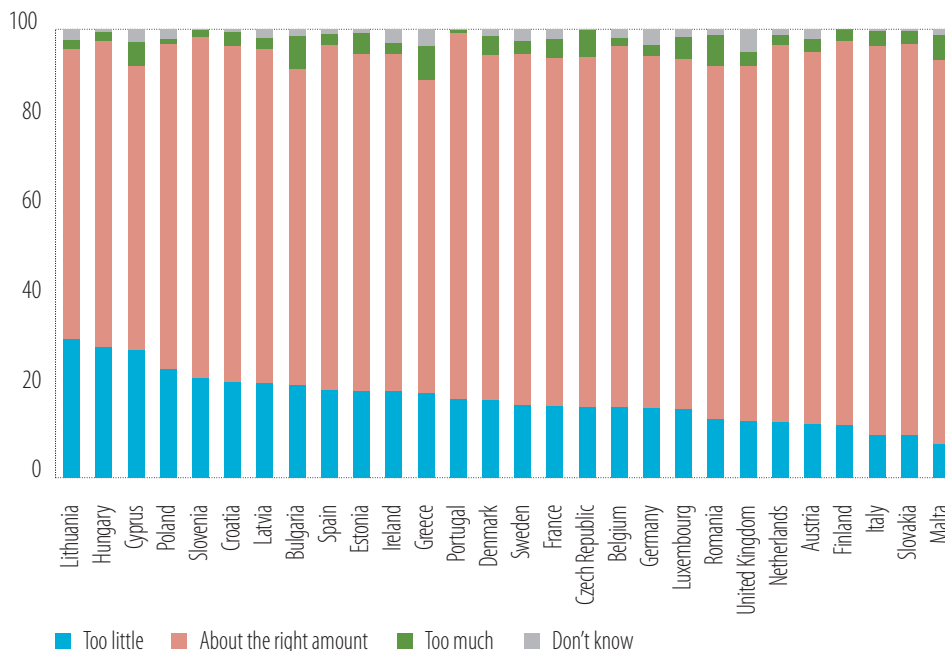
Figure 10 Drivers of investment (Net balance %)

Source: EIBIS2017. Base: All firms.

Q: "Do you think that each of the following will improve, stay the same, or get worse over the next 12 months?"

Despite a positive investment situation, perceived investment gaps remain largely unchanged. The share of firms that consider their investment activities to have been below their needs over the past three years has remained constant. Looking back at their investment activities over the past three years, 15% of firms stated that their investment activities were below their needs. This is identical to the share of firms that reported under-investment in the previous year.

The net balance of firms that state that they invested too much minus those that say that they invested too little is highest in the manufacturing and construction sectors (at -15 percentage points and -11 percentage points, respectively). Firms in Lithuania, Hungary, Cyprus and Poland show the largest perceived investment gaps from a cross-country perspective (with net balances of between -29 percentage points and -23 percentage points), while firms active in Malta, Romania and Italy display the smallest gaps (-2, -6 and -6 percentage points).

Figure 11 Reported investment gaps

Source: EIBIS2017.

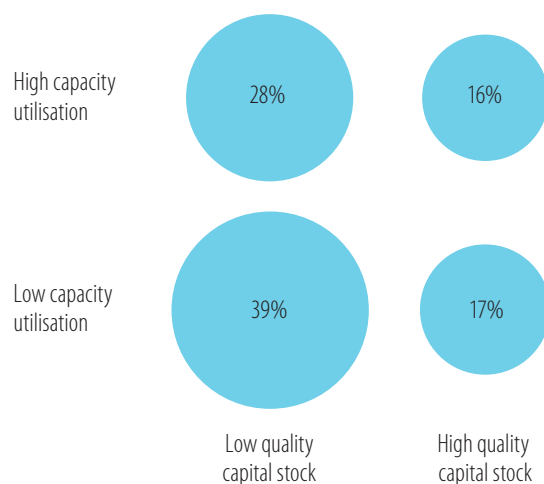
Note: Base: All firms.

Q: "Looking back at your investment over the last three years, was it too much, too little, or about the right amount to ensure the success of your business going forward?"

Perceived investment gaps are closely correlated with the quality of firms' capital stock (but not so much with the quantity). In line with the findings presented in EIB (2017), the new wave of EIBIS data shows that firms operating at or above capacity are no more likely to report an investment gap (and, if anything, less likely).

Instead, two out of three firms that say that they have under-invested in the last three years also say that most of their machinery and equipment is dated (that is, no longer up to the latest available standards). What this suggests is that what firms have in mind when they report under-investment in fact has little to do with capacity constraints, but rather reflects a fear of falling behind in terms of competitiveness.⁸

⁸ See Box 2 for more details on the link with the quality of firms' capital stock and how this relates to firm performance.

Figure 12 Reported investment gaps - drivers

Source: *EIBIS2017.*

Note: *Base: All firms that report having invested "too little" in the past three years. Firms are placed in the high-quality capital stock grouping on the basis of whether they report 50%+ of their machinery and equipment to be state-of-the-art.*

Q1: *"In the last financial year, was your company operating above or at the maximum capacity attainable under normal circumstances?"*

Q2: *"What proportion, if any, of your machinery and equipment including ICT, would you say is state-of-the-art?"*

While the positive investment environment helps close perceived investment gaps, an improving economic outlook works in the opposite direction, leaving overall perceived investment gaps unchanged. A simple regression analysis shows that both changes in investment activities and changes in the economic outlook affect how firms assess their past investment activities relative to needs.⁹

While an increase in firms' investment activities tends to reduce the likelihood that firms report an investment gap, improvements in the economic outlook work in the opposite direction – leading, all else being equal, to a higher likelihood that firms report an investment gap.

The intuition for the second finding is that as firms' economic outlook improves, they tend to adjust their assessment of future needs upward (while past investment remains, of course, unchanged). This leads to a widening of the perceived gap between future needs and past investment and, hence, a higher likelihood for firms to report under-investment.

This analysis holds equally for firms operating at or above capacity and firms operating below full capacity. This result suggests that when firms revise their future needs upward in light of an improving economic outlook, they make their decision in terms of both quantity of capital stock (capacity) and quality of capital stock (productivity-enhancing investments).

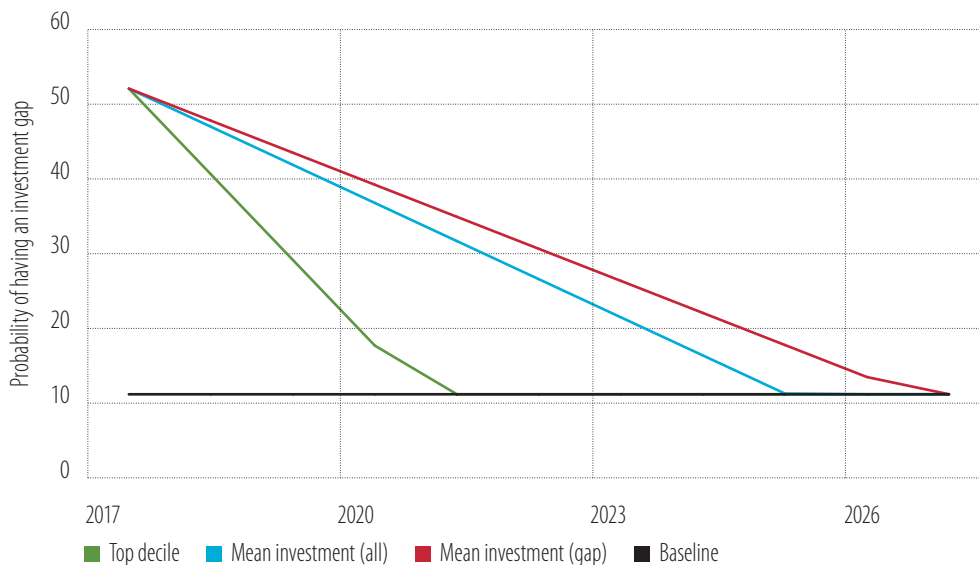
⁹ We regress whether firms report an investment gap on (1) whether they reported one last year; (2) their investment activities in the last financial year; (3) an interaction term between (1) and (2); (4) the change in economic outlook from the previous year; and (5) a set of control variables.

Even under fairly optimistic assumptions, it will take between four and 10 years for perceived investment gaps to narrow. Taking the results of the analysis above, Figure 13 plots how long it would take for perceived investment gaps to largely disappear. Specifically, it shows the time needed for a firm that reports an investment gap today to be no more likely to report one going forward than a firm that does not report an investment gap today. (We consider the latter to be a more realistic benchmark for a narrowing investment gap than, say, a zero likelihood of reporting an investment gap going forward.)¹⁰

The figure shows that for perceived investment gaps to largely disappear, it will take between four and 10 years, depending on what is expected to happen to firm investment activities going forward.

If firms that report a gap today increase their investment activities from 20% of total fixed assets at present to about 90% (which corresponds to the top decile across all firms), it will take about four years to narrow the perceived investment gap to the baseline level. A more realistic scenario in which firms increase their investment activities to 30% (or the mean of all firms) implies a minimum of eight years. Should investment activities continue at the current rate, it will take even longer (until 2027).¹¹

Figure 13 Time necessary to narrow existing investment gaps



Source: EIBIS2016 and EIBIS2017.

Note: The lines show – for different assumptions about firms' investment activities going forward – how long it would take for the likelihood of firms that report a gap today converging to the same likelihood of reporting a gap tomorrow as a firm that does not report a gap today.

¹⁰ The likelihood of a firm that reported an investment gap last year also reporting one today is 51%. This compares to 11% for a firm that did not report a gap last year.

¹¹ The analysis assumes that firms' overall economic outlook remains unchanged. If, instead, we assume that the economic outlook continues to improve, the time necessary to narrow existing investment gaps (to the baseline level) is longer.

Box 2 Capital profiles in EIBIS2016

Technological progress is embodied in new capital goods, so research, development, and innovation investments in the manufacturing of capital goods drive overall productivity development in the manufacturing industry to a great extent.

Traditionally, capital accumulation models have treated all capital goods as equal: that is, the quality and productivity of capital goods is considered homogeneous. In reality, capital stock is composed of different vintages of capital goods, the performance of which depends on their age because of technical development. Many capital goods deteriorate with time; they become partly or fully dysfunctional or obsolete and hence may deter the full-scale usage of complementary capital goods or cause labour productivity to deteriorate. Moreover, the ageing process varies by the type of technology embedded in the capital good.

A vintage capital model addresses this challenge. At the same time, it offers a tool to analyse the impact of obsolescence, investment volatility, optimal investment policies, economic growth and technology adoption. Central to the model is the assumption of technological progress being embodied in new capital goods, which makes creative destruction endogenous in the model. In equilibrium it would be optimal to scrap old capital goods and replace them with new and more productive goods. While the process involves simultaneous creation and destruction, investments are replacement investments. Over time the investment pattern appears uneven or “lumpy”.

Research into vintage capital has largely remained theoretical due to technical and accounting problems in constructing a vintage capital stock in the national accounts framework. In theory, it would be built by subtracting capital sold/scrapped from net fixed capital formation. However, the problem would be the impossibility of knowing what the vintage of the sold and/or scrapped capital is and which vintage the maintenance and repair activities address. In addition, the output would be the net vintage capital.

There are, however, empirical results at the plant level supporting the theoretical outcomes. For example, around 60% of aggregate output growth in the US is due to investment-specific technological progress (Greenwood, Hercowitz and Krusell, 1997); investments occur in infrequent bursts (Doms and Dunne, 1998), being more common in times of high economic activity (Cooper, Haltiwanger and Power, 1995); and plants with more advanced technologies grow faster and are more likely to survive (Doms, Dunne, and Roberts, 1995). The speed at which capital is becoming obsolete has accelerated over time, emphasising the need for faster and continuous capital modernisation and replacement (Jovanovic and Rousseau, 2005). Consequently, the older the capital stock, the more likely are investments in (new) capital goods (Cooper, Haltiwanger and Power, 1995). Bahk and Gort (1993a) found a strong negative correlation between output and the average age of capital. In the first five years after adoption of new technology, employment increases, but then starts to decline thereafter (Davis, Haltiwanger and Schuh 1996), whereas positive productivity effects may appear with a lag as learning-by-doing is required for the new technology to reach peak efficiency (Greenwood and Yorokoglu, 1997; Hornstein and Krusell, 1996).

This analysis focuses on characterising capital profiles of countries and industries as well as comparing firms with different capital profiles. It relies on the 2016 European Investment Bank Investment Survey (EIBIS), combining two questions on the share of state-of-the-art capital.¹²

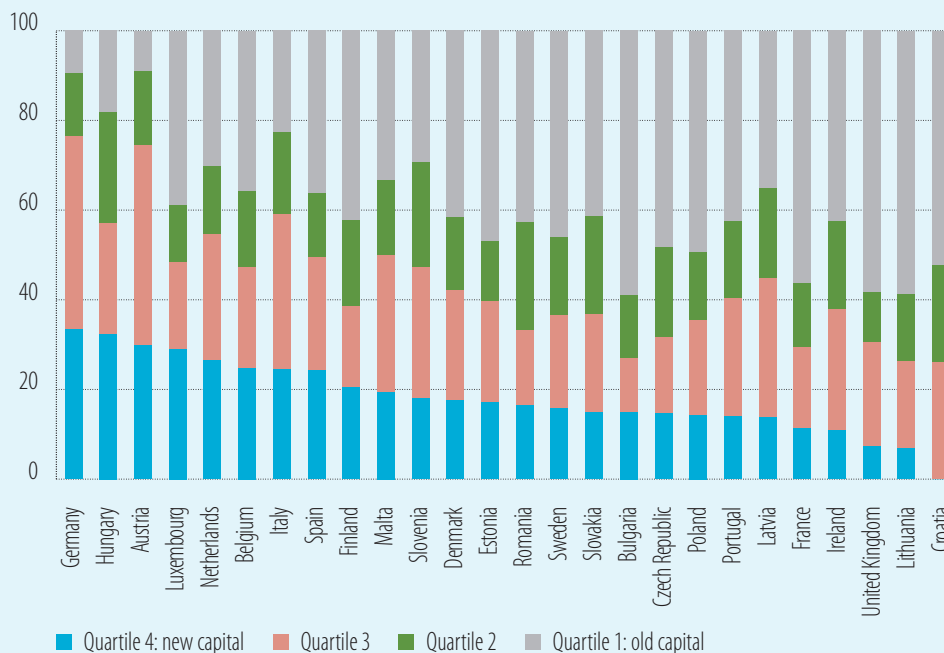
¹² The EIBIS questions on vintage capital stock are (1) “What proportion, if any, of your machinery and equipment, including ICT, would you say is state-of-the-art? By state-of-the-art I mean cutting edge or developed from the most recent ideas or methods”; and (2) “If the exact figure is not known, could you estimate the percentage?”

This provides a rough estimate of the age distribution of the capital in a firm. Even if the current measurement tool is imperfect, it allows for dividing firms into two categories:

- 1) Quartile 1 (Q1) – Old capital stock profile (“laggards”): firms with less than 25% of machinery and equipment being state-of-the-art.
- 2) Quartile 4 (Q4) – New capital stock profile (“leaders”): firms with at least 75% of machinery and equipment being state-of-the-art.

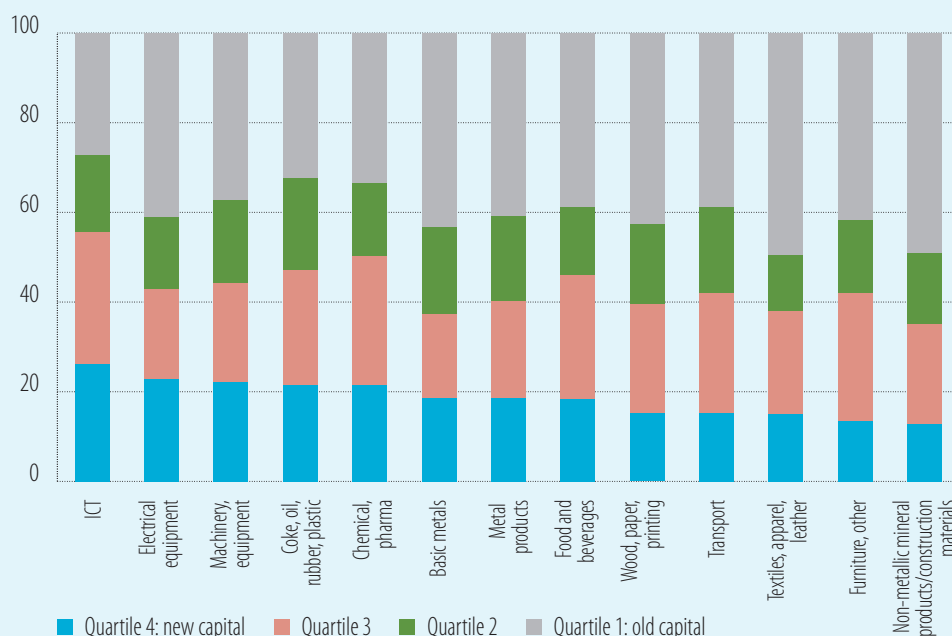
The data confirm some of the stylised facts presented above. Capital profiles by country (Figure 1) indicate that over a quarter of firms in Germany, Hungary, Austria, Luxembourg and the Netherlands belong to the top quartile, implying that they have the new capital stock profile. On the contrary, over half of firms in Bulgaria, Lithuania, the UK, France and Croatia fall into the bottom quartile, thus having a relatively older capital stock.

Figure 1 Capital profile by country



Source: EIBIS2016 and author's calculation.

Capital profiles by industry (Figure 2) rank information and communications technology (ICT), manufacture of electrical equipment, and manufacture of machinery and equipment as having the highest share of firms in the top quartile. By contrast, manufacture of textiles, apparel and leather goods, manufacture of non-metallic mineral products and construction materials, and manufacture of basic metals have the highest share of firms in the bottom quartile.

Figure 2 Capital profile by industry

Source: EIBIS2016 and author's calculation.

Note: ICT = information and communication technologies.

Table 1 presents additional statistics indicating that firms with old capital profiles acknowledge that they invested too little in the last three years. Among bottom-quartile firms, 31.3% reported investments that were too low, whereas among top-quartile firms only some 10% considered that they had invested too little. Satisfaction with the last three years' investments was higher among top-quartile firms, with 87.2% confirming having invested about the right level, whereas the corresponding figure for firms with an old capital profile (Q1) was 64.2%. Furthermore, firms with a new capital profile (Q4) are associated with less frequently shrinking employment than firms with an old capital profile. Overall the previous year's results were more often positive (negative) in top-quartile (bottom-quartile) firms.

Among those firms that had invested in the previous year, the investment more often increased employment in top-quartile firms (Q4), but more frequently decreased it in bottom-quartile firms (Q1). Hence, it might be possible that the positive employment effects are observed with a shorter delay in firms with a new capital profile. Underlying reasons could be related to the experience gained by frequently investing firms in implementing learning-by-doing processes and adjusting existing machinery and equipment to work in sync with the new capital goods to maximise the benefits of the new investment. It might also be that the firms in the bottom quartile invest in old technologies in order to ensure interoperability between new acquisitions and existing old capital goods.

Similarly, it is interesting to see how firms with different capital profiles perceive the obstacles to investment. Availability of finance is reported as an obstacle more often by bottom-quartile firms than by top-quartile firms. Similarly, uncertainty about the future tends to restrict willingness to invest more in bottom-quartile firms than in top-quartile firms.

Table 1 Enterprise behaviour by capital profile

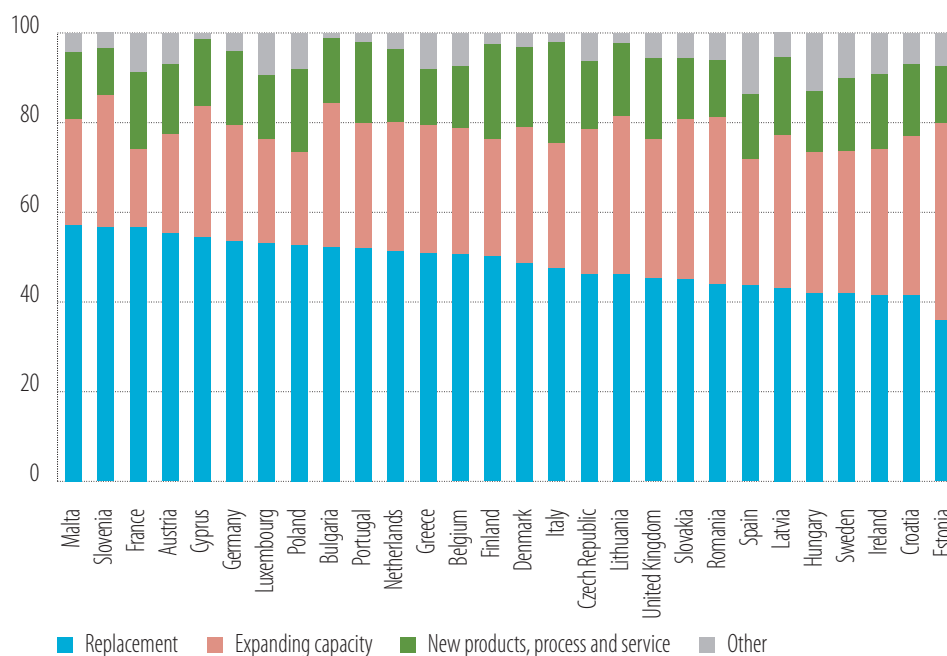
		Share of firms (%)	
		Profile Quartile 1 – Old capital stock profile	Profile Quartile 4 – New capital stock profile
Employment	Lower than three years ago	27.8	14.1
	Too much	4.16	2.96
Satisfaction with investment level in last three years	Too little	31.3	9.9
	About right amount	64.2	87.2
Impact of previous year's investment on employment	Increase	22.3	33.4
	Decrease	7.4	1.6
Profit before tax	Pre-tax profit	72.3	87.2
	Loss	19.9	6.6
Major obstacles to investment	Availability of finance	27.7	14.6
	Uncertainty about the future	44.3	28.2

Source: EIBIS2016.

Note: All differences between Quartile 1 and Quartile 4 are also statistically significant when country and industry are controlled for.

Firms with old capital (Q1) are characterised by decreasing employment, worse financial results, and overall weaker prospects. Due to the cross-sectional nature of the data, it is difficult to prove causality between the capital profile and the recorded outcomes. However, some support for causality is offered by the observation that bottom-quartile (Q1) firms that have invested in the previous year are characterised by a lower employment effect of the investments this year.

In sum, these statistics emphasise the role of continuous capital investments, the importance of availability of finance across all manufacturing industries, and the fact that investments tend to be more associated with positive outcomes when flowing into capital of the latest vintage, consequently highlighting the benefits of being a “leader”. The investment focus of firms continues to be on replacing existing capacity (Figure 14). On average, 50% of firms' investment spent in the last financial year went into the replacement of existing buildings, machinery, equipment and information technology (IT). This was more or less the same as in the previous year. Investments in capacity expansion and innovation also remained largely constant, at 27% and 17%, respectively.

Figure 14 Investment by investment purpose (% of investment)

Source: EIBIS2017.

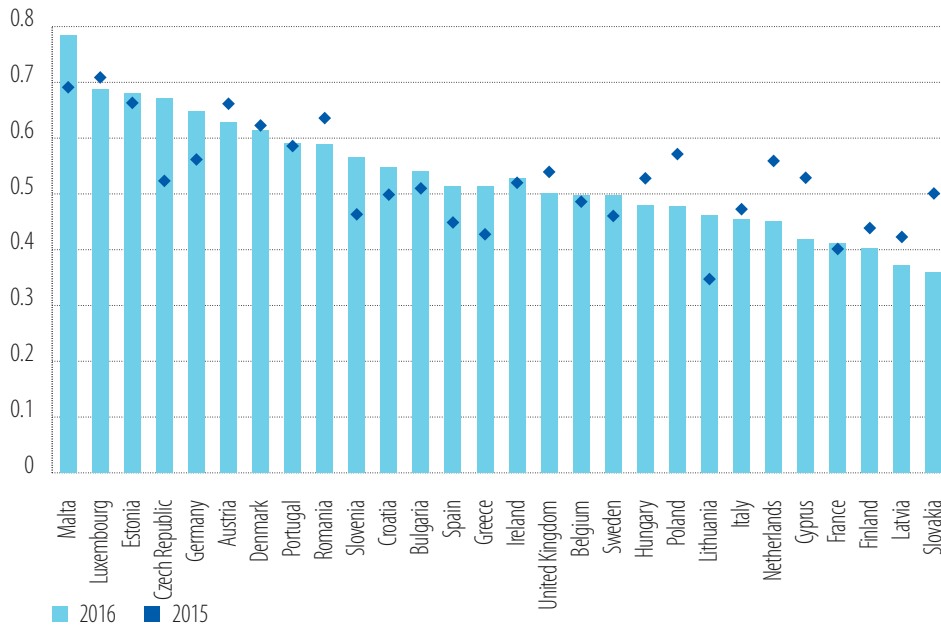
Note: Base: All firms that invested in the last financial year.

Q: "What proportion of total investment was for (a) replacing existing buildings, machinery, equipment, IT; (b) expanding capacity for existing products/services; (c) developing or introducing new products, processes, services?"

The (only) countries likely to see upward pressure on their existing capacity going forward are Malta, Luxembourg and, to a lesser extent, Austria. Previous research shows that firms tend to allocate a larger part of their investment activities to capacity expansion when utilisation rates are high and firms' business outlook is favourable.

While firms' business outlook improved over the last year, the share of firms operating at or above capacity remained relatively constant (+1 percentage points) (Figure 15).

Figure 15 Share of firms operating at or above capacity (% of firms)



Source: EIBIS2016 and EIBIS2017.

Note: Base: All firms.

Q: "In the last financial year, was your company operating above or at the maximum capacity attainable under normal circumstances?" Full capacity is the maximum capacity attainable under normal conditions, for example, a company's general practices regarding the utilisation of machines and equipment, overtime, work shifts, holidays, etc.

Combining the information on firms' business outlook with that on their current levels of capacity utilisation, Figure 16 shows that, in the coming year, upward pressure on firms' capacity will be high (at best) in Malta, Luxembourg and, to a lesser extent, Austria, whereas firms in Latvia, Lithuania, and Greece are likely to continue to struggle to fill (existing) capacity.

Figure 16 Capacity utilisation and firms' sector-specific business outlook (%)

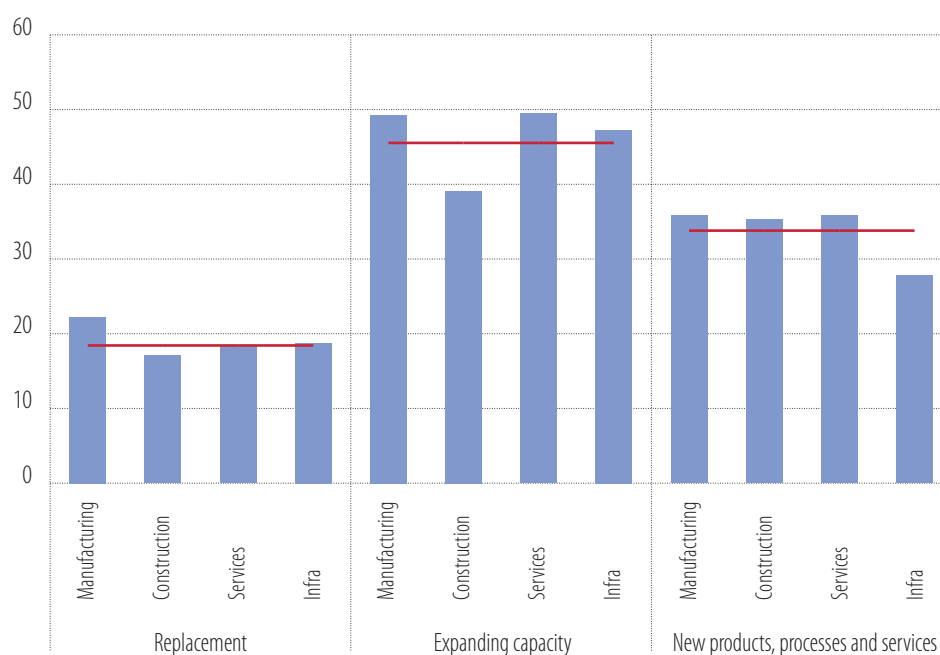


Source: EIBIS2016 and EIBIS2017.

The (continued) focus on replacement implies a low employment elasticity of investment activities going forward. Figure 17 shows that while firms report a positive employment effect of their investment activities on average, this effect is significantly lower for firms allocating the biggest share of their investment outlays to the replacement of existing machinery, equipment and IT than it is for firms focusing on innovation or the expansion of existing capacity.

This result holds across all sectors, and also if we control for country, sector and size fixed effects in a regression framework.

Figure 17 Employment change associated with investment in different areas (Net balance)



Source: EIBIS2017.

Note: Base: All firms. The red line indicates the average across sectors.

Q: "How much, if at all, do you expect the number of employees in your business to increase or decrease as a direct effect of your investment in the last financial year? Please count employees who were and will be recruited as a direct result of your investment and subtract all employees who were and will be rationalised."

Lack of staff with the right skills is now the most frequently cited obstacle to investment in the EU. The EIBIS asks firms about (absolute) obstacles to investment in their countries of operation. Whereas "uncertainty about the future" topped the list of issues in the first wave of the survey, it has now been overtaken by "lack of staff with the right skills" (which previously came in second).

Overall, 72% of firms cite lack of staff with the right skills as an obstacle to their investment activities. This is followed by uncertainty about the future (with 71% of mentions), and business regulation (63%). Access to finance is in seventh place (with 44% of mentions) after labour market regulation (62%), high energy costs (56%), and lack of demand (47%).

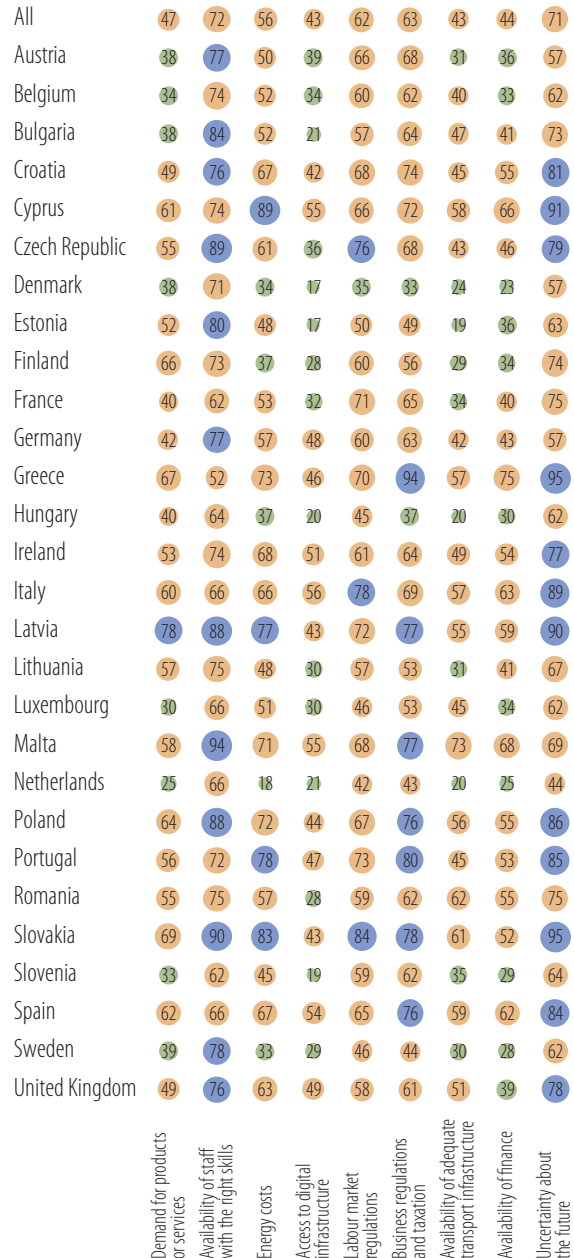
There are few differences in the order of obstacles across countries. Figure 18 summarises the share of firms citing each area as either a minor or major obstacle to investment by country. It illustrates that while the share of firms citing a certain barrier to investment differs across countries, the order in which issues are listed is broadly the same across countries.

Compared to the previous year, lack of staff with the right skills, labour market regulation, and (lack of) access to digital infrastructure all became more important in the most recent survey. Lack of staff with the right skills became more important in most countries, with the countries that saw the largest increase being Cyprus, the Netherlands and Belgium (albeit from relatively low levels in all three cases).

Labour market regulation saw significant increases in particular in Germany, Cyprus and the Czech Republic. Lack of access to digital infrastructure increased considerably in Germany, Malta and the United Kingdom.

The cyclical upturn of European economies improved their economic and business outlooks but also exposed their structural weaknesses. Despite the significant variation across countries, the share of firms seeing business and labour market regulations as impediments to their investment activities has increased in most EU economies. This underlines the importance of addressing these issues by making labour markets more flexible, reducing product and service market regulations, and optimising regulation to become more transparent and business-friendly.

Figure 18 Obstacles to investment by country



Source: EIBIS2017.

Note: Base: All firms. The size of the circle indicates the relative importance of the obstacle.

Q: "Thinking about your investment activities in #country#, to what extent is each of the following an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all?"

Note: A blue circle means that the share of mentions of a particular obstacle is in the top quartile; a green circle means that it is in the bottom quartile; and an orange circle means that it is between the two. The size of the circle and the number inside indicate the share of firms mentioning an area as either a minor or major obstacle.

An in-depth analysis shows that “lack of staff with the right skills” often refers to a “lack of high-skilled staff”. Box 3 explores what firms might have in mind when they cite lack of staff with the right skills as a barrier to investment. Drawing on the literature, we first develop a typology of “lack of staff with the right skills” and then employ a clustering analysis to see which types prevail where. The findings suggest that most often lack of staff with the right skills refers to a lack of high-skilled staff, but it can also refer to mismatches between the skills found in the labour force and those sought by employers, in particular for lower levels of skills.

From a geographical perspective, the results suggest that there are shortages of staff in the Baltic States and the Czech Republic, while larger economies, including Germany, France and the UK, are struggling more with skill mismatches. The share of firms looking for high-skilled staff is higher than the share of firms searching for low-skilled staff in most countries. However, there is also a significant unsatisfied need for low-skilled labour in many countries, with Sweden leading the pack in this respect.

More research is needed to understand the drivers of “lack of skilled staff”. To the extent that close to all investment in education is local, whereas the returns on these investments accrue at the European or even the global level – either through labour mobility or the mobility of ideas – a promising avenue for further exploration is whether national investment in education should be complemented by supranational funds (similar to the case of research and development).

Addressing the issue of lack of staff with the right skills is a pressing task, but it cannot be accomplished overnight. The short-term response can be rather limited. Experience suggests that key factors for success include boosting training (with the close involvement of the business sector) and standardising and constantly reviewing curricula in light of ever faster-changing skill requirements. The longer-term response necessarily involves reforming the education and training systems to refocus them away from preparing people to spend their career in one or two workplaces.

Box 3 Lack of staff with the right skills

“Lack of staff with the right skills” is perceived to be the most important obstacle to investment by European companies. It is cited as a barrier to investment by around 70% of all firms. However, it remains unclear what firms have in mind when they report a lack of staff with the right skills as an obstacle to investment.

On the one hand, this may refer to a lack of individuals with a very high level of education. The fact that high-tech firms (based on the Eurostat high-tech classification) and firms in innovative sectors (based on the OECD innovation-intensity ranking) cite lack of staff with the right skills more often than other firms (70% and 76% versus 65% and 65%, respectively) seems to suggest this interpretation.

On the other hand, the survey data also show that firms that report lack of staff with the right skills as a barrier to investment tend to invest a lot abroad. To the extent that this could reflect at least to some degree a strategy to address a lack of staff with the right skills at the lower end of the skill spectrum, it would suggest that (for some of these companies) “lack of staff with the right skills” may refer to a lack of low-to-medium-level skills.

Delineating what “lack of staff with the right skills” may mean

Given this ambiguity in the data, and building on the literature (Green et al., 1998), we postulate that there are (at least) five different possibilities that firms may have in mind when they report a “lack of staff with the right skills” as a barrier to investment. They may be referring to (1) a lack of available workers per se (a skill shortage) or (2) a mismatch of available and sought-after skills (a skill mismatch). The former would be a situation found in tight labour markets, meaning that even though the workforce generally comes with the right skills, workers are short in supply. The latter situation would be one in which the sought-after skills differ from those generally available in the workforce. Furthermore, both types can prevail at the high end of the skill distribution (3) or the low end (4). Finally, some firms might report a lack of staff with the right skills out of general unhappiness with their economic situation (5).

Identifying firms with the different types of “lack of staff with the right skills”

To get an idea of the type of lack of staff with the right skills firms have in mind when they report this as a barrier to investment, we apply a two-step approach. First, on the basis of the types of lack of staff with the right skills identified in the previous section, we select a series of variables that we expect to be associated with these categories. In the second step, we apply a clustering algorithm to divide firms into different groupings on the basis of these variables. The algorithm will do so given firms’ proximity to each other with respect to each of the variables specified.¹³

Once the clustering is run, we can compare the firms that ended up together in each grouping and see whether their similarities in terms of characteristics correspond to what we would have expected given our ex ante reasoning and, if that is the case, how prevalent each type of lack of staff with the right skills is across countries/sectors etc.

Linking types of lack of staff with the right skills to variables

With regard to the first step, we postulate that the different types of lack of staff with the right skills are correlated by and large with whether firms that report this as an issue are high-tech firms, export, experience wage pressure, invest a lot in training, direct their investment activities into capital deepening (investments with a low labour elasticity) and/or invest abroad (Table 1).

Table 1 Lack of staff with the right skills for different types of firms

Skill level	Mismatch	Shortage
High level of skills	High-tech firms; exporting firms	Exporting firms
Lower level of skills	Wage pressure; training	Capital deepening; direct investment
Misreporting: capacity utilisation, multiple obstacles named		

The intuition is the following: If “lack of staff with the right skills” is primarily about high-skill mismatches, we would expect relatively more exporting and high-tech firms to report a lack of staff with the right skills as an obstacle to investment.

¹³ More precisely, we rely on a hierarchical cluster analysis using the Wards algorithm and the Grower dissimilarity measure to perform the cluster analysis. We choose Wards because this algorithm delivers more homogeneous cluster sizes, and we use Grower because we have both categorical and continuous variables in our cluster.

Exporting firms tend to be higher-productivity firms that generally need employees with higher levels of skills. The high-tech variable helps us distinguish between mismatches and shortages: insofar as the high-tech sector is more likely to require very specialised skills (for example, nano-engineering skills rather than just engineering skills) it is more likely to face issues of mismatches than high-productivity, non-high-tech firms.

If “lack of staff with the right skills” is about low-skill mismatches, on the other hand, we would expect more firms with a high share of investment in training and also high employment costs to report a lack of staff with the right skills as an issue.

To the extent that it is possible for individual firms to address skill mismatches (but not shortages) at low levels of skills through investments in training and education, we would expect this type of lack of staff with the right skills to be associated more with firms with higher training outlays.

The same is not true for mismatches at high-skill levels. A large literature has shown that higher costs of training, and consequently higher losses if an employee leaves the company after the training, make training activities a less effective and less common approach to addressing skill mismatches at the higher end of the skill spectrum than at the lower one.

If “lack of staff with the right skills” is about low-skill shortages, we would expect to see relatively more firms with a low labour elasticity of investment and/or investment activities abroad among those that report a lack of staff with the right skills as an obstacle. The intuition for this is that, in this situation, firms should want to substitute away from the scarce factor (labour) towards the one that is more readily available (capital) and/or tap foreign labour markets to address their shortages.¹⁴

Misreporting due to a general unhappiness with the economic situation should result in relatively more firms with low capacity utilisation and a high frequency of mentions of other areas as obstacles to investment among those that report a lack of staff with the right skills as an obstacle.

Which types prevail where?

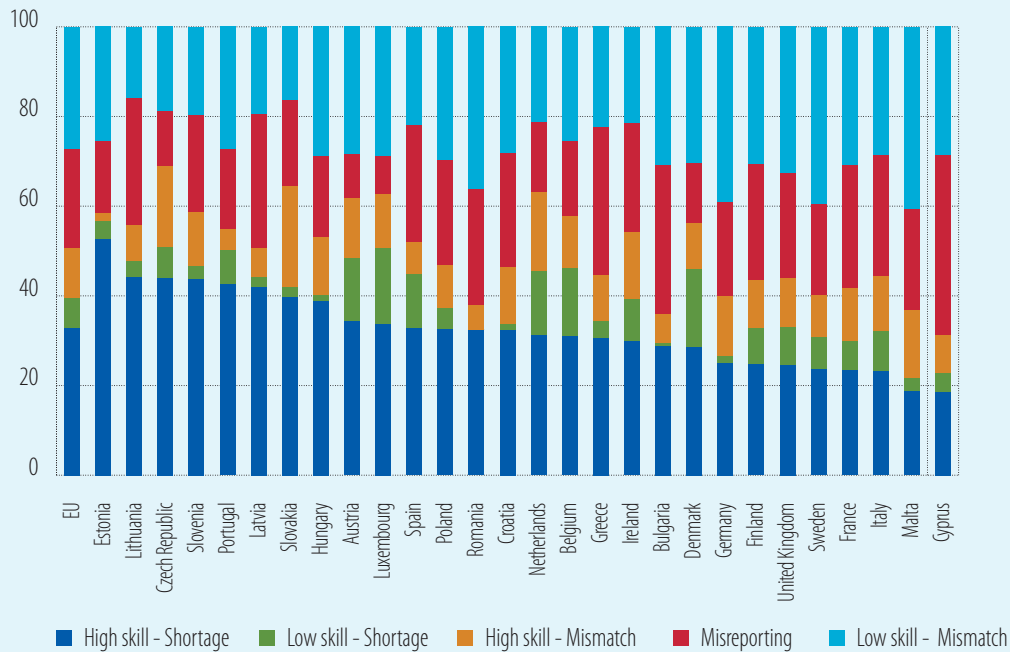
Our cluster algorithm divides firms into the five groups. Despite the fact that the variables used are only rough proxies, each one of the groups corresponds to one of the types of “lack of staff with the right skills” postulated above (see Table 1 for details).

If we plot the results of this exercise by country, we find that countries in the Central, Eastern, and Southeastern Europe (CESEE) region tend to have relatively high shares of firms that fall into one of the two high-skill staff categories (Figure 1). Sweden is the only country with a significant share of firms in the two low-skill categories.

We find a rather diverse pattern with respect to skill mismatches. The results for larger economies like France, Germany and the UK indicate that skill mismatches are likely to be a more prevalent problem there, as they also are in Sweden, Malta, Bulgaria, Romania, Cyprus and Greece.

In the Baltic countries, the Czech Republic, Portugal and Spain, on the other hand, staff shortages seem to be more prevalent in particular for higher levels of skills. The countries with the highest shares of misreporting firms are Bulgaria, Cyprus and Greece, with a share above 30%.

¹⁴ In order to control for sector/country differences, we used the residuals after a regression of this variable on country and sector fixed effects.

Figure 1 Different kinds of “lack of staff with the right skills” by country

Source: EIBIS2017 and EIB staff calculations.

Policy implications

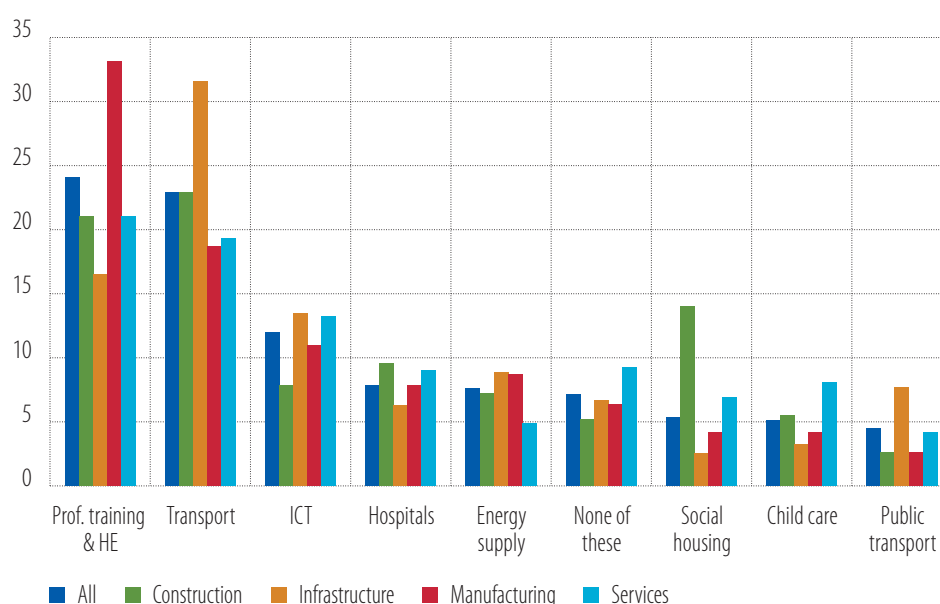
While the results of this analysis should be taken as indicative only given the approximative nature of the approach, we find evidence suggesting that the two most prevalent issues of “lack of staff with the right skills” are shortages of high-skilled staff and skill mismatches at the lower end of the skill spectrum. While the problem of too low numbers of high-skilled staff could be solved by higher tertiary education rates and higher educational spending, addressing mismatches for lower skills raises the question of whether existing educational programmes can be better tailored to the needs of the market.

Free movement of people within the EU means that investment in skills and knowledge that is financed by national public budgets may pay off elsewhere, something that EU Member States that have recently joined the Union have intensely experienced. Thus a promising avenue for further research is whether national investment in education and skills-building should be complemented by supranational funds, similar to the case of research and development.

In line with firms' concern about a lack of staff with the right skills, investment in professional training is the policy area cited most frequently by firms as deserving particular policy attention going forward. In the second wave of the EIBIS, firms were asked – for the first time – which area of public investment they would want to see prioritised most. Firms could choose between transport infrastructure, public transportation, hospitals and care, child care, professional training and higher education, information and communications technology (ICT) infrastructure, energy infrastructure, and social housing.

The area cited most frequently by firms was professional training and higher education: overall, 24% of firms cited this as the most important policy area for public investment, followed by transport infrastructure (mentioned by 22% of firms) and ICT infrastructure (12%). Manufacturing sector firms placed the most emphasis on professional training and higher education; infrastructure firms, on the other hand, were more concerned about transport infrastructure.

Figure 19 Public investment priorities



Source: EIBIS2017.

Note: Base: All firms. ICT = information and communication technologies. HE = Higher education.

Q: "From your business's perspective, if you had to prioritise one area of public investment for the next three years, which one would it be?" Policy areas add up to 100% minus don't know/refused responses.

From a cross-country perspective, firms in Bulgaria, the Czech Republic and Austria cited professional training and higher education most frequently (Table 1). Within countries, it was often larger firms that cited professional training and higher education as the main policy priority for the coming years.

Transport as a policy priority featured most prominently in Romania and Slovenia (with more than 40% of mentions). This was followed by Malta and Luxembourg (with 37% and 33% of mentions, respectively). ICT infrastructure was most frequently cited by firms in the Netherlands, Ireland and Spain. A survey of 555 municipalities that was carried out in parallel with the EIBIS firm-level survey further shows that perceived infrastructure gaps in the ICT sector are often associated with capacity constraints and needs for modernisation, whereas in other infrastructure sectors gaps primarily concern repair and replacement (see Chapter 2 for details).

Energy infrastructure is of particular concern to firms in Slovakia, Slovenia, Hungary and Greece. When correlating the various energy-related questions with each other, we find that firms that cited energy infrastructure as a policy priority often consider high energy costs to be a barrier to investment, thus providing some intuition for the result.

Table 1 Public investment priorities by country (%)

	Transport	Public transport	Information and communications technology	Child care	Professional training and higher education	Hospitals	Energy supply	Social housing	None of these
Slovakia	20	0	6	2	32	7	24	2	4
Slovenia	42	1	6	1	14	6	16	4	10
Hungary	15	2	6	2	26	13	14	1	18
Greece	15	4	16	5	11	16	12	1	10
Belgium	28	6	9	2	23	8	11	2	7
Spain	26	3	19	1	18	7	11	1	9
Finland	32	2	11	5	24	7	11	5	1
Italy	22	6	14	4	17	8	11	4	11
Lithuania	12	4	3	14	32	16	10	2	3
Estonia	18	0	14	2	28	6	9	1	11
Cyprus	5	7	10	9	6	39	9	5	6
Portugal	18	8	7	5	22	16	9	4	9
Poland	32	5	7	2	16	11	9	3	14
Austria	16	5	7	7	34	8	7	6	4
Netherlands	27	3	20	2	22	6	7	4	7
Latvia	32	1	4	6	31	9	7	1	7
Germany	19	5	10	10	30	4	7	6	3
Bulgaria	22	5	4	7	35	8	7	1	5
Malta	37	9	6	3	18	11	7	1	8
UK	28	3	13	4	17	13	6	7	6
Ireland	16	4	20	4	11	15	6	18	4
Croatia	17	4	18	7	26	10	6	3	6
Denmark	29	3	10	7	23	5	6	5	7
Sweden	28	3	10	3	23	6	6	7	9
France	16	5	11	2	32	8	5	6	12
Czech Rep.	26	6	9	6	34	3	5	4	4
Luxembourg	33	11	16	4	16	6	3	7	2
Romania	47	3	3	5	19	11	1	3	7

Source: EIBIS2017.

Base: All firms.

Q: "From your business's perspective, if you had to prioritise one area of public investment for the next three years, which one would it be?" The table shows the share of firms that name each area as a policy priority. Cells highlighted in green received less than 5% of mentions; cells in orange between 5% and 10%; and cells in pink more than 10%.

Overall, Figure 18 also shows the relevance of the business environment as an obstacle to investment. Some 63% of European firms consider business regulation and taxation to be an impediment, while some 62% consider labour market regulation to be so. As the analysis in Chapter 10 shows, labour market regulation in particular is influencing the efficient allocation of resources in terms of both labour and capital. Constraints are particularly felt in some countries and some sectors. The strengthening of the EU semester recommendations in incentivising reforms in those areas is thus important.

Conclusion and policy implications

Investment in Europe was one of the major casualties of the 2007 global financial crisis and the ensuing sovereign debt crisis. Gross fixed capital formation declined abruptly across the EU and remained below pre-crisis levels for a long time: at the end of 2016, aggregate investment in the EU was still some 4% below its pre-crisis peak.

The weakness of investment activity in the wake of the financial crisis was expected, as the financial system had to be mended and all sectors of the economy were in need of balance sheet adjustment and repair. The sovereign debt crisis in Europe reinforced the negative consequences of the global financial crisis and slowed down the investment recovery.

Ten years after the beginning of the global financial crisis, the European economy is on an expansionary path. Aggregate demand has improved in a virtuous loop, with improving labour markets and growing employment. Investment has increased, driven by the corporate sector and recently by the household sector. While still below historical averages, investment rates are gradually increasing, driven by solid contributions of investment in machinery and equipment and intellectual property products.

The economic recovery has not yet put pressure on corporate production capacity. Rather, firms are worried that their capital needs to be updated and its quality upgraded in order to move closer to the best available technology and stay competitive. This perception of being behind the curve may take many years to overcome despite strengthening investment activity, as this chapter has argued.

As the economy improves, the lack of workers with relevant skills has become a key concern for firms, overtaking uncertainty as the most often mentioned impediment to investment activity. This obstacle is difficult to tackle in the short term. Incentivising and supporting targeted training programmes both within firms for existing staff and for job seekers might be the only feasible policy action to address the problem immediately. This can only be part of a longer-term solution, however. EU economies also need policies to address structural problems in their labour markets and in education and professional training. The old model of preparing and training people to work in the same place and in the same profession throughout their working lives seems outdated today. Education and professional training should be oriented to life-long learning, preparing people to easily and quickly adapt to rapidly changing job content, disappearance of whole professions, and emergence of new jobs requiring new skills.

The general government is the only institutional sector where investment has remained weak and has been a drag on the investment recovery over the past few years. Political choices prioritising current expenditure at the cost of capital expenditure prove detrimental to perceptions about infrastructure quality and availability of adequate infrastructure services. As the worst effects of the financial crisis and the economic recession wane, governments should refocus their priorities on investment because productive investment increases future productive potential and prospective government revenue.

Failure to address the problems outlined here will not only drag down current investment, but will also hurt the future competitiveness of the European Union.

Annex A. Decomposition of investment-rate changes

The economy-wide investment rate changes when industries change their specific investment rates and when the relative shares of industries with different investment intensities change. It is not possible to disentangle these two effects only by examining the contribution of each sector-specific investment rate to the total change. The analysis in this annex therefore employs a decomposition that is similar to the dynamic shift-share analysis used in regional studies. In particular, the change in the investment rate over two periods is decomposed into three elements: a within-industry (static) shift, cross-industry reallocation, and a dynamic shift.

In the equation, the economy-wide investment rate in period t is denoted by $x_t = \frac{I_t}{GVA_t}$ and the share of value added of industry s in the total in period t by $p_{s,t} = \frac{GVA_{s,t}}{\sum_{s=1}^n GVA_{s,t}}$, where I_t is investment in period t and GVA_t is gross value added in period t . Then one can express the economy-wide investment rate as a weighted average of industry-specific investment rates:

$$\frac{I_t}{GVA_t} = \sum_{s=1}^n x_{s,t} p_{s,t}.$$

We are interested in understanding the change in the economy-wide investment rate over time. With the help of some algebraic transformations, the change in the investment rate can be expressed as:

$$x_t - x_{t-1} = \underbrace{\sum_{s=1}^n x_{s,t-1} (p_{s,t} - p_{s,t-1})}_{\text{Reallocation effect}} + \underbrace{\sum_{s=1}^n p_{s,t-1} (x_{s,t} - x_{s,t-1})}_{\text{Static shift}} + \underbrace{\sum_{s=1}^n (x_{s,t} - x_{s,t-1}) (p_{s,t} - p_{s,t-1})}_{\text{Dynamic shift}}.$$

The first term on the left-hand side measures the effect of the change of the industrial composition of the economy (the reallocation effect), holding fixed the investment intensity in the benchmark period. The second term collects the total of within-sector changes of investment intensities (the static shift effect), weighted by the industries' respective shares of economy-wide gross value added in the benchmark period. This element of the decomposition therefore gauges the effect of within-sector changes in investment intensity, holding fixed the industrial composition of the economy to its value in the benchmark period. Finally, the last term measures the dynamic effect. It is positive if growing (declining) industries increase (decrease) their investment intensity and negative otherwise.

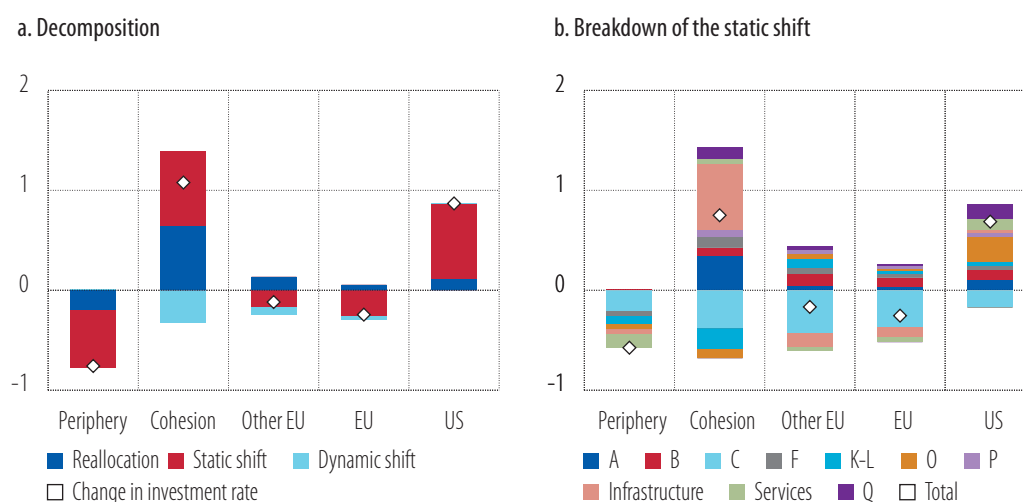
This decomposition is applied to data on gross fixed capital formation and gross value added by one-digit NACE Rev. 2 sectors for 20 EU countries in 2010 chain-linked volumes in euros, and for the US in 2009 chain-linked volumes in US dollars. We have excluded eight EU economies due to missing data for the period of the analysis. We use 19 of the 21 one-digit industries and our economy-wide investment represents the sum of industries used. Due to missing data in many countries, we exclude industries T (Activities of households as employers) and U (Activities of extraterritorial organisations and bodies).

To focus on the change between the post-crisis period and the late 1990s, we exclude the period between 2003 and 2007. Furthermore, to reduce the impact of cyclical economic fluctuations, we take averages over periods. Thus we compute the decomposition for the change in the average investment rate during the period 2010–14 over the average investment rate during the period 1998–2002. We check the robustness of the results by varying the span of the post-crisis period and the pre-boom period, and the results are qualitatively similar.

Figure 4 in the main text of the chapter underlines the special role of investment in machinery and equipment and intellectual property products in the US: investment rates in these two asset types have grown much more than in the EU and have underpinned the US recovery. The decomposition outlined above gives additional insights into the forces driving this difference between the EU and the US.

Figure A1 plots the decomposition of investment rates in machinery and equipment. Investment rates in the EU have declined in the post-crisis period relative to the late 1990s, whereas in the US they have increased. The decline in the EU has been driven by falling within-industry investment rates (static shift) in most countries outside the cohesion group. In the US, the static shift was positive for most industries. Investment rates in cohesion countries grew due to both reallocation to industries with higher usage of machinery and equipment and because industries have increased their investment rates for this asset type.

Figure A1 Contribution of sectors to the within-industry component: machinery and equipment



Source: Eurostat, National Accounts, and EIB staff calculations.

Note: Periphery = Greece, Italy, Portugal, Spain, Slovenia. Cohesion = Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Slovakia. Other EU = Finland, France, Germany, Luxembourg, the Netherlands, Sweden, the UK. The investment rate is calculated as the ratio of gross fixed capital formation to gross value added, both in euros, 2010 chain-linked volumes for the EU in euros, and 2009 chain-linked volumes for the US in US dollars. A = Agriculture; B = Mining; C = Manufacturing; F = Construction; K-L = Finance, insurance and real estate; O = Public administration and defence; P = Education; Infrastructure = Electricity and gas (D); Water and waste management (E); Transport (H); Communication (J). Services = G, I, M, N, R, S. Q = Health and social work.

The manufacturing sector has been driving the decline in investment in machinery and equipment across countries, including the US. This, together with the observation that investment rates in manufacturing dropped well before the financial crisis (see Figure 1 in Box 1 in the main text), suggests that the decline is not of a cyclical nature. The decline of investment intensity of this asset type accounts for roughly 10% of the decline in investment intensity for total fixed assets in the EU.

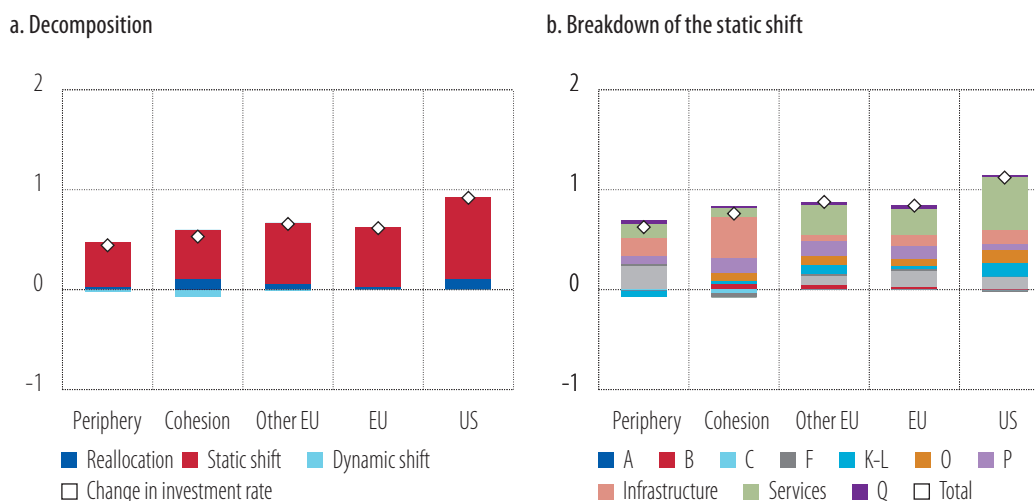
The remarkable increase in the investment rate in the US has been largely driven by the public sector. Public administration and defence (O) and education (P) industries accounted for about a half of the increase. Agriculture (A), mining (B), and health and social work (Q) also contributed to the increase. Investment intensity in the public sector grew substantially between 2000 and 2008 relative to the late 1990s. It fell somewhat in the post-crisis period, but remained well above the levels in the 1990s. While rates in public administration and defence have fallen slightly since 2008, investment rates in education have continued increasing. Investment rates in services rose significantly after 2008, reaching a 20-year maximum in 2015. Machinery and equipment investment in agriculture also experienced a boom after 2008, increasing by 10 percentage points of gross value added of the sector.

The academic literature has identified investment in information and communications technology (ICT) equipment, which is part of machinery and equipment, as a catalyst of productivity and economic growth. According to the OECD, the US is the global leader in investment in this asset type as a share of GDP. Assuming that the increase identified in Figure A1 is driven by ICT equipment, one can expect that productivity and quality of service improvements in these industries may give further competitive advantage to the US relative to the EU. Breakdowns of machinery and equipment into ICT and non-ICT by industry, however, are not available.

Finally, investment rates in intellectual property products have increased in all countries and nearly all sectors relative to the late 1990s. In the US the increase is nearly 1 percentage point of gross value added, while in periphery and cohesion countries it is closer to 0.5 of a percentage point. Most of the difference with respect to the late 1990s is explained by a static shift, that is, a within-industry increase of investment rates (Figure A2). In the US and the Other EU economies group, the main contribution comes from services and the public sector. The role of services in the US is much larger than in the EU, whereas the contribution of the public sector in the EU is larger than that in the US. Infrastructure industries have been driving increases in the cohesion and periphery groups.

Using growth accounting, Uppenberg (2011) demonstrates that investment in intangible fixed assets and ICT equipment in the service sector can help explain the gap in labour productivity between the EU and US in the pre-crisis period. The analysis here suggests that these differences in investment in intangible assets and equipment persist well into the post-crisis period.

Figure A2 Contribution of sectors to the within-industry component: intellectual property products



Source: Eurostat, National Accounts and EIB staff calculations.

Note: Periphery = Greece, Italy, Spain, Portugal and Slovenia; Cohesion = Estonia, Bulgaria, Latvia, Slovakia, the Czech Republic and Hungary; Other EU = Germany, Finland, France, Luxembourg, the Netherlands, Sweden and the UK. The investment rate is calculated as the ratio of gross fixed capital formation to gross value added, both in euros, 2010 chain-linked volumes, for the EU, and in US dollars, 2009 chain-linked volumes, for the US. A = Agriculture; B = Mining; C = Manufacturing; F = Construction; K-L = Finance, insurance and real estate; O = Public administration and defence; P = Education; Infrastructure = Electricity and gas (D); Water and waste management (E); Transport (H); Communication (J). Services = G, I, M, N, R, S. Q = Health and social work.

Annex B. Investment in dwellings

Investment in dwellings accounts for a significant part of the decline in the investment rate in the EU (see Figure 5 in the main text of the chapter). Its recovery is therefore crucial for total investment in the economy. It is not clear, however, how much of the shortfall vis-à-vis the period before 2005 can be recovered. Residential investment was booming in several EU countries even before 2005 and it is difficult to evaluate how much of it is sustainable.

Residential investment is very sensitive to mortgage rates, as most dwellings are bought on credit. This sensitivity is intensified by the high leverage of households in many countries. Changes in the demographic structure can also have an impact on demand for housing in the medium term.

This annex presents an empirical analysis of the determinants of residential investment in the EU using a model similar to Tobin's Q theory.¹⁵ In this model, investors are more likely to invest in new buildings if the price of existing dwellings exceeds the cost of new building or the replacement cost. As construction costs increase and exceed prices of existing dwellings, investment in new residential buildings falls.

In this model, Q is taken to be the ratio of the price of existing dwellings and the construction costs for new dwellings. Since the housing stock is fixed in the short run, changing demand for housing will change house prices (the numerator), while construction costs (the denominator) are governed by unrelated factors like the cost of materials, capital and labour. Thus increased demand for housing raises prices in the short run relative to construction costs and increases the margin between construction costs and selling prices. This provides an incentive for investors to build new dwellings, increasing the supply in the medium term. As a result, the ratio of house prices and construction costs, Q in this model, is positively related to investment in dwellings.

For the analysis, national averages for both of these variables have been available from Eurostat since 2005. In addition, we control for the cost of borrowing with the spread of annual average mortgage rates to long-term government bond yields. The unemployment rate controls for the business cycle, as it is tightly linked to aggregate gross disposable income. The debt-to-income ratio of households controls for balance sheet strength. The share of persons aged 25-54 in the total population is a proxy for demographic developments. The data are an unbalanced panel that covers 26 EU countries, as there are no data on house prices for Greece and Croatia. Data are at annual frequency for the period 2005–16:

$$IR_{c,t} = \beta_1 Q_{c,t} + \beta_2 X_{c,t} + E_{c,t}, \quad [1]$$

where $IR_{c,t}$ is the ratio of real investment in dwellings to real GDP in country c and year t . $Q_{c,t}$ is the ratio of the price index for existing dwellings to the price index of construction costs for new dwellings. The matrix $X_{c,t}$ collects a range of controls for each country and year, including the average annual unemployment rate, the average annual mortgage rate net of the long-term government bond yield, the ratio of persons aged 25-54 to the total population, and the gross-debt-to-income ratio of households.

¹⁵ This approach has been explored by Barot and Yang (2002), Tsoukis and Westaway (1994) and Corder and Roberts (2008), among others.

The results of the empirical analysis are reported in Table B1. Regression (1) reports the coefficients of a pooling ordinary least squares regression of the investment rate on Q. It has a large positive effect on investment in dwellings. If the price of existing dwellings increases by 10% relative to construction costs, the investment rate in dwellings should increase by about 0.4 of a percentage point of GDP. The Q ratio accounts for one-fifth of the total variation of investment in dwellings. Adding controls for country-specific, time-invariant characteristics in regression (2) further increases the estimated positive effect of Q. In regression (3), further controls are added for the business cycle, financing conditions, demographics and the aggregate household balance sheet. High unemployment and lending spreads reduce investment rates in dwellings, whereas the share of people of active working age increases it. A higher aggregate household-debt-to-income ratio reduces investment in dwellings.

The financial crisis has had a conspicuous effect on the impact of households' balance sheets and the sensitivity of the investment rate to the Q ratio. After 2008, the coefficient of the debt-to-income ratio is more negative, whereas the positive effect of higher relative prices of existing dwellings diminished. The latter probably reflects the holdup behaviour in the face of uncertainty generated by the financial crisis.

Table B1 Estimated coefficients of regression model 1

	Residential investment rate			
	(1)	(2)	(3)	(4)
Q	4.14*** (0.53)	5.52*** (0.28)	4.46*** (0.41)	4.51*** (0.42)
Crisis				0.77* (0.42)
Unemployment			-0.06*** (0.02)	-0.06*** (0.02)
Mortgage spread			-0.07*** (0.02)	-0.07*** (0.02)
Share 25-54 years old			0.21*** (0.06)	0.12* (0.07)
Debt-to-income ratio			-0.01*** (0.004)	-0.01* (0.004)
Q*Crisis				-0.80** (0.4)
Debt to income*Crisis				-0.003** (0.001)
Constant	0.08 (0.52)			
Country fixed effects	No	Yes	Yes	Yes
Observations	250	250	223	223
R2	0.19	0.63	0.77	0.79
Adjusted R2	0.19	0.59	0.74	0.76

Note: *p<0.1; **p<0.05; ***p<0.01.

The academic literature finds investment in dwellings to be highly cyclical (Piazzesi and Schneider, 2016). This is also confirmed by the analysis here. The most important drivers in the regressions in this analysis relate to cyclical factors. The analysis confirms expectations of an improving housing market in the EU as the economy strengthens and households' balance sheets improve. However, this improvement may be conditioned by the profile of future interest rate increases and the way the banking system translates these increases into mortgage rates. Good health of the banking system is crucial to avoid disruptions. Finally, it may be difficult to reach the long-term averages of housing investment in the EU based on current demographic trends in most countries. For the EU, the share of the population aged 24-54 has declined 2 percentage points since 1995. The model above implies that demographic developments have reduced the investment rate in dwellings by about 0.25 of a percentage point of GDP.

References

- Abiad, A., Furceri, D. and Topalova, P. (2015). "The Macroeconomic Effects of Public Investment: Evidence from Advanced Economies." IMF Working Paper 15/95. International Monetary Fund, Washington, DC.
- Alesina, A., Ardagna, S. Nicoletti, G. and Schiantarelli, F. (2005). "Regulation and Investment." *Journal of the European Economic Association*, 3(4), 791–825.
- Bahk, B. and Gort, M. (1993). "Decomposing Learning by Doing in Plants." *Journal of Political Economy*, (101), 561–583.
- Barkbu, B., Berkmen, S. P., Lukyantsau, P., Saksonovs, S. and Schoelermann, H. (2015). "Investment in the Euro Area: Why Has It Been Weak?" IMF Working Paper 15/32. International Monetary Fund, Washington, DC.
- Barot, B. and Yang, Z. (2002), "House Prices and Housing Investment in Sweden and the United Kingdom: Econometric Analysis for the Period 1970–98" *Review of Urban and Regional Development Studies*, 14(2), 189–216.
- Bussière, M., Ferrara, L. and Milovich, J. (2017). "Explaining the Recent Slump in Investment: The Role of Expected Demand and Uncertainty." *Rue de La Banque*, 44 (May).
- Cooper, R., Haltiwanger, J. and Power, L. (1995). "Machine Replacement and the Business Cycle: Lumps and Bumps." NBER Working Paper No. 5260. National Bureau of Economic Research, Cambridge, MA.
- Corder, M. and Roberts, N. (2008), "Understanding Dwellings Investment." *Bank of England Quarterly Bulletin (December)*, 393–403.
- Davis, S.J., Haltiwanger, J.C. and Schuh, S. (1996). *Job Creation and Destruction*. Cambridge, MA: MIT Press.
- Doms, M. and Dunne, T. (1998). "Capital Adjustment Patterns in Manufacturing Plants." *Review of Economic Dynamics*, 1(2), 409–429.
- Doms, M., Dunne, T. and Roberts, M. (1995). "The Role of Technology Use in the Survival and Growth of Manufacturing Plants." *International Journal of Industrial Organization*, (13), 523–453.
- ECB. (2016). "Investment in the Euro Area: Why Has It Been Weak?" *Economic Bulletin*, (2). European Central Bank, Frankfurt.
- EIB. (2016a). *Investment and Investment Finance in Europe: Financing Productivity Growth*. Luxembourg: European Investment Bank.
- (2016b). "Restoring Competitiveness: An Update." European Investment Bank, Luxembourg.
- EIB (2017). *EIBIS 2016/2017: Surveying Corporate Investment Activities, Needs and Financing in the EU*. Luxembourg: European Investment Bank.
- European Commission. (2016). "Towards a Positive Fiscal Stance for the Euro Area." 727 Final. COM(2016). November 16.

- Grayburn, J. and Haug, T. (2015). "European Regulators' WACC Decisions Risk Undermining Investment Decisions." *Energy Regulation Insights*. NERA Economic Consulting.
- Green F., Machin S., Wilkinson D. (1998). "The Meaning and Determinants of Skills Shortages.", *Oxford Bulletin of Economics and Statistics*, 60 (2), 165-187.
- Greenwood, J. and Yorokoglu, M. (1997). "1974." *Carnegie-Rochester Conference Series on Public Policy*, 46 (June), 97-106.
- Greenwood, J., Hercowitz, Z. and Krusell, P. (1997). "Long-Run Implications of Investment-Specific Technological Change." *American Economic Review*, (87), 342-362.
- Hornstein, A. and Krusell, P. (1996). *NBER Macroeconomics Annual*. Cambridge, MA: National Bureau of Economic Research.
- Jovanovic, B. and Rousseau, P. L. (2005). "General Purpose Technologies." NBER Working Paper No. 11093. National Bureau of Economic Research, Cambridge, MA
- Nicoletti, G. and Scarpetta, S. (2003). "Regulation, Productivity, and Growth: OECD Evidence." *Economic Policy*, 18(36), 11-72.
- Perrin, L.-M. (2013). "Mapping Power and Utilities Regulation in Europe." Ernst & Young. May.
- Piazzesi, M. and Schneider, M. (2016). "Housing and Macroeconomics." NBER Working Paper No. 22354. National Bureau of Economic Research, Cambridge, MA.
- Szent-Iványi, B. (2017). *Foreign Direct Investment in Central and Eastern Europe*. Springer.
- Tsoukis, C. and Westaway, P. (1994), "A Forward Looking Model of Housing Construction in the UK." *Economic Modelling*, 11(2), 266-279.
- Uppenberg, K. (2011). "Economic Growth in the US and the EU: A Sectoral Decomposition." *EIB Papers*, 16(1).
- WEF-EIB (2017). "Behind the Equity-Efficiency Trade-off: Practical Ideas for Inclusive Growth and Competitiveness in Europe." World Economic Forum and European investment Bank. Available at: http://www3.weforum.org/docs/WEF_EUROPE-LAB.pdf.

Chapter 2

Recent trends in infrastructure investment in Europe: fiscal constraints and planning capacity matter

Chapter at a glance

An adequate supply of infrastructure is an essential ingredient of economic growth and well-being. An intensive debate has emerged on how much more investment is needed, precisely what type of investment and where. This chapter analyses infrastructure investment trends and needs in the EU based on a unique combination of the EIB's infrastructure investment database and a survey of 555 European municipalities. Several main findings emerge from the analysis:

- *The negative trend in infrastructure investment activities in the EU levelled off in 2015 and 2016 to settle at about 20% below investment rates before the global financial crisis. Compared to 2009, infrastructure investment declined most in the transport sector, followed by the utilities sector and education.*
- *A key driver of the decline in infrastructure investment is a broad-based retreat of the government sector from its infrastructure activities. At the core of this is a shift in public outlays from gross fixed capital formation towards current expenditure. This reflects cyclical factors, including automatic stabilisers, but also political choices driven by short-term considerations.*
- *Corporate infrastructure investment has held up somewhat better but – in part due to regulatory pressure on allowed returns – has also struggled to keep up with pre-crisis rates. Investments by special purpose vehicles are well below pre-crisis levels.*
- *Countries with lower levels of infrastructure quality were more affected by the fall in infrastructure investment. This led to a slowdown – and in some cases, even a halt – of the convergence process in terms of infrastructure quality in recent years.*
- *Reported investment activities at the municipality level held up better than the aggregate data would suggest, but poor overall infrastructure investment activities have also left their mark on municipalities: one in three report that investment activities in the past five years were below needs.*
- *Perceived under-investment has often come at the cost of modernisation and/or activities to expand capacity.*
- *Fiscal constraints and regulatory and political instability are identified most often as obstacles to infrastructure investment, especially by municipalities with perceived infrastructure gaps. 75% of municipalities that report infrastructure gaps consider fiscal constraints to be a major obstacle.*
- *While municipalities perceive fiscal constraints to be the main barrier to infrastructure investment, loosening fiscal rules requires effective planning and prioritisation of infrastructure projects. Our survey data suggest that so far only a few local governments are engaging in an efficient planning process with respect to infrastructure investment activities. Less than 40% of municipalities assess the quality of infrastructure projects prior to implementation and use this information when making decisions.*
- *More generally, the analysis in this chapter suggests that the policy debate on infrastructure investment should pay more attention to adequate prioritisation and planning of infrastructure projects. Prioritisation of infrastructure investment is key at all levels of government, including at the EU level, to overcome the fragmentation of the single market. It is also important in light of weakening potential growth in many countries and a need to respond to mega-trends such as technological change, globalisation and demographic change. Moreover, the increasing need to ensure that economic growth is socially inclusive must be reflected in the planning and prioritisation of infrastructure projects.*

Declines in infrastructure investment levelled off in 2015 and 2016, but current rates are low and imply a marked slowdown of the convergence process in terms of infrastructure quality

Infrastructure is an important driver of economic growth and well-being. The longer-term economic performance of the European Union and the global economy critically depends on the availability of adequate and high-quality infrastructure. A large body of literature has underscored the positive relationship between infrastructure and productivity (see, for example, Berg, Buffie and Cashin, 2012; Calderon and Servén, 2014). It has also shown that the availability of infrastructure is key to making economic growth greener and more inclusive as well as to achieving many of the UN Sustainable Development Goals (Woetzel et al., 2016; United Nations, 2016).

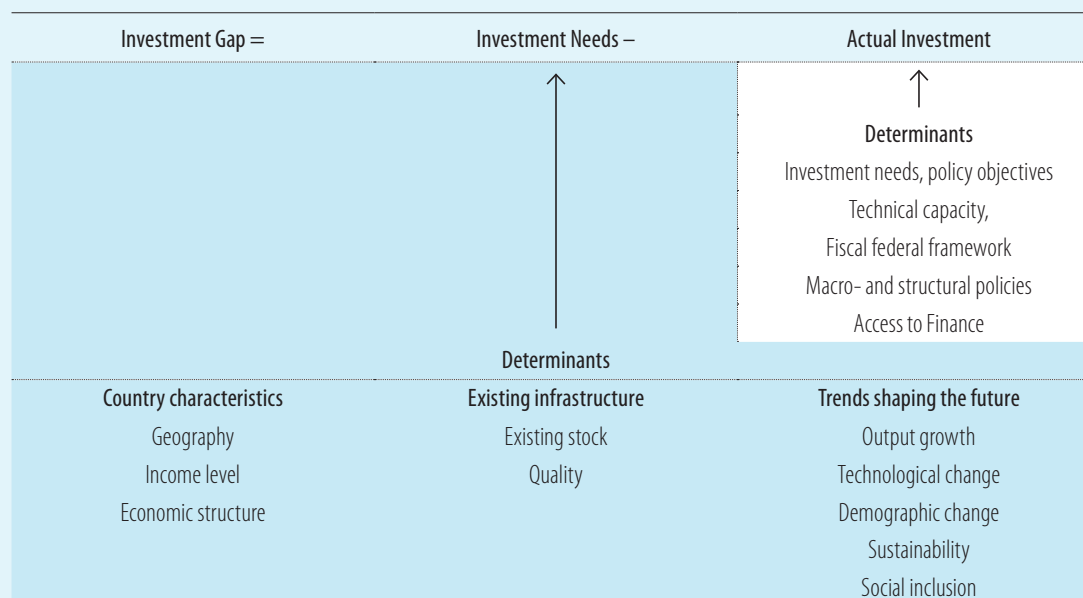
While there is a broad consensus that a long period of very low investment in infrastructure is detrimental to long-term growth, data gaps make it difficult to pinpoint exactly how much and what type of investment is missing and where. Infrastructure investment has fallen to its lowest levels in over a decade, both globally and in the EU (Bhattacharya et al., 2016b; EIB, 2016a). Most observers agree that current levels are below what is required to sustain economic growth and well-being going forward (see Box 1). A lack of detailed data makes it difficult, however, to determine what type of investment is needed most and where.

This chapter uses a unique combination of the EIB's infrastructure investment database and a survey of 555 European municipalities to shed light on perceived infrastructure investment gaps in Europe. The first part of the chapter discusses the latest infrastructure investment trends at the macroeconomic level based on the EIB's infrastructure database. The second part follows up with the results of a novel survey of municipalities, showing how the macro trends affected investment activities at the municipality level, how municipalities assess past investment relative to needs, what type of investment they think is needed most going forward, and what obstacles they see to more infrastructure investment. The results of the survey on municipalities are cross-checked with responses by firms in the European Investment Bank Investment Survey (EIBIS) 2017.

Box 1 A literature review of infrastructure investment gaps

Estimating infrastructure investment gaps is not straightforward, notably because of the difficulty in assessing infrastructure investment needs. This is reflected in an intensive ongoing discussion on how to estimate infrastructure gaps.

Infrastructure investment gaps are typically defined as the difference between infrastructure investment needs, or how much countries should be spending on infrastructure, and actual infrastructure investment (Figure B.1.1). Data on actual infrastructure investment are not readily available but can be estimated based on existing macro and project-level data (see Section 1). Estimating infrastructure investment needs, on the other hand, is very challenging, as they are unobservable and highly state- and time-dependent. Investment needs are determined by the existing infrastructure stock, income levels and the economy's structure, and mega-trends including technological, demographic and climate change. The relevance of these determinants can substantially change over time, with far-reaching implications for infrastructure needs. Moreover, the long life-cycle of infrastructure projects, often beyond 30 years, requires an assessment of infrastructure needs far into the future, which further complicates the task of placing investment spending and needs in relation to each other.

Figure B1.1 Definition and determinants of infrastructure investment gap

Source: EIB.

Several papers identify a rationale for accelerating infrastructure investment in the context of very low interest rates, in both advanced economies and emerging markets. The rationale is supported by macroeconomic and microeconomic evidence. For Europe, EIB (2016) identifies investment needs of some EUR 688bn per year in energy, transport, water and sanitation, and telecoms (Table B1.1). The EIB study uses a bottom-up approach, based on sectorial experts' estimations of additional investment needed to catch up with economic peers, notably the US, or to achieve political targets set by the EU.

Table B1.1 Selected estimates of annual infrastructure investment needs, 2015 EUR billion and %

	Geographical coverage	Total (% of GDP)	Total	Energy	Transport	Water and sanitation	Telecoms
EIB (2016b)	EU	4.7	688	230	160	138	160
OECD (2017)	World	7.5	5678	1893	2434	811	541
Bhattacharya et al. (2016)	World	9.7	7331	1967	2772	1252	1341
Woetzel et al., (2016)	World	3.9	2956	883	1124	451	499
NCE (2014)	World	7.5	5678	2974	901	1352	451

Source: EIB (2016b), OECD (2017), Bhattacharya et al. (2016), Woetzel et al. (2016), NCE (2014).

Note: Estimates refer to 2015-30 for EIB (2016), Bhattacharya et al. (2016) and NCE (2014) and to 2016-30 for OECD (2017) and Woetzel et al. (2016). Authors calculations.

For the world as a whole, estimates of infrastructure investment needs are typically higher, ranging from 3.9% to 9.7% of GDP (see Table B1.1), due to lower quality of the existing infrastructure, substantial catch-up potential and faster population growth in many developing and emerging markets. Middle-income countries are expected to represent around 60% to 70% of future infrastructure needs (OECD, 2017). The size of the gap could triple if the additional investment

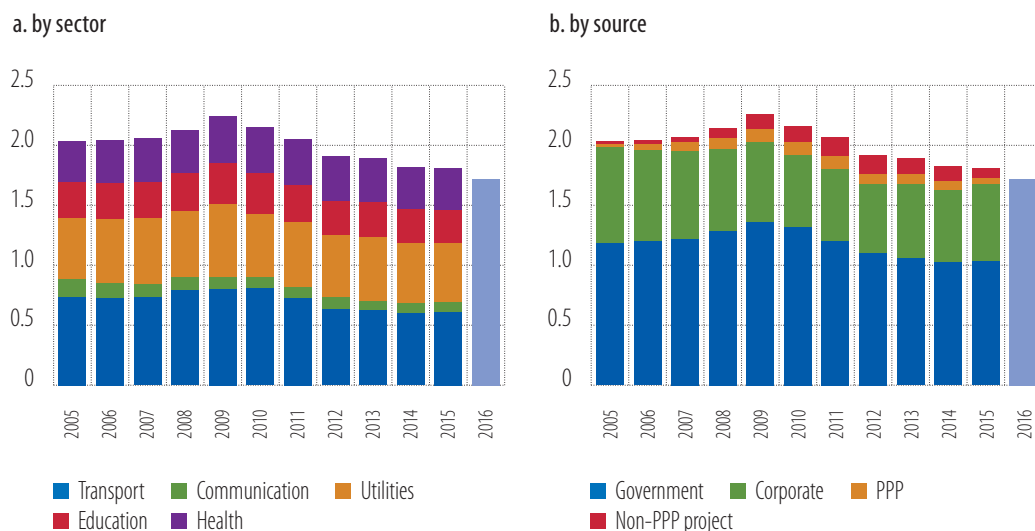
required to meet the new UN Sustainable Development Goals is included (Woetzel et al., 2016). The WEF and EIB have recently highlighted that infrastructure investment is crucial for competitiveness and inclusive economic growth (EIB and WEF, 2017).

The complexity of estimating infrastructure needs is reflected in the broad range of methods used in the literature. Most studies assessing infrastructure needs are based on projected GDP growth and country-level elasticities of infrastructure spending to growth (Woetzel et al., 2016; NCE, 2016). Such studies are highly dependent on the assumptions underlying projected GDP growth. In contrast, simulations based on global models often lack country-specific characteristics and priorities (OECD, 2017). Referring to declared policy objectives is a straightforward way to capture infrastructure needs, but this approach is highly dependent on the way these policy objectives are set and the underlying assumptions about future trends and needs (EIB, 2016b).

The negative trend in infrastructure investment activities in Europe levelled off in 2015 and 2016 to settle at about 20% below the rates before the global financial crisis. Using the approach to estimating infrastructure investment activities first proposed by Wagenvoort et al. (2010) and later refined by Revoltella et al. (2016), we find that infrastructure investment ceased to decline in 2015 and (most probably)¹ 2016 (Figure 1). After a decline in infrastructure investment of 0.4pp (percentage points) between 2009 and 2014 (from 2.2% to 1.8% of GDP), this means a stabilisation of investment rates at about 80% of their pre-crisis levels.

Compared to 2009, current infrastructure investment declined most in Europe in the transport sector (0.2 pp of GDP), followed by the utilities sector and education.

Figure 1 Infrastructure investment by sector and source, 2005–16 (in % of GDP)



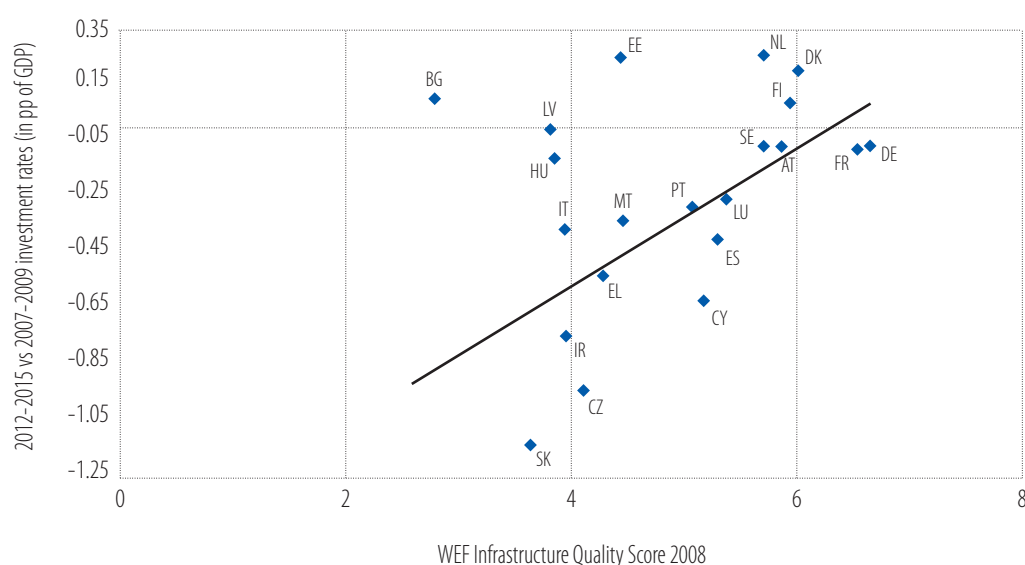
Source: Eurostat, Projectware, EPEC.

Note: Based on EIB Infrastructure Database. Data are missing for Belgium, Croatia, Lithuania, Poland, Romania and the UK. 2016 figures are preliminary. PPP: public-private partnership. Authors calculations.

¹ At the time of writing, data for 2016 were still incomplete. This assessment for 2016 is based on information for the following countries only: Bulgaria, Germany, Estonia, Ireland, France, Austria, Slovakia, Slovenia, Finland.

The decline in infrastructure investment was largest in countries with a low infrastructure quality, leading to a slowdown in the convergence process in terms of infrastructure quality. Figure 2 correlates the decline in economic infrastructure investment (infrastructure excluding education and health)² across countries following the global financial crisis with the corresponding infrastructure quality scores from the World Economic Forum for 2008/09. The figure shows that infrastructure investment declined most in those countries that recorded the weakest infrastructure quality before the crisis. The same broad conclusion holds for health and education (for which there are individual WEF scores) – albeit less significantly.³

Figure 2 Infrastructure quality and changes in infrastructure investment, 2012–15 compared to the 2007–09 average



Source: Eurostat, Projectware, EPEC, World Economic Forum.

Note: Average annual change refers to the change in investment rates for economic infrastructure between 2009 and 2015 vis-à-vis the average investment activities in 2007-09. Authors calculations.

² We exclude these two sectors to make the figures comparable to the WEF infrastructure index (which focuses on economic infrastructure only).

³ For the country-by-country analysis, we use average annual changes to control for outlier values in 2014 and 2015 due to accelerated absorption rates in terms of EU structural funds. To avoid outlier values for the reference period, as well, we use the average of 2007-09. The conclusions of the analysis are robust to the exact choice of reference period.

Weak infrastructure investment is driven by a shift in public outlays from investment to current expenditure

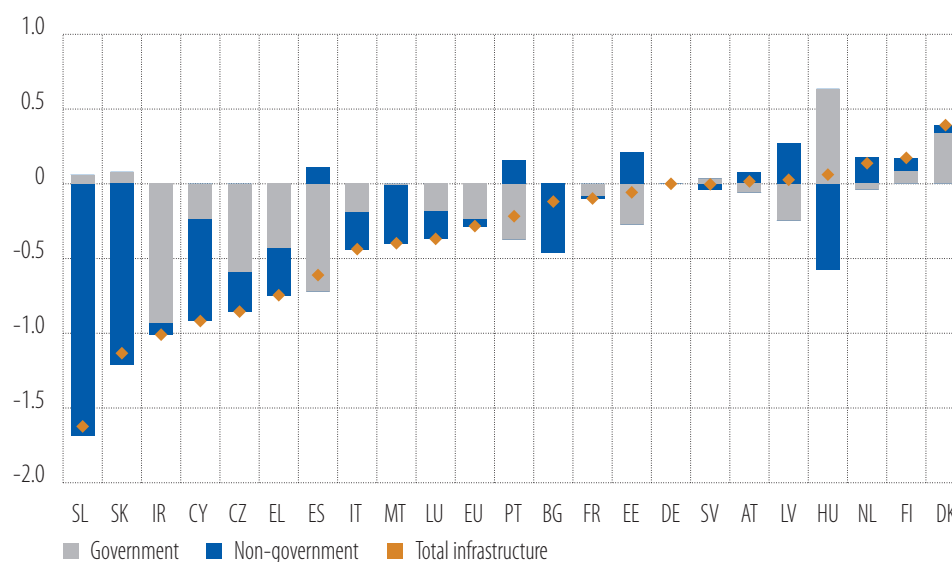
Weak infrastructure investment in the EU reflects a broad-based retreat of the government sector from its infrastructure investment activities. Overall, the government component of aggregate infrastructure investment declined by 0.33 pp of GDP between 2009 and 2015, whereas non-government investment fell by 0.11 pp. The fall in government investment thus explains about three-quarters of the entire fall in infrastructure investment activities since 2009.

Weak government investment accounts for the largest part of the fall in infrastructure investment compared to pre-crisis levels in most countries, but, particularly in Ireland, the Czech Republic, Spain, Portugal, Estonia and Latvia (Figure 3).

Slovenia, Slovakia, Malta, Bulgaria and Hungary are the main exceptions. There, the non-government sector pulled down infrastructure investment more than the government sector. Reasons for this include very high pre-crisis investment rates in the non-government sector (for example, due to investment booms in renewables that have since subsided); heightened price pressure on utilities and public-private partnerships (PPPs), which has led to a drop in profitability and investment activities; and outright balance sheet crises of state-owned enterprises (as in Slovenia).

In countries in which the government sector reduced its infrastructure activities most, this has often been due to a decline in sub-national government investment. On average, sub-national authorities are responsible for some 50% of the gross fixed capital formation of the general government. Comparing 2007 and 2015 levels, we find that changes in investment activities by regional and local authorities can explain as much as 75% of the overall fall in public investment (for more details, see Chapter 1 in EIB, 2016a).

Figure 3 Change in infrastructure investment: government versus non-government component, 2009–15 compared to the 2007–09 average (in % of GDP)



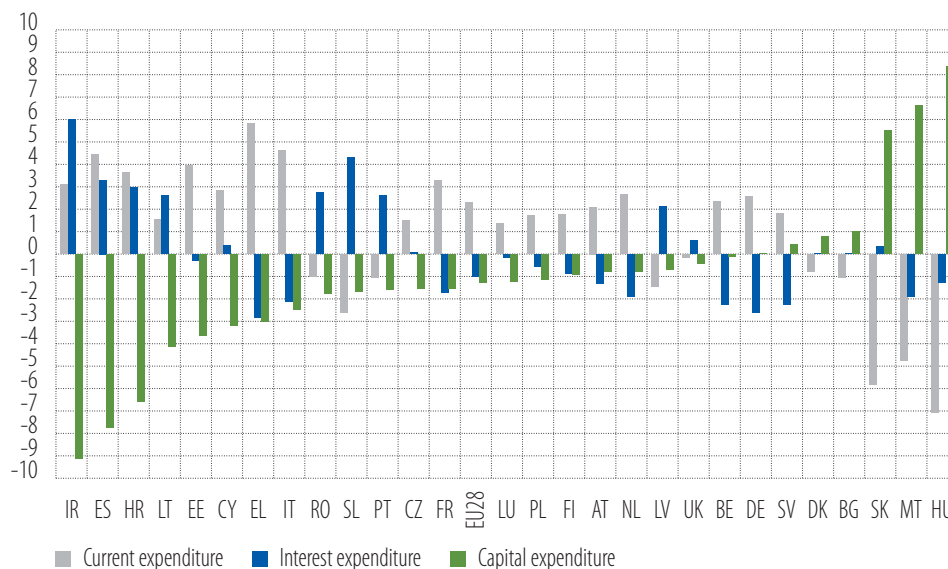
Source: Eurostat, Projectware, EPEC.

Note: Average annual change refers to the change in investment rates for total infrastructure investment between 2009 and 2015 vis-à-vis the average investment activities in 2007-09. Authors calculations.

At the core of the decrease in government investment across all levels of government is a shift in public outlays from gross fixed capital formation towards current expenditure. The strong decline in government infrastructure investment in Ireland, the Czech Republic, Spain, Portugal, Estonia and Latvia has come hand in hand with a shift in government outlays from investment towards current expenditure (Figure 4).⁴

This shift towards current expenditure reflects cyclical factors, but also political choices in favour of short-term considerations rather than longer-term needs. Since the crisis, current expenditure has increased to some extent because of automatic stabilisers, which – in the light of often-binding fiscal rules – has crowded out some public investment. However, we find that the shift away from gross fixed capital formation towards current expenditure is much longer-term, starting well before the onset of the crisis and continuing even as the recovery is picking up momentum in most countries.

⁴ It is worth noting that a 1:1 re-balancing of public outlays from gross fixed capital formation towards current expenditure can have quite dramatic implications for overall government investment. Insofar as – on average – gross fixed capital formation accounts for some 9% of total government spending, whereas current expenditure accounts for 90%, a re-balancing of funds from the former to the latter can mean a decline in gross fixed capital formation of as much as 85% (as in the case of Ireland).

Figure 4 Changes in government outlays, 2015 versus 2008 (in % of total)

Source: Eurostat, COFOG Statistics.

Note: Change in the share of current expenditure, interest expenses and capital expenditure as a share of total government outlays. Authors calculations.

Payments from the European budget through the European Structural and Investment Funds – in particular, the European Regional Development Fund (ERDF) and the Cohesion Fund – ensured that government investment did not drop by even more. The ERDF and Cohesion Fund have increasingly supported infrastructure investment, particularly in cohesion countries (contributing nearly 2% of GDP to public capital investment in 2015 and 1% in 2016). In the periphery, the contribution of European cohesion policy to investment was lower by a level of magnitude, but it increased substantially between 2012 and 2015, ensuring that the drop in infrastructure investment, while steep, was somewhat cushioned.

Looking ahead, the outlook for government infrastructure investment remains subdued. National budgetary documents (national reform and stability programmes) presented during the 2017 European semester by large European economies do not contemplate significant increases of public investment levels over the medium term. Substantial heterogeneity remains, however. France,⁵ Italy, Denmark and the Netherlands are expected to register all-time lows in terms of public investment in this period. Public investment in Poland,⁶ Germany, Belgium, Hungary and Romania, on the other hand, is expected to exceed long-term averages, most certainly translating into higher infrastructure spending in these countries.

5 The French results do not take into account “le grand plan d’investissement 2018–2022” announced in September 2017. This plan might change the forecasts for public sector investment in the country.

6 Among the large European economies, the Polish stability programme is the only document reporting a fairly significant increase in public investment, with 4.5% of GDP in 2017 and 5% in 2018.

Corporate infrastructure investment

Corporate infrastructure investment held up somewhat better than government investment but – in part due to regulatory pressure on allowed returns – has also struggled to keep up with pre-crisis rates. Corporate infrastructure investment accounts for some 35% of total infrastructure investment in Europe, which compares to 55% for the government sector and 10% for investment by special purpose vehicles (PPPs and non-PPP projects) (see Figure 1).

After a decline in 2011/12, corporate infrastructure recovered in recent years, reaching its 2009 investment rates in 2015.

The recovery can be explained to a large extent by improvements in balance sheet health over this period. While median corporate leverage increased in the infrastructure sector⁷ in the period before the crisis, it has been falling ever since. As a result – and in combination with declining user costs of debt – interest payments as a share of earnings have decreased quite markedly over the same period (by about 40% between 2008 and 2014), freeing up financial room for additional infrastructure investment activities.

Corporate sector investment was held back by low returns (Grayburn and Haug, 2015). In the infrastructure sector, corporate returns are often set by regulators according to a simple formula combining the risk-free rate plus an equity risk premium (along the lines of the capital asset pricing model, CAPM), where sovereign bond yields typically serve as a proxy for the former and historical equity risk premia for the latter.

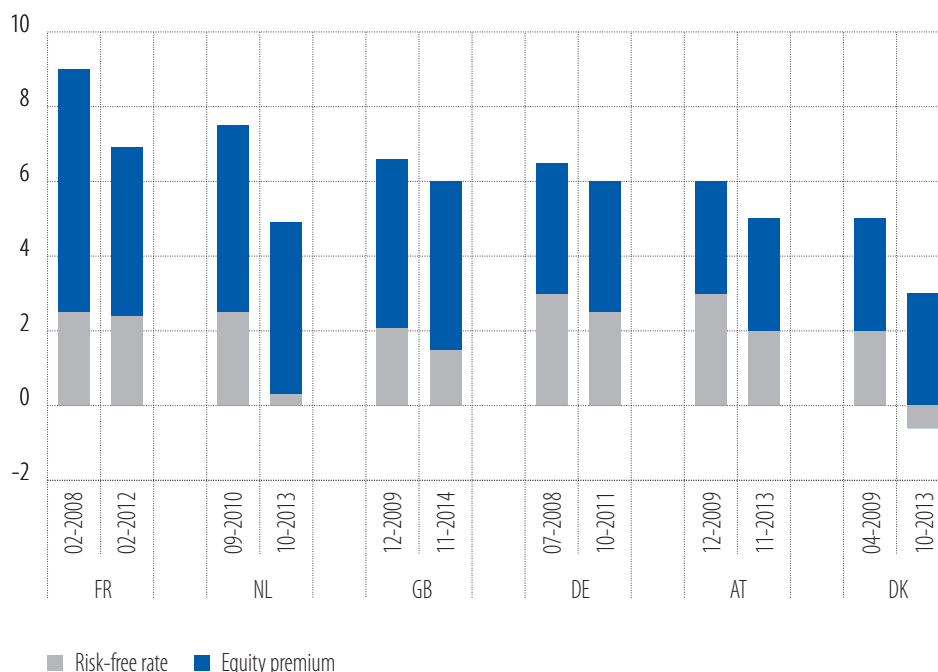
In recent years, as sovereign bond yields fell, regulators adjusted the allowed rates of return for infrastructure/utility companies downwards. However, regulators in Europe did not sufficiently account for the increase in equity risk premia, which occurred over the same period and should have pushed up allowed returns.⁸ This has reduced firms' incentive to invest in infrastructure. Figure 5 shows how allowed returns have declined almost 1:1 with falling sovereign yields in a series of European countries, putting downward pressure on firms' incentive to invest.⁹

The approach by European regulators was very different from that of their US counterparts. As the US Federal Energy Regulatory Commission explicitly noted in 2014, "The currently low treasury bond rate environment creates a need to adjust the CAPM results, consistent with ... financial theory [which suggests] that the equity risk premium exceeds the long-term average when long-term US treasury bond rates are lower than average, and vice versa".

7 Results are based on Bureau van Dijk ORBIS data for companies active in the infrastructure sectors with more than ten employees. They should be considered an approximation since we must use firms that are active in the infrastructure sector as a proxy for infrastructure firms.

8 The inverse relationship between the risk-free rate and the equity premium is illustrated in Grayburn and Haug (2015) and can be explained intuitively by the "flight to safety" during the crisis (which pushed down the return on safe assets but pushed up the premium on more risky investments).

9 The results are also in line with the results of a micro data estimation in Revoltella and Brutscher (forthcoming), which shows falling returns over the period in question.

Figure 5 European regulators' allowed returns on equity, 2008–14 (in %)


Source: Grayburn and Haug (2015).

Note: Authors calculations.

The market for public-private partnerships remains weak

The PPP market improved slightly in 2016, but investment activities remain at historically low levels. In the light of weak government infrastructure investment and, at best, stable corporate infrastructure investment activities, many observers have placed high hopes in public-private partnerships to fill the gap vis-à-vis pre-crisis investment rates.

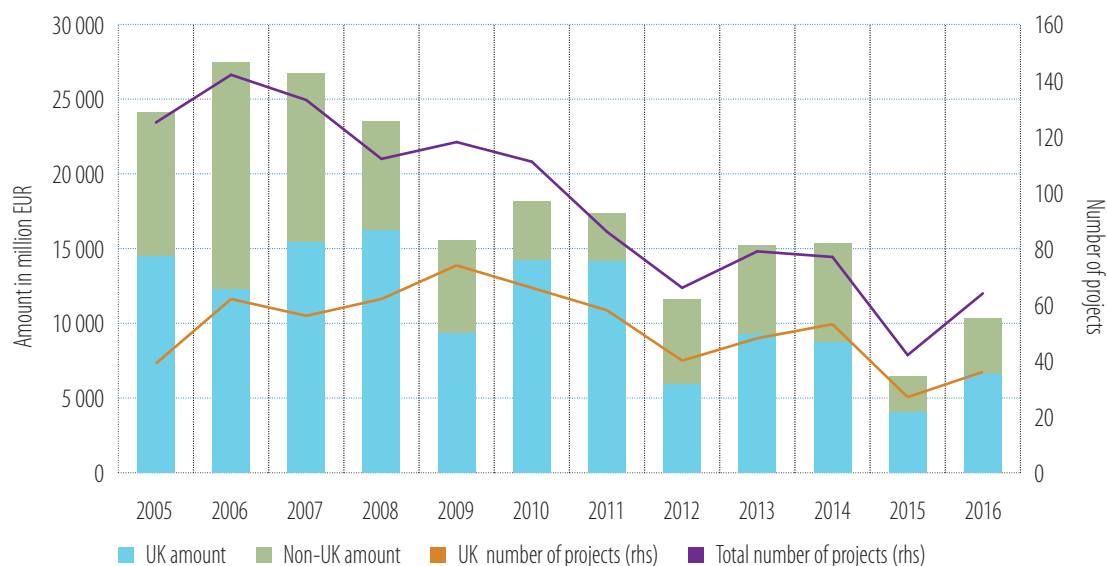
So far, this hope has not materialised. This is partly due to the fact that even before the crisis, the PPP market played a relatively small role in the overall infrastructure sector (accounting for only some 5% of the total); and it is partly due to the PPP market's relatively poor performance in recent years.

Figure 6 shows the number and aggregate value of PPP projects over the past decade. The blue bars/lines present the value of PPPs in the UK – by far the largest PPP market in the EU – while the green bars/lines show the rest of the EU market.

Since the global financial crisis – in line with overall infrastructure activities – the European PPP market has been in more or less constant decline, both in terms of volume and the total number of deals.¹⁰ PPP activity picked up slightly in 2016, but deal volumes and numbers remain far below pre-crisis levels.

An important reason for the weak performance of PPPs is the UK market. Between 2006 and 2016, the UK market shrank from around EUR 12bn to only EUR 6.5bn, accounting for about 35% of the overall decline in PPPs (in terms of volume). Part of this (disproportionate) fall in PPPs was due to a change in political sentiment and the public perception of PPPs and the value for money that they deliver.

¹⁰ See also Riess (2005) and Strauss (2010).

Figure 6 The European market for public-private partnerships, 2005–16

Source: EIB/EPEC PPP database.

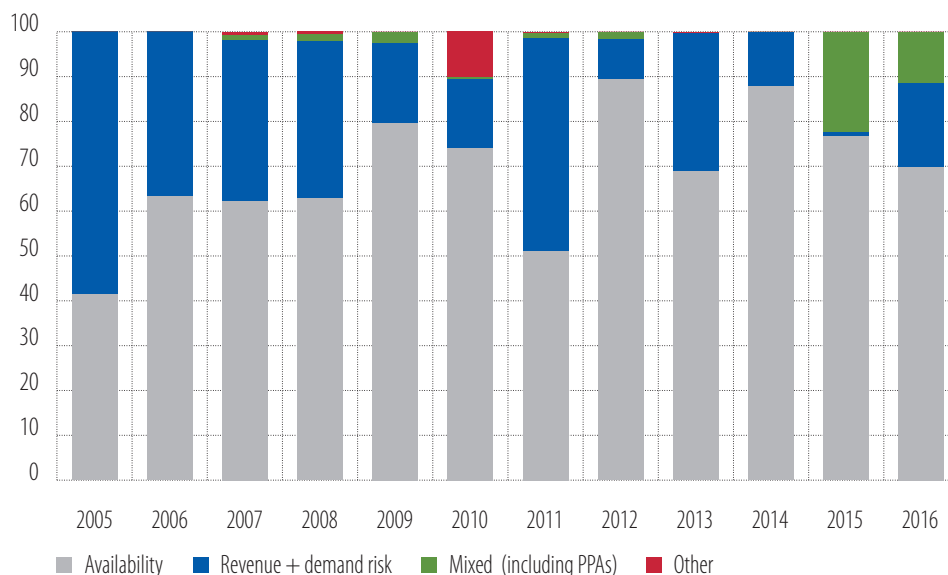
Note: The project values quoted refer to the projects' external funding requirements at the time of financial close (the sum of debt and equity) and exclude public capital contributions. The external funding requirement of a project can differ significantly from its capital investment costs. Authors calculations.

Various factors have held back PPPs across Europe. In particular, the retreat of many banks from the project finance market (partly due to sharper regulation),¹¹ limited fiscal space (of sovereigns and sub-sovereigns) and a deterioration in project credit quality (as a result of the decline in monoline insurers) has led to a spike in PPP credit spreads from which the market has not yet fully recovered, at least in some parts of Europe.

As lenders have become scarcer and access to finance more difficult, the relative importance of revenue and demand risk modes has changed. PPPs can be structured in various ways. At one end of the spectrum, PPP companies are subject to full revenue risk, as in the case of conventional toll roads, where revenues derive from toll payments. At the other end of the spectrum lies “availability-based” pricing, in which PPP companies receive fixed periodic payments from the relevant authorities as long as a certain public service (such a road) is available for use. In between these two models are several options designed to share revenue risks, often referred to as “mixed models”.

Figure 7 shows that while access to funding became more difficult, the relative importance of revenue and demand models declined (from somewhere between 40% and 60% to less than 20%), whereas availability-based pricing models became more important.

¹¹ Basel 3 and Solvency 2 require banks and insurers to hold more capital for financing longer-term risky infrastructure projects.

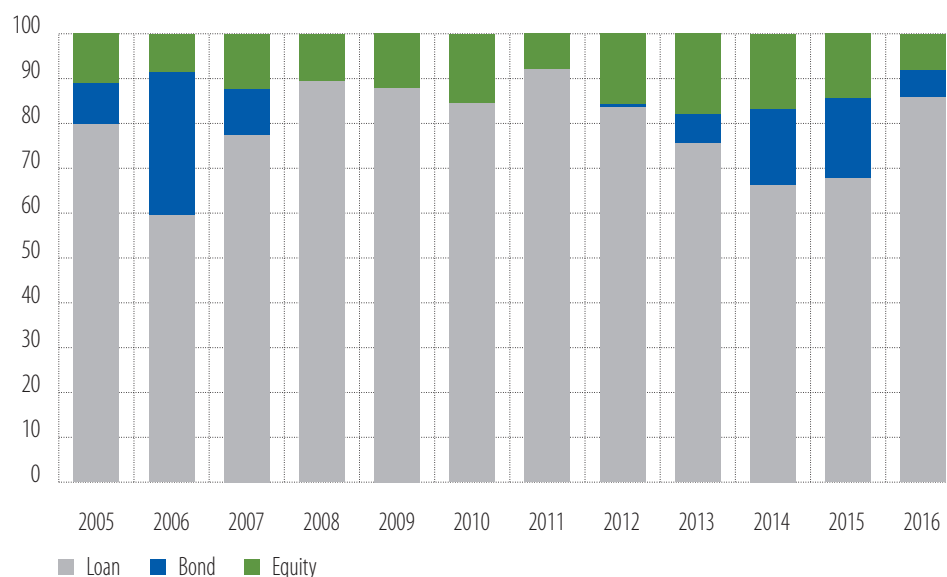
Figure 7 The relative importance of different PPP models, 2005-16 (in %)

Source: EIB/EPEC PPP database.

Note: Revenue and demand risk models include toll and shadow toll pricing; PPAs are included in mixed models. PPA: Purchase Power Agreement, PPP: public-private partnership. Authors calculations.

On a more positive note, bond financing is making a comeback in the PPP market, albeit at much lower levels than before 2008 (Figure 8). In the years following 2008, bonds disappeared from PPPs' financing mix, returning only in 2013.

The slow recovery of PPP-related bonds is accompanied by a geographical diversification. Bond issuances were largely limited to two markets before 2008: the UK and Germany. Since 2013, issuances have been reported in Belgium, France, Germany, Ireland, the Netherlands, and the UK.

Figure 8 Financing structure of European public-private partnerships, 2005–16 (in %)

Source: EIB/EPEC PPP database.

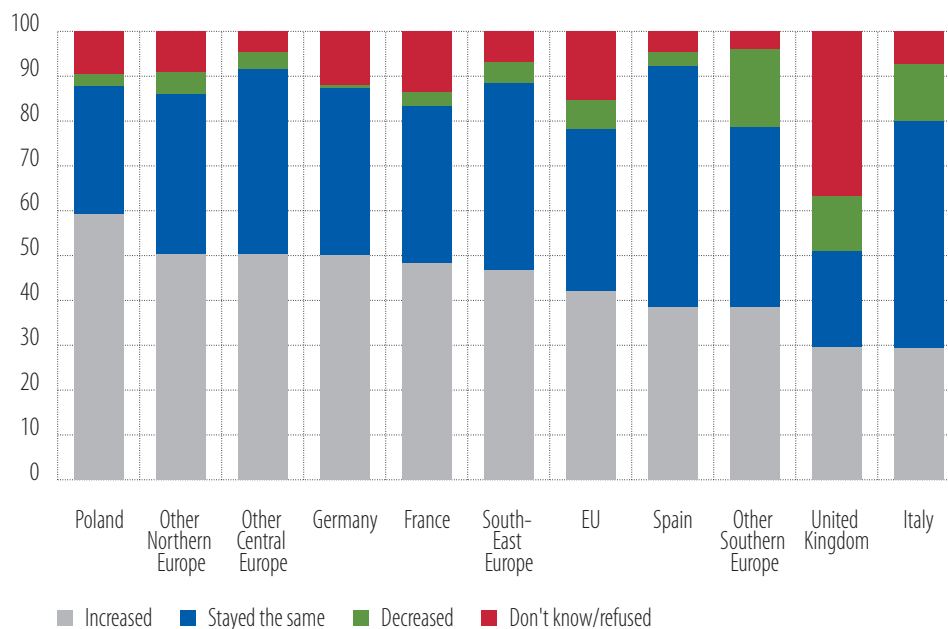
Note: A breakdown by source of finance is only available for roughly 80% of all PPP projects in our database. The numbers must therefore be interpreted with caution. Authors calculations.

Municipality infrastructure investment fared better than aggregate infrastructure investment

On balance, infrastructure investment activities have increased in larger municipalities over the past five years. Between April and August 2017, the EIB interviewed 555 larger municipalities in all 28 Member States about their infrastructure investment activities, needs, gaps and obstacles, on the back of the EIB Investment Survey (EIBIS). For details of the survey and its design, see Box 2.

When asked how infrastructure investment activities had evolved in their jurisdiction over the past five years – irrespective of who is in charge of these investments – 42% of municipalities answered that they saw an increase in nominal investment activities, 36% reported broadly unchanged investment activities, and only 6% observed a decline in infrastructure investment activities. The net balance of municipalities where investment activities increased over the past five years is thus positive (Figure 9).

Figure 9 Change in infrastructure investment activities in European municipalities (Share of municipalities, in %)



Source: EIB Municipality Survey.

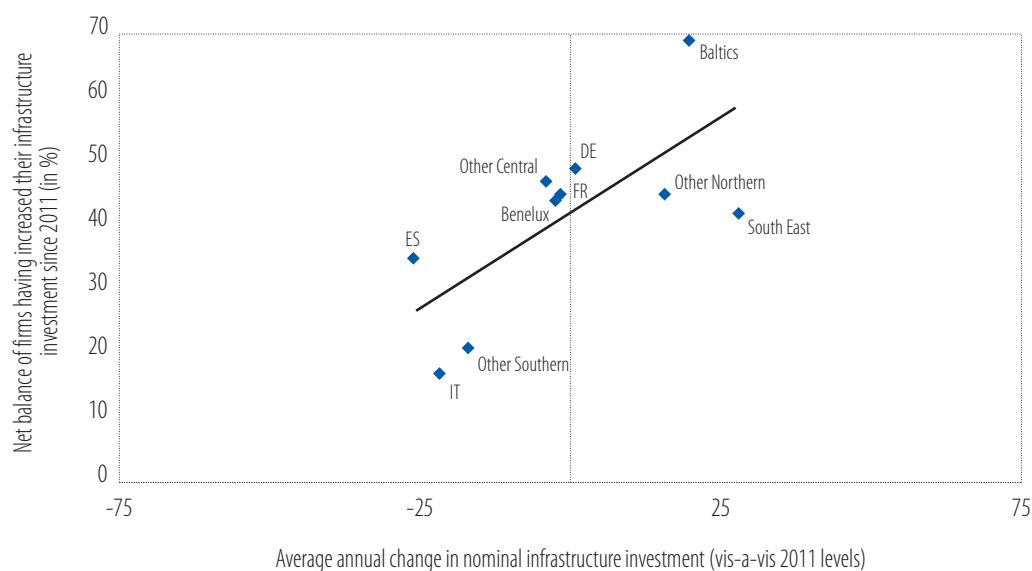
Note: Authors calculations.

Question: If exclusively responsible for infrastructure investment activities: Over the last five years has your investment spending increased, decreased or stayed around the same? If partially responsible: Has the overall investment spending on infrastructure in your municipality increased, decreased or stayed around the same over the last five years?

While municipalities' view is more positive than the macro figures would suggest, (weak) aggregate infrastructure investment rates have (also) left their mark on municipalities. The net balance of municipalities that reported an increase in investment activities over the past five years is positive across all countries/country groupings (regions), even in those cases in which aggregate investment was negative over the same period. This suggests that larger cities have been less affected by the decline in infrastructure investment than other areas – presumably more rural areas, not captured by the survey.¹²

This notwithstanding, weak aggregate infrastructure investment has (also) left its mark on municipalities: Figure 10 shows a clear correlation between the average change in aggregate infrastructure investment over the past five years and municipalities' assessment of how infrastructure investment evolved in their jurisdiction over this period. In countries/regions that had larger declines in aggregate infrastructure investment, municipalities are on balance less positive about the evolution of infrastructure investment in their jurisdiction.

¹² Behavioural biases may also partly explain the somewhat more positive picture drawn by municipalities – even though the survey was carried out anonymously and the question at hand aims to ascertain overall infrastructure investment activities (and not just those carried out by municipalities themselves).

Figure 10 Investment activities in European municipalities versus aggregate investment

Source: Eurostat, Projectware, EPEC plus World Economic Forum plus EIB Municipality Survey.

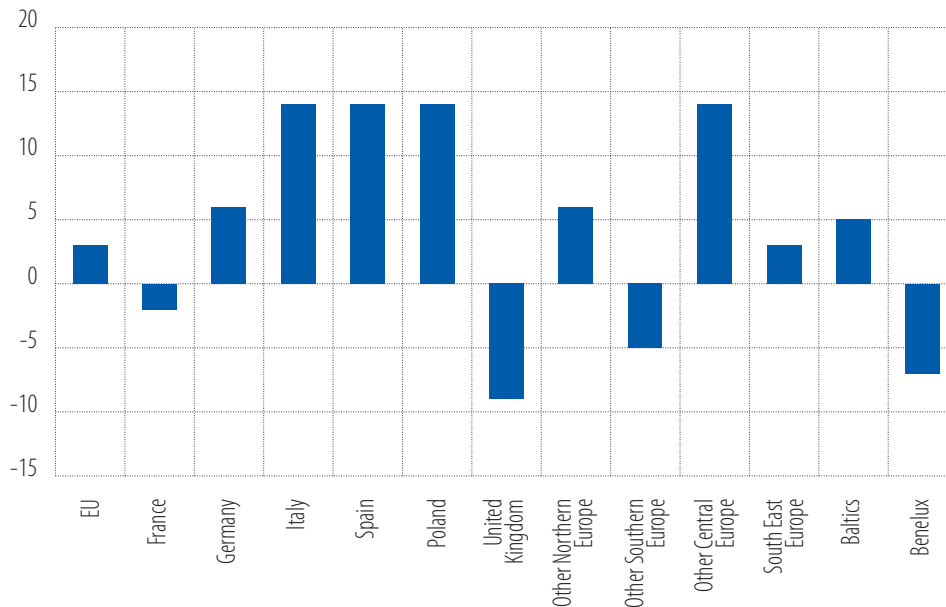
Note: Horizontal axis plots the average annual change in nominal investment for total infrastructure investment between 2011 and 2015 vis-à-vis 2011 levels. The vertical axis plots the net balance of municipalities that have seen an increase in infrastructure investment activities over the past five years. Authors calculations.

Question: If exclusively responsible for infrastructure investment activities: Over the last five years has your investment spending increased, decreased or stayed around the same? If partially responsible: Has the overall investment spending on infrastructure in your municipality increased, decreased or stayed around the same over the last five years?

Over the past five years, municipalities report that their share in overall infrastructure investment has increased relative to other sources of infrastructure investment. When asked how their own investment activities fared relative to overall infrastructure investment in their jurisdiction, municipalities report, on balance, that their own activities fared better than aggregate infrastructure investment, which implies an increase in the municipality share of infrastructure investment (vis-à-vis other sources).

The main exceptions to this are France, the UK, the Other Southern Europe group (comprising Cyprus, Greece, Malta and Portugal), and the Benelux countries (Belgium, Netherlands, Luxembourg), where municipalities report, on balance, a decline in their investment share over the past five years (Figure 11).

Figure 11 Change in municipality investment share. Net balance of municipalities that saw their investment share increase/decrease (in %)



Source: EIB Municipality Survey.

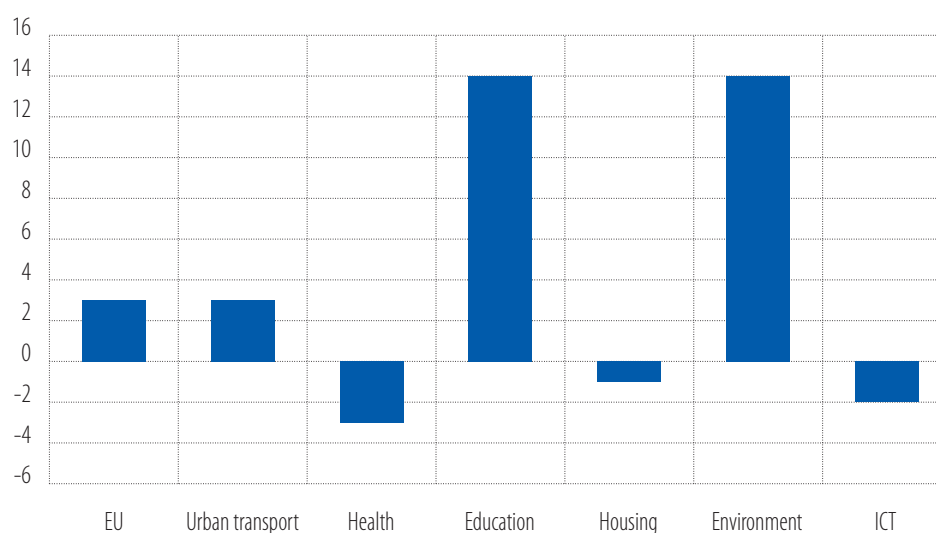
Note: Authors calculations.

Question: Over the last five years has the infrastructure investment share of your municipality increased, decreased or stayed around the same?

Municipalities stepped up their activities in particular in the areas of education and environmental infrastructure. The increase in municipalities' investment share at the EU level is driven primarily by higher investment shares in the education and environmental sector. Italy is an exception to this, with a fall in the municipality share of infrastructure investment in the education sector.¹³ The relative importance of municipality investment in the health and information and communications technology (ICT) sectors, on the other hand, declined in most countries, with the largest declines reported by municipalities in the UK and Germany (Figure 12).

¹³ Investment activities at the local level seem to have held up better than at the aggregate level. This is particularly pronounced in the education sector. A possible explanation for this might also be that for this sector – more than others – municipalities may have answered the question taking into account investment activities that go beyond the bricks and mortar component of infrastructure investment (that is captured in the aggregate figures).

Figure 12 Change in municipality investment share by sector. Net balance of municipalities that saw their investment share increase/decrease (in %)



Source: EIB Municipality Survey.

Note: ICT: information and communications technology. Authors calculations.

Question: Over the last five years has the infrastructure investment share of your municipality increased, decreased or stayed around the same?

Box 2 The EIB Municipality Survey

A key motivation for carrying out this survey is that municipalities should be well placed to assess how infrastructure investment activities relate to infrastructure investment needs and gaps and what bottlenecks impede infrastructure investment activities as they are involved in infrastructure investment activities – from planning to actual implementation – on a day-to-day basis.

The survey was administered by telephone (in the local language) and targeted mayors, treasurers and/or municipalities' chief civil engineers. It took on average (median) 20 minutes to complete. Fieldwork took place between April and August 2017. As part of the survey, 555 municipalities were interviewed in all 28 Member States, split across the following countries and country groupings (regions).

France	36
Germany	30
Italy	30
Spain	30
Poland	30
UK	35
Other Northern Europe (Austria, Denmark, Finland, Ireland, Sweden)	92
Other Southern Europe (Cyprus, Greece, Malta, Portugal)	58
Other Central Europe (Czech Republic, Hungary, Slovakia, Slovenia)	67
South East Europe (Bulgaria, Croatia, Romania)	56
Baltics (Estonia, Latvia, Lithuania)	45
Benelux (Belgium, Netherlands, Luxembourg)	46

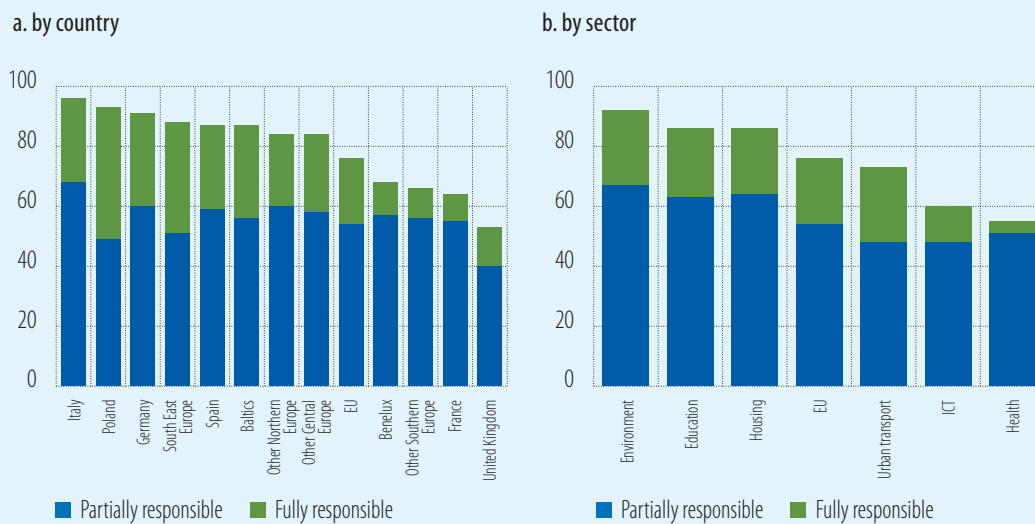
The sample frame from which municipalities were randomly selected was a comprehensive list of European cities. All larger municipalities were eligible to be included in the exercise. The exact size cut-off was decided country by country to ensure a minimum number of interviews per country, which was between 10 and 35 (depending on the size of the country).¹⁴ The survey results can thus be interpreted as reflecting the views of larger municipalities in each country.

Sector-specific answers were aggregated into an infrastructure aggregate using country-specific sector weights based on public investment shares by sector. Regional and EU-wide figures are weighted using country weights based on the urban population in each country, thus taking into account size differences across countries. Within countries, answers are unweighted, giving each municipality the same weight.

More information about the design of the Municipality Survey can be found in the 2017 EIBIS technical report. Detailed results of the survey will be published in a separate publication entitled “EIBIS 2017: Municipality Infrastructure Investment Activities”. Both publications will be available on www.eib.org/eibis.

The survey results show that, on average, about 75% of municipalities are at least partially responsible for infrastructure investment activities within their jurisdiction. This share is highest in Italy (with 96% of municipalities reporting at least partial responsibility for infrastructure investment activities) and lowest in the UK (with 53%). From a sectorial perspective, municipality responsibilities are particularly high in the environmental sector (92%), education sector (87%), and for investments related to social housing (87%) (Figure B.2.1).

Figure B2.1 Share of municipalities with at least partial responsibility for infrastructure investment, by country and sector (Share of municipalities, in %)



Source: EIB Municipality Survey.

Note: ICT: information and communications technology. Authors calculations.

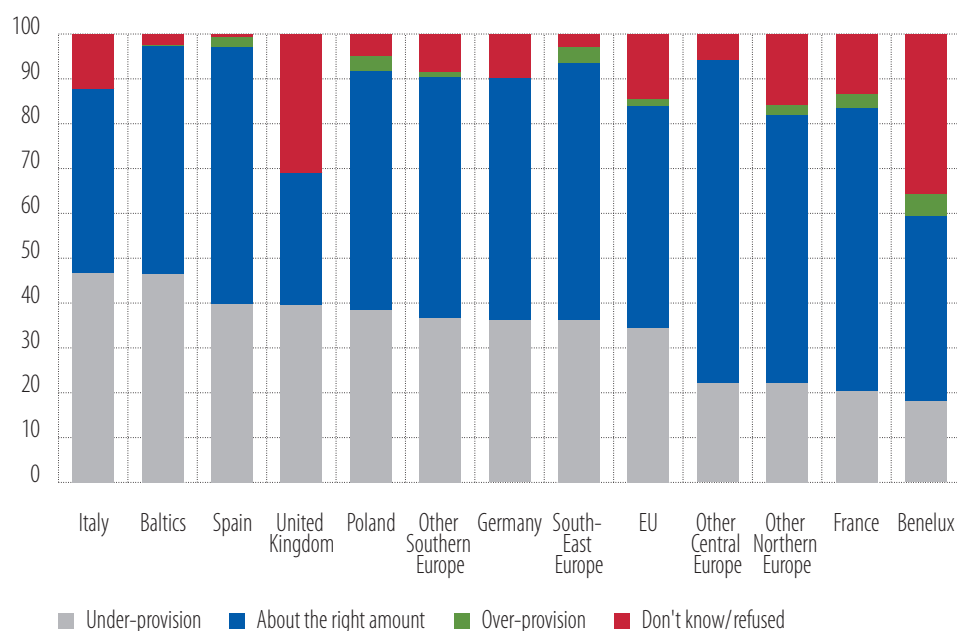
Question: Is your municipality fully responsible, partially responsible or not at all responsible for each area?

¹⁴ The sample was generally provided at a ratio of 5:1 (for each completed interview).

Despite a better than overall investment performance, municipalities report substantial infrastructure gaps

The slightly better than overall investment activities were not sufficient to prevent perceived investment gaps from arising. When asked whether they consider their investment activities over the past five years to have been in line with needs, above needs, or below needs, 50% of municipalities state that activities have been more or less in line with needs, 34% say that they have been below needs, but only 0.5% say that they have been above needs. Perceived gaps are bigger among larger municipalities and most pronounced in Italy, the Baltics and the UK, where on balance nearly one in two municipalities report under-investment (Figure 13).

Figure 13 Infrastructure investment gaps (% of municipalities)



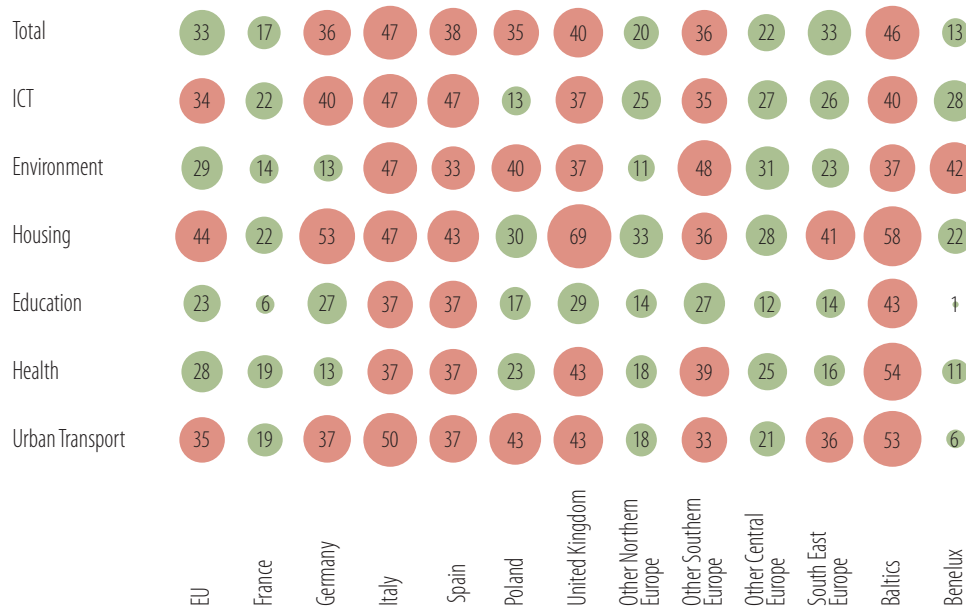
Source: EIB Municipality Survey.

Note: Authors calculations.

Question: For each of the following, would you say that, overall, past investment in your municipality has ensured the right amount of infrastructure, or led to an under-provision or over-provision of infrastructure capacity?

Social housing, urban transport and ICT are most frequently named as areas where investment activities have been below needs. However, factors specific to the country or region dominate sectorial factors when it comes to perceived investment gaps. Figure 14 plots the net balance of municipalities that report under-investment by country/region and sector. It shows that while social housing, urban transport and ICT are the sectors most frequently named as having seen investments below needs, the extent to which this is true differs across countries. For example, while under-investment in ICT infrastructure seems to be a big issue in Germany, Italy, Spain and the Baltics, the same cannot be said about Poland or France.

More generally, Figure 14 shows that perceived infrastructure investment gaps tend to have a strong country dimension, so that either all sectors in a particular country/region receive relatively high mentions or none do. This suggests that country-specific/regional factors have a stronger effect on infrastructure investment (relative to needs) than sectorial ones.

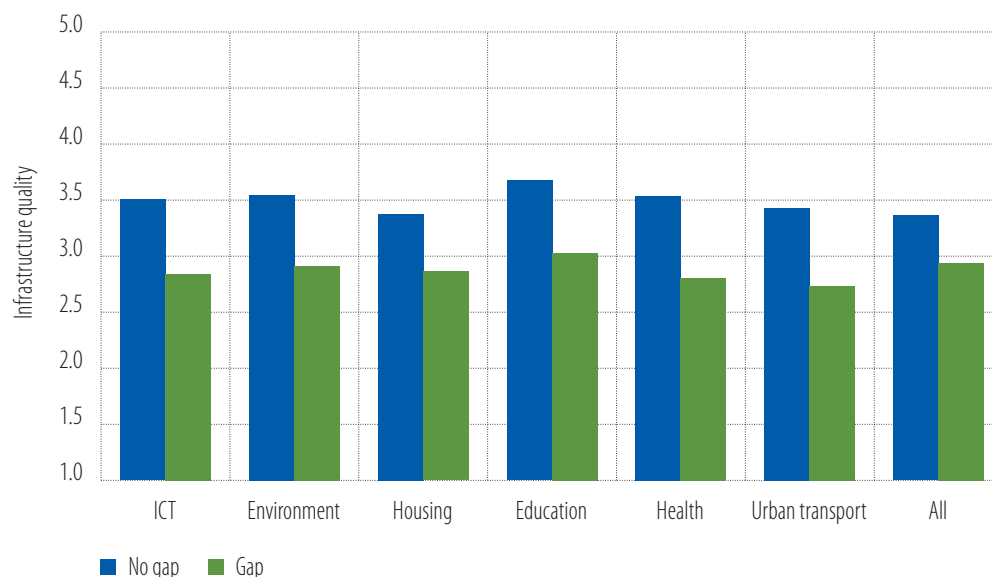
Figure 14 Under-provision of infrastructure by country and sector (%)

Source: EIB Municipality Survey.

Note: The figure plots the net balance of municipalities that report under-investment by country/region and sector. The number inside each circle states the net balance of municipalities that report under-investment vis-à-vis over-investment for a particular area in a country/region (in %). A red circle indicates a net balance above the median, a green one below the median. Authors calculations.

Question: For each of the following, would you say that, overall, past investment in your municipality has ensured the right amount of infrastructure, or led to an under-provision or over-provision of infrastructure capacity?

Perceived infrastructure gaps are correlated with poor infrastructure quality. As part of the survey, municipalities were asked to assess, for each sector, the quality of the infrastructure in their jurisdiction on a scale from 1 to 5, where 1 means completely outdated and 5 up to the latest international standards. Comparing municipalities' answer to this question for those that report under-investment and those that report sufficient investment over the past five years, clear differences occur: municipalities that have seen under-investment in infrastructure in the past five years tend to report, across all sectors, a lower quality of the infrastructure stock in their jurisdiction, suggesting that under-investment has either left a mark on municipalities' infrastructure stock and/or, in line with the macro picture, has affected municipalities with a poor infrastructure stock disproportionately (Figure 15).

Figure 15 Infrastructure quality by sector and investment gap

Source: EIB Municipality Survey.

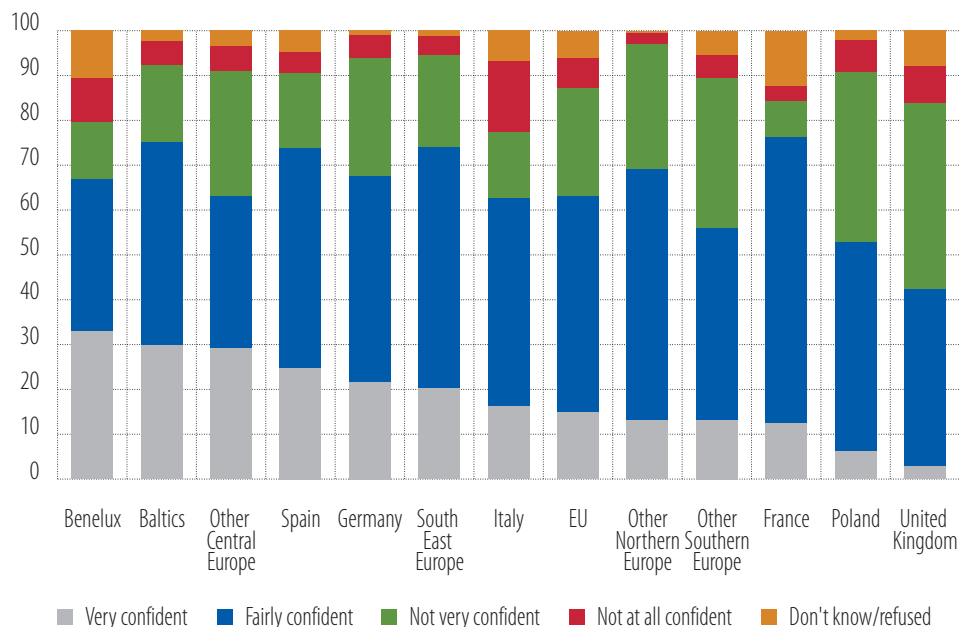
Note: ICT: information and communications technologies. No gap means sufficient investment. Gap means under-investment. Authors calculations.

Question: How would you assess the quality of infrastructure in each of these areas in your municipality on a scale of 1 to 5, where 1 means it is completely outdated and 5 means it is up to latest international standards?

Large perceived infrastructure gaps notwithstanding, municipalities are modestly optimistic that perceived gaps can be closed over the next five years (Figure 16). 63% of municipalities are fairly or even very optimistic that perceived investment gaps can be closed in the next five years; 6% don't know; and 31% are sceptical. Municipalities are most optimistic (very confident or fairly confident) in France (76% of municipalities are fairly or very optimistic), the Baltic States (75%) and the countries in the South East Europe region, comprising Bulgaria, Croatia and Romania (74%).

The highest share of sceptical answers (not very confident or not at all confident) are in the United Kingdom (49%), Poland (45%), and the group of Other Southern European countries (Cyprus, Greece, Malta, Portugal) (38%).

From a sectorial perspective, municipalities are most optimistic that perceived investment gaps can be closed for the ICT and education sectors, and least optimistic for health and urban transport.

Figure 16 Ability to close investment gap (% of municipalities)

Source: EIB Municipality Survey.

Note: Authors calculations.

Question: How confident are you that the under-provision will be addressed in the next five years?

Political and regulatory (in)stability is a key factor limiting the ability of municipalities to close the perceived investment gaps. We regressed whether a municipality believes that a perceived investment gap can be closed in the next few years on what it considers to be (major) obstacles to infrastructure investment – including the balance between revenues and expenditures, debt ceilings, access to external finance, technical capacity, coordination with other entities, the length of the regulatory process for infrastructure projects, and political and regulatory (in)stability, and also taking into account country/region fixed effects. The one variable that stands out is political and regulatory (in)stability.

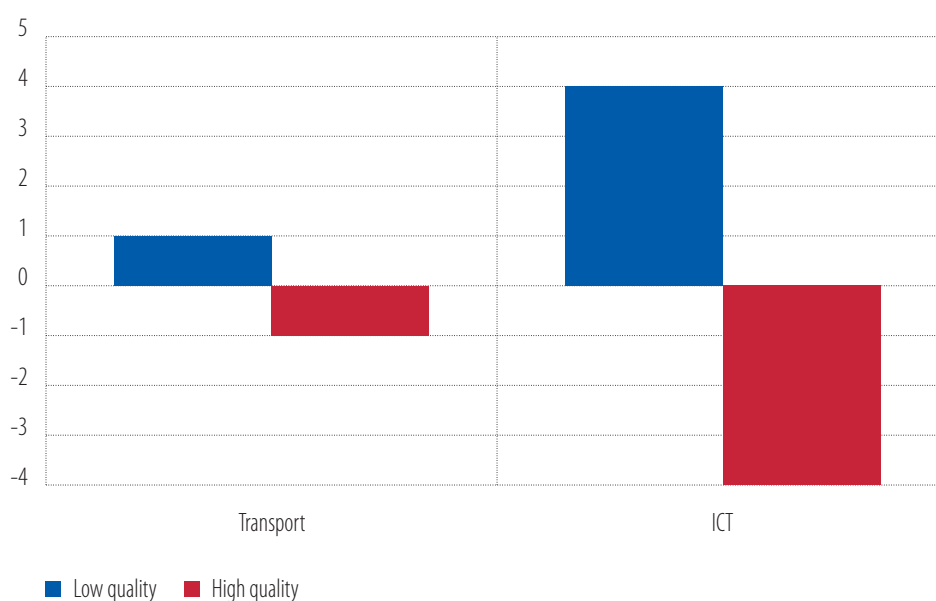
Municipalities that struggle with this dimension are more pessimistic that perceived investment gaps can be closed. This is true particularly in the case of health and education projects (which seem to be especially sensitive to political and regulatory instability). In the case of social housing, the balance between revenues and expenditures also matters, possibly because municipalities tend to rely more on their own funds for investment activities in this area.

Municipalities' assessment of their infrastructure stock is mirrored in companies' views

Municipalities' assessment of the quality of the infrastructure stock in their jurisdiction corresponds largely with firms' views. Every year, the main module of the EIB Investment Survey asks about 12,500 companies across all 28 Member States about their investment activities, needs, gaps and obstacles to investment. In 2017, for the first time, firms were also asked what area of public spending they would prioritise if they could pick just one. The areas firms could choose from included public transport, child care, social housing, energy supply, hospitals and health care, ICT, transport infrastructure (more generally) and professional training and higher education.

Matching firms' answers to this question with the corresponding municipality answers (at the regional level),¹⁵ we find a positive correlation between municipalities' assessment of the state of the infrastructure stock in their jurisdiction and firms' views on this issue. Figure 17 shows that in regions where municipalities tend to report a below-average infrastructure stock, in either transport infrastructure or ICT infrastructure,¹⁶ firms also tend to report these two areas more often as the most important policy priorities for the coming years.

Figure 17 Share of firms that report transport or ICT infrastructure as the main policy priority for the coming years, by regions with low and high reported quality. Difference (in %)



Source: EIB Municipality Survey and EIBIS main module.

Note: Authors calculations.

Question: Firms: From your business's perspective, if you had to prioritise one area of public investment for the next three years, which one would it be?

Poor infrastructure quality hampers firms' investment. Apart from asking what firms consider to be the most important public policy priority for the coming years, EIBIS also asks how different aspects (including poor transport infrastructure and/or ICT infrastructure) affect their investment activities.

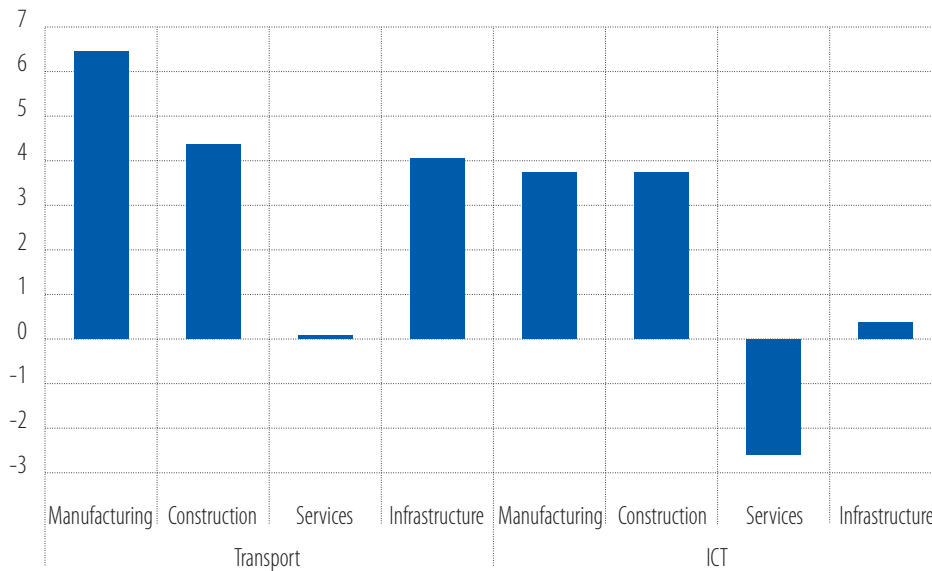
The matched firm-municipality data show that firms that are located in regions where municipalities consider the local infrastructure to be rather poor are more likely to also regard it as a barrier to investment. This is true in particular for firms active in the manufacturing and construction sectors, as well as – in the case of transport – firms active in the infrastructure sector.

Figure 18 illustrates this relationship, plotting the difference between the share of firms naming transport/ICT a barrier to investment for those located in regions with a poor infrastructure quality and those located in regions with a high infrastructure quality. It shows that the share of firms reporting transport/ICT as an obstacle is higher in the first group than the second one for most sectors (but most so in manufacturing and the construction sector).

¹⁵ We aggregate municipalities' answers at the NUTS3 (Nomenclature of Territorial Units for Statistics) level of small regions for specific diagnosis. A more detailed matching is not possible due to the anonymity of answering municipalities.

¹⁶ We focus on ICT and transport infrastructure because these are the two areas with the biggest overlap between the EIBIS firm-level and municipality surveys.

Figure 18 Share of municipalities considering transport and ICT infrastructure to be barriers to investment. Difference between regions with poor infrastructure quality and high infrastructure quality (in %)



Source: EIB Municipality Survey and EIBIS main module.

Note: ICT: information and communications technologies. Authors calculations.

Question: Firms: Thinking about your investment activities in the country, to what extent is each of the following an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all?

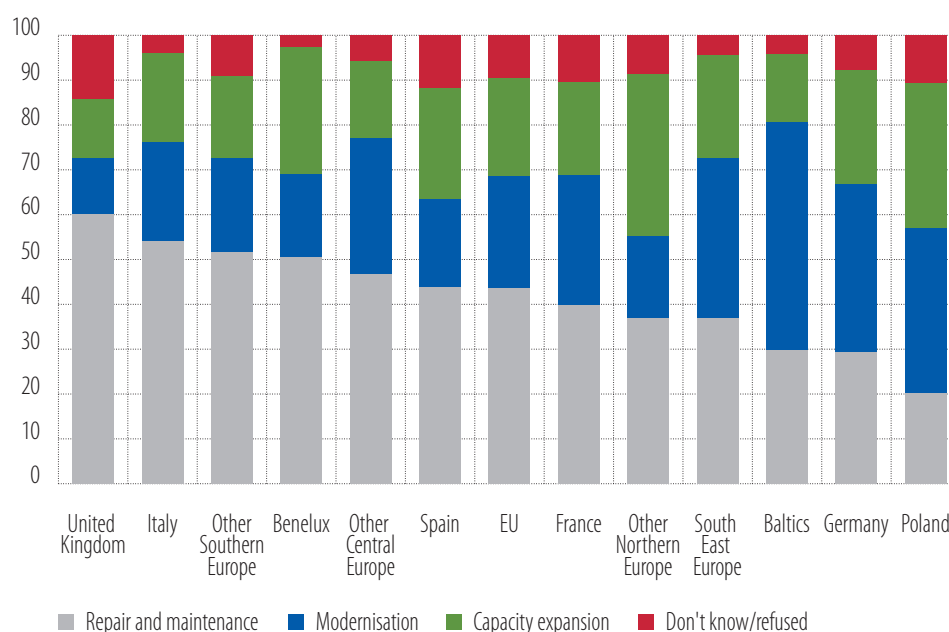
The link between reported infrastructure gaps and firms' perceptions of (inadequate) infrastructure as a barrier to investment is probably an understatement of the issue. Firms for which the state of the infrastructure stock is critical to their activities are likely to have located to areas with a better infrastructure stock. What this means is that firms that are most sensitive to changes in infrastructure investment/infrastructure gaps are least likely to be located in regions that have a very poor infrastructure quality. This suggests that the link between reported infrastructure quality and firms' perception of whether poor infrastructure is a barrier to investment is most certainly a lower-bound estimate of the relationship between the two variables.

Perceived investment gaps are often related to the need for capacity expansion and modernisation

Looking ahead, municipalities expect to allocate the largest share of their investment spend to the "repair and maintenance" of existing infrastructure. 44% of municipalities name this as their main investment area for the next five years. This is followed by "modernisation" of existing infrastructure (with 25% of mentions) and "capacity expansion" activities (21%).

This pattern holds for most countries/regions (Figure 19). Municipalities in Germany, Poland and the Baltics are the only ones where "modernisation" plans predominate over "repair and maintenance." "Capacity expansion" activities play the most prominent role in the group of Other Northern European countries, comprising Austria, Denmark, Finland, Ireland and Sweden, receiving the same share of mentions as "repair and maintenance."

Figure 19 Main infrastructure investment areas for the next three years (% of municipalities)



Source: EIB Municipality Survey.

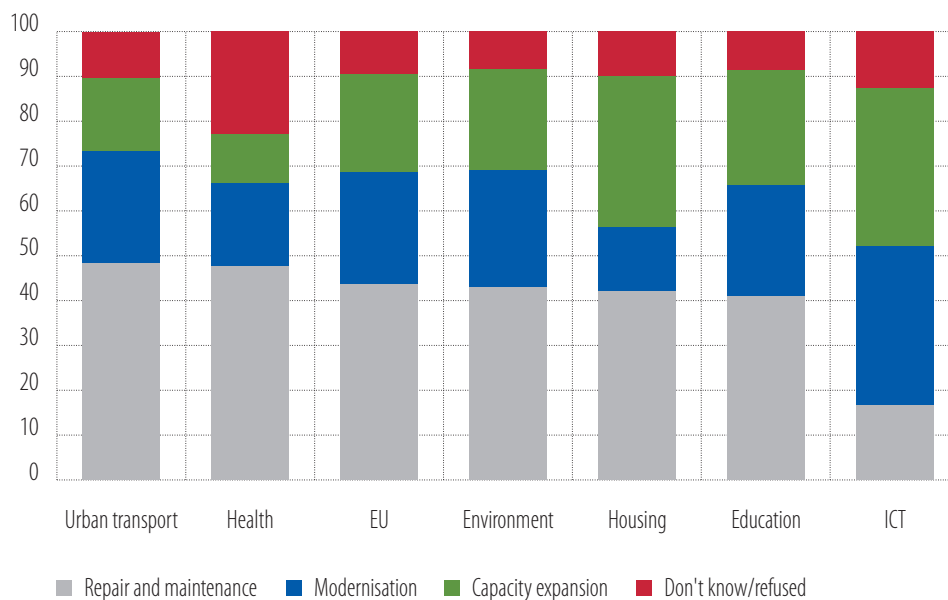
Note: Authors calculations.

Question: Looking ahead to the next five years, will the largest share of your spending on infrastructure in each of these areas be for maintenance and repair, modernisation or the construction of new infrastructure?

There are few differences in main investment areas for the coming years across sectors, with “repair and maintenance” mentioned most often (Figure 20). The one exception is ICT: about 35% of municipalities state that their main investment area in ICT will be “capacity expansion,” matched by “modernisation” (also 35%), with “repair and maintenance” taking only a distant third place (17%).

The high share of “capacity expansion” plans in ICT is driven in particular by the group of Other Northern European countries, Germany and Benelux.

Figure 20 Main infrastructure investment areas for the next three years by sector (% of municipalities)



Source: EIB Municipality Survey.

Note: ICT: Information and communications technologies. Authors calculations.

Question: Looking ahead to the next five years, will the largest share of your spending on infrastructure in each of these areas be for maintenance and repair, modernisation or the construction of new infrastructure?

Perceived investment gaps are often related to capacity constraints and modernisation needs. While “repair and maintenance” is most frequently named by municipalities as a future investment focus, municipalities with perceived under-investment more often report “capacity expansion” and “modernisation” as their investment focus for the coming five years.

Figure 21 shows the share of municipalities that report investment priorities by country and region, separately for municipalities that report under-investment and those that do not. It shows that for municipalities that report under-investment, “capacity expansion” and “modernisation” plans tend to play a more important role than for municipalities that report investment in line with/above needs.¹⁷

This suggests that under-investment is often related to a need to add new capacity and/or upgrade the existing infrastructure stock, assuming that these differences reflect – at least to some extent – the true nature of perceived investment gaps.

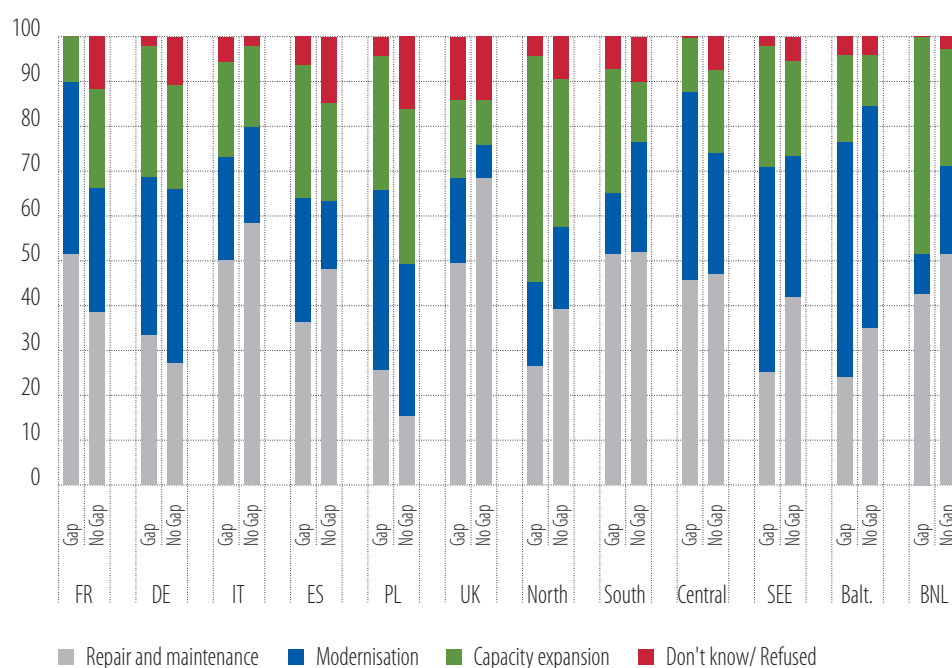
Figure 21 also shows that the link between investment and “capacity expansion” plans is particularly notable in the Other Northern European countries’ grouping (with the education, social housing and ICT sectors driving the results) and the Benelux countries (where education, environment and ICT are driving the differences).

Perceived investment gaps and modernisation needs are particularly closely intertwined in France and the Other Central European countries group. An in-depth look suggests that this is due to urban transport and ICT in the case of France, and urban transport, ICT and education in the Other Central European countries.

¹⁷ This finding also holds in a regression framework.

Repeating the same exercise for each sector separately, we find that perceived investment gaps are related to capacity and modernisation needs in the ICT and environmental sectors, and to capacity expansion plans alone in the education, health and social housing sectors. Urban transport is the only sector in which there is no association between perceived investment gaps and the need for repair and maintenance, modernisation and/or capacity expansion, respectively.

Figure 21 Principal infrastructure investment areas for the next three years by country and perceived investment gap (in %)



Source: EIB Municipality Survey.

Note: Authors calculations.

Note: This chart combines two variables:

Question: Looking ahead to the next five years, will the largest share of your spending on infrastructure in each of these areas be for maintenance and repair, modernisation or the construction of new infrastructure? and

Question: For each of the following, would you say that, overall, past investment in your municipality has ensured the right amount of infrastructure, or led to an under-provision or over-provision of infrastructure capacity?

Balt.: Baltics; BNL: Belgium, Netherlands, Luxembourg; North: Other Northern European countries; South: Other Southern European countries; Central: Other Central European countries; SEE: South East Europe. No gap means sufficient investment. Gap means under-investment.

Policy priorities are sector-dependent

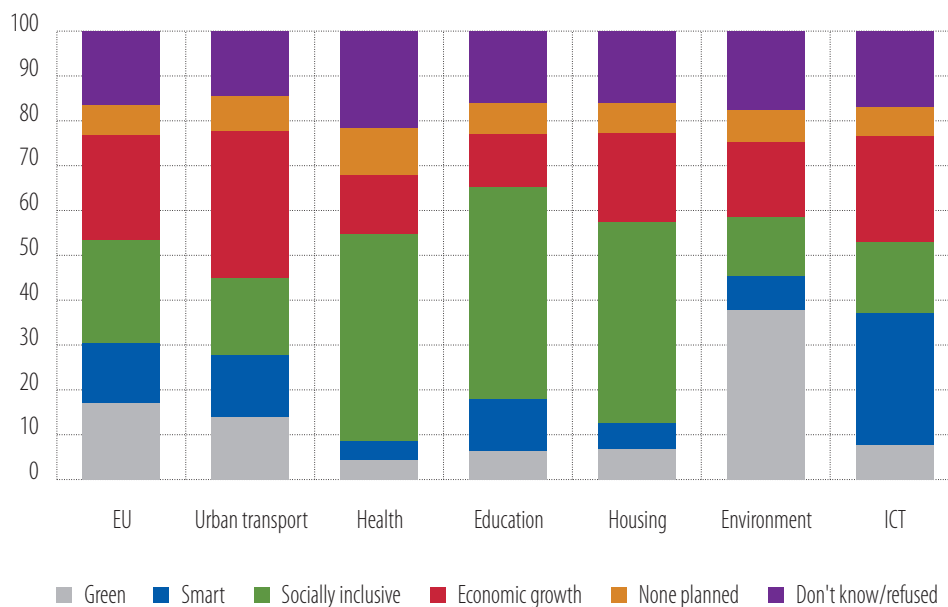
From a policy perspective, municipalities' main focus for the coming years is to invest in growth-friendly infrastructure and infrastructure that is socially inclusive (Figure 22). Infrastructure investments can address different policy purposes: they can help to make a municipality greener, smarter or more socially inclusive, and/or boost economic growth. When asked which of these will play the most important role in the coming years, 23% of municipalities cite as their first priority to boost economic growth; 23% to make the existing infrastructure more socially inclusive; 17% to make it greener; and 13% to make it smarter.¹⁸

Each sector has a "salient" policy priority from which municipalities tend not to deviate. Differences in municipalities' policy priorities reflect different needs and exposure to mega-trends such as technological change, globalisation and demographic change (Box 3 examines the latter in detail).

Equally important are municipalities' sectorial responsibilities: municipalities tend to put most emphasis on making infrastructure more socially inclusive in the health, education and housing sectors. For investments in urban transport, they tend to focus on the growth effect of infrastructure investments, whereas for environmental investments, the key policy priority is to work towards greener infrastructure (Figure 22).

As a consequence, in countries/regions in which municipalities are heavily involved in infrastructure investment activities in one or more sectors, this will also be reflected in the choice of policy priorities.

Figure 22 Future policy priorities by sector (% of municipalities)



Source: EIB Municipality Survey.

Note: Authors calculations.

Note: ICT: Information and communications technologies.

Question: Of the following, what would you say will be the main priority over the next five years?

¹⁸ Green infrastructure was defined in the questionnaire as infrastructure that is designed to improve biodiversity and mitigate against/adapt to climate change. Smart infrastructure was defined as infrastructure that makes use of information technology to increase the delivery of public services. Socially inclusive infrastructure was defined as infrastructure that is equally accessible for all individuals and groups in a municipality.

Indeed, further analyses¹⁹ show that municipalities tend not to deviate much from the “salient” policy priority within each sector across countries: that is, across all countries, municipalities aim to make the infrastructure in their jurisdiction more socially inclusive in the health, education and housing sectors; greener in the environmental sectors; smarter for ICT infrastructure; and more growth friendly in the urban transport sector.

Notable exceptions exist, however. In Spain, for instance, municipalities put a relatively large emphasis on green infrastructure and making their infrastructure more socially inclusive in the area of urban transport. Municipalities in the Baltics and South East Europe (which includes Bulgaria, Croatia and Romania) stand out in terms of paying attention to making existing infrastructure smart (particularly in the education sector). Municipalities in Germany, the UK, and Poland place more emphasis on a positive growth effect in the area of environmental infrastructure investment.

About 16% of municipalities say that they have no investment planned for the next five years. About one in six municipalities say that they have no infrastructure investment foreseen for the next five years.

Box 3 Demographic change and infrastructure needs

The size and age structure of the population are important determinants of infrastructure needs. Size matters because it determines the number of potential users. Changes in the age structure affect infrastructure needs, though this link is less well researched. For example, an ageing society is likely to require fewer schools but more investment in health infrastructure. Also, consumption patterns change by age, with important implications for infrastructure needs. For instance, older people are more likely to live in rural areas, travel less and use different transport and communication means compared to mid-aged individuals.

Moreover, migration patterns can substantially affect the size, age structure and consumption patterns of a population, with far-reaching implications for infrastructure needs. Inward and international migration is also one reason for the substantial regional differences in demographic developments and thus future infrastructure needs (National Infrastructure Commission, 2017; OECD, 2017).

Though less obvious, infrastructure investment may also affect demographic trends. This reversed link highlights the leeway policymakers have in responding to demographic trends by providing adequate infrastructure. For instance, the quality and quantity of available childcare facilities affects fertility and location choices of individuals, which over time may affect the demographic characteristics of a region (Noya et al., 2012).

Current trends in demographic change and urbanisation imply a shrinking and ageing population in many municipalities and rural areas in the EU. This requires investment in the conversion and demolition of existing infrastructure stocks (Noya et al., 2012).

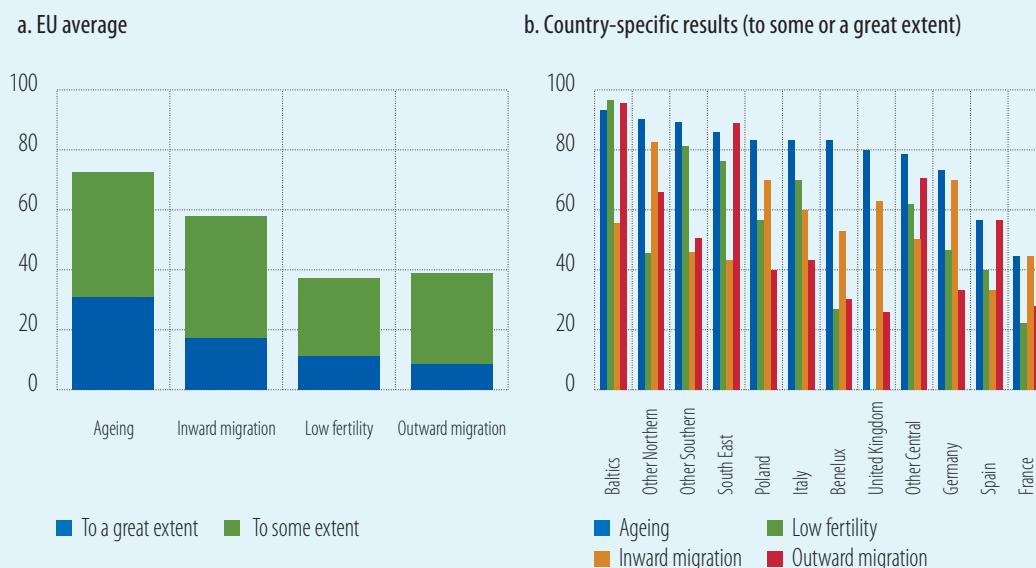
In Germany, where demographic change sets in comparatively early, municipalities identify a considerable need for investment in age-appropriate infrastructure due to an ageing society, and for demolition of existing infrastructure due to population shrinkage (Köller, 2013).

¹⁹ We regressed municipalities’ choice of policy priorities in each sector on country/region dummies using a multinomial logit framework in which the “salient” policy priority for each sector is taken as the “base outcome”.

The EIB Municipality Survey 2017 reveals that ageing is an important driver of demographic change (Figure B4.1). 73% of municipalities consider ageing to a great or some extent to be a driver of demographic trends, followed by inward migration. Low fertility and outward migration play less of a role.

Ageing is a critical driver of demographic change in almost all countries. Only in France do less than 50% of municipalities report ageing as a driver of demographic change. Low fertility was particularly often mentioned by municipalities in the Baltics and Other Southern European countries. Inward migration is reported as a driver of demographic change most often in Northern Europe, Poland and Germany. By contrast, outward migration is most often mentioned by municipalities in the Baltics and South East Europe.

Figure B3.1 Drivers of demographic trends (%)



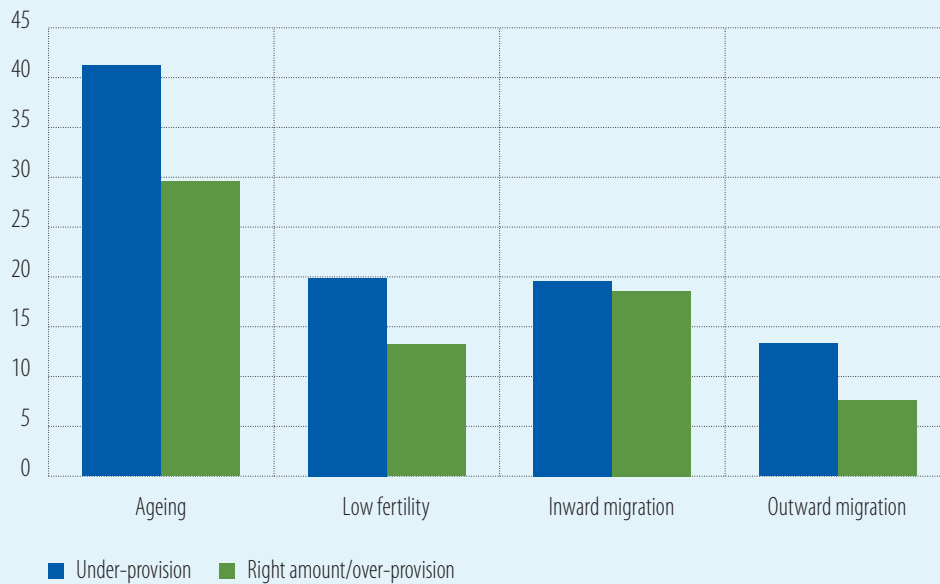
Source: EIB Municipality Survey.

Note: Authors calculations.

Question: To what extent does each of the following impact the demographic situation in your municipality?

All four drivers of demographic change are reported more often by municipalities with perceived infrastructure gaps (Figure B3.2). The difference between municipalities with and without perceived infrastructure gaps is most pronounced for ageing. This finding suggests that municipalities see a link between ageing and perceived infrastructure investment gaps.

Figure B3.2 Perceived infrastructure investment gaps and main drivers of demographic change
(% of municipalities with/without perceived infrastructure investment gap)



Source: EIB Municipality Survey.

Note: Authors calculations.

Question: To what extent does each of the following impact the demographic situation in your municipality?

Question: For each of the following, would you say that, overall, past investment in your municipality has ensured the right amount of infrastructure, or led to an under-provision or over-provision of infrastructure capacity?

Interestingly, differences in demographics are not reflected in municipalities' infrastructure investment plans. Regressing municipalities' policy priorities for the next five years on their assessment of the demographic situation in their jurisdiction reveals no significant pattern between demographics and infrastructure investment plans.

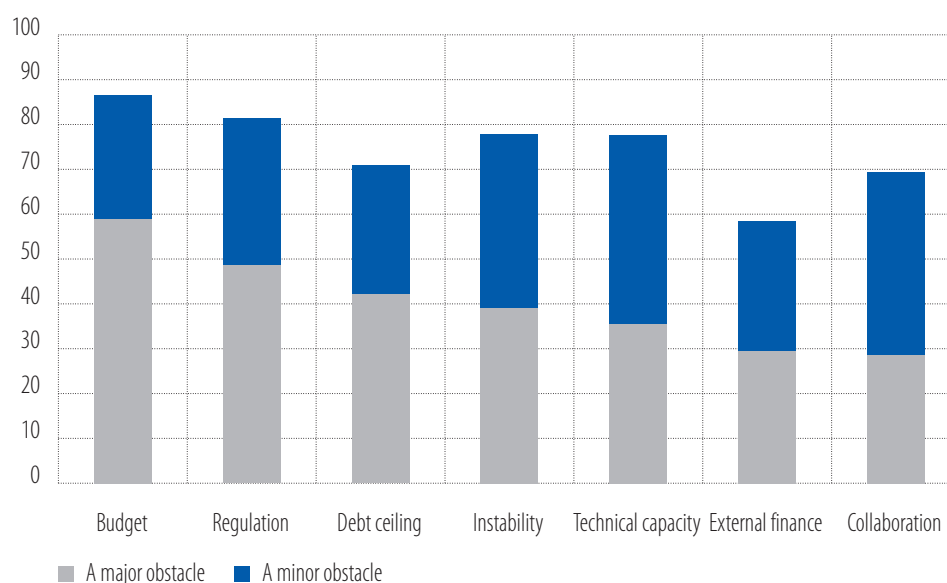
This suggests that ageing, migration and fertility have not yet found their way into the infrastructure planning processes, though perceived as important drivers of demographics by municipalities.

Municipalities perceive fiscal constraints and regulation to be the main obstacles to infrastructure investment

Infrastructure investment by municipalities is held back by a range of obstacles, with fiscal constraints and regulation reported most often (Figure 23). 59% of municipalities report tight budgets as a major obstacle, while 42% report the debt ceiling as a major constraint. Overall, 70% of municipalities report at least one of the two as major obstacles to infrastructure investment, highlighting the importance of fiscal constraints for local infrastructure investment.

Moreover, half of the municipalities report the length of the regulatory process to approve a project as a major obstacle for their infrastructure investment. Capacity building and collaboration with national authorities and other municipalities are mentioned by roughly one third of municipalities as major obstacles (see Box 4). Less than 30% of municipalities report external finance as a major obstacle. On the financing side, budgetary limitations as well as debt ceilings seem to constrain infrastructure investment more than access to finance.

Figure 23 Obstacles to infrastructure investment reported by municipalities (% of municipalities)



Source: EIB Municipality Survey.

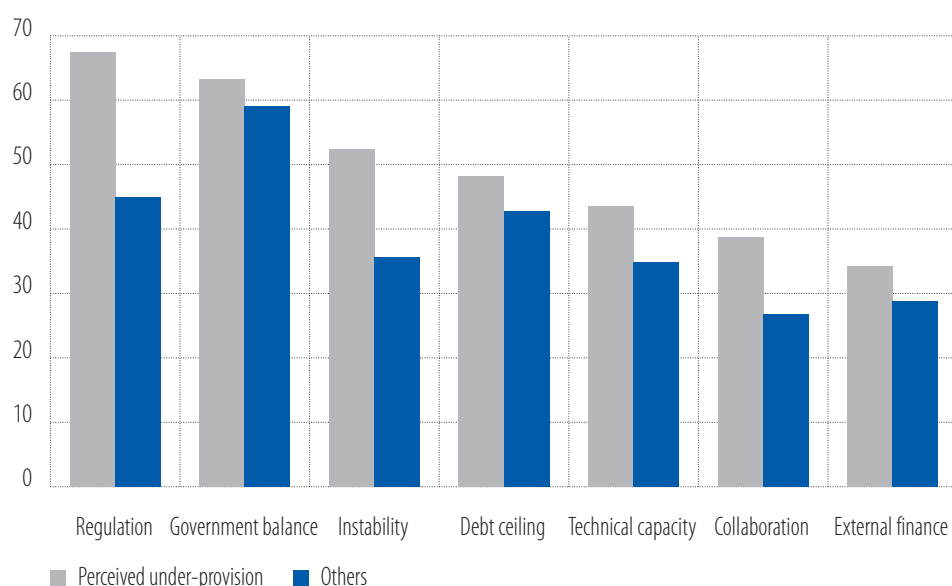
Note: Authors calculations.

Question: To what extent is each of the following an obstacle to the implementation of your infrastructure investment activities? Is it a major obstacle, a minor obstacle or not an obstacle at all? (1) Balance between revenues and operating expenditure; (2) Limit on amount of debt the municipality can borrow; (3) Access to external finance (excluding funding from other government bodies); (4) Technical capacity to plan and implement infrastructure projects; (5) Coordination between regional and national policy priorities (including among municipalities); (6) Length of regulatory process to approve a project; (7) Political and regulatory stability.

Municipalities with perceived infrastructure investment gaps report all obstacles more often than municipalities without perceived gaps, particularly for regulation and instability (Figure 24). Looking only at municipalities with perceived investment gaps within their jurisdiction reveals that 75% of them say that the government balance and/or debt ceilings are major obstacles to their infrastructure investment. The difference between municipalities with and without perceived investment gaps is particularly pronounced and statistically significant for regulation, instability and collaboration.

It is important to note that municipalities report obstacles with respect to their own infrastructure investment, whereas perceived infrastructure investment gaps refer to overall infrastructure investment within the boundaries of the municipalities. Perceived gaps therefore also include infrastructure for which the municipality is not in charge, such as infrastructure that is financed by and under the control of the central government.

Figure 24 Major obstacles and reported infrastructure investment
(% of municipalities with perceived under-provision, or other municipalities)



Source: EIB Municipality Survey.

Note: Authors calculations.

Question: To what extent is each of the following an obstacle to the implementation of your infrastructure investment activities? Is it a major obstacle, a minor obstacle or not an obstacle at all? (1) Balance between revenues and operating expenditure; (2) Limit on amount of debt the municipality can borrow; (3) Access to external finance (excluding funding from other government bodies); (4) Technical capacity to plan and implement infrastructure projects; (5) Coordination between regional and national policy priorities (including among municipalities); (6) Length of regulatory process to approve a project; (7) Political and regulatory stability.

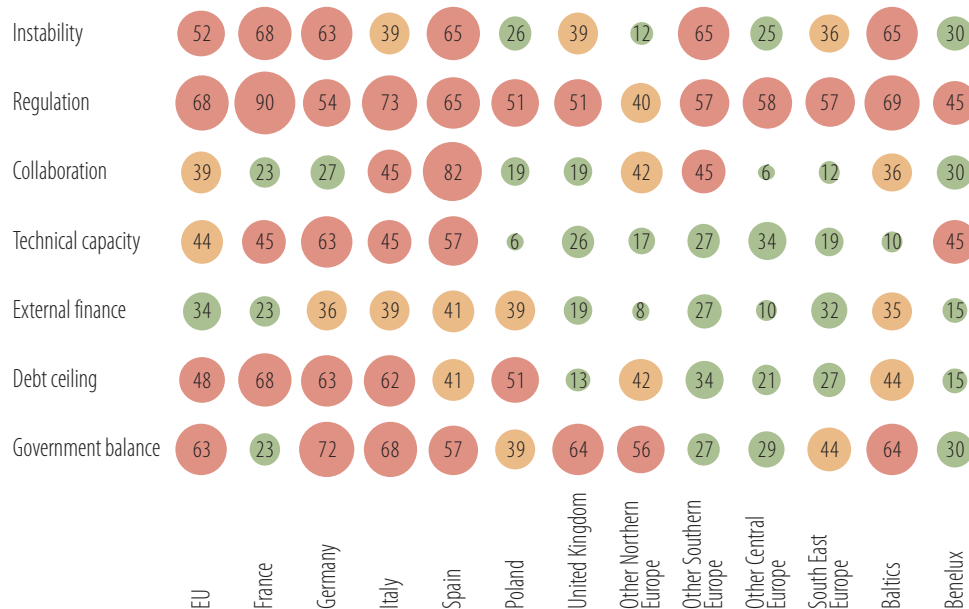
Question: For each of the following, would you say that, overall, past investment in your municipality has ensured the right amount of infrastructure, or led to an under-provision or over-provision of infrastructure capacity?

Substantial differences exist across countries in the assessment of obstacles to local infrastructure investment. Figure 25 shows the share of municipalities with a perceived infrastructure gap that report certain areas as major obstacles to their infrastructure investment by country or region. The share of municipalities with perceived investment gaps that report regulation as a major constraint is particularly high, notably in France and Italy. Political and regulatory instability is a concern for comparatively many municipalities in France, the Baltics and Spain. For France, this may partly reflect uncertainty due to the presidential elections in 2017, which roughly coincided with the period when data were collected. The budget balance is often mentioned as a major constraint by municipalities in Germany and Italy. The share of municipalities reporting external funding as a major obstacle is highest in Italy, Spain and Poland.

The figure also shows that perceived obstacles to infrastructure investment tend to have a strong country dimension. For instance, five constraints are identified as major obstacles by a fairly high proportion of municipalities in Germany, Spain and Italy. By contrast, the share of municipalities reporting major obstacles is low for all but one category in Other Northern European, Other Central European, and South East European countries. Overall, one in two municipalities reports three or more major obstacles.

This suggests that obstacles are often interrelated in various ways. For example, tight debt ceilings may lead to stronger restrictions on municipalities' budget balances. This in turn may create more political tension on how to allocate funds.

Figure 25 Major obstacles identified by municipalities reporting under-provision of infrastructure (%)



Source: EIB Municipality Survey.

In % of municipalities reporting under-provision of infrastructure, a green circle signifies a share of mentions below the 40th percentile and a red circle a share above the 60th percentile. Orange signifies shares in between these two thresholds. The number inside each circle indicates the net balance of municipalities that report under-investment for a particular area in a country or country grouping (region).

Note: Authors calculations.

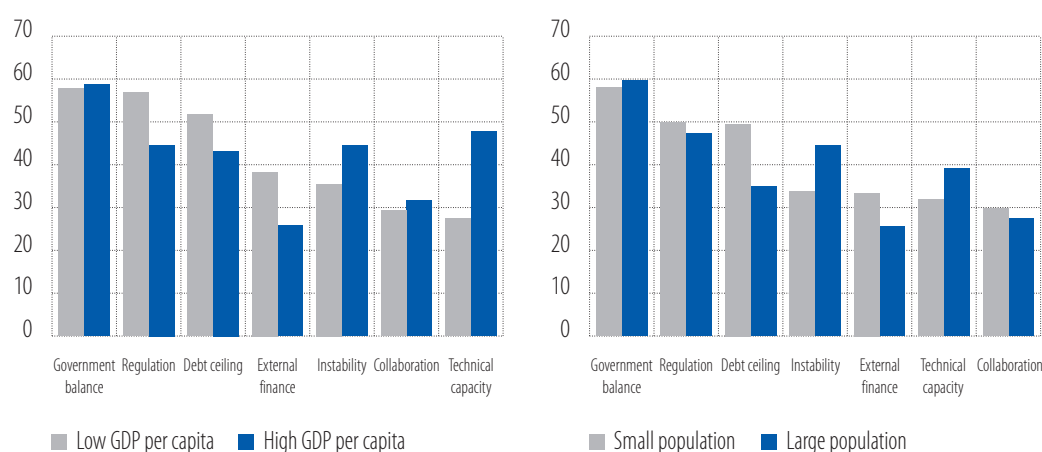
Question: To what extent is each of the following an obstacle to the implementation of your infrastructure investment activities? Is it a major obstacle, a minor obstacle or not an obstacle at all? (1) Balance between revenues and operating expenditure; (2) Limit on amount of debt the municipality can borrow; (3) Access to external finance (excluding funding from other government bodies); (4) Technical capacity to plan and implement infrastructure projects; (5) Coordination between regional and national policy priorities (including among municipalities); (6) Length of regulatory process to approve a project; (7) Political and regulatory stability.

Question: For each of the following, would you say that, overall, past investment in your municipality has ensured the right amount of infrastructure, or led to an under-provision or over-provision of infrastructure capacity?

The assessment of obstacles varies substantially between municipalities with high and low GDP per capita, notably for external finance, regulation and technical capacity (Figure 26). Municipalities with low GDP per capita report external finance and regulation as a major obstacle considerably more often than municipalities with high GDP per capita. Technical capacity is comparatively more often reported as a major obstacle by municipalities with high GDP per capita. One explanation may be that municipalities with high GDP per capita are more likely to deal with complex infrastructure projects.

The assessment of obstacles also varies by size of municipality. Municipalities with a population size below the median report more often debt ceiling and external finance as major obstacles. By contrast, municipalities with a population size above the median more often report instability and technical capacity as major obstacles. It is important to bear in mind, however, that the survey was targeted at larger municipalities, making the results less representative for smaller ones.

Figure 26 Major obstacles and GDP per capita of municipalities
(% of municipalities with low/high GDP per capita or small/large populations)



Source: EIB Municipality Survey.

Note: Authors calculations.

Question: To what extent is each of the following an obstacle to the implementation of your infrastructure investment activities? Is it a major obstacle, a minor obstacle or not an obstacle at all? (1) Balance between revenues and operating expenditure; (2) Limit on amount of debt the municipality can borrow; (3) Access to external finance (excluding funding from other government bodies); (4) Technical capacity to plan and implement infrastructure projects; (5) Coordination between regional and national policy priorities (including among municipalities); (6) Length of regulatory process to approve a project; (7) Political and regulatory stability.

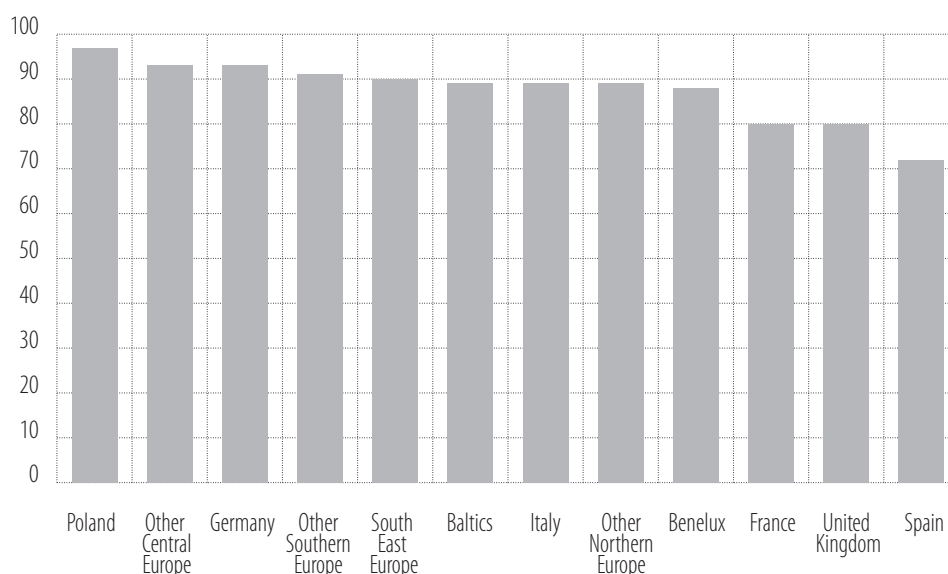
Also use Eurostat data unemployment/income/debt/demography.

Loosening fiscal constraints requires, however, efficient planning and implementation of complex infrastructure projects

Achieving policy priorities requires both sufficient spending and the efficient allocation of resources. A large literature makes the point that EUR 1 spent on public investment does not always yield EUR 1 of productive capital. In the October 2014 *World Economic Outlook*, the International Monetary Fund argues, for example, that when “the efficiency of the public investment process is relatively low – so that project selection and execution are poor and only a fraction of the amount invested is converted into productive capital stock – increased public investment leads to more limited long-term output gains” (IMF 2014).

At first glance, municipalities seem to be aware of the complexities associated with an efficient allocation of resources (Figure 27). For example, 84% of municipalities state that they have an urban development strategy: that is, a document spelling out the various intertwined challenges – economic, social and environmental – that they face and how best to deal with them. This share is highest in Poland (97%), followed by the group of Other Central European countries (93%) and Germany (93%). The country with the lowest share of municipalities that have an urban development strategy is Spain (72%). Urban development plans are requested for the release of a number of EU funds.

Figure 27 Share of municipalities with an urban development strategy (% of municipalities)



Source: EIB Municipality Survey.

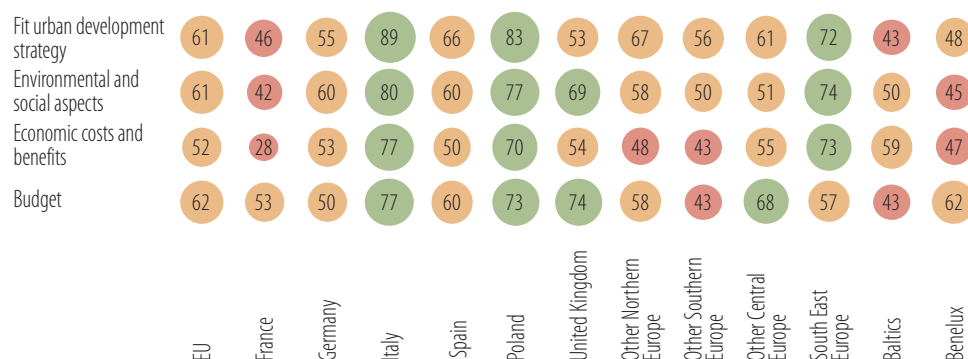
Note: Authors calculations.

Question: Does your municipality have an urban development strategy?

However, not all municipalities take these strategies into consideration when it comes to actual infrastructure planning. Of all municipalities that have an urban development strategy, less than three-quarters (72%) consult this document in the process of planning infrastructure projects. In other words, only 60% of all municipalities assess whether a project is in line with an urban development strategy.

This share corresponds more or less to the share of municipalities that carry out environmental and social impact assessments on infrastructure projects before implementing them (ex ante), and/or assess the budgetary implications of such a project. The share of municipalities that assess the economic costs and benefits of infrastructure investments is even lower (52%). Figure 28 shows the breakdown of different types of ex ante assessments by country.

Figure 28 Ex ante assessments of infrastructure projects (%)



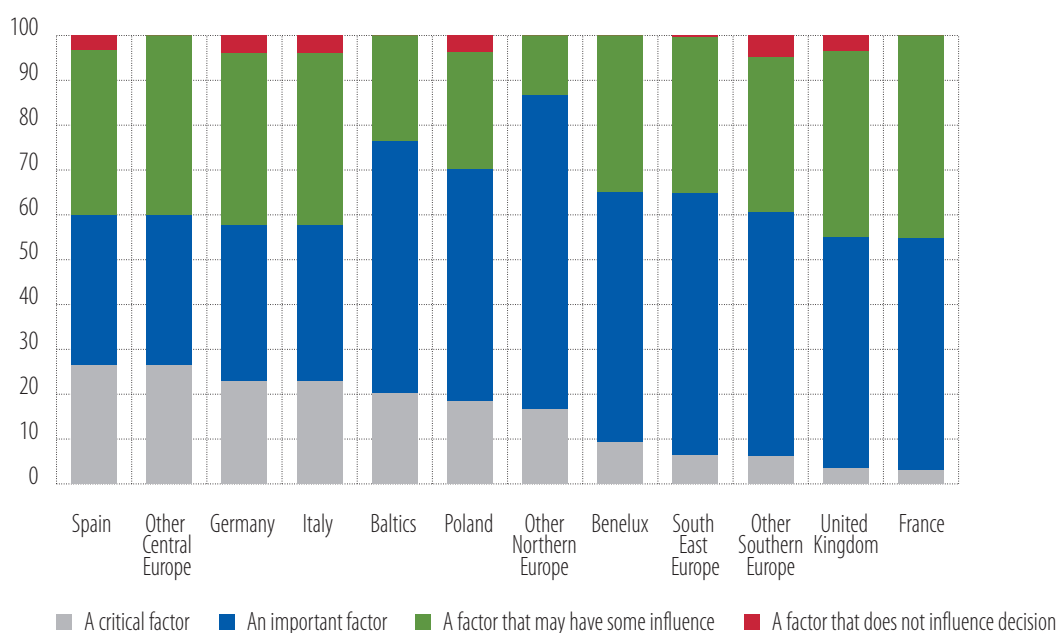
Source: EIB Municipality Survey.

Note: The share of municipalities carrying out an assessment of how an infrastructure project fits their urban development strategy refers to all municipalities (not just those that have an urban development strategy). A green circle signifies a share in the upper tertile, an orange one a share in the middle tertile and a red one a share in the lower tertile. Authors calculations.

Question: Before going ahead with an infrastructure project, do you carry out an independent assessment of...? And: how important would you say are the results of the independent assessment/s when deciding whether or not to go ahead with a project?

Things look less good, once we examine the importance that municipalities attribute to ex ante assessments of infrastructure projects (Figure 29). Overall, of the 60% or so of municipalities that carry out some type of ex ante assessment, only about two-thirds (63%) consider it a critical or important factor. This suggests that the share of municipalities for which ex ante assessments matter in the infrastructure planning process is below 40%.

Figure 29 Importance of ex ante assessments of infrastructure projects (% of municipalities)



Source: EIB Municipality Survey.

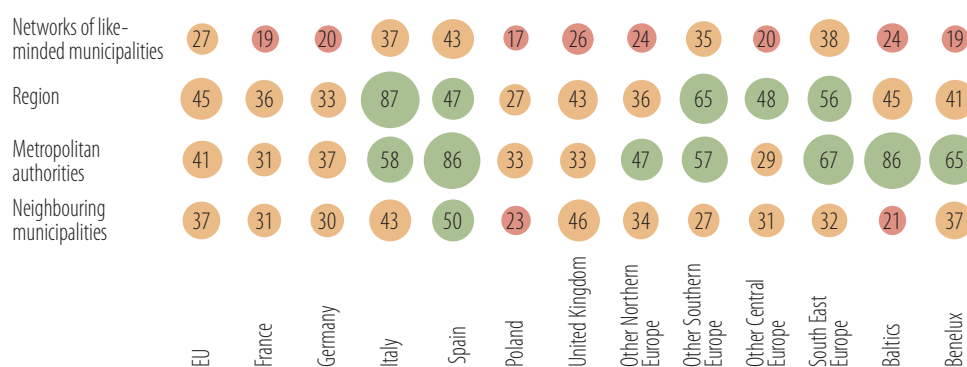
Note: Authors calculations.

Question: And how important would you say are the results of the independent assessment/s when deciding whether or not to go ahead with a project?

Similarly, when it comes to the coordination of infrastructure investment activities with other bodies, there seems to be room for improvement. Less than half of municipalities say that, for infrastructure investment activities, they coordinate with networks of like-minded municipalities (27%); the region in which they are located (45%); the broader metropolitan authorities (41% of cases in which this is applicable)²⁰; or neighbouring municipalities (37%). Figure 30 plots the corresponding results by country or region. There are very few exceptions to these patterns apart from Italy, where cooperation with regional authorities plays a somewhat more important role, or Spain and the Baltics, where municipalities cooperate (where applicable) relatively more often with metropolitan authorities.

Larger municipalities report more often that they carry out ex ante assessments (in particular environmental and social) than smaller ones, and they are more likely to take these assessments into consideration in the decision-making process and tend to consult more frequently with neighbouring municipalities, regions or like-minded municipalities.²¹

Figure 30 Coordination in infrastructure planning and implementation (% of municipalities)



Source: EIB Municipality Survey.

Note: The share of municipalities that consult with other bodies when planning to carry out an infrastructure project. A green circle signifies a share in the upper tertile, an orange one a share in the middle tertile and a red one a share in the lower tertile. Authors calculations.

Question: How often does your municipality coordinate its investment projects with...?

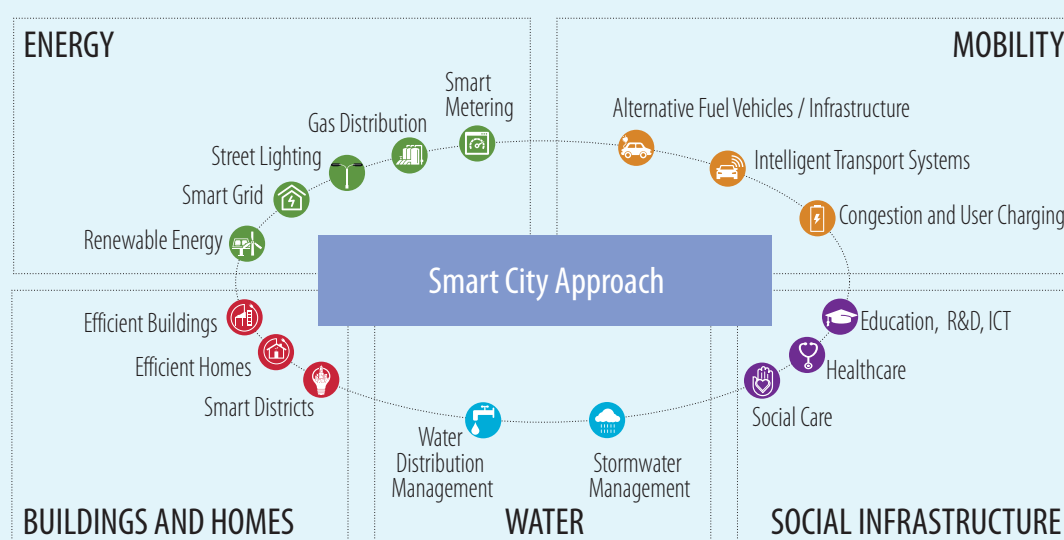
²⁰ Not all municipalities are part of a greater metropolitan area.

²¹ It is important to bear in mind that the survey was targeted at larger municipalities and is thus less representative for smaller ones.

Box 4 EIB and Smarter City Development

Cities are hubs of talent and innovation and hotspots of culture and creativity, and contribute significantly to national growth and employment. By the same token, cities are challenged by congestion, pollution, climate change, crime and inequality. The needs and challenges can substantially vary even within cities: pockets of extreme deprivation can be found even in some of Europe's most prosperous cities. Not surprisingly, therefore, EU cities vary markedly in their performance in meeting the impending EU cohesion objectives. Smart investment is needed to make the most of the positive social, environmental and economic functions of each city: that is, to upgrade and exploit its assets to maximum advantage, and respond to the specific challenges each city faces. Such investments, as shown in Figure B4.1, entail many different fields in mobility, energy, housing, water and social infrastructure. The figure presents the EIB's approach to smarter territorial development, which is informed by the EU 2020 strategy and Urban Agenda aimed at integrated action to achieve sustainable urban development.

Figure B4.1 EIB's Smart City Approach



Source: EIB.

Note: Authors calculations.

The smart development of cities entails a place-sensitive, coordinated and integrated approach to making investments. It seeks to implement a holistic vision for the city. Table B4.1 highlights those characteristics that the EIB considers when assessing the smart components of any proposed investment programme.

Table B4.1 Towards an EIB “Smart City Concept”**Smart cities**

- › Have a multisector sustainable development strategy or have considered plan
- › Have set investment priorities, taking into account the city’s comparative advantages
- › Consider and incorporate the opinions of the city’s stakeholders
- › Adopt a comprehensive approach to making investment decisions
- › Make use of skills, innovation and new technologies
- › Foster an environment that promotes innovation.

Source: EIB.

To unlock investments for smarter city development, local authorities will need to build up sufficient administrative and financial capacity. Improving the performance of urban systems through investments in many different sectors requires urban planning competence and sector-specific experts.

Building on two decades of experience in urban development, the EIB provides support to municipalities in the preparation and implementation of projects and programmes through (1) technical advice (such as JASPERS, Joint Assistance to Support Projects in European Regions); (2) financial advice and; (3) finance.

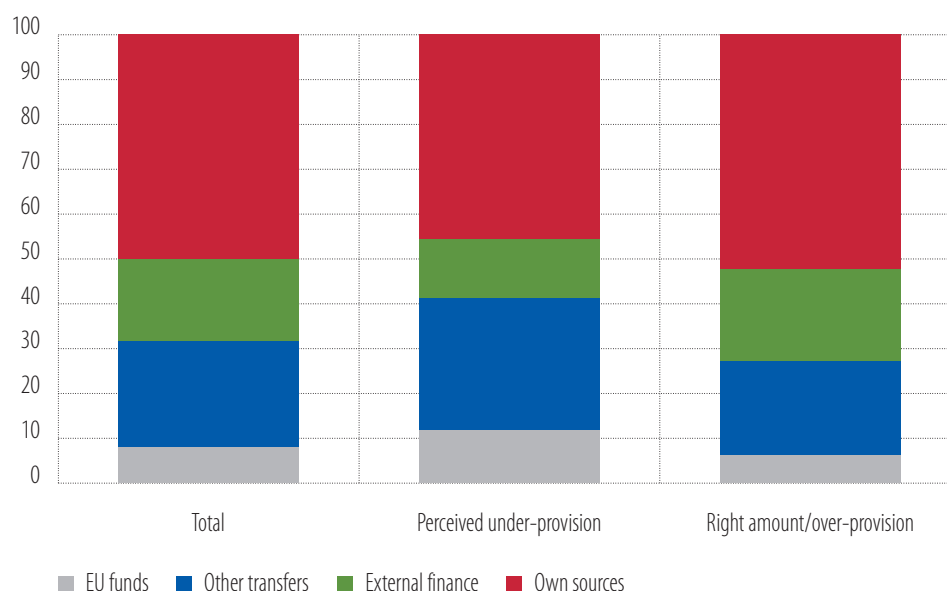
To unlock the potential of smarter city development, strategic and technical advisory support in the preparation of strategies and associated investment programmes are crucial.

Internal funding is municipalities' most common source of infrastructure finance

Municipalities tend to finance their infrastructure investment predominantly through internal sources (Figure 31). Own sources cover 50% of municipalities' infrastructure investment financing in the EU, followed by transfers (24%), external finance (18%) and EU funds (8%).

There are interesting differences in terms of funding mix between those that say that their past investment activities have been in line with needs or below needs. External funding is less used by municipalities with perceived infrastructure investment gaps. Instead, municipalities with perceived infrastructure investment gaps in their jurisdiction seem to have more access to EU funds and other transfers to finance their infrastructure investment. This may reflect the fact that EU funds and transfers tend to be directed towards municipalities with low GDP per capita, which also have higher perceived infrastructure gaps.

Figure 31 Source of municipalities' finance and reported infrastructure investment (%)



Source: EIB Municipality Survey.

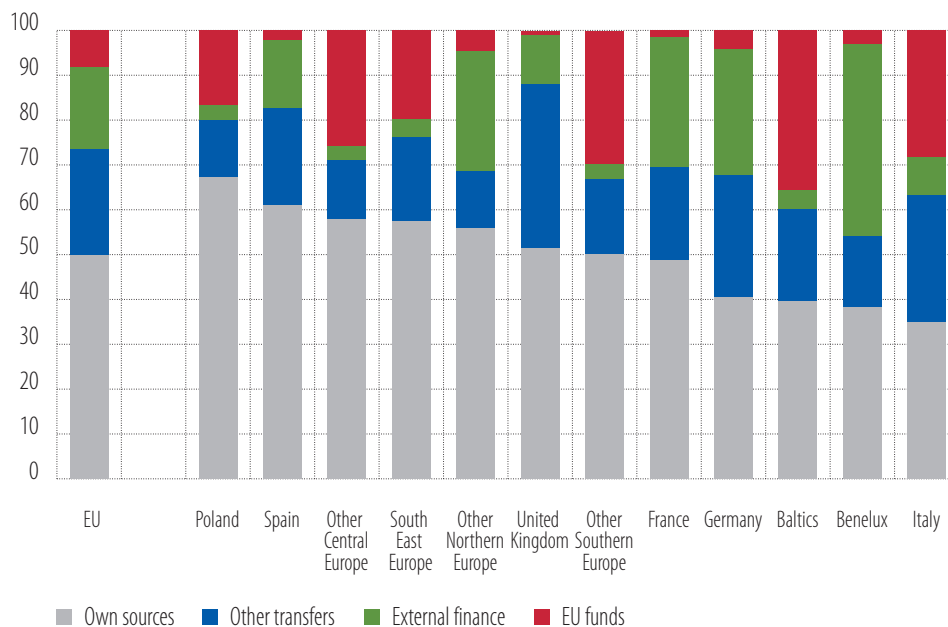
Note: Authors calculations.

Question: Can you indicate approximately what proportion of your infrastructure investment activities was financed by each of the following?

Question: Would you say that, overall, past investment in your municipality has ensured the right amount of infrastructure, or led to an under-provision or over-provision of infrastructure capacity?

Substantial differences in the infrastructure funding mix exist across countries (Figure 32). Internal funding is particularly important in Poland and Spain. EU funds are a particularly important source of infrastructure investment finance in the Baltics, Italy and Other Southern European countries.

External funding is comparatively widespread in Benelux, Germany, France and Other Northern European countries. These countries are characterised by fairly high GDP per capita and fairly strong governance structures, which may facilitate the absorption of external funding. Further analysis is needed to understand the drivers of the funding composition of municipalities' infrastructure investment, which may include fiscal federal frameworks, technical capacity or a lack of access to external finance.

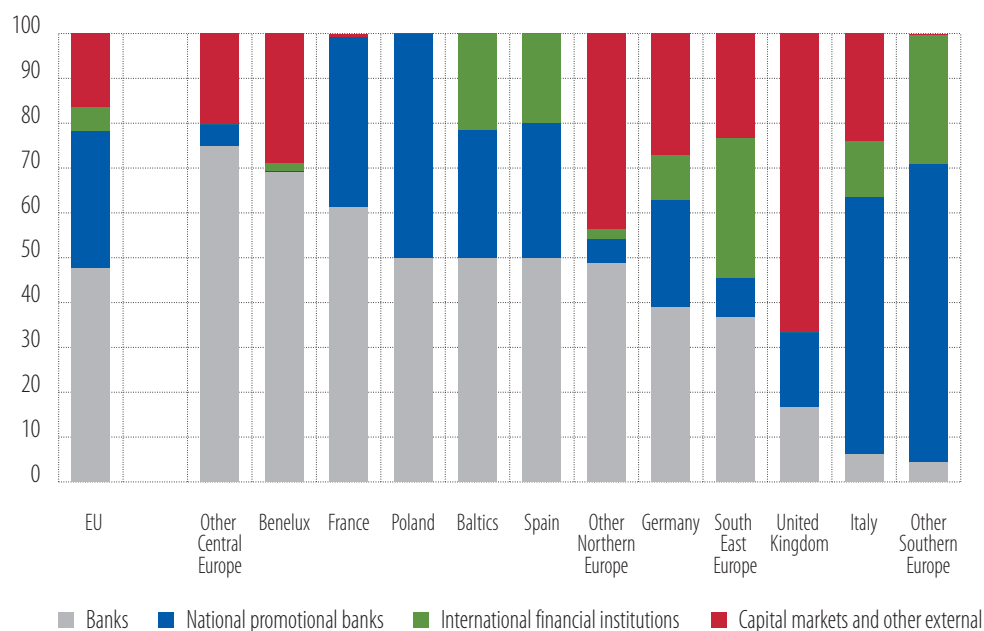
Figure 32 Sources of municipalities' infrastructure investment finance (% of municipalities)

Source: EIB Municipality Survey.

Note: Authors calculations.

Question: Can you indicate approximately what proportion of your infrastructure investment activities was financed by each of the following?

Municipalities mainly use banks and national promotional banks as external funding sources (Figure 33). International financial institutions account for only 6% of total external funding. However, substantial differences exist across countries. International financial institutions and national promotional banks tend to provide high shares of external funding in Southern Europe, Poland and the UK.

Figure 33 Composition of external finance (% of municipalities that use external finance)

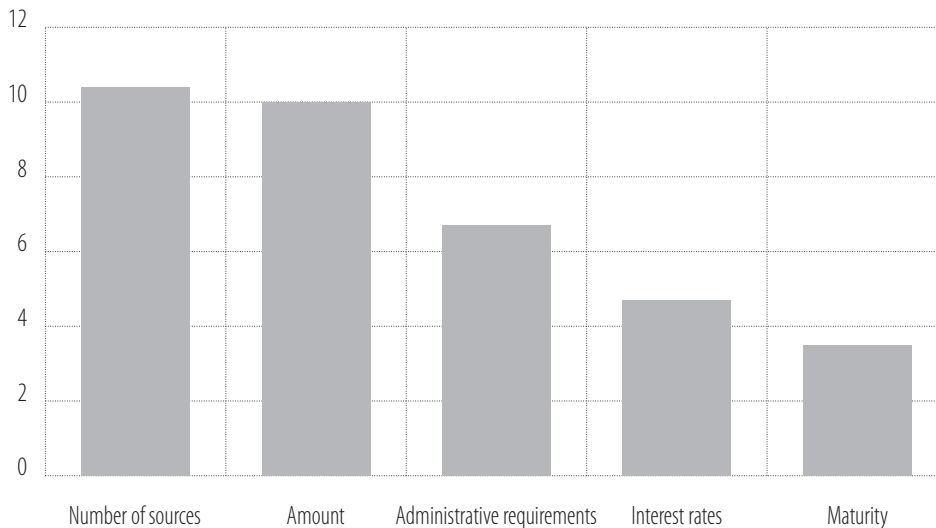
Source: EIB Municipality Survey.

Note: Authors calculations.

Question: Approximately what proportion of your external finance does each of the following represent?

Municipalities that use external funding for their infrastructure investment activities are least satisfied with the number of external funding sources and the amount offered (Figure 34). This suggests that a considerable number of municipalities, close to 10%, find it difficult to raise the large amounts needed to fund infrastructure projects. Interest rates and the maturities offered are less of a concern for municipalities in the current low interest rate environment. Overall, access to external finance appears to be less of a concern for municipalities than fiscal and regulatory constraints (see Figure 23).

Figure 34 Share of municipalities that are very or fairly dissatisfied with external funding (% of municipalities that use external finance)



Source: EIB Municipality Survey.

Note: Authors calculations.

Question: Thinking about all of the external finance you used for your infrastructure investment activities, how satisfied or dissatisfied are you with ...?

21% of municipalities are external finance-constrained (Figure 35). Municipalities may face external finance constraints for four reasons: (1) they did not use external funding because of fiscal constraints;²² (2) the external funding available was too expensive; (3) they applied for external funding but were rejected; or (4) they applied for external funding but did not receive the full amount.

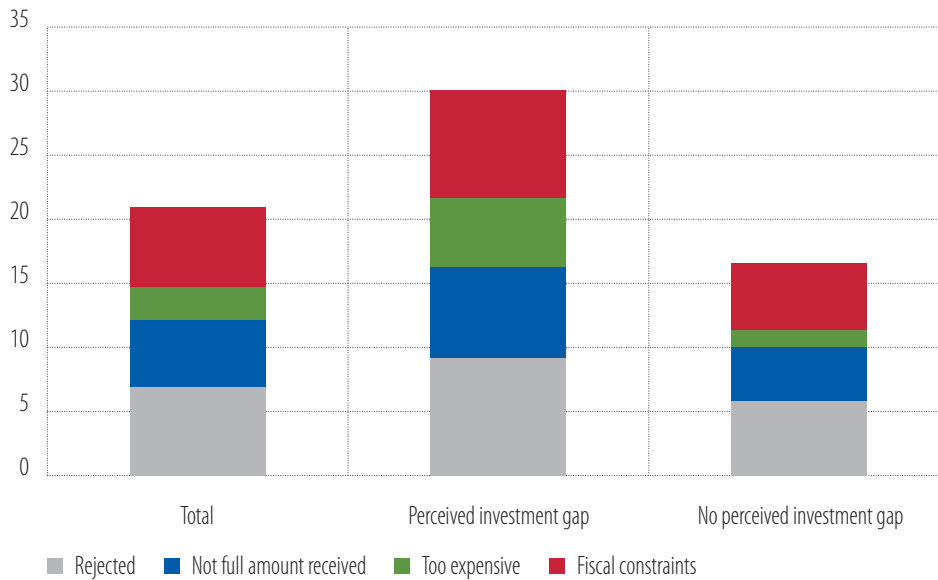
The share of municipalities that experience external finance constraints is substantially higher among municipalities with perceived investment gaps, at 30%. All four reasons for being external finance-constrained appear to be more relevant for these municipalities. With 8%, fiscal constraints are also reported most often among municipalities with perceived investment gaps.

60% of municipalities that did not use external funding responded that they had no needs, either because they preferred internal funds or they did not plan any projects.²³

²² Fiscal constraints comprise binding debt ceilings and/or fiscal rules that do not allow borrowing.

²³ Among municipalities that are finance-constrained, the role of fiscal rules as a barrier looks less important. This is because fiscal rules may influence how much external finance municipalities may seek. For example, a municipality might want to fund an infrastructure project costing 5 million, but its fiscal rules state that it can only invest 1 million. In this case, the municipality would consider the rules to be a barrier to investment, but may not necessarily be constrained in borrowing 1 million.

Figure 35 External finance constraints and perceived infrastructure investment gaps (% of municipalities)

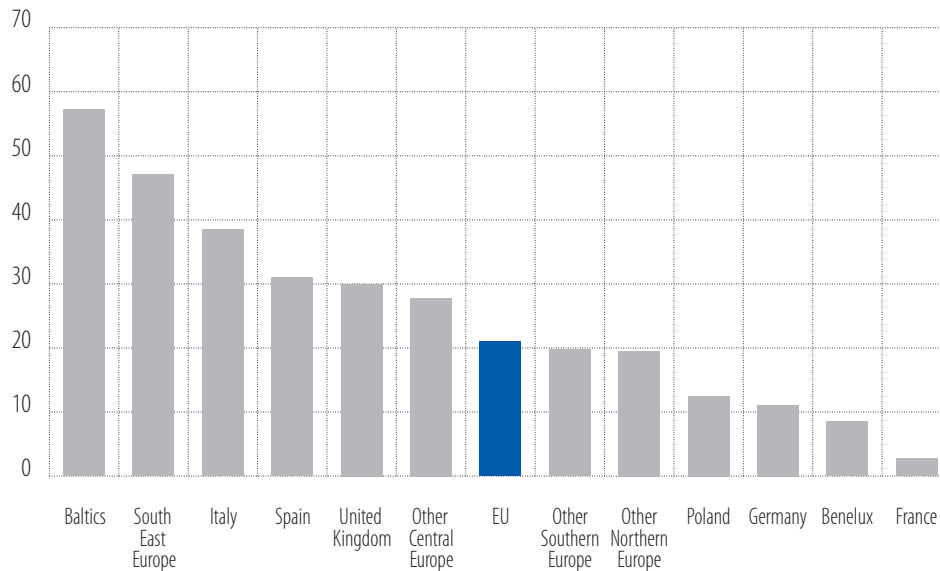


Source: EIB Municipality Survey.

Note: Authors calculations.

Question: Combination of four questions: (1) What was your main reason for not seeking external finance for your investment activities? (2) Did you seek any external financing (i.e. bank finance or capital market finance) for your infrastructure investment activities in...? (3) Can you tell me approximately what proportion of your infrastructure investment activities in... was financed by each of the following? (4) Thinking about all of the external finance you used for your infrastructure investment activities, how satisfied or dissatisfied are you with...?

The extent of external finance constraints varies substantially across countries (Figure 36). The share of municipalities that face external finance constraints is highest in the Baltics and South East Europe and lowest in the Benelux countries and France.

Figure 36 External finance constraints by country (% of municipalities)

Source: EIB Municipality Survey.

Note: Authors calculations.

Question: Combination of four questions: (1) What was your main reason for not seeking external finance for your investment activities? (2) Did you seek any external financing (i.e. bank finance or capital market finance) for your infrastructure investment activities in...? (3) Can you tell me approximately what proportion of your infrastructure investment activities in... was financed by each of the following? (4) Thinking about all of the external finance you used for your infrastructure investment activities, how satisfied or dissatisfied are you with...?

Conclusion and policy implications

Achieving and maintaining efficient transport, ICT, energy and social infrastructure requires adequate long-term investment in line with infrastructure investment needs. This chapter has shown that while the decline in infrastructure investment levelled off in 2015/16, current investment rates are well below pre-crisis rates.

The overall decline was driven primarily by the retreat of the government sector from its infrastructure investment activities, partly reflecting an observed shift from capital to current expenditure. Corporate infrastructure investment has kept up better, but – in part due to regulatory pressure on allowed returns – has also struggled to keep up with pre-crisis rates. PPPs have not (yet) recovered from their post-crisis decline, with access to finance continuing to be a bottleneck.

Current infrastructure investment rates led to a slowdown in the convergence process of infrastructure quality and are reflected in perceived infrastructure gaps at the municipality level. The decline in infrastructure investment has been more pronounced in countries whose infrastructure quality is poor. This has led to a marked slowdown – and, in some cases, even a halt – of the convergence process in the EU in terms of infrastructure quality.

In addition, about one third of municipalities state that infrastructure investment in their jurisdiction has been below their needs in the past five years. The fall in infrastructure investment has therefore led to perceived investment gaps.

Municipalities perceive fiscal constraints to be the main barrier to infrastructure investment, but loosening fiscal rules would require a more comprehensive process of planning infrastructure projects in many instances. Borrowing and debt constraints appear to be the most important constraints for local infrastructure investment, with 70% of municipalities reporting at least one of them as a major obstacle to their infrastructure investment.

However, without efficient planning and collaboration at the local level in infrastructure investment, more fiscal flexibility may undermine fiscal sustainability and lead to an inefficient use of public money. Only 60% of all municipalities assess whether or not a project is in line with an urban development strategy. The share of municipalities that assess the economic costs and benefits of infrastructure investments is even lower, at 52%. Infrastructure investment decisions should systematically be based on cost-benefit analysis and be in line with a binding strategy for infrastructure development.

The analysis thus suggests that the policy debate on infrastructure investment should pay more attention to adequate prioritisation and planning of infrastructure projects. Prioritisation of infrastructure investment is key at all levels of government, including at the EU level, not least to overcome the fragmentation of the single market. It is also important in light of weakening potential growth in many countries and a need to respond to mega-trends such as technological change, globalisation and demographic change. Moreover, the increasing need to ensure that economic growth is socially inclusive must be reflected in the planning and prioritisation of infrastructure projects.

Enhancing coordination and the technical capacity of municipalities to prioritise, plan and implement projects can help to promote local public infrastructure investment and ensure that EU funds are directed towards their most effective use. EPEC (the European PPP Expertise Centre) and the new European Investment Advisory Hub are examples of EU-level initiatives that can help raise the technical capacity of and coordination among governments across Europe. Such initiatives can also promote private investment in infrastructure, which is needed to maximise the impact of scarce public funds.

Steps to address regulatory barriers and uncertainty are also important to generate an enabling environment for municipalities to undertake sound and adequate infrastructure investment. The length of regulatory processes to approve a project is a major barrier for most municipalities in Europe. Removing such regulatory barriers is a comparatively low-cost policy instrument to revive infrastructure investment in Europe and is conducive to deepening the EU single market.

Addressing uncertainties for municipalities intending to invest in infrastructure is also key to closing Europe's perceived infrastructure investment gaps (see Chapter 8). A large share of municipalities reports political and regulatory instability as a major obstacle to infrastructure investment. Uncertainty weighs particularly heavily on infrastructure investment because of its long-term nature.

References

- Berg, A., Buffie, E.F. and Cashin, A. (2012). *Public Investment, Growth, and Debt Sustainability: Putting Together the Pieces*. IMF Working Paper WP/12/144, International Monetary Fund, Washington DC.
- Bhattacharya, A., Meltzer, J.P., Oppenheim, J., Qureshi, Z. and Stern, N. (2016). *Delivering on Sustainable Infrastructure for Better Development and Better Climate*. Washington, DC: Brookings Institution.
- Calderon, C., and Serven, L. (2014). *Infrastructure, Growth and Inequality: An Overview*. Washington, DC: World Bank.
- EIB. (2016a). *Investment and Investment Finance in Europe*. Luxembourg: European Investment Bank.
- EIB. (2016b). *Restoring EU Competitiveness, 2016 updated version*. Luxembourg: European Investment Bank.
- EIB and WEF (World Economic Forum). (2017). *Beyond the Equity-Efficiency Trade-Off: Practical Ideas for Inclusive Growth and Competitiveness in Europe*. White Paper, The Europe Inclusive Growth and Competitiveness Lab, March.
- Grayburn and Haug. 2015. *European Regulators' WACC Decisions Risk Undermining Investment Decisions*. in: Insight in Economics. Issue: 41. NERA Economic Consulting.
- IMF. (2014). *Is It Time for an Infrastructure Push? The Macroeconomic Effects of Public Investment*. In World Economic Outlook: Legacies, Clouds, Uncertainties (October). Washington, DC: International Monetary Fund.
- Köller, M. (2013). *Municipalities under Construction: Demographic Change Meets Communal Infrastructure*. Focus on Economics, No. 30, KfW Economic Research, KfW, Frankfurt.
- National Infrastructure Commission (United Kingdom). (2017). *The Impact of Population Change and Demography on Future Infrastructure Demand*. London.
- Global Commission on the Economy and Climate. (2014). *Better Growth, Better Climate*. Washington, DC and London: New Climate Economy.
- Noya, A., Martinez-Fernandez, C., Naoko, K. and Weyman, T. (2012). *Demographic Change and Local Development: Shrinkage, Regeneration and Social Dynamics*. Paris: OECD Publishing.
- OECD. (2017). *Investing in Climate, Investing in Growth*. Paris: OECD Publishing.
- Revoltella, D. and Brutscher, Ph.B. (forthcoming). *Infrastructure Investment in Europe. New Data, Market Dynamics, Policy Actions, and the Role of the European Investment Bank*. Chapter 17 in *Finance and Investment: The European Case*, edited by Meyer, C., Micossi, S., Onado, M., Pagano, M., and Polo, A. Oxford University Press.
- Revoltella, D., Brutscher, P.-B., Tsiotras, A. and Weiss, C. (2016). *Linking Local Businesses with Global Growth Opportunities: The Role of Infrastructure*. Oxford Review of Economic Policy 32 (3, 1): 410–430.
- Riess, A., editor. (2005). *Innovative Financing of Infrastructure – The Role of Public-Private Partnerships: Lessons from the Early Movers*. EIB Papers 10 (2). European Investment Bank.
- Strauss, H., editor. (2010). *Public and Private Financing of Infrastructure: Evolution and Economics of Private Infrastructure Finance*. EIB Papers 15 (1). European Investment Bank.
- United Nations. (2016). *Industry, Innovation and Infrastructure: Why it Matters? United Nations Sustainable Development Goals: 17 Goals to Transform our World*.
- US Federal Energy Regulatory Commission. 2014. *Order Accepting Tariff filing Subject to Condition and Denying Waiver*. Docket No. ER14-500-000, p36.
- Wagenvoort, R., de Nicola, C., and Kappeler, A. (2010). *Infrastructure Finance in Europe: Composition, Evolution and Crisis Impact*. EIB Papers 15 (1): 16–39.
- Woetzel, J., Garemo, N., Mischke, J., Hjerpe, M., and Palter, R. (2016). *Bridging Global Infrastructure Gaps*. McKinsey & Company.

Chapter 3

Recent developments in research and development, intangible investment, and innovation in the EU: how to change gears?

Chapter at a glance

Investment in intangible assets – including research and development (R&D), software and databases, organisational capital, and employee training – is one of the main drivers of innovation, productivity, and long-term economic growth for advanced economies:

- *Global R&D expenditures have been increasing at a fast pace over the last two decades. China has become one of the top three global players for R&D, together with the US and the EU.*
- *However, as a percentage of GDP, the EU is spending less on R&D than other major economies.*
- *The share of business R&D in total R&D expenditures is substantially lower in the EU than in the US, China, Japan, and South Korea.*
- *The EU is not on track to reach the EU2020 target of 3% of GDP invested in R&D by 2020, and the difference in R&D intensity across EU Member States is largely driven by business R&D investment.*

To catch up with peers, the EU will need to create better framework conditions and provide the right incentives to support more R&D investment by the business sector. But investing in R&D alone is not sufficient. Policy action should consider a wider range of intangible assets and should not concentrate on only supporting R&D because of important complementarities between intangibles.

- *The EIB Investment Survey (EIBIS) finds that, on average, firms in the EU spent 37% of overall investment on intangible assets, while 63% went into fixed assets.*
- *While firms in manufacturing invest much more in R&D than other industries, firms in services invest a higher share of investment in software and databases.*
- *Compared to large companies, small and medium-sized enterprises (SMEs) tend to put a larger share of their investment into intangibles, even after controlling for industry composition in each country.*
- *More productive firms and exporters also invest more in intangibles.*
- *Firms that invest more in intangibles tend to rely more on internal finance to finance their investments. They are also typically less satisfied with the conditions to obtain external finance and are more likely to report that they are finance-constrained.*
- *The degree of innovation increases with the diversification of financial instruments: firms that use a more diversified mix of financial instruments are more likely to invest in intangibles and to develop or introduce new products, processes, or services than firms that use a limited number of financing instruments.*

Public policies in the EU should aim to foster innovation at the technological frontier. But policies should also support firms that adopt existing technologies, and support the diffusion of innovation across all firms.

- *EIBIS finds that the availability of staff with the right skills, labour market regulations, and business regulations are among the most serious obstacles to investment for innovative firms.*
- *This highlights the importance of structural reforms at the national level, but also at the EU level, as well as the need for more diversified financial instruments to support risky investments and innovative firms.*

Investment in research and development

Investment in creating knowledge is one of the main drivers of long-term prosperity and inclusive economic growth for advanced economies such as those in the European Union, and the United States. Innovation is expected to help address pressing societal challenges – including an ageing population, climate change, and various health and environmental issues. New products, processes, or services will have to be developed, creating new growth opportunities for firms as well as new skill needs and job opportunities for workers (OECD, 2016). An environment that facilitates investment in innovation and supports highly innovative firms will enhance the competitiveness of an economy. But policy makers should also aim to create an eco-system that enables the effective diffusion, circulation, commercialisation, and use of this knowledge, especially for firms that do not innovate at the technological frontier (European Commission, 2016).

The innovation activities of firms are typically difficult to measure well. To compare investment in innovation across countries and firms, this chapter uses macroeconomic statistics on research and development (R&D) investment that are widely available across countries, as R&D investment is treated as gross fixed capital formation in national accounts. However, in addition to R&D, other intangible assets – including employee training, software and databases, and organisational capital – are considered to be important sources of innovation and economic growth in advanced economies.¹ Harmonised macroeconomic data on intangible assets are available from the INTAN-Invest database, but only for a limited number of EU countries and the US. This chapter also relies on firm-level data from the EIB Investment Survey (EIBIS) that asks questions to firms in all 28 EU Members States regarding their investment in intangible assets as well as the share of investment spent on developing or introducing new products, processes, or services.

Innovation is usually the result of a costly and risky process requiring systematic and deliberate investment in research and experimental development activities (EIB, 2016).² Both the public and private sectors are engaged in R&D with crucial and complementary roles. In most advanced economies, the business sector is the largest contributor to R&D investment. However, R&D investments by public higher education institutions and research institutes are also essential to generate new knowledge, human capital, and skills that are needed by innovative firms. While most of business R&D spending is on experimental development and applied research, the government also makes major investments in basic science.³ In addition to the direct involvement in R&D activities, the public sector plays a key role in providing supportive framework conditions for innovative firms.

China has become one of the top three global players for R&D next to the EU and the US. Despite the economic slowdown following the global financial crisis, investment in R&D has remained resilient in the leading global economies, including the EU, the US, and China. But the crisis has also reinforced the changes in R&D investment trends at the global level (OECD, 2014). While all major economies are becoming more R&D-intensive, the relative weight of the EU and the US is decreasing, mainly due to the rapid rise of China. The US represented 37% of global R&D expenditures in 2000 but only 27% in 2015, while the EU share fell from 25% to 20% (Figure 1). Over the same period, China's share of global R&D investment increased from around 5% in 2000 to 21% in 2015.

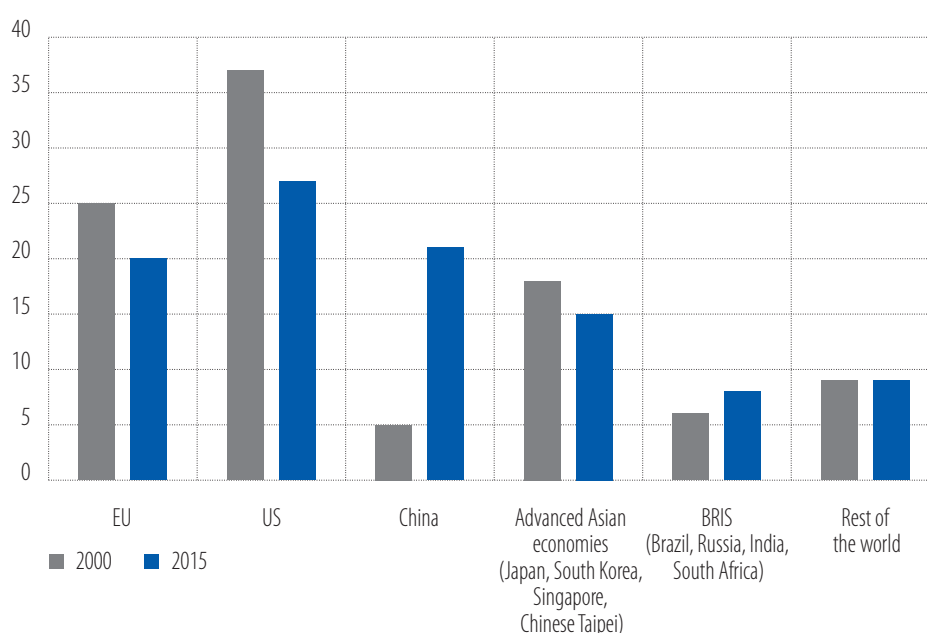
1 The issue of how to better address skills shortages and skills mismatches to support EU firms is discussed in Chapter 1 of this report.

2 As defined in the OECD Frascati manual, R&D activities “comprise creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge” (OECD 2015a, p. 45). R&D activities must be novel (aimed at new findings), creative (based on original concepts and hypotheses), uncertain (with a high risk of failure), systematic (planned and budgeted), and transferable or reproducible.

3 According to the OECD Frascati manual, there are three broad types of R&D activities: basic research, applied research, and experimental development. Basic and applied research are both based on experimental or theoretical work undertaken to acquire new knowledge but, unlike applied research, basic research is not directed towards any particular application or use. Experimental development is directed towards producing new products or processes and to improving existing products or processes. But basic research does not necessarily lead to applied research and then to experimental development (OECD 2015a). Experimental development can support basic research with new findings and basic research can also lead directly to new products, processes or services.

Global R&D expenditures more than doubled over the past 15 years. The largest contributor to the rise in global R&D expenditures was China, accounting for more than one-third of the increase between 2003 and 2013. During this period, China's R&D investment increased by almost 20% annually (or around 17% adjusted for inflation). After China, about 20% of the increase in global R&D expenditures comes from the US, 15% from the EU, and around 5% each from Japan and South Korea (National Science Board, 2016).

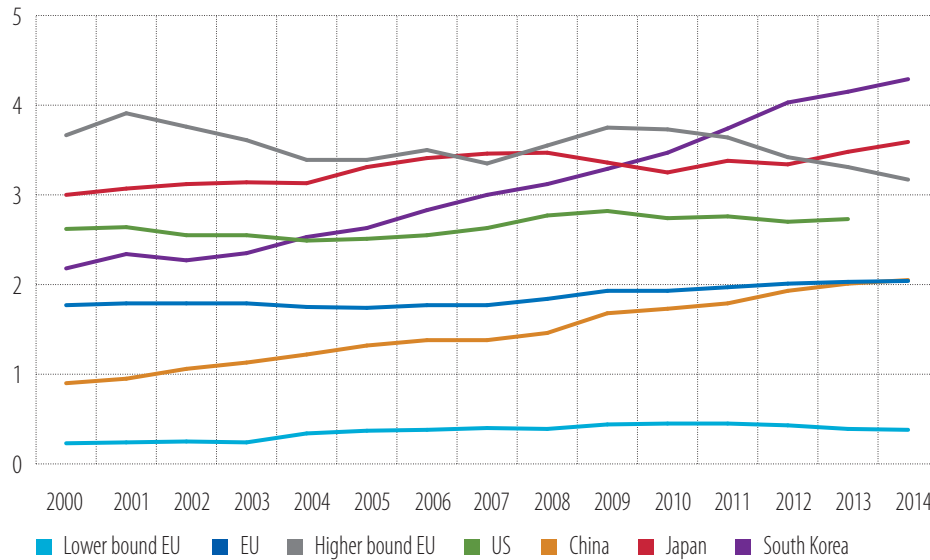
Figure 1 Share of global R&D expenditures in 2000 and 2015, EU and selected groups of countries (% of total)



Source: European Commission (2018).

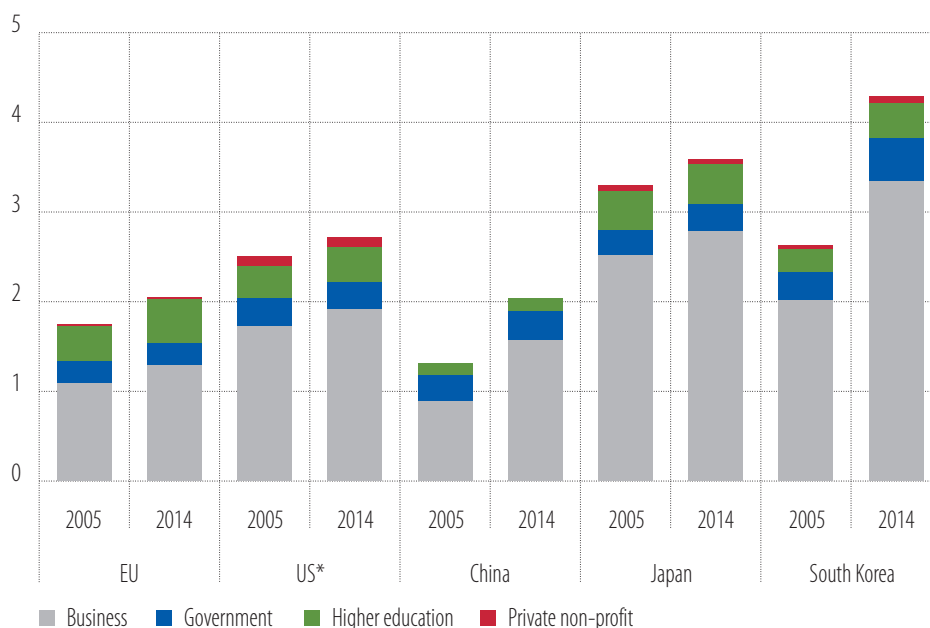
As a share of GDP, the EU is investing less in R&D than other major economies. Over the past 10 years, China and South Korea have rapidly increased their R&D investment intensity (R&D expenditure as a percentage of GDP), while the US, Japan, and the EU have been less dynamic (Figure 2). South Korea has the highest R&D intensity in the world among major economies, at 4.3% of GDP in 2014, after overtaking Japan in 2009 and Israel in 2013. In 2014, China reached the level of the EU in terms of R&D intensity (2.05% of GDP for China compared to 2.04% of GDP for the EU). The EU is investing less in R&D as a share of GDP than the other key global players, with potential negative implications for innovation and long-term growth. If policy measures are not taken to boost R&D investment, some highly innovative EU firms may lose their comparative advantage compared to firms based in other countries.

Looking at the dispersion across EU Member States, Finland and Sweden were the top performers in 2014 and Cyprus and Romania were at the bottom in terms of R&D intensity. There has been only a small amount of catching up over time by the countries that were investing relatively little in R&D in 2000. In fact, the convergence across the EU is only driven by the fact that Finland, one of the top performers in the EU in terms of R&D intensity over the past 15 years, has seen its R&D investment falling rapidly since 2009.

Figure 2 R&D expenditures in the EU and selected countries, 2000–2015 (% of GDP)

Source: Eurostat; and OECD.

R&D expenditures can be disaggregated according to the different sectors carrying out R&D activities: the business sector, government, higher education, and private non-profit institutions. The share of business R&D in total R&D expenditures is substantially lower in the EU, at only 64%, than in the US (70%) or China, Japan, and South Korea, where business R&D accounts for almost 80% of total R&D expenditures (Figure 3). And even when the sectoral composition of the economies is taken into account, the EU has lower business R&D intensity than other major global players (EIB, 2013). But while most Asian R&D is funded or performed by the business sector, this does not mean that the government is not supporting business R&D. For instance, many Chinese large private companies are controlled or influenced by the state (Veugelers, 2013).

Figure 3 Composition of R&D expenditures in 2005 and 2014, EU and selected countries (% of GDP)

Sources: Eurostat; and OECD.

Note: *US data are for 2013.

The share of business R&D in total R&D expenditures is substantially lower in the EU than in the US, China, Japan, and South Korea. Business R&D expenditures are the driver of the rapid increase in R&D investment intensity in China and South Korea (Figure 4). South Korea has been increasing its business R&D intensity rapidly since 2000, overtaking the US in 2003 and Japan in 2010, while China overtook the EU in 2009. In China, the share of employment in R&D-intensive manufacturing has increased from 20% in the early 1980s to about 35% in recent years (OECD, 2015b). However, R&D investment in China is still heavily oriented towards developing science and technology infrastructure (i.e. buildings and equipment), while investment in basic research remains relatively low – at 4% in 2013 compared to the OECD average of 17% (EIB, 2016).

Figure 4 Business R&D expenditures, Index EU and selected countries, 2000–2015 (% of GDP)

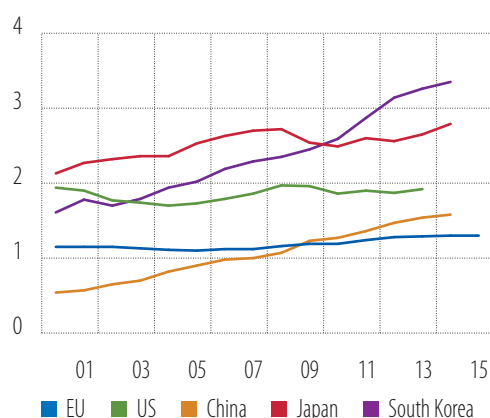
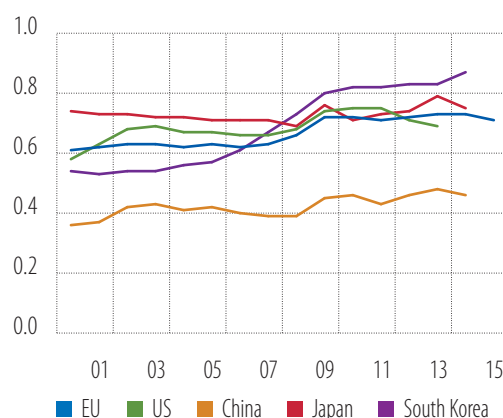


Figure 5 Public R&D expenditures, Index EU and selected countries, 2000–2015 (% of GDP)



Source: Eurostat; and OECD.

China and South Korea were traditionally considered as “innovation followers” that would adopt technologies and products, such as semiconductors and smartphones, in order to improve and produce them at a cheaper cost. In fact, the information and communication technology (ICT) sector, which also includes semiconductors, accounts for a large share of business R&D in China and South Korea, while the US and the EU continue to be the main global players for pharmaceuticals (Veugelers, 2013). But China and South Korea are also increasingly introducing innovations at the technological frontier. For instance, South Korea is a world leader in the number of patent applications (relative to its population), followed by Japan, Germany, and the US, in part thanks to industry leaders such as Samsung and LG (Zastrow, 2016).⁴

While the services sector represents more than two-thirds of GDP and employment in the EU, most business R&D remains concentrated in manufacturing. Services represent around 30% of business R&D investment in the EU and the US. But the share of business R&D performed by the services sector is less than 15% in Japan, South Korea, or China (EIB, 2015). In the EU, the increase in business R&D investment over the last decade has been driven by both manufacturing and services. Indeed, many sectors, including low-tech sectors and services, became more R&D-intensive. In addition, some highly R&D-intensive sectors (e.g. pharmaceuticals) were more resilient during the crisis and increased their contribution to the EU economy in recent years (European Commission, 2016).

The persistent gap between the EU and the US in business R&D intensity has been attributed to the lower number of leading companies in new high-tech-intensive sectors in the EU as well as the lower average rates of return on R&D investment. The impact of the global financial crisis on business

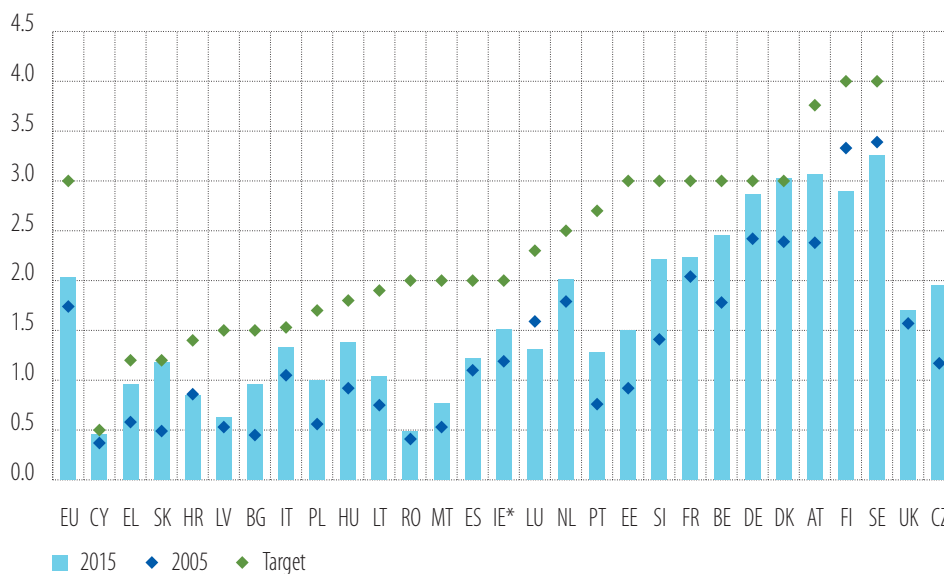
4 While R&D investment represents an input into innovation, the number of patents can be seen as a more direct measure of output from innovation.

R&D has also been milder in the EU than in the US and Japan, where business R&D investment intensity fell after 2008. However, there is a persistent gap between the EU and the US that has been linked to the fact that the EU specialises less in high-tech sectors (EIB, 2015). In particular, the lower number of leading innovators in the new high-technology-intensive sectors is one of the main drivers of the EU deficit relative to the US, and this is associated with the lower average rates of return on R&D investment for firms based in the EU compared to the US (Cincera and Veugelers, 2014). This is likely due to different business conditions, including access to finance, and a regulatory environment that does not support young firms undertaking risky and innovative investments (European Commission, 2016).

In terms of public R&D (government and higher education R&D investment), China is still lagging behind the other major players (Figure 5). At the same time, South Korea increased not only business R&D investment at a fast pace over the past decade, but also public R&D investment. In the EU, while limited fiscal space has kept government R&D relatively flat in the years following the financial crisis in many EU countries, this has been offset by expenditures on R&D in higher education in the EU that have increased over time. However, in many countries a small number of universities carry out most of the research (European Commission, 2016). In addition, the rapid increase in public R&D intensity between 2007 and 2009 was driven by falling real GDP in several EU countries.

The EU is not on track to reach the EU 2020 target of 3% of GDP invested in R&D by 2020. Focusing on the EU, R&D is one of the five headline targets of the EU 2020 strategy, together with employment, climate change and energy, education, and poverty and social exclusion. By 2020, the EU aims to reach an overall R&D intensity of 3% (2% for business R&D intensity) through different national targets. While R&D expenditures have increased in most Member States over the last decade, it is unlikely that the EU target of 3% of GDP will be met by 2020, as EU R&D intensity only increased from 1.75% of GDP in 2005 to 2.03% in 2015.

Figure 6 R&D expenditures in 2005 and 2015 and the EU2020 R&D target, 28 EU Member States (% of GDP)



Source: Eurostat.

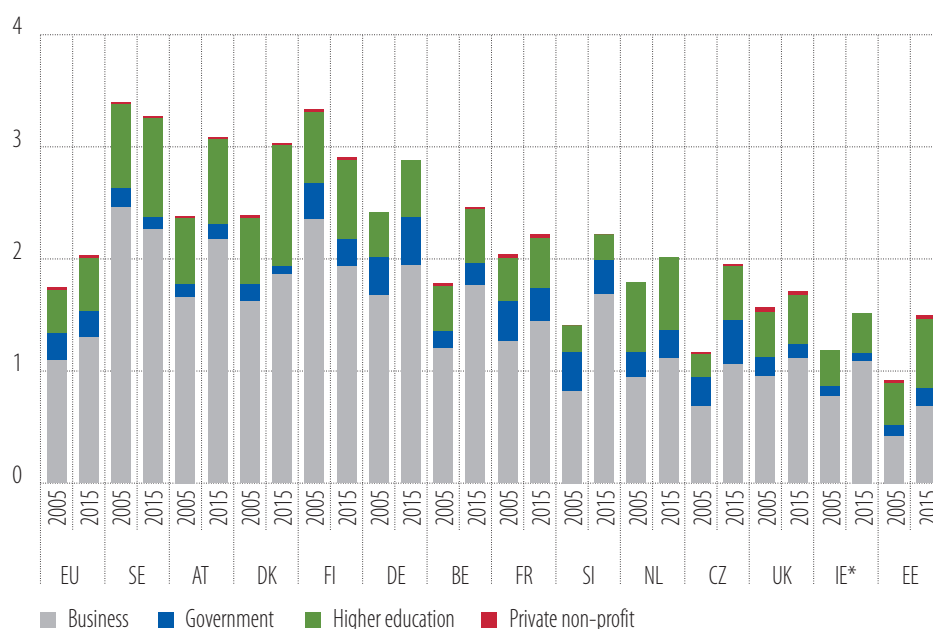
Note: * Data for Ireland are for 2014. The target for Ireland is 2.5% of GNP, which corresponds to approximately 2% of GDP. The target for Luxembourg is between 2.3% and 2.6% of GDP. The target for Portugal is between 2.7% and 3.3% of GDP. There are no targets for the UK and the Czech Republic. The Czech Republic has a target of 1% of GDP for public R&D investment. Countries are ordered based on their national EU2020 targets for R&D.

As of 2015, only Cyprus, Slovakia, and Denmark had reached their national EU 2020 target, and it was expected that Germany would reach it soon thereafter (Figure 6). Slovenia, Hungary, and Belgium may reach the target by 2020 if their R&D intensity continues to grow at the same pace as during the last decade. But most Member States will need to increase their R&D investment if they are to attain their national target by 2020. Some countries – Sweden, Finland, and Luxembourg – were even investing less in R&D (as a share of GDP) in 2015 than in 2005.

The difference in R&D intensity across EU Member States is mainly driven by business R&D investment. An examination of the composition of R&D investment suggests that business R&D investment is driving the differences in total R&D investment across EU Member States (Figures 7 and 8). This suggests that to catch up with peers, the EU will need to create better framework conditions and provide the right incentives for supporting more R&D investment by the business sector.

The European Innovation Scoreboard classifies EU Member States according to their innovation performance based on a number of indicators – including business and public R&D expenditure, scientific publications by universities, number of doctoral students, patent and trademark applications, broadband penetration, investment in other intangibles beyond R&D such as ICT training, and innovative activities by firms. The scoreboard defines four categories of countries: innovation leaders, strong innovators, moderate innovators, and modest innovators. All innovation leaders and strong innovators invest more than 1.5% of GDP in R&D (except Luxembourg). Their share of business investment in total investment is 65%, while in countries that are classified as moderate or modest innovators, the share of business investment is only 45%. Among the countries that joined the EU after 2004, some Member States, including Slovenia, the Czech Republic, and Estonia, have been catching up rapidly with innovation leaders. For instance, Slovenia now has a R&D intensity above the Netherlands or the UK.

Figure 7 Composition of R&D expenditures in 2005 and 2015 in EU Member States that invested more than 1.5% of GDP in R&D in 2015 (% of GDP)



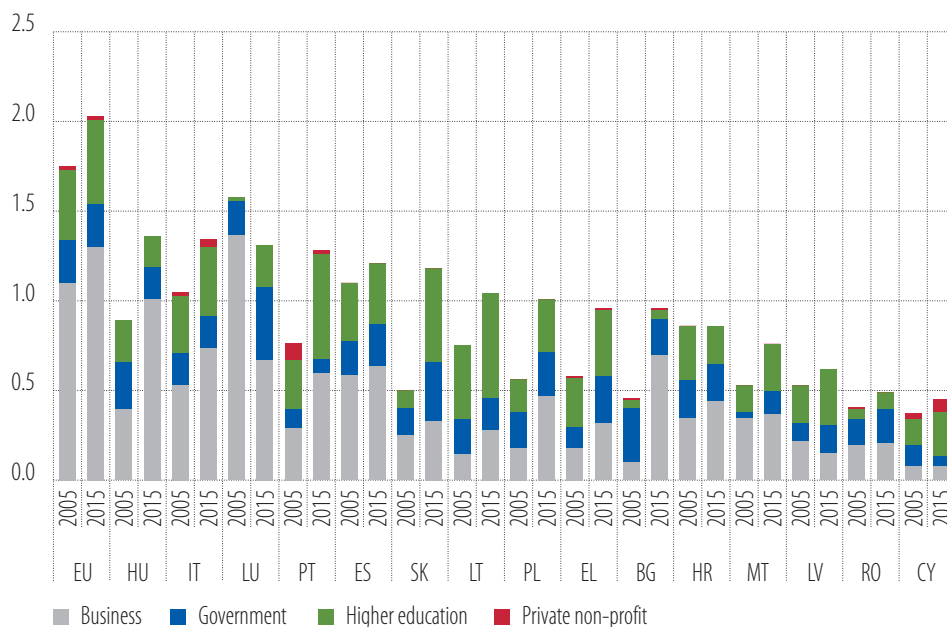
Source: Eurostat.

Note: * Data for Ireland are for 2014. Countries are ordered based on their R&D intensity in 2015.

Business R&D investment is an important driver of the rapid increase in R&D intensity experienced by several Member States – including Slovenia, Hungary, Portugal, Poland, and Bulgaria – and their share of business investment has risen substantially. In Poland, foreign direct investment seems to have also played an important role. In some countries that had relatively little R&D business investment ten years ago, this rapid increase may be linked to a very limited number of investments or it may be concentrated in some specific industry and does not necessarily reflect the attractiveness of the overall business sector for R&D investment. For instance, in Bulgaria, the increase has been concentrated in one sector (R&D services) and may be linked to clinical trials carried out for foreign pharmaceutical companies (European Commission, 2016).

In countries where the business R&D intensity was already high in 2005, further increases during the past decade can be linked to policies supporting business R&D expenditures, including R&D tax incentives, combined with their industrial specialisation (e.g. pharmaceuticals in Belgium and Denmark, or motor vehicles in Germany). The decline in business R&D intensity in Sweden and Finland is mainly driven by lower R&D expenditures in the ICT sector (European Commission, 2016). However, the differences in business R&D investment across EU Member States are only partly driven by the industry specialisation of the country. In other words, this variation is also due to differences in the business environment, access to finance, cultural differences with respect to risk-taking and entrepreneurship, human capital, and skills of the labour force (European Commission, 2016). Given the large differences in business R&D investment across EU countries, there is scope for public policy to intervene on several fronts to make R&D investments more attractive. Box 1 discusses tax incentives to support business R&D investment and innovation in the EU.

Figure 8 Composition of R&D expenditures in 2005 and 2015 in EU Member States that invested less than 1.5% of GDP in R&D in 2015 (% of GDP)



Source: Eurostat.

Note: Countries are ordered based on R&D intensity in 2015.

Public support for business R&D increasingly relies on R&D tax incentives. In other countries that also experienced a rapid increase in R&D intensity over the last decade – such as the Czech Republic, Slovakia, Greece, and Malta – public R&D investment, and in particular R&D investment by higher education institutions, was the key driving force. In addition, some countries increased their public R&D intensity

with the support of EU structural funds, notably Estonia, the Czech Republic, and Malta (European Commission, 2016). Many Member States that already had a strong public R&D system before the global financial crisis have also continued to increase their investments since 2007, notably Denmark and Germany. However, some other countries that had relatively low public R&D intensity before the crisis – including Romania, Bulgaria, Croatia, and Hungary – have reduced funding for public R&D, with potential strong negative implications for long-term growth.

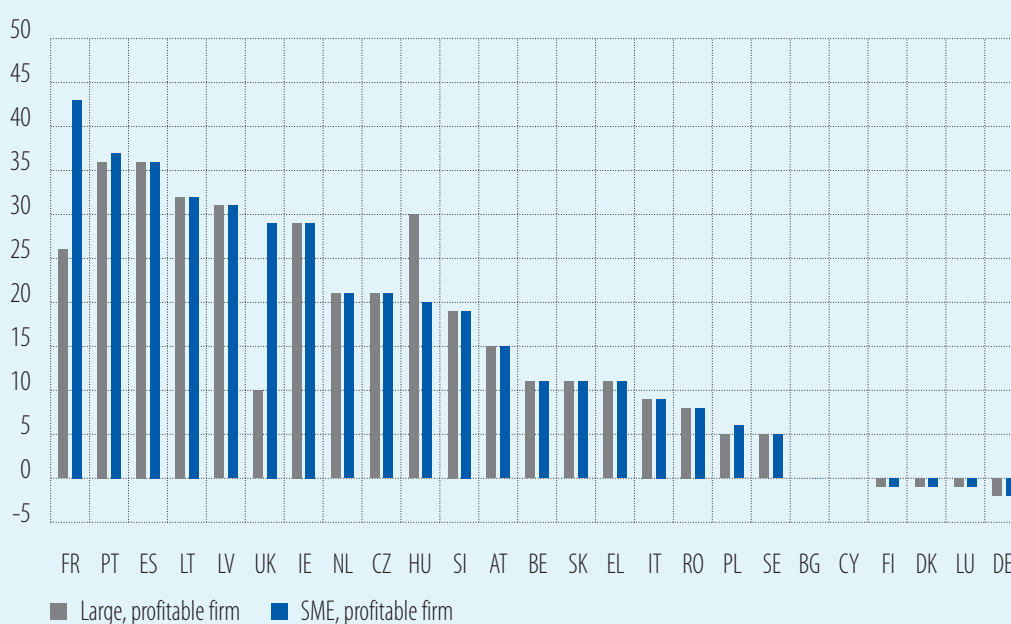
Box 1 R&D tax incentives in the EU

In addition to R&D investment made by the public sector, EU governments support business R&D investment with direct funding via public procurement and grants and with indirect funding such as R&D tax incentives. EU Member States increasingly rely on fiscal incentives to support business R&D, in particular since the global financial crisis that obliged some governments to introduce fiscal consolidation measures.

From a policy perspective, SMEs are the main targets of these measures, but tax incentives are also used for specific sectors or geographical areas (e.g. free economic zones or less developed regions). R&D support measures range from tax credits and tax allowances to facilitating the acquisition of equipment for new products or processes (through accelerated depreciation of fixed assets). Most incentives are based on corporate income taxes and differ widely in their targeting (firm age, location, size, and field of activity) and overall generosity (when compared to corporate investment and the government budget).

One advantage of tax incentives is that they enable governments to stimulate R&D without having to explicitly choose projects. This allows governments to address the problem of asymmetric information because the activities are performed by the private sector: firms remain free to choose the R&D projects they invest in and bear the risk of failure. In addition, R&D tax incentives have low administrative costs in comparison to direct subsidies for specific R&D activities.

Figure 1 Tax subsidy rate on R&D expenditure in 2016 (in %)



Source: OECD.

Note: No data for Estonia, Croatia, and Malta.

As shown in Figure 1, the tax subsidy rate for SMEs is particularly high in France, Portugal, and Spain, while the tax treatment of R&D spending in Germany, Luxembourg, Denmark, and Finland is not favourable to companies.⁵ Currently only Germany, Estonia, and Finland do not have any tax policy aimed at stimulating business R&D (Ognyanova, 2017). This does not mean that R&D is not encouraged by public policies: Germany supports R&D through sector-specific research grants on a competitive basis. This type of incentive was adopted by other countries in a less systematic fashion. An example is Finland, which provides grants and loans through its innovation agency Tekes, which has evolved in recent years with an increased orientation towards start-ups and entrepreneurship.

In most countries, SMEs and large firms benefit equally from tax subsidies. However, in the UK and France, smaller companies have a higher subsidy rate. In 2017, most Central, Eastern, and South-eastern Europe (CESEE) countries were offering SMEs (and larger companies) super-deduction schemes for R&D ranging from 125% of eligible R&D spending in the Slovakia to 300% in Latvia and Lithuania. Notably, Romania launched a corporate tax exemption for ten years for research-based companies. Alternatively, many non-cohesion countries in the euro area (notably in the periphery countries) are adopting or extending schemes for the deduction of qualifying patent income on corporate tax returns (“patent box”).

Support for R&D through taxation is one of the main objectives of the proposed EU Common Consolidated Corporate Tax Base. The proposal confirms the deductibility of all R&D expenses (already in place in most EU countries) and proposes an additional harmonised super-deduction of 50%.

Tax incentives must be complemented by the right framework conditions. Making R&D tax incentives more generous in countries where conditions for innovation are lacking may not be the best use of government resources (Straathof et al., 2014). Broad R&D tax incentives that are not targeted may not necessarily support the projects with the highest positive externalities, such as the basic research conducted by public or private universities and research institutes. They may also create an incentive for firms to “re-label” activities that were not R&D to obtain tax breaks. The definition of R&D activities may also be too narrow if it focuses on formal R&D conducted by manufacturing firms and does not apply to firms in the services sector. This suggests that in addition to well-designed R&D tax incentives, policymakers should also focus on policies that improve overall framework conditions for business R&D investment.

In 2016 and 2017, several more general measures were launched to support corporate fixed investment or adjust corporate taxes to favour competitiveness. Some of these measures are expected to generate a rather significant macroeconomic impact (European Commission, 2017). For instance, Italy and France launched and later extended accelerated depreciation schemes for capital expenditure related to new equipment. Overall, most EU countries offer capital expenditure incentives, with sectoral, dimensional, and geographical eligibility depending on the country. In cohesion countries, investment incentives are largely financed via the operational programmes of EFSI. In addition, new national promotional banks are being established in some countries (e.g. Malta and Greece) to support domestic investment.

Over the last couple of years, several Member States have reduced their stock of government guarantees for R&D investment. Nevertheless, guarantees remain crucial for SMEs to access finance and to alleviate market failures, especially in some countries (EIF, 2017). In particular, SME guarantees are significant in Italy (2% of GDP), Portugal (1.8%), and Hungary (1.7%). Overall, in Europe, 2.85 million SMEs are beneficiaries of guarantees.

⁵ The tax subsidy rate is calculated by the OECD as 1 minus the B-index, a measure of the before-tax income needed to break even on USD 1 of R&D outlays, measuring the marginal cost of R&D to users. In some countries, the B-index can be larger than 1, leading to negative tax subsidy rates on R&D expenditures.

Recent macroeconomic statistics on intangible investment

In addition to R&D, other intangible assets – including software and databases, employee training, and organisational capital – are important sources of economic growth in advanced economies. The changing nature of the global economy has focused more attention on intangible assets as a source of productivity and economic growth in advanced economies (OECD, 2013). Knowledge creation is driven not only by R&D investment but also by expenditure on other intangible assets such as software development, databases, employee training, design of products and services, reputation and branding, business process improvements, and organisational developments (EIB, 2016). 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 also 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 has been estimated to account for more than 5% of GDP, with advertising alone amounting to almost 2% of GDP (Arkolakis, 2010), which is evidence that firms find it profitable to undertake this type of intangible investment.

The measurement of intangible investment has improved in recent years. Since the adoption of the European System of National and Regional Accounts 2010 (ESA 2010, which replaces ESA 1995), R&D expenditure has been capitalised as capital formation – similar to investments in tangible assets such as machinery and equipment or dwellings and other structures. In fact, most investments in intangible assets currently recorded in national accounts as gross fixed capital formation consist of R&D (Thum-Thysen et al., 2017). The treatment of other intangible assets in national accounts has also changed with the decision to capitalise software expenditure as capital formation. Software is an important category of intangible assets because it can transform knowledge into computerised information.

Although this fixed-asset boundary in national accounts has been expanded to better account for the role of intangibles, official statistics treat only a limited range of intangible assets as investment. Many intangible assets are notoriously difficult to measure or are simply not measured systematically or consistently across firms or countries. 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 Bloom and Van Reenen, 2010, for management practices; Belo et al., 2014, for marketing expenditures; and Black and Lynch, 1996, for firm training).

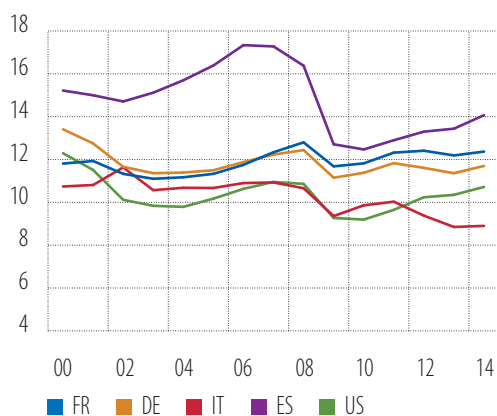
Comparable cross-country data on intangible investments are only available for a limited number of countries. Corrado et al. (2012) further expanded the core concept of gross fixed capital formation by the business sector in national accounts by adding additional expenditures on intangible assets – such as design, brand equity, firm-specific training, and organisational efficiency – that are currently treated as intermediate costs in national accounts. They define intangible assets as investments that enable knowledge to be commercialised and classify them into three broad categories (Table 1). The category of software and databases refers to “knowledge embedded in computer programs and computerised databases”, innovative property refers to “knowledge acquired through scientific R&D and non-scientific inventive and creative activities,” and economic competencies refer to “knowledge embedded in company-specific human and structural resources including brand names” (Corrado et al., 2012). Innovative property covers the costs of 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.

Table 1 Intangible assets and national accounts conventions

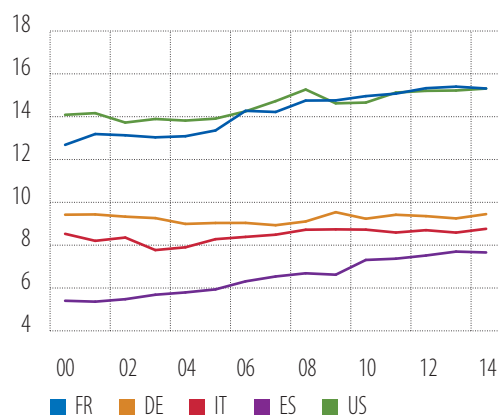
Intangible asset	Included in national accounts
Software and databases	
Computer software	Yes
Databases	Yes
Innovative property	
R&D	Yes
Design	No
Entertainment, artistic and literary originals	No
Mineral exploration	No
New product development in the financial industry	No
Economic competencies	
Advertising	No
Market research	No
Organisational capital	No
Training	No

Source: EIB (2016).

Unlike investment in physical capital, investment in intangible assets was relatively resilient during the global financial crisis and did not contract sharply after 2008. Over the last two decades, investment in intangible assets has been increasing more rapidly than GDP in the US and the EU (EIB, 2015). Intangible investment intensity has also been less volatile than gross fixed capital formation by the business sector (Figures 9 and 10).

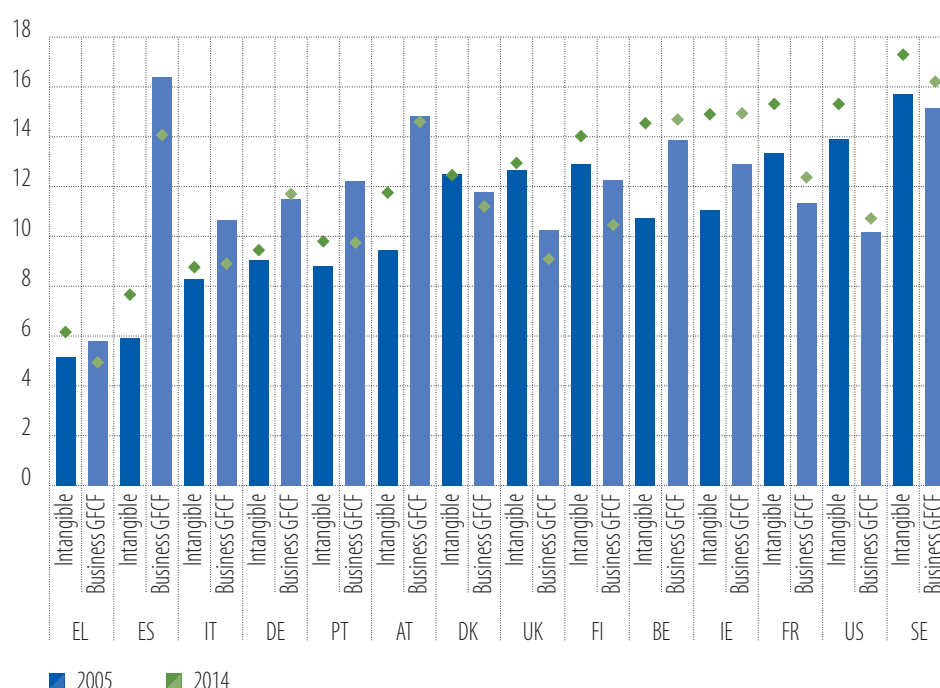
Figure 9 Gross fixed capital formation by the business sector, selected EU Member States and the US, 2000–2014 (% of GDP)


Source: Eurostat; OECD; and INTAN-Invest.

Figure 10 Intangible investment by the business sector, selected EU Member States and the US, 2000–2014 (% of GDP)


Gross fixed capital formation by the business sector was lower in many EU countries (except Germany, Belgium, Ireland, France, and Sweden) in 2014 than in 2005 (Figure 11).⁶ But business investment in intangibles has been increasing over time (except in Denmark). In countries such as Denmark, Finland, France, Sweden, and the US, intangible investment intensity was already higher than business gross fixed capital formation before the crisis and this gap in investment intensity has been increasing over time. In Greece and Portugal, business gross fixed capital formation was higher than intangible investment before the crisis but is now lower, on the back of the sharp drop in business investment following the crisis. Finally, in the remaining countries, including Spain, Italy, Germany, Austria, Belgium, and Ireland, business gross fixed capital formation (as a share of GDP) is higher than intangible intensity in both periods, but the gap has been closing rapidly over time.

Figure 11 Gross fixed capital formation and intangible investment by the business sector, EU Member States and the US, 2005 and 2014 (% of GDP)



Source: INTAN-invest; Eurostat; and OECD.

Note: Countries are ordered based on intangible intensity in the period 2008–2014. GFCF: gross fixed capital formation.

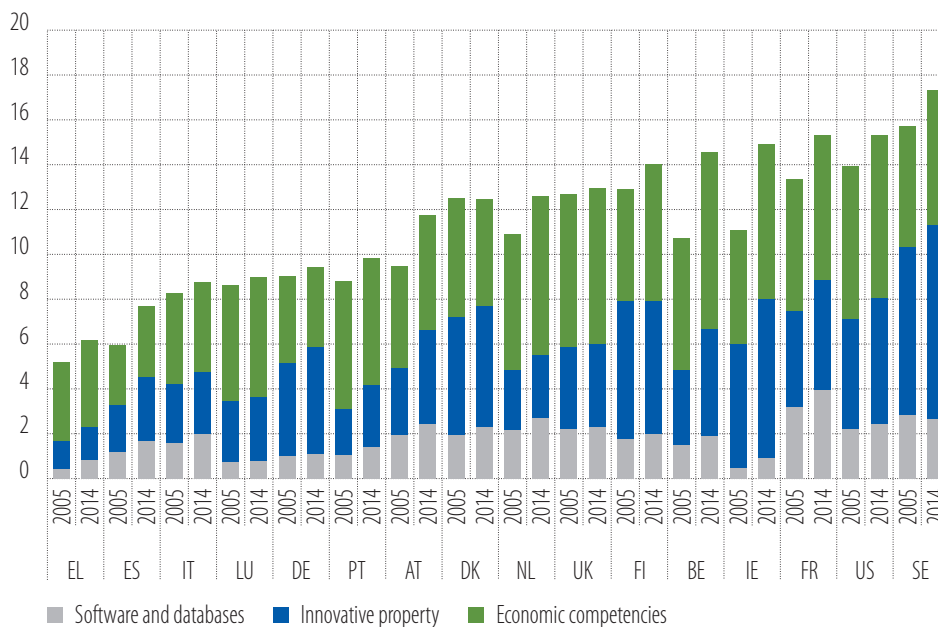
Countries with higher GDP tend to have higher intangible intensity because of their industry specialisation but also their more developed financial markets. At the country level, higher rates of intangible investment are usually associated with higher GDP per capita. In addition, the economic literature finds that intangible investment has been an important determinant of labour productivity growth over the last 15 years (EIB, 2016). This may reflect 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 rely on technology and business processes developed elsewhere and invest in industries where low wages provide a competitive advantage. But this tends to change as their production moves up the supply chain to activities with higher valued-added (EIB, 2015).

⁶ When using averages for the periods 2001–2007 and 2008–2014 (instead of only using the years 2005 and 2014), Germany and the US also have lower gross fixed capital formation by the business sector after the crisis.

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. In recent years, there have also been innovations in intangible-based lending and equity investment (EIB, 2015). 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.

Economic competencies (firm brand, organisational capital, and employee training) are the largest component of intangible investment, followed by innovative property (R&D, design, innovation in the financial industry, and mineral exploration). By looking at the composition of intangible investment, it is clear that economic competencies are the largest component of intangible investment in almost all countries, as they represented almost half of total intangible investment in both 2005 and 2014 (Figure 12). Economic competencies include intangible assets such as advertising, market research, organisational capital, and employee training. In countries such as Belgium, the US, Netherlands, the UK, and Ireland, firms invested around 7% of GDP in economic competencies. 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 (EIB, 2016).

Figure 12 Composition of intangible investment, EU Member States and the US, 2004 and 2015 (% of GDP)



Source: INTAN-Invest.

The second-largest component of intangible investment was innovative property – except in Denmark, Germany, Ireland, 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 amounts to around half of the total of investment

in innovative property, while design makes up around a third of the total. EU countries differ significantly in the intensity of investment in R&D (Figure 6). R&D enlarges the technological frontier but it also enhances firms' ability to absorb existing technologies. Design can also enable firms to pull away from cost-based competition. A number of successful products owe at least part of their success to different facets of design (OECD, 2013). 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 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.

Software and databases represented the smallest component of intangible investment in both 2005 and 2014. However, it is the component that has been increasing the most over time (as a share of both GDP and total intangible investments). While this share represented – on average – around 15% of total intangible investments in 2005, it amounted to more than 20% of the total in many economies in 2014. In countries such as France, Sweden, and the Netherlands, investment in software and databases reached more than 2.5% of GDP in 2014. Firms have increased their investments 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 industries in these countries. For instance 90% of new car features in the automotive sector have a significant software component (OECD, 2013). The electronic controls that regulate the operation of motors, generators, and batteries are important components of a car. Indeed, hybrid and electric vehicles require huge volumes of computer code.

Intangible investment in the EIB Investment Survey

The EIB Investment Survey (EIBIS) finds that 37% of investment in 2016 went into intangible assets, while 63% went into fixed assets. The innovation activities of firms are typically difficult to measure well. The remainder of this chapter is based on the EIB Investment Survey (EIBIS). The results use the second wave of the survey that was conducted in 2017 and refer to investments made by firms in fiscal year 2016. The survey also covers innovation activities with questions on the share of investment spent on intangible assets as well as on the share of investment spent to develop or introduce new products, processes, or services.

Firms invest in intangible assets because they expect a return on their investment. EIBIS covers four different categories of intangible investment: R&D (including the acquisition of intellectual property); software, data, IT networks, and website activities; training of employees; and organisation and business process improvements. For fixed tangible assets, the two categories are land, buildings and infrastructure; and machinery and equipment. EIBIS finds that in 2016, 37% of total investment by non-financial corporations in the EU went into intangible assets, while 63% went into fixed assets (Figure 13).⁷ These figures are in line with macroeconomic statistics on intangible investment. While the share of intangible investment remained stable between 2015 and 2016, expenditures on intangibles went up together with the increase in total investment made by EU firms.

Machinery and equipment represented almost half (47%) of investment by non-financial companies in the EU in 2016. Land, business buildings, and infrastructure accounted for 17% of total investment. Software and databases was the largest component of intangible investment in the EU, and represented around 13% of total investment, followed by employee training (10%), R&D (8%), and organisational and

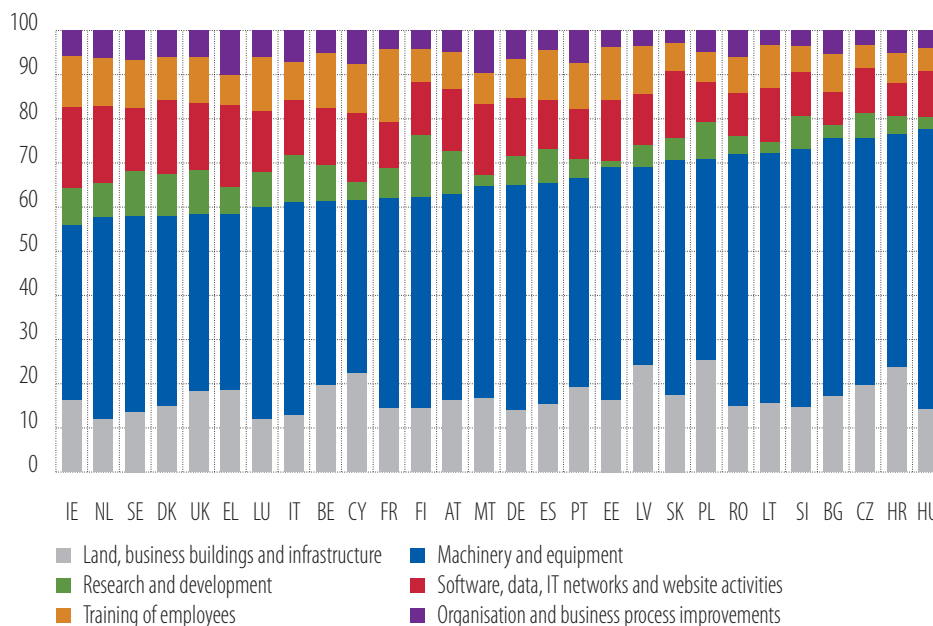
⁷ Investment is highly correlated with fixed assets or turnover. The correlation coefficient between the logarithm of investment and the logarithm of fixed assets in 2016 was 0.72, and the correlation coefficient between the logarithm of investment and the logarithm of turnover was 0.7. This section uses data on the share of intangible investment in total investment, but the findings reported here would be very similar if intangible investment intensity were defined as the ratio of intangible investment to fixed assets (or to turnover).

Investment in tangible and intangible capital

business process improvements (6%). Compared to the composition of intangible investment in the macroeconomic data from INTAN-invest, innovative properties are only covered by R&D in EIBIS (but not, for example, design) and this could explain why the share of investment that goes into innovative properties is lower than the share going into software and databases. In addition, EIBIS does not capture investments in mineral exploration or new product development in the financial industry, as the survey focuses on non-financial corporations in a more limited number of industries than the industries covered by INTAN-invest. But EIBIS provides comparable data on intangible assets in all 28 EU Member States that can be further disaggregated by industry, firm size, firm age, export status, or other relevant variables.

There is substantial variation in the share of intangibles across EU Member States, ranging from less than 25% in Hungary, Croatia, the Czech Republic, and Bulgaria to more than 40% in Greece, the UK, Denmark, Sweden, the Netherlands, and Ireland (Figure 13). The lower share of intangible investment in the CESEE region can be explained (at least to some extent) by the catching-up of firms in the region in terms of investment in tangible fixed assets. But the differences across countries in the share of intangible investment are not only driven by the industry composition in the economy of each Member State. The higher share of intangible investment in the northern countries may partly be due to the relatively favourable tax treatment and a better eco-system for investment in intangibles in these countries. This suggests that there is room for public policy to give incentives to firms to invest more in intangibles in several EU economies.

Figure 13 Investment areas by country, 2016 (% of total investment)



Source: EIB Investment Survey.

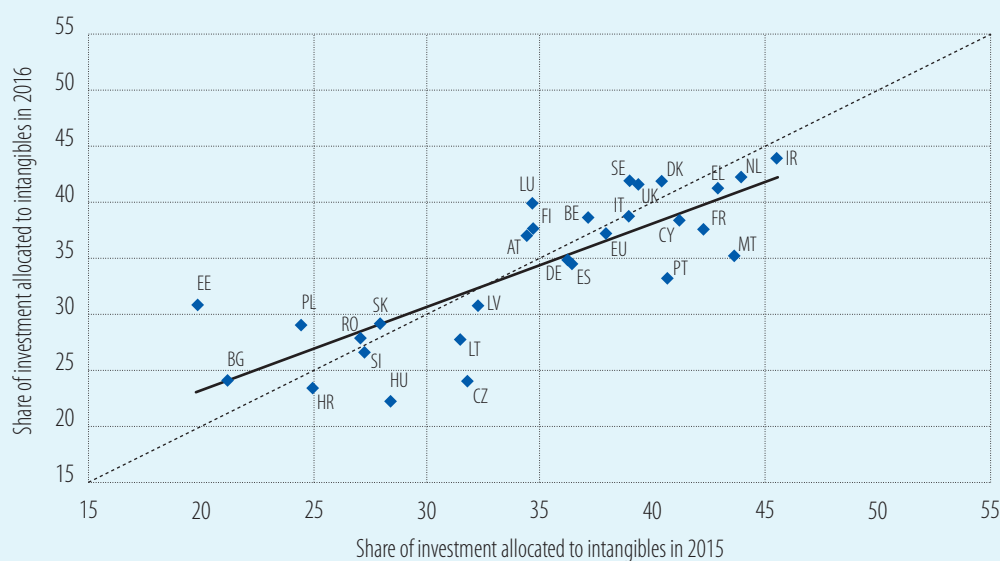
Note: Question: In the last financial year, how much did your business invest in each of the following with the intention of maintaining or increasing your company's future earnings? Base: All firms that have invested in the last financial year (excluding don't know/refused responses). Countries are ordered according to share of intangible investment.

Firms in manufacturing invest relatively more in R&D, while firms in services allocate a higher share of investment to software and databases. The share of intangible investment in EIBIS also varies across industries, with firms in infrastructure allocating a third of their investment to intangibles, while this share reaches 42% for firms in services (Figure 14). Construction is the only industry where there was a marked fall in the share of intangible investment, from 43% of total investment in 2015 to 38% in 2016.

Box 2 Changes in intangible investment between 2015 and 2016

The share of investment that firms allocate to intangibles is relatively stable at the country level. Figure 1 shows the share of firms' investment that went into intangibles at the country level for 2015 and 2016. Points above the 45-degree line indicate that the share of investment in intangibles has increased in the last year (vis-à-vis the previous one); points below the 45-degree line indicate that the share has decreased. The figure shows little changes in the investment pattern (at this level of aggregation) over time, with investment shares in intangibles in the last financial year very much in line with those the year before.

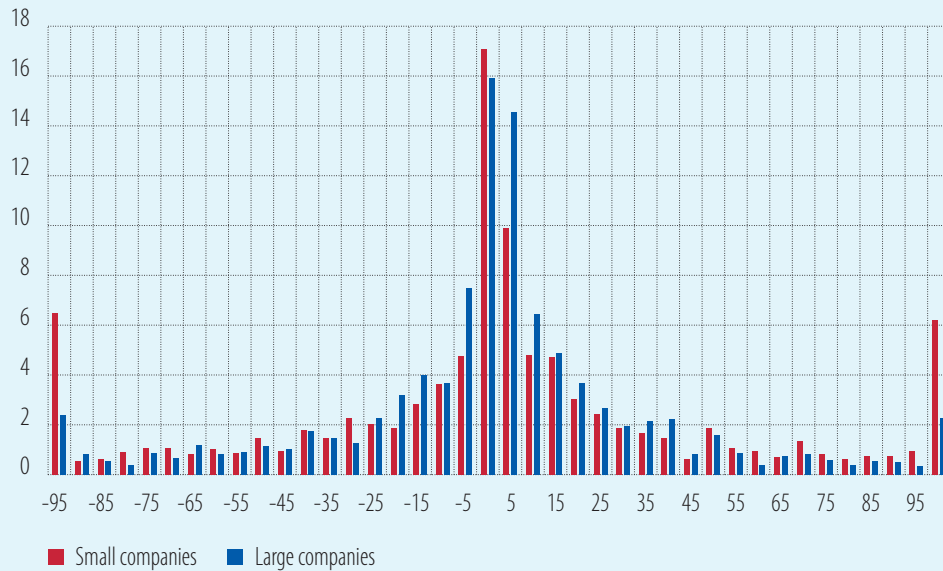
Figure 1 Change in the share of investment allocated to intangibles between 2015 and 2016



Source: EIBIS16 and EIBIS17.

The picture is different at the firm level. Comparing for each firm separately the share of investment allocated to intangibles in 2015 and 2016 shows notable changes from one year to the next: that is, while, at the country level, the share of investment that goes into intangibles appears stable, individual firms adjust how much they invest in intangibles and tangibles quite markedly from year to year.

Figure 2 illustrates this and shows that about 12% of small firms that invested in intangibles in one year no longer invested in intangibles in the following year or vice-versa. About 20% of small firms moved from allocating more than three-quarters of investment to less than one-quarter of investment in the two years (or again the other way round). The changes are less pronounced for larger firms.

Figure 2 Change in the share of investment allocated to intangibles between 2015 and 2016

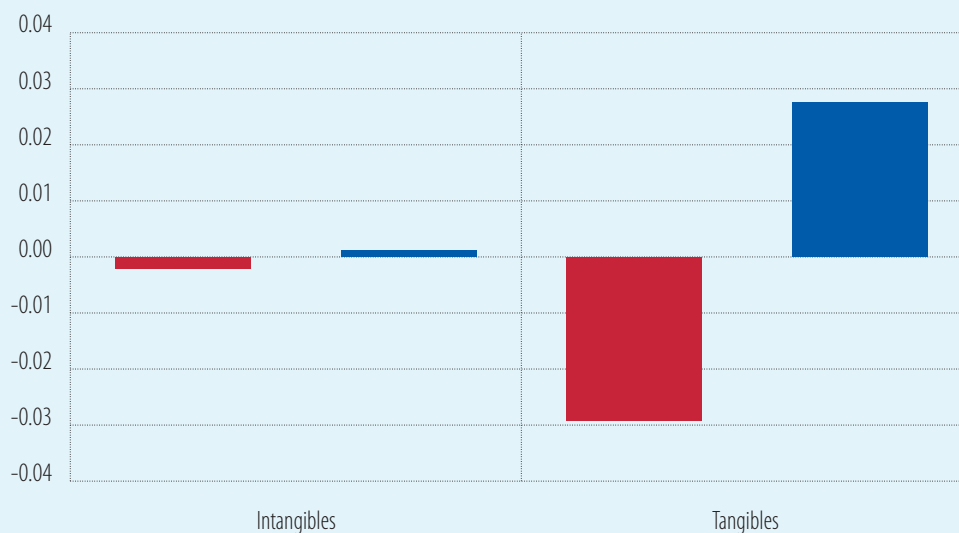
Sources: EIBIS16 and EIBIS17.

Note: Only panel firms are used. The figure is a histogram that plots the distribution of the within-firm change in the intangible share of investment. It is based only on those firms that have invested in intangibles at all at one point. The x-axis shows the change in the share of investment in intangibles in percentage points from 2015 to 2016; the y-axis shows the share of firms falling into a change-category.

The changing investment patterns at the firm level are driven by the strong(er) cyclical nature of investments in tangibles. Figure 3 shows the change in investment in tangibles and intangibles (as a share of total fixed assets) if overall investment increases and decreases, respectively. In line with the macro evidence shown in Chapter 1 of this report, the figure shows that if overall investment improves or deteriorates, investments in tangibles tend to respond a lot more to that than investments in intangibles. It is this asymmetry in how different types of investments respond to changes in the investment climate that explains a large part of the within-firm changes in investment patterns from one year to the next.⁸

⁸ The same conclusion holds if instead of overall changes in investment, changes in turnover or firms' investment outlook are used.

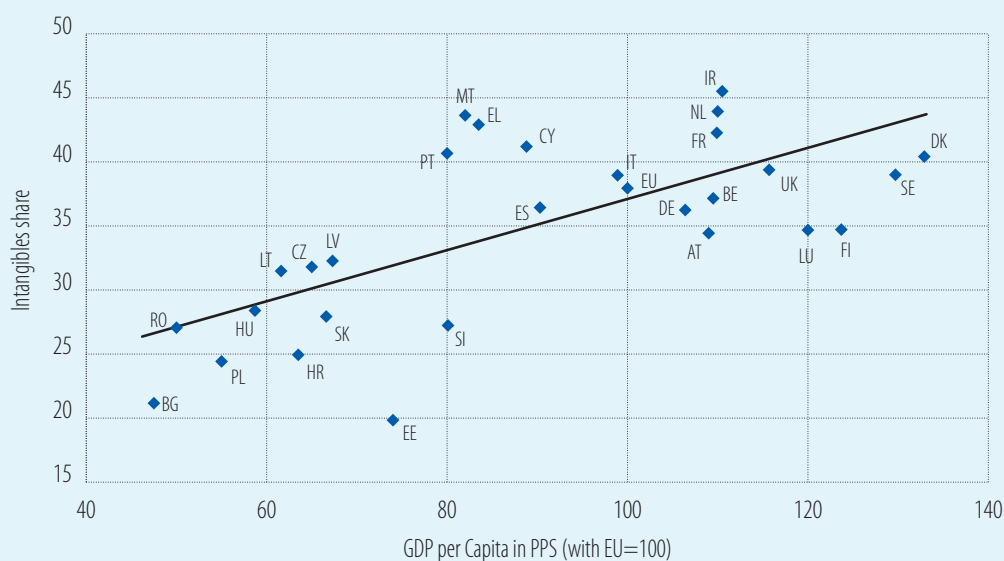
Figure 3 Changes in investment intensity from one year to the next by type of investment (in %)



Sources: EIBIS16 and EIBIS17.

Note: Only panel firms are used. The figure shows the change in median investment intensity for tangible and intangible investments (defined as investment over total fixed asset in both cases) from one year to the next. The numbers represent percentage points. The changes are plotted separately for firms that increased their total investment activities and firms that decreased them. Firms with no change in investment activities are ignored for this analysis. Two groups of firms are created: firms that saw an increase in total investment from 2015 to 2016, and firms that saw a decrease in investment over this period. For each firm in the two groups, the change in investment in tangibles and intangibles (as a share of total fixed assets) from 2015 to 2016 is calculated. (Only panel firms were considered for this.) The figure plots the median changes in investment intensities for groups 1 and 2, respectively.

Figure 4 GDP per capita (in Purchasing Power Standards, PPS) and investment in intangibles



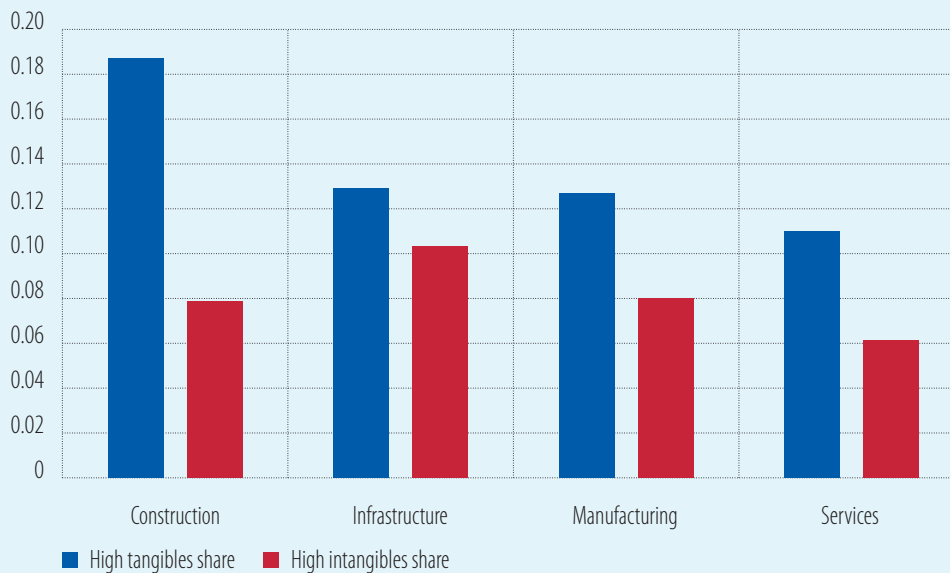
Sources: EIBIS16 and EIBIS17.

As firms move up the value chain, investments in intangibles become more important, while overall investment outlays tend to decline. There is a strong positive correlation between firms' position in

the value chain and the share of investment that firms allocate to investment in intangibles. Figure 4 provides a simple illustration of this: it shows the relationship between GDP per capita (as a proxy for economic development) and firms' intangibles share, exemplifying the positive association between the two variables. A similar result occurs if firms' intangibles' share is regressed on the quality of their capital stock.

As firms move up the value chain and the share of investment that goes into intangibles increases, this creates downward pressure on overall investment outlays. Figure 5 shows the difference in investment outlays of firms that allocate a large part of their investment to intangibles (49%+) and firms that allocate a large part to tangibles (50%+). It shows that, for all sectors, firms with a high share of investment in intangibles tend to invest less than firms with a high share of investment in tangibles.

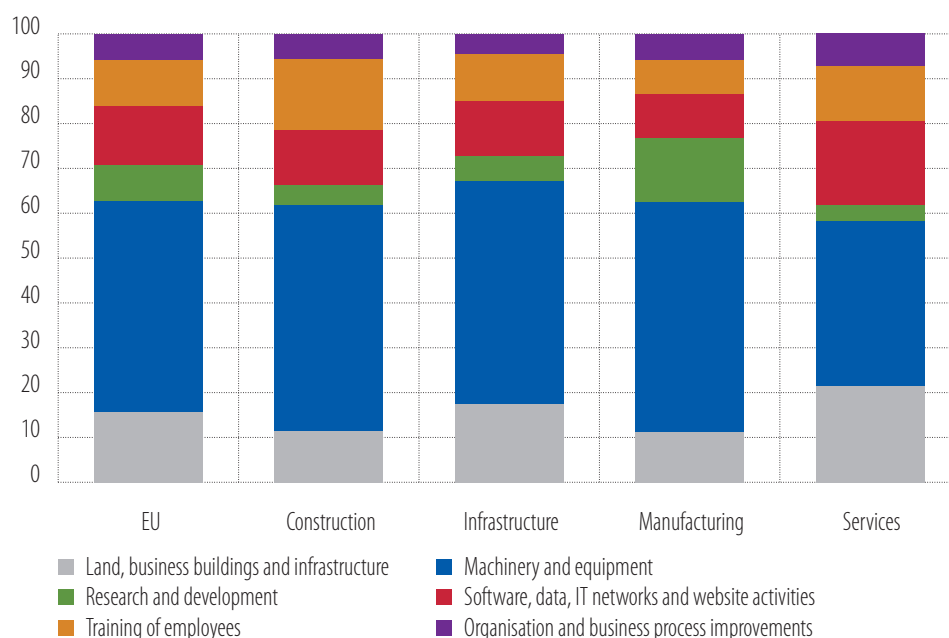
Figure 5 Difference in investment intensity of firms that invest more in tangibles and firms that invest more in intangibles



Source: EIBIS17.

Note: The figure shows the median investment intensity, defined as total investment outlays over firms' total fixed assets for firms that invest more in intangibles (R&D, software, IT and web services, training, and organisation and process improvements) and firms that invest more in tangibles (land, business buildings, infrastructure, and machinery and equipment). The threshold value is 49% in the case of intangibles and 50% in the case of tangibles.

Software and databases represent only 10% of total investment for manufacturing firms and 12% for construction and infrastructure firms, but this share rises to 19% for services. Investment in software, data, IT networks, and website activities are particularly relevant for firms in services, as it allows them to adopt the latest technologies and differentiate themselves from their competitors. Software and databases is also the largest component of intangible investment for infrastructure firms, which typically invest less in intangibles than firms operating in other industries.

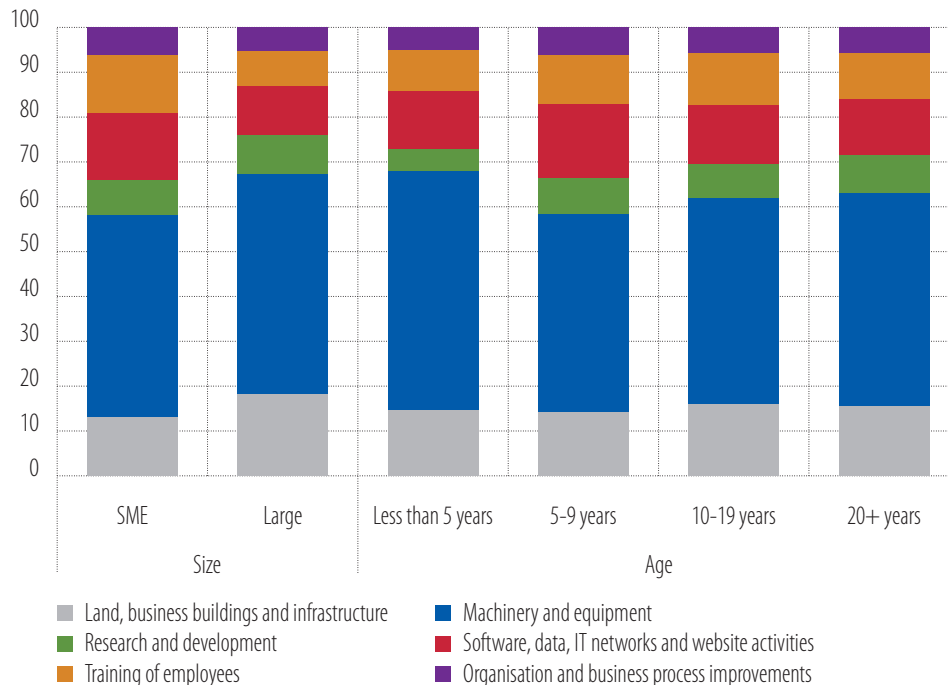
Figure 14 Investment areas by industry, 2016 (% of total investment)

Source: EIB Investment Survey.

Note: Question: In the last financial year, how much did your business invest in each of the following with the intention of maintaining or increasing your company's future earnings? Base: All firms that have invested in the last financial year (excluding don't know/refused responses).

Manufacturing firms conduct much more R&D than other industries, as R&D investment represents almost 15% of total investment. The share of R&D investment in the construction and infrastructure sectors is around 5% of total investment and the figure is less than 4% for services. At the same time, employee training represents 8% of total investment in manufacturing, and the share increases to 10% for firms in the infrastructure sector, 12% in services, and 16% in construction. Firm training is thus the largest component of intangible investment for firms in the construction sector, which could reflect the primary purpose of offsetting years of shedding labour. For manufacturing, investment in organisation and business process improvements represents the smallest component of intangible investment, at only 6% of total investment. This share ranges from 5% of total investment for firms in infrastructure to 7% for firms in services.

Compared to large companies, SMEs tend to allocate a larger share of their investment to intangibles. While the size of the investments is much smaller for SMEs, they tend to invest a higher share in intangibles (42%) compared to larger firms, whose share is one-third (Figure 15). The largest differences are for investment in software and databases (15% of total investment for SMEs, compared to 11% for large companies) and employee training (13% for SMEs, compared to 8% for large firms). Remarkably, large firms and SMEs invest almost the same shares in R&D and in organisation and business process improvements. The share of intangible investment does not vary much with firm age, except for very young firms (less than five years), which tend to invest a larger share in machinery and equipment.

Figure 15 Investment areas by firm size and age, 2016 (% of total investment)

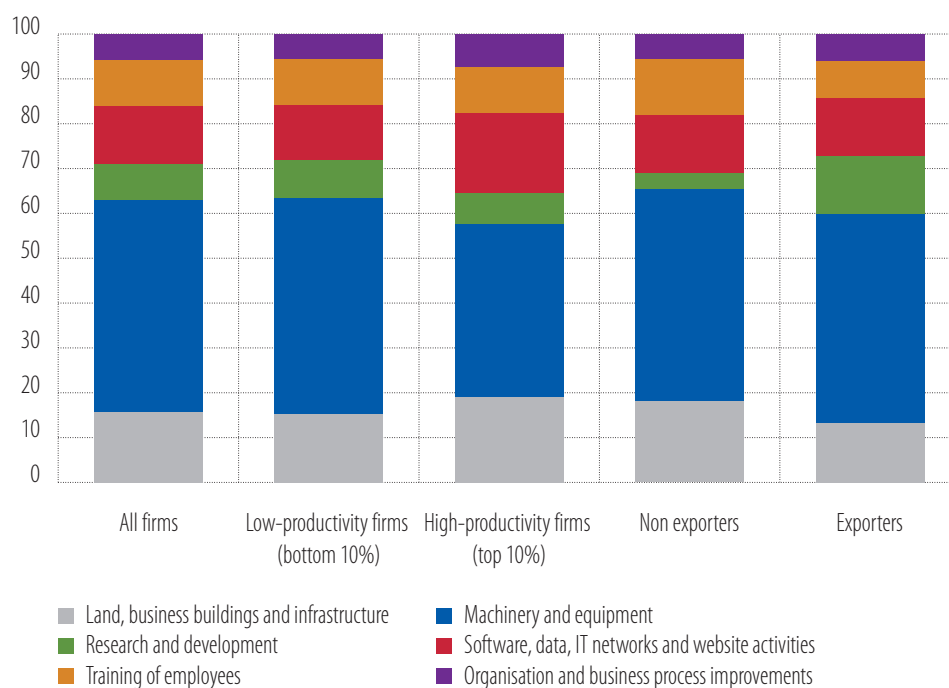
Source: EIB Investment Survey.

Note: Question: In the last financial year, how much did your business invest in each of the following with the intention of maintaining or increasing your company's future earnings? Base: All firms that have invested in the last financial year (excluding don't know/refused responses).

High productivity firms allocate more investment to intangibles. They invest more in the four components of intangibles, especially in software and databases, and exporters, which invest more in R&D. High-productivity firms tend to invest more in intangible assets (Figure 16). While low-productivity firms invest less than 30% of their total investment in intangible assets, high-productivity firms invest 50%.⁹ In particular, high-productivity firms invest a much higher share in software and databases: almost 20% of total investment, compared to a share of only 11% for low-productivity firms. High-productivity firms also allocate a higher share of investment to the other three intangible assets. The economic literature stresses that firms that export are more productive (Melitz and Redding, 2015) and, indeed, exporters also tend to invest more in intangibles, especially in R&D. Clearly, while the correlation between intangible assets and firm performance does not imply causation, this firm-level evidence is in line with the macroeconomic literature that identifies the decisive role of intangible assets, and especially R&D, as a source of productivity growth (Thum-Thyssen et al., 2017). There is some evidence that the complementarities between investment areas appear to matter as well. For instance, firms that invest in machinery and equipment and in employee training at the same time tend to have higher value added or higher turnover.

⁹ Regression analysis that takes into account the effects of country, industry, firm size, and firm age also finds that firms that invest more in intangible assets (particularly R&D) tend to perform better.

Figure 16 Investment areas by level of productivity and export status, 2016 (% of total investment)



Source: EIB Investment Survey.

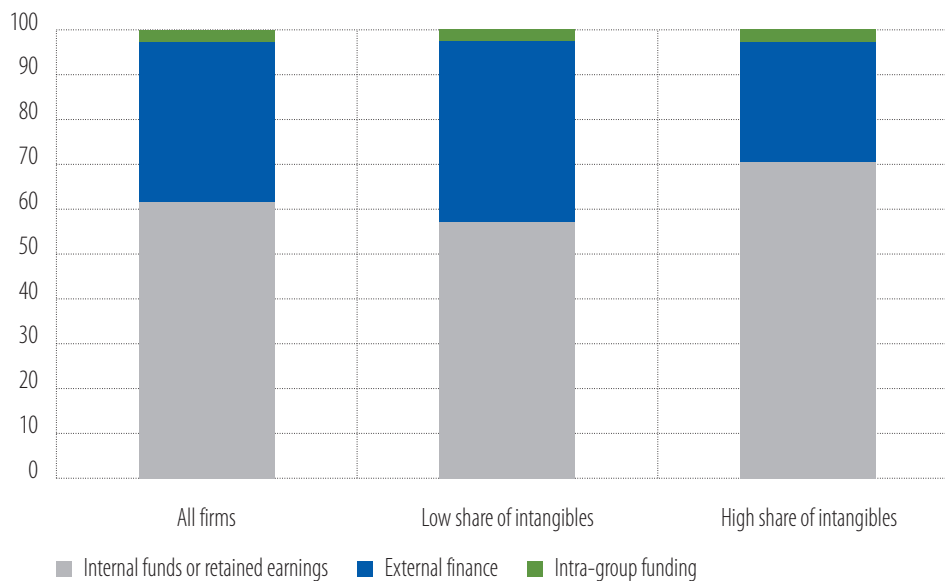
Note: Total factor productivity (TFP) is the residual of a pooled ordinary least squares regression where value added (in logarithm) is the dependent variable and the number of employees and fixed assets (both in logarithm) are explanatory variables. The regressions include the interactions of country and year (2015 and 2016) and are estimated separately for seven different industries. Low-productivity firms (bottom 10%) are defined as firms in the bottom 10% of the distribution of TFP within each country in 2016 (i.e. there are 10% of firms with low productivity in each country). High-productivity firms (top 10%) are defined as firms in the top 10% of the distribution of TFP within each country in 2016 (i.e. there are 10% of firms with high productivity in each country). Exporters are firms that directly exported goods and services to another country. Question: In the last financial year, how much did your business invest in each of the following with the intention of maintaining or increasing your company's future earnings? Base: All firms that have invested in the last financial year (excluding don't know/refused responses).

Firms that invest more in intangibles tend to rely less on external finance to fund their investments. Given the increasing role of intangible investment as a source of economic growth for the EU, it is critical for effective policy-making to better understand how firms finance their investments in order to relaunch productive investments in the EU. Firms in the EU rely to a large extent on internal funds (62%) to finance their investment activities, while external finance represents only 36% of investment finance.¹⁰ But there is some variation across sectors, and infrastructure firms (42%) are more likely to rely on external funds, possibly because they have more collateral to access external finance. The share of external finance also varies with the development of the financial sector across countries: more than 40% of investments by firms in France, Belgium, and Italy relies on external finance, while the share of external finance for investment activities is less than 20% in Greece and Cyprus.

¹⁰ See also Box 3 for a deeper analysis of the sources of finance and investment activities in R&D.

Comparing firms with high intangible investment intensity with those with lower intangible investment intensity allows us to identify whether there are differences in the way firms finance their investment.¹¹ Firms that spend the majority of their investment on intangibles tend to rely more on internal finance, with a share of 71%, compared to those with lower intangible investment intensity – whose share of internal finance is only 57% (Figure 17). This may also indicate that firms with high intangible investment intensity have more problems providing the required collateral to access external sources of finance.

Figure 17 Sources of finance by intangible investment intensity, 2016 (% of total investment)



Source: EIB Investment Survey.

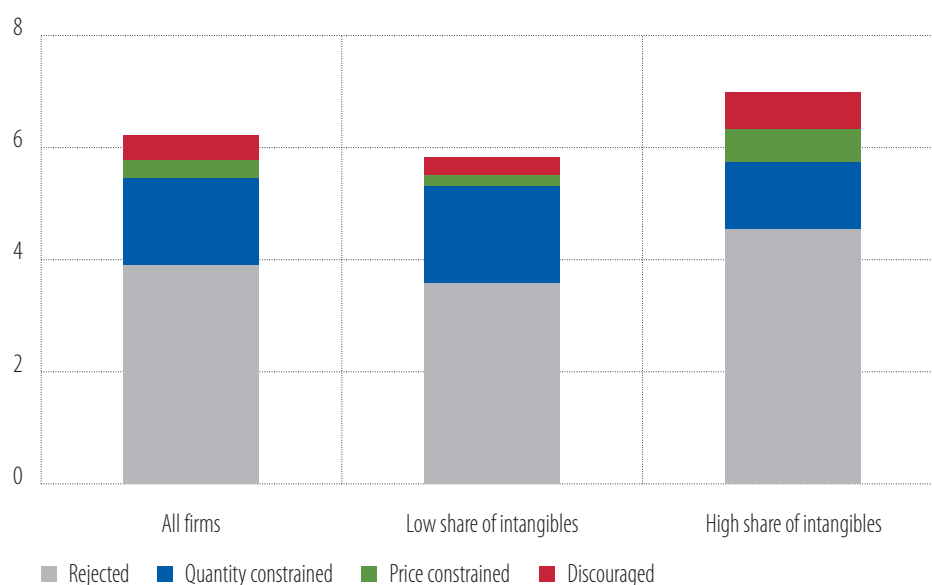
Note: Firms with a high share of intangible investment allocate 50% or more of their investment to intangible assets. Question: Approximately what proportion of your investment in the last financial year was financed by each of the following? Base: All firms that have invested in the last financial year (excluding don't know/refused responses).

Firms that invest more in intangibles are typically less satisfied with the conditions of the external finance obtained and are more likely to report that they are finance-constrained. There are also substantial differences in satisfaction with external finance between firms with high intangible investment intensity and those with low intangible investment intensity. Firms that invest more in intangibles are more likely to report that they are dissatisfied with the conditions for external finance that they obtained. This holds along different dimensions of external finance, and particularly for the amount obtained, the cost of funding, and collateral requirements. Firms with high intangible intensity not only report being less satisfied with the conditions for external finance that they obtain. They are also more likely to be financially constrained (Figure 18). Finance-constrained firms can be classified in four categories: firms that were not able to get finance when seeking it (“rejected”); firms that received less than they asked for (“quantity constrained”); firms that did not seek external finance because they thought that the borrowing costs would be too high (“price constrained”); and firms that did not seek external finance because they would be turned down (“discouraged”).

¹¹ Firms with high intangible investment intensity are defined as firms that invest 50% or more in intangibles as a share of total investment. In the EU, 34% of firms allocate a majority of their investment to intangibles. This share varies by industry (ranging from 29% in infrastructure to 39% in services), country (ranging from less than 20% in Hungary, the Czech Republic, Slovakia and Croatia to more than 40% in Sweden and the UK), and firm size class (larger firms tend to invest less in intangible assets). The results are similar when using a different threshold to define high intangible investment intensity (such as above the country-specific median of intangible intensity).

When they apply for external finance, firms with high intangible intensity report being rejected much more frequently. They are also more likely to report that they found the loan offer to be too expensive or that they simply did not apply because they were discouraged. While more productive firms and exporters are less likely to be finance constrained, firms that invest more in intangible assets are more finance-constrained. This could be linked to the fact that intangible assets cannot always be used as collateral.

Figure 18 Finance-constrained firms by intangible investment intensity, 2016 (% of all firms)



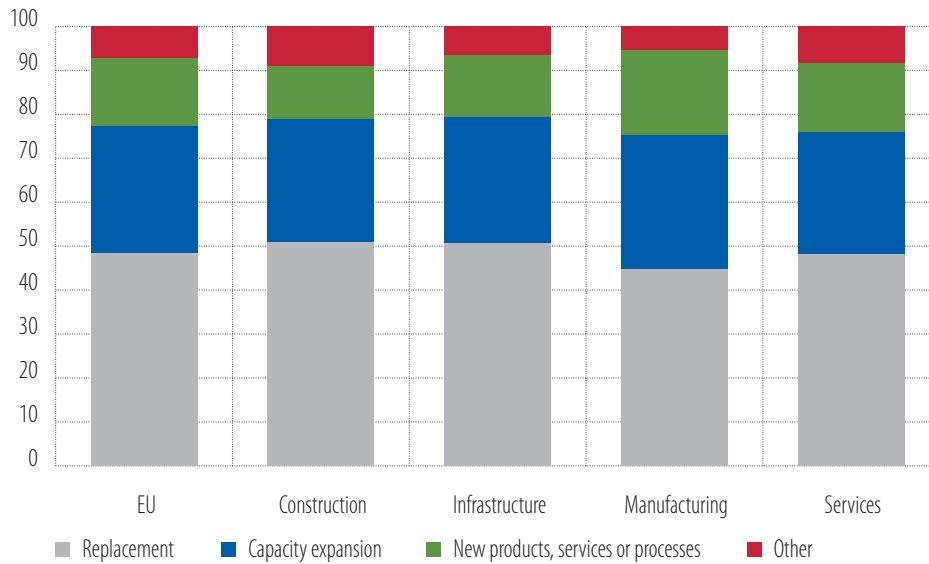
Source: EIB Investment Survey.

Note: Firms with a high share of intangible investment allocate 50% or more of their investment to intangible assets. Base: All firms that have invested in the last financial year (excluding don't know/refused responses).

Investing in new products, processes, or services

Firms make investment decisions to increase profits and reduce costs. In addition to R&D and intangible investment, EIBIS also asks a question about the share of investment spent for different purposes. In 2016, almost half (48%) of total investment was spent on replacing existing buildings, machinery, equipment, and ICT (Figure 19), while around 29% went into capacity expansion, and 16% was spent on developing or introducing new products, processes, or services. Clearly, replacement remains the investment priority for firms in the EU. The share spent on replacement ranges from 45% in manufacturing to 51% in construction and infrastructure, while the share of investment for capacity expansion does not really vary across sectors, ranging from 28% in services and construction to 30% in manufacturing.

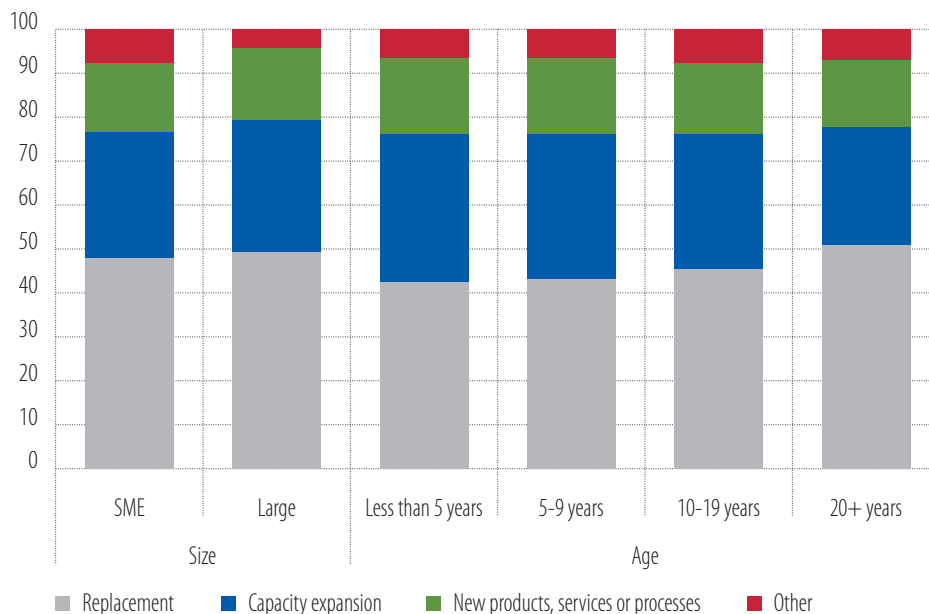
Figure 19 Investment purpose by industry, 2016 (% of total investment)



Source: EIB Investment Survey.

Note: Question: What proportion of total investment in the last financial year was for...? Base: All firms that have invested in the last financial year (excluding don't know/refused responses).

Figure 20 Investment purposes by firm size and firm age, 2016 (% of total investment)



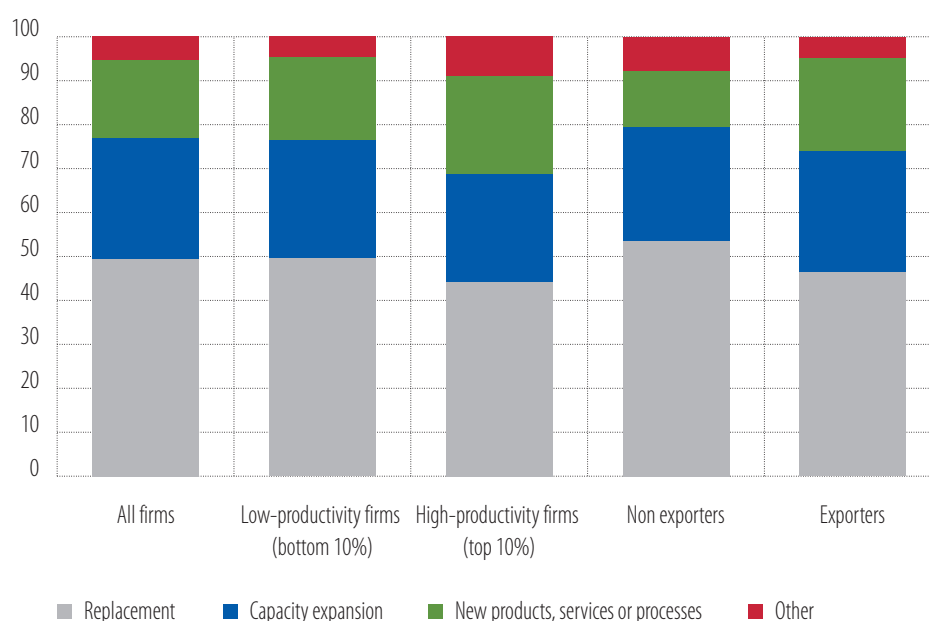
Source: EIB Investment Survey.

Note: Question: What proportion of total investment in the last financial year was for...? Base: All firms that have invested in the last financial year (excluding don't know/refused responses).

Compared to other sectors, firms in manufacturing tend to spend a higher share of their investment on developing or introducing new products, processes, or services. In terms of innovation, the category that is more directly relevant is whether firms invest to develop or introduce new products, processes, or services. Firms in manufacturing tend to spend more on new products, with a share of total investment of 19%, compared to services (16%), infrastructure (14%), and construction (12%). While there is little variation in the share of investment for different purposes across firm size, older firms tend to spend a higher investment share on replacement and a lower share on capacity expansion (Figure 20). But older firms do not spend less on developing or introducing new products, processes, or products. This suggests that innovation does not necessarily come only from young and small firms. This issue will be discussed in more detail in Chapter 9 of this report.

More productive firms and exporters allocate a larger share of investment to developing or introducing new products, processes, or services (Figure 21). And this pattern is not only driven by manufacturing firms, indicating that firms that want to remain at the technological or productivity frontier and compete with firms from other countries in export markets need to invest in new products to maintain their market share.

Figure 21 Investment purposes by level of productivity and export status, 2016 (% of total investment)



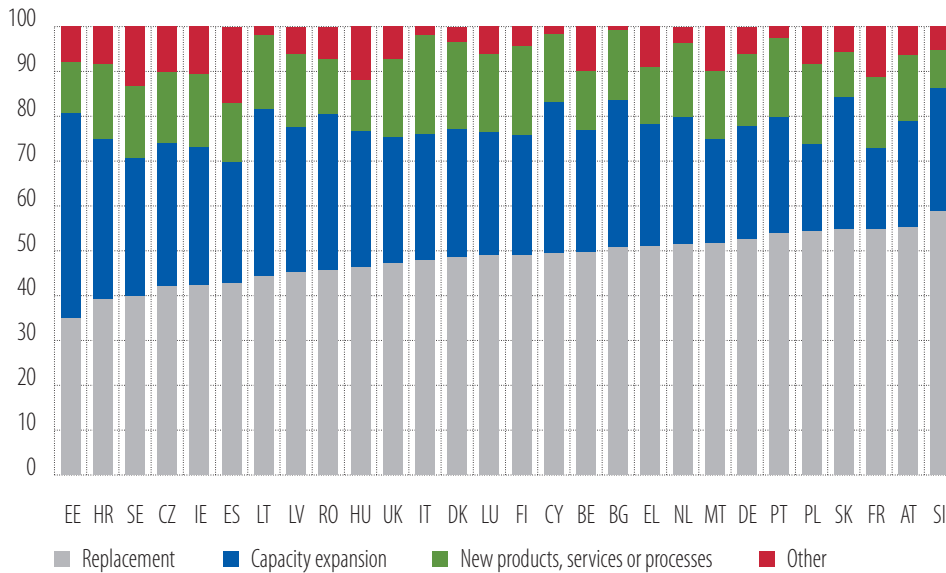
Source: EIB Investment Survey.

Note: Total factor productivity (TFP) is the residual of a pooled ordinary least squares regression where value added (in logarithm) is the dependent variable and the number of employees and fixed assets (both in logarithm) are explanatory variables. The regressions include the interactions of country and year (2015 and 2016) and are estimated separately for seven different industries. Low-productivity firms (bottom 10%) are defined as firms in the bottom 10% of the distribution of TFP within each country in 2016 (i.e. there are 10% of firms with low productivity in each country). High-productivity firms (top 10%) are defined as firms in the top 10% of the distribution of TFP within each country in 2016 (i.e. there are 10% of firms with high productivity in each country). Exporters are firms that directly exported goods and services to another country. Question: What proportion of the total investment in the last financial year was for...? Base: All firms that have invested in the last financial year (excluding don't know/refused responses).

The variation in investment purposes across countries is also substantial: the share of investment spent on developing or introducing new products, processes, or services varies from less than 12% of total investment in Slovenia and Slovakia to more than 18% in Denmark, Finland, and Italy (Figure 22). Firms operating in different EU Member States have different investment priorities due to

the economic cycle, but also due to more structural features of the economy, such as the concentration and competition in some specific industries, as well as public support provided to innovators.

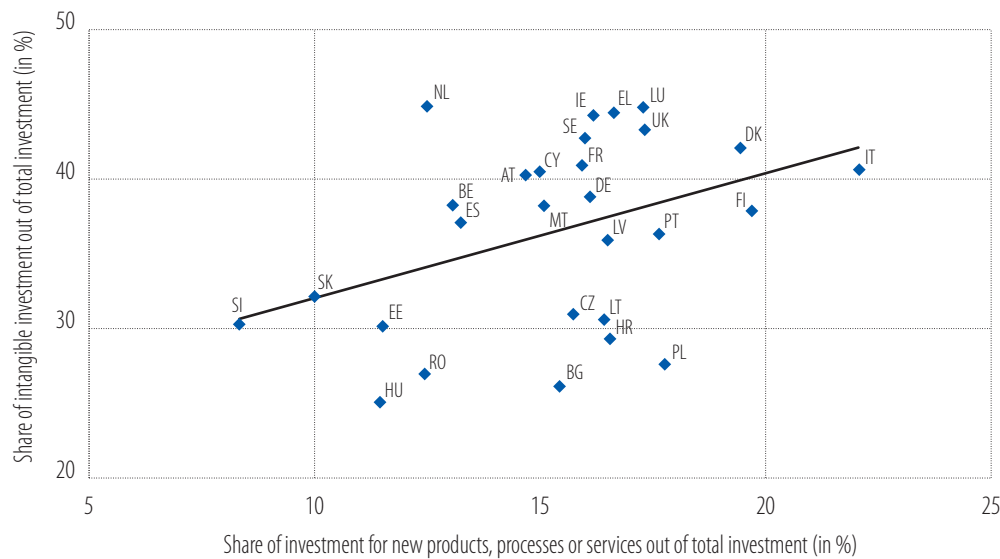
Figure 22 Purpose of investment, by country



Source: EIB Investment Survey.

Note: Question: What proportion of total investment in the last financial year was for...? Base: All firms that have invested in the last financial year (excluding don't know/refused responses).

Figure 23 Share of investment in new products, services, or processes, and the share of intangible investment by country, 2016 (%)



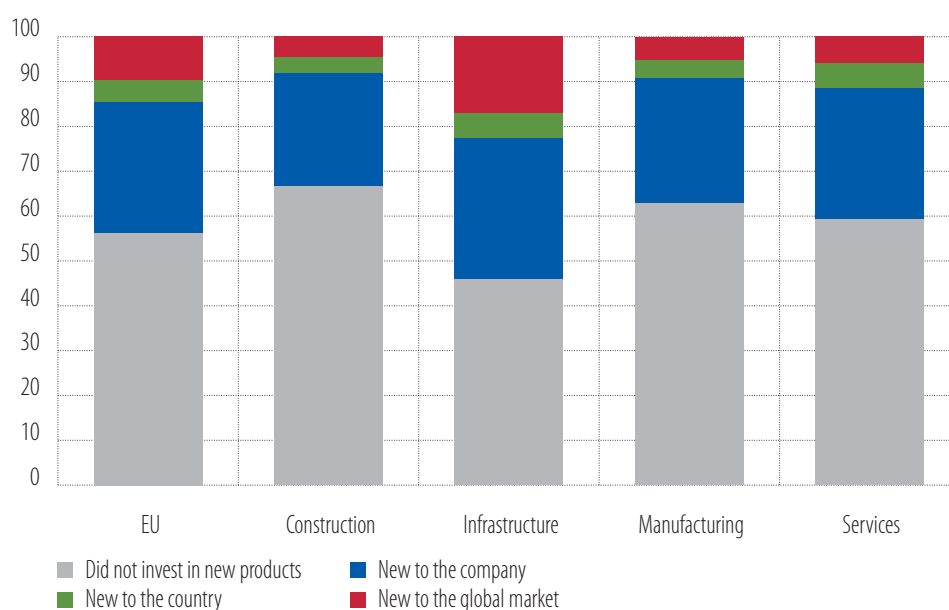
Source: EIB Investment Survey.

Note: Question: What proportion of the total investment in the last financial year was for developing or introducing new products, processes, or services? Base: All firms that have invested in the last financial year (excluding don't know/refused responses).

Innovation activities are correlated with investment in intangibles. There is a positive correlation between the share of total investment spent on intangibles (R&D, firm training, organisational capital, and software and databases) and the share invested in developing or introducing new products, services, or processes (Figure 23).¹² Chapter 9 of this report exploits this information to group firms into five categories based on their investment in R&D and their investment in developing new products. When looking at the different components of intangible assets, R&D investment is the main driver of this positive correlation between intangible assets and investing in the development or introduction of new products, processes, or services. However, investments in organisation and business process improvements matter as well, across all sectors. In addition, investing in software and databases is also relevant for firms in services and infrastructure. This again emphasises the importance of the complementarity across intangible assets for firm innovation, suggesting that public policies aiming to support innovation in the EU should not only promote R&D investment.

There is a large variation in innovative activities across EU Member States and sectors, with manufacturing firms much more likely to introduce products that are new to the global market. Firms in manufacturing are more likely to introduce products that are new to the global market (Figure 24). This is partly driven by the fact that manufacturing firms conduct more business R&D and they are more likely to export their goods and services. In fact, high-productivity firms and exporters are much more likely to invest in products that are new to the country and global market, suggesting that investing in innovation at the frontier is especially relevant for these firms if they want to remain competitive (Figure 25).

Figure 24 Products, processes, or services new to the company, the country, or the global market, by industry, 2016 (% of total investment)

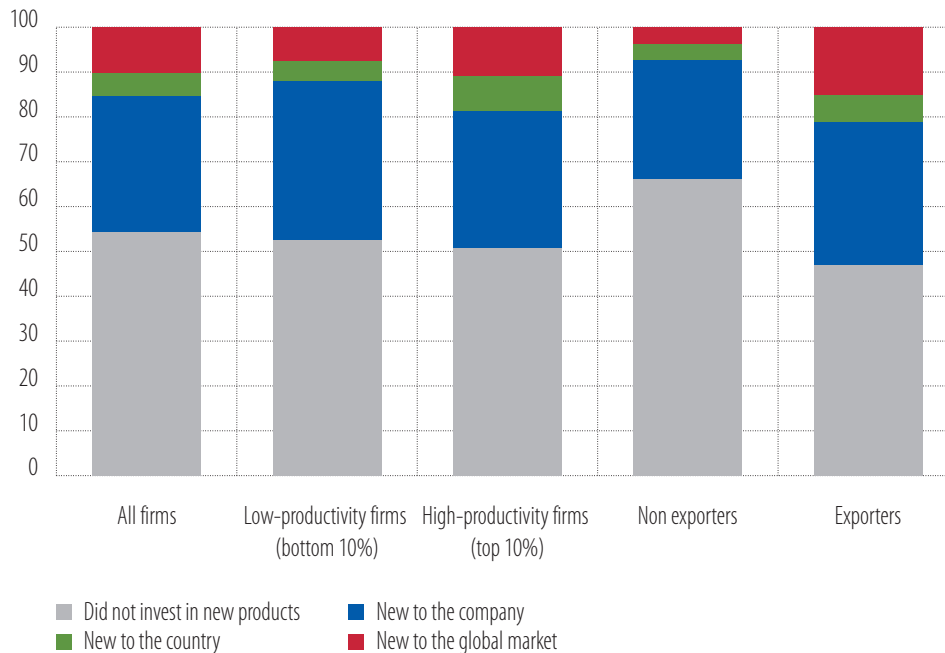


Source: EIB Investment Survey.

Note: Question: Were the new products, process, or services new to...? Base: All firms that have invested in the last financial year (excluding don't know/refused responses).

¹² The results also hold in a regression at the firm level that controls for the effects of country, sector, firm size, and firm age.

Figure 25 Products, processes, or services new to the company, the country, or global market, by level of productivity and export status, 2016 (% of total investment)

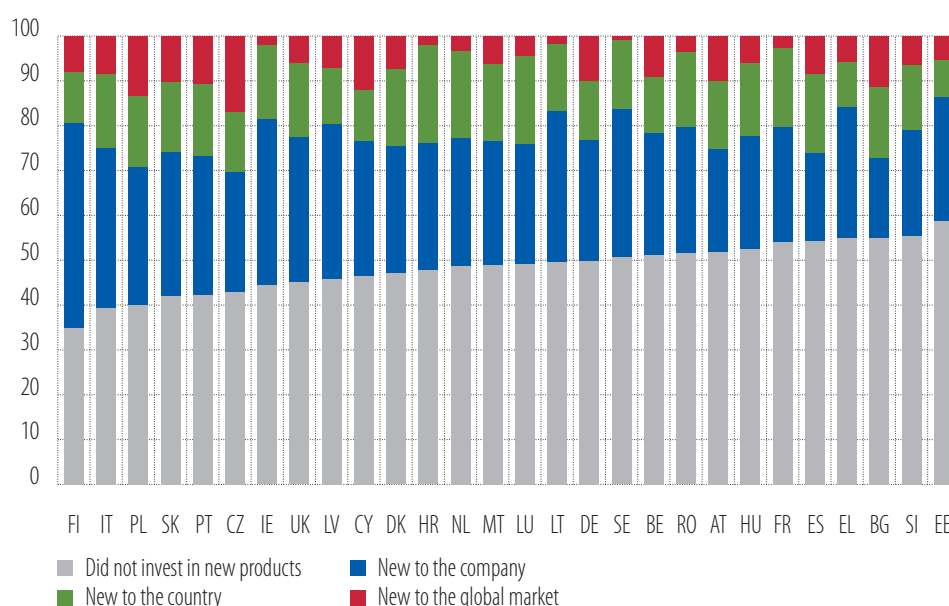


Source: EIB Investment Survey.

Note: Total factor productivity (TFP) is the residual of a pooled ordinary least squares regression where value added (in logarithm) is the dependent variable and the number of employees and fixed assets (both in logarithm) are explanatory variables. The regressions include the interactions of country and year (2015 and 2016) and are estimated separately for seven different industries. Low-productivity firms (bottom 10%) are defined as firms in the bottom 10% of the distribution of TFP within each country in 2016 (i.e. there are 10% of firms with low productivity in each country). High-productivity firms (top 10%) are defined as firms in the top 10% of the distribution of TFP within each country in 2016 (i.e. there are 10% of firms with high productivity in each country). Exporters are firms that directly exported goods and services to another country. Question: Were the new products, process or services new to...? Base: All firms that have invested in the last financial year (excluding don't know/refused responses).

Innovation does not necessarily need to come through the development or introduction of products, processes, or services that are new to the global market. Firms can also adopt existing technologies. For instance, in Italy or Portugal, where the majority of the firms invested in introducing and developing new products, processes, or services, more than two-thirds of the innovators consider that the new products were new only to the company (as opposed to new to the country or new to global markets). At the same time, in some countries where few firms invested in new products, processes, or services – such as Spain or Slovenia – the small number of innovators consider that the new products are new to the global market (Figure 26). In addition to fostering innovation at the technological frontier, however, it is vital that all EU countries also foster the diffusion of innovation across all firms so that they all move closer to the frontier.

Figure 26 Products, processes, or services new to the company, the country, or the global market, by country, 2016 (% of total investment)



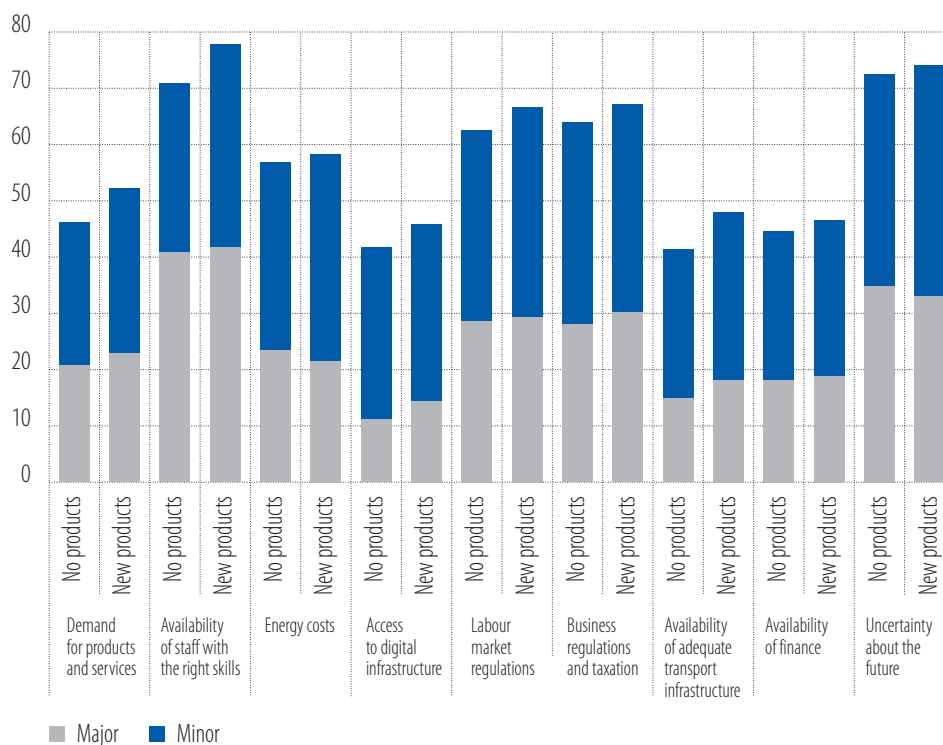
Source: EIB Investment Survey.

Note: Question: Were the new products, processes, or services new to...? Base: All firms that have invested in the last financial year (excluding don't know/refused responses).

Given the increasing role of intangible investment as well as the need to develop and introduce new products, processes, or services to maintain the competitiveness of EU firms, it is important to understand the constraints that hold back investment for innovative firms. EU firms consider uncertainty about the future and the availability of staff with the right skills to be the main structural barriers to investment, with more than two-thirds of firms considering them to be obstacles to their investment activities. Most EU firms consider business regulations and taxation, labour market regulations, and energy costs to also be serious long-term obstacles.

Some of the structural barriers to investment are more severe for innovative firms than for other EU firms (Figure 27). For instance, firms that invest in developing or introducing new products, processes, or services are more likely to report that the availability of staff with the right skills is an obstacle to investment. In addition, labour market and business regulations also tend to be more serious constraints for them. At the same time, firms that invest in intangibles are also more likely to report that these obstacles constrain their investment, and this is likely driven by the high correlation between the two measures of innovative activities. This indicates again the importance of taking into account the diversity of intangible assets and their complementarity.

Figure 27 Long-term obstacles to investment for firms that invest (or do not invest) in developing or introducing new products, services, and processes, 2016



Source: EIB Investment Survey.

Note: Firms with "no products" did not invest in developing or introducing new products, processes, or services, while firms with "new products" invested a positive amount. Question: Thinking about your investment activities, to what extent is each of the following an obstacle? Is it a major obstacle, a minor obstacle, or not an obstacle at all?

Conclusion and policy implications

When designing and developing new schemes (particularly innovative financial instruments) to support intangible investment, policy makers in the EU should take into account the differences between firms that invest little and firms that invest a lot in intangible assets. These include the fact that firms that invest more in intangibles tend to be more productive and export more, are more likely to be financially constrained, and have a lower share of external finance. Clearly, some new policy measures could be developed to increase and diversify the sources of external finance for firms that invest in intangibles. More generally, the strong association between intangible investment and productivity at both the firm level and the macroeconomic level indicates that there is scope for governments to implement policy measures to make investment in intangible assets more attractive for firms in the EU. At the same time, the diversity of intangible assets and their complementarity should be emphasised, so that public policies not only promote R&D investment or manufacturing firms, but also cover other intangible investment by firms in all sectors of the economy.

The differences in the severity of obstacles felt by firms that invest in innovation compared to firms that do not should be taken into account when developing policies to support innovation in the EU. As innovative firms report being more affected by these obstacles, this also highlights the importance of structural reforms to improve the business environment at the national level, but also at the EU level, as well as the need for more diversified financial instruments to support risky investments and innovative firms.

Diversification of finance sources is key for innovation. To explore in more depth the role played by finance in the innovation activities of EU firms, Box 3 presents a cluster analysis that links various financing instruments that firms use when investing to their innovation behaviour. The analysis shows that firms with diversified financial instruments are significantly more likely to invest in R&D activities and develop products new to the market or new globally compared to firms using fewer financing instruments (e.g. firms that only use internal finance or bank-related products). In addition, it suggests that firms that rely entirely on bank financing or use mostly internal financing are less likely to be innovative.

Policy makers should support the diffusion of innovation by all firms so that the benefits of innovation are not concentrated on a limited number of companies. Box 4 discusses the link between business R&D investment and productivity growth as well the importance of providing better framework conditions that support the adoption and diffusion of innovation in the EU. In addition, Chapter 9 presents different types of innovators and discusses how they finance their innovative activities. While there is a debate between policy makers on the best way to increase incentives for investment in intangible assets and innovation through different financial instruments (including direct funding with public procurement and grants, and indirect funding such as R&D tax incentives), the results in Chapter 9 suggest that grants are positively associated with innovative activities. At the same time, countries with more favourable tax treatment of intangible investment tend to have more innovative firms. This suggests that the incentives provided by public authorities tend to go in the right direction. But to better understand whether – and through which mechanisms – public support can lead to intangible investment and innovation, further analysis is needed to identify the policy measures that work best in different EU Member States and how to adapt them to the local context.

Box 3 Access to finance and the innovativeness of EU firms

The analysis uses cluster analysis to group EU firms using information on their financing decisions in order to understand the link between finance and innovation. Seven financing clusters are identified. The analysis shows that the degree of innovativeness increases with the diversification of financial instruments: firms that use several financing instruments are more likely to invest in R&D activities and develop new products than firms that use a more limited number of financing instruments.

Cluster analysis divides data into groups in such a way that firms inside the groups are homogenous, while the groups are very distinct from each other. The clusters are formed using firm-level data from the EIB Investment Survey (EIBIS) to identify groups of firms that use similar financing instruments. EIBIS includes questions on choices of finance for firms in the EU. First, the firms were asked what percentage of their investment was financed (1) internally, (2) externally, and (3) using intra-group funding. Second, firms were asked whether their external financing included one or more of the following options: (1) bank loans, excluding subsidised bank loans, overdrafts, and other credit lines, (2) other types of bank finance, including overdrafts and other credit lines, (3) newly issued bonds, (4) newly issued equity, (5) leasing or hire purchases, (6) factoring/invoicing discounting, (7) loans from family/friends/business partners, (8) grants, and (9) other types of finance not otherwise specified. These financing instruments were used as variables for identifying different firm clusters.

The empirical analysis is based on data from the 2016 wave of the EIBIS survey that refer to investment decisions in 2015. Out of 12,500 interviewed enterprises, 9,067 answered the relevant questions for cluster identification.

Seven distinct clusters are identified.¹³ Table 1 presents the clusters by starting with those using a mix of financing instruments and moving towards clusters that use fewer financing options.

- **Mixed-financed (intra-group):** This cluster consists of 270 (3%) firms that use a mix of up to ten different financing instruments, with a particular reliance on intra-group financing (used by all firms in the cluster).
- **Mixed-financed (grants):** This cluster consists of 482 (5.3%) firms that use all 11 financing instruments, with a special focus on grants (support from public sources) that are used by all firms in this cluster.
- **Mixed-financed:** This cluster consists of 1,165 (12.8%) firms that use a mix of up to 11 financing instruments.
- **Asset/debt-backed financing:** This cluster consists of 1,000 (11%) firms that rely on asset-backed financing. Specifically, all firms in this cluster use leasing or hire purchases.
- **Internal/bank-loan financing:** This cluster consists of 1,325 (14.6%) firms that use internal funding and bank loans to finance their investment activities.
- **Internal financing only:** This cluster is the largest one in the study, consisting of 4,554 (50.2%) firms that finance their investment activities using internal funding.
- **Bank financing only:** The last cluster consists of 271 (3%) firms that rely solely on bank financing.

Table 1 Cluster composition (%)

	Mixed financed (intra-group)	Mixed financed (grants)	Mixed financed	Asset/debt backed financing	Internal/bank loans financing	Internal financing only	Bank financing only	Pearson Chi ²
Internal	54.1	89.2	83.9	80.8	100	100	0	3927.40**
Intra-group	100	2.3	1.7	0	0	0	0	8119.64**
Bank loans	31.9	50.4	44.7	35.0	100	0	100	5810.21**
Other bank finance	12.2	20.1	67.6	0	0	0	0	5087.14**
Newly issued bonds	0	1.9	4.7	0	0	0	0	330.00**
Newly issued equity	1.1	1.2	3.3	0	0	0	0	220.19**
Leasing/hire purchase	20.4	23.2	37.7	100	0	0	0	6299.66**
Factoring/invoicing	5.2	8.7	21.3	0	0	0	0	1450.01**
Family/friends	1.5	6.2	19.5	0	0	0	0	1382.27**
Grants	1.1	100	0.9	0	0	0	0	8817.43**
Other	1.1	0.6	5.8	0	0	0	0	415.39**
N	270	482	1165	1000	1325	4554	271	9067
Percentage of firms	3.0	5.3	12.8	11.0	14.6	50.2	3.0	

Source: EIBIS16 survey data for 2015.

Note: Pearson's chi-square test: ** $p < 0.01$, * $p < 0.05$.

¹³ The algorithm used to identify the clusters is the Ward's method – a type of hierarchical clustering technique (Ward 1963). To test the validity of the cluster solution, the Elbow criteria proposed by Hair et al. (1998) is used.

Figure 1 presents the distribution of firm size (number of employees) for the seven clusters in our study. The figure shows that the mixed-financed clusters in general include larger firms compared to clusters that use fewer financing instruments. For instance, 72% of firms in the mixed-financed (intra-group) cluster are large firms, 21% are medium-size firms, 5% are small firms, and only 1% are microenterprises. Similarly, in the mixed-financed (grants) cluster, 51% of companies are large, 29% are medium-sized, 16% are small, and 3% are micro firms. On the other hand, in the bank financing cluster, 27% of firms are large, 23% are medium-sized, 35% are small, and 15% are micro firms.

Figure 1 Firm size by financing clusters (weighted percentages)

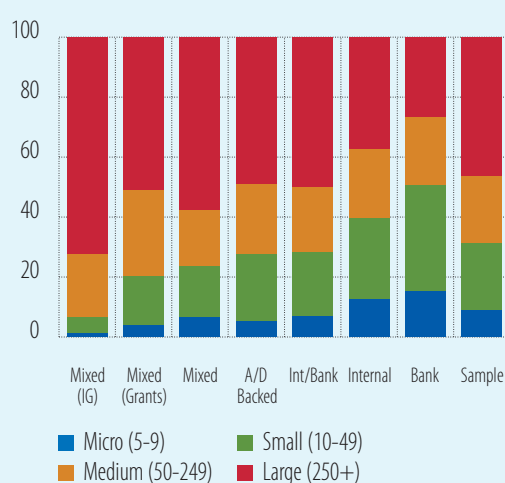
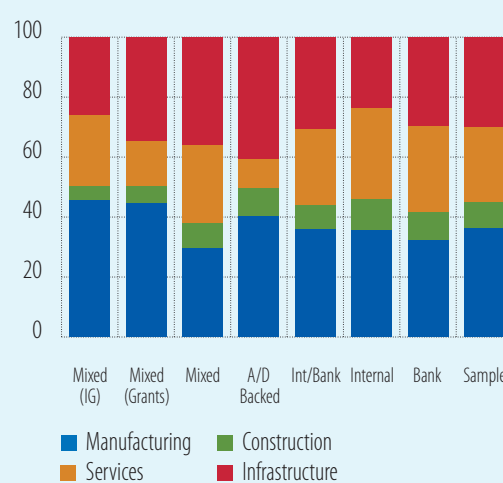


Figure 2 Sectoral breakdown of financing clusters (weighted percentages)

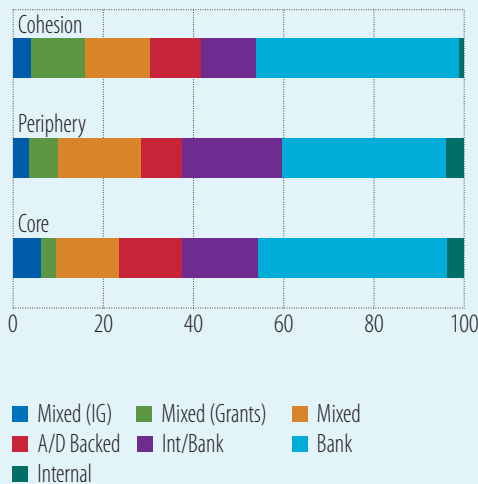
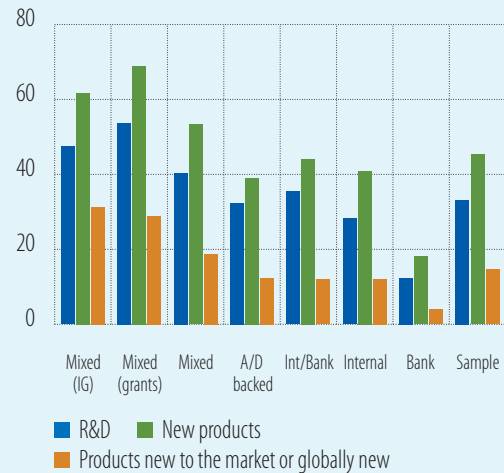


Source: EIBIS16 survey data for 2015.

Looking at the sectoral composition, Figure 2 shows that there are no striking differences across the seven clusters, except in the asset/debt-backed financing cluster where firms come less often from the services sector and more often from the infrastructure sector. This is not surprising, as leasing is more common for infrastructure firms that have more tangibles compared to services sector companies.

The distribution of firms in terms of their age does not differ significantly across different clusters. Similarly, when looking at the profitability of firms, in most of the clusters the fraction of firms that operate at a loss is between 7% and 10%, while the remainder of firms operate at a profit. The exception is the mixed-financed (intra-group) cluster, where 36% of firms operate at a loss.

Figure 3 presents the financing clusters composition in the three country groups. In cohesion countries, firms are more likely to be in the internally financed cluster, and less likely to be in the bank-related financing clusters (bank financing only and internal/bank loan financing). Furthermore, firms in cohesion countries more often pertain to the cluster that particularly relies on support from public sources of finance (mixed-financed – grants).

Figure 3 Country groups and financing clusters**Figure 4** Firm innovativeness by financing clusters

Source: EIBIS16 survey data for 2015.

This section investigates whether heterogeneity of firms across the innovation dimension is related to the firm finance mix. Figure 4 plots three indicators of firm innovativeness for the seven financing clusters. The indicators show the fraction of firms that (1) invested in R&D activities; (2) issued products new to the company; and (3) issued products new to the market or globally new. The figure shows that all three indicators are higher for firms with a more diversified financing mix. For instance, the percentage of firms that invest in R&D activities is 47% for the mixed (intra-group) cluster and 54% for the mixed (grants) clusters, while the average for the bank financing and internal financing clusters is 12% and 28%, respectively. Similarly, the fraction of firms issuing new products is 62% for the mixed (intra-group) cluster, 69% for the mixed (grants) cluster, and 53% for the mixed-financed cluster, while in the remaining clusters the percentage of firms issuing new products is lower. Finally, in the mixed-financed clusters the share of firms developing products new to the market or globally new ranges between 18% and 31%, compared to only 3% to 12% in the remaining clusters.

To further investigate the link between firm innovativeness and finance, a logistic regression model is used. This allows us to control for the differences in firm size, age, industry, and country. Three innovativeness indicators are used as dependent variables and finance clusters as independent variables. Table 2 presents the results, which suggest that firms in the bank-financing cluster are less likely to have invested in R&D activities than those in the internal-financing cluster (omitted – reference category). Firms in the internal/bank loans and asset/debt-backed clusters are not significantly different than the internally financed firms. On the other hand, firms in the mixed-financed and mixed-financed (grants) clusters are significantly more likely to invest in R&D activities. When it comes to issuing new products, firms in the bank-financing-only cluster are less likely to have new products than internally financed firms, while firms in all three mixed-financed clusters are more likely to have new products than internally financed firms. Similarly, firms in the three mixed-financed clusters are more likely to issue products that are new to the market or globally new.

Table 2 Firm innovation and financing clusters

	R&D	New products	Products new to the market or globally new
Bank financing only	-0.13** (0.06)	-0.19*** (0.05)	-0.08*** (0.02)
Internal/bank loans financing	0.05 (0.03)	0.03 (0.03)	0.01 (0.02)
Asset/debt-backed financing	0.00 (0.04)	-0.05 (0.04)	-0.02 (0.03)
Mixed financed	0.07** (0.03)	0.09** (0.04)	0.05* (0.03)
Mixed financed (grants)	0.20*** (0.04)	0.22*** (0.04)	0.12*** (0.04)
Mixed financed (intra-group)	0.07 (0.06)	0.16** (0.06)	0.15*** (0.05)
Observations	8,139	8,212	7,827
Pseudo R2	0.148	0.073	0.093

Source: *ELBIS16 survey data for 2015.*

Note: *The table reports marginal effects estimated after logistic regression. The omitted (reference) category is the internal-financing cluster. Robust standard errors in parentheses. Controls include firm size, age, country, and industry dummies. The results are based on ELBIS16 survey data for 2015. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.*

Box 4 Research and innovation as drivers of productivity growth in Europe

More robust economic growth in Europe will require boosting productivity growth that has been sluggish. Europe has just come out of the worst economic and financial crisis in decades, and while economic growth is resilient, it remains modest at less than 2%. Unemployment levels remain relatively high, notably among vulnerable segments of the population such as young people or the long-term unemployed.

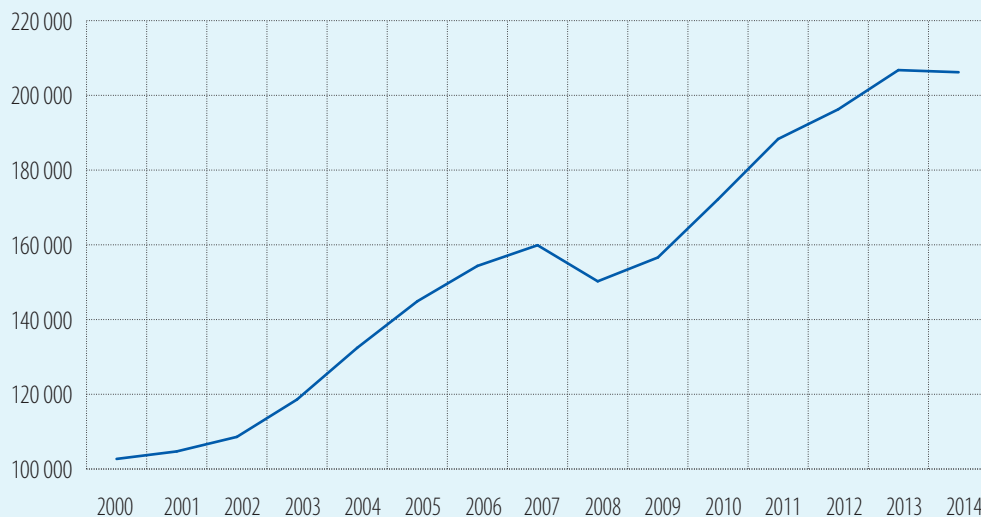
Fostering more robust economic growth that ensures higher levels of prosperity will require addressing the sluggish productivity growth that seems to have settled in in Europe for more than a decade. Total factor productivity (TFP), or the efficiency in combining production factors to create value added, has been flat in the EU for much of the past decade. While this productivity slowdown is not specific to Europe – other advanced economies such as the United States and Japan also suffer from it – it has been particularly acute in Europe, where only a handful of countries have managed to substantially increase productivity. On the other hand, TFP was stagnant in countries like the Netherlands and the United Kingdom, and dropped in countries like Italy and Greece. A lack of progress in boosting productivity levels will hinder more robust economic growth in Europe and social prosperity.

Boosting productivity growth will require enhancing Europe's ability to unlock technological advances, innovation, and entrepreneurship. While some have argued that there may be potential statistical mismeasurement in the current multifactor productivity growth statistics (Syverson, 2016), there is ample recognition that one of Europe's most pressing challenges is to address the

productivity challenge (Draghi, 2016; IMF, 2017; OECD, 2017). There are many factors that drive TFP. For example, increased capital investment, notably through foreign direct investment, has driven much of the recent growth in several Central and Eastern European countries, such as Slovakia, Romania, and Poland (Arratibel et al., 2007). However, for advanced economies, much of the productivity growth is determined by their ability to improve their innovation performance, and thus is linked to their ability to boost productive investment in R&D, innovation, and skills.

Productivity growth continues to stall despite the emergence of several new technologies promising large productivity gains and robust innovation-based production, which may be partially explained by a slowdown in the diffusion of innovation across firms due to the changing nature of innovation. The recent rise and development of new research-and-innovation-enabled digital technologies, such as the Internet of Things, Big Data, and Artificial Intelligence, has promised large productivity gains. However, authors such as Gordon (2012) argue that current innovations are less productive and generate fewer net gains than those produced in the past, notably when compared to the steam engine or electricity associated with past industrial revolutions. However, other authors such as Brynjolfsson and McAfee (2011) argue that these new technologies are just entering the market and may not have reached their full maturity, and thus have not yet shown their full results. In addition, a slowdown in innovation-based production does not seem to be occurring. For example, the number of patents has continued to increase and, despite a modest decline in 2014, remains at a very high level, as shown in Figure 1.

Figure 1 Total patent applications under the World Patent Cooperation Treaty, 2000–2014



Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research and Innovation Policies. Data from OECD.

Note: The figure shows patents filed under the Patent Cooperation Treaty as designated by the European Patent Office, by priority date and inventor's country of residence.

Digitalisation is dramatically changing the nature of innovation and the traditional “innovation pipeline” from research to growth via discovery and innovation. The nature of the innovation process is increasingly propelled by the rapidity of innovation change, the complexity of the innovation process that blends several technologies and non-technological skills, and a strong concentration of benefits in a set of superstar companies due to economies of scale and scope that

are associated with big data and data analytics. Many of the benefits of the digital revolution are so far concentrated in particular sectors, such as retail or location-based services. A new wave of innovation is yet to come from the convergence of existing and emerging technologies, notably in sectors that have until now been heavily regulated and that face significant resistance from incumbents, such as education, health, and public services.

In addition, recent analyses show that much of the productivity slowdown around the world is driven by increasing intra-industry gaps in productivity growth between leading and laggard firms that puts a brake on the diffusion of innovation (Andrews et al., 2015; ECB, 2017). This is illustrated in Figures 2 and 3. While there is limited evidence concerning the main drivers of this lack of sufficient diffusion of innovation across firms, some potential factors that have been put forward to explain this phenomenon are the increasing complexity of the innovation process and the concentration of benefits in certain superstar companies (The Economist, 2016).

Figure 2 Comparing multi-factor productivity: global frontier firms, non-frontier firms – ICT services, 2001–2013

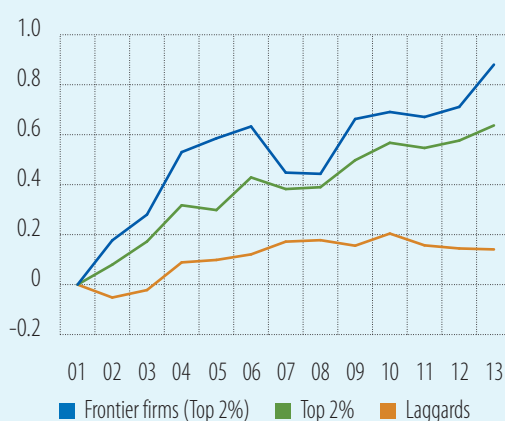
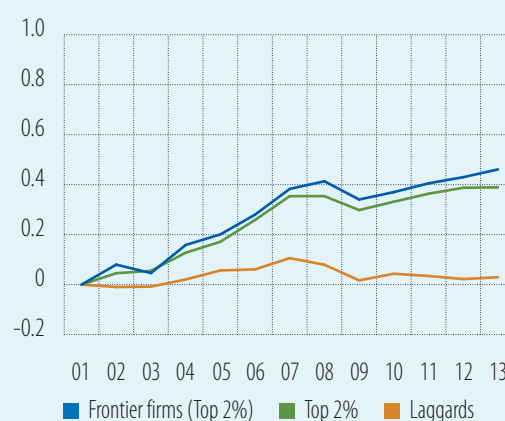


Figure 3 Comparing multi-factor productivity: global frontier firms, non-frontier firms – non-ICT services, 2001–2013



Source: OECD calculations based on the Orbis database of Bureau van Dijk.

Decisive policy action is needed, ranging from more investment in R&D and other intangible actions to measures to ensure effective revitalisation of firms that allows for the orderly exit of unproductive firms. These changes in the nature of innovation bear implications for the formulation of innovation policy and highlight the need to (1) boost public investment in R&D and other intangible assets, such as skills development, through education and training policies; (2) provide efficient support for private investment in intangible assets; (3) build an innovation-friendly regulation and competition policy that supports the acceleration of innovation adoption and diffusion; and (4) enhance business dynamism to support disruptive and market-creating innovation and avoid a lock-in of resources in unproductive or zombie firms.

References

- Andrews, D., Criscuolo, C., and Gal P.N. (2015). "Frontier Firms, Technology Diffusion and Public Policy: Micro Evidence from OECD Countries." OECD The Future of Productivity: Main Background Papers. Organisation for Economic Co-operation and Development, Paris.
- Arkolakis, C. (2010). "Market Penetration Costs and the New Consumers Margin in International Trade." *Journal of Political Economy*, 118(6), 1151-1199.
- Arratibel, O., Heinz, F., Martin, F., Przybyla, M., Rawdanowicz, L., Serafini, R. and Zumer, T. (2007). "Determinants of Economic Growth in Central and Eastern European EU Member States: A Production Function Approach." ECB Occasional Paper Series No. 61. European Central Bank, Frankfurt.
- Belo, F., Linc, X. and Vitorino, M.A. (2014). "Brand Capital and Firm Value." *Review of Economic Dynamics*, 17(1), 150-169.
- Black, S.E. and Lynch L.M. (1996). "Human-Capital Investments and Productivity." *American Economic Review*, 86(2), 263-267.
- Bloom, N. and van Reenen J. (2010). "Why Do Management Practices Differ across Firms and Countries?" *Journal of Economic Perspectives*, 24(1), 203-224.
- Brynjolfsson, E. and McAfee A. (2011). "Race against the Machine: How the Digital Revolution is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and the Economy". Lexington, MA: Digital Frontier Press.
- Cincera, M. and Veugelers R. (2014). "Differences in the Rates of Return to R&D for European and US Young Leading R&D Firms." *Research Policy*, 43(8), 1413-1421.
- Corrado, C., Haskel, J., Jona-Lasinio, C. and Iommi, M. (2012). "Intangible Capital and Growth in Advanced Economies: Measurement Methods and Comparative Results." Working Paper. ITAN Invest. Available at <http://www.intan-invest.net/>.
- Draghi, M. (2016). "The Productivity Challenge for Europe." *Lectio Magistralis Deusto Business School*.
- ECB. (2017). "ECB Economic Bulletin Issue 3/2017". European Central Bank, Frankfurt.
- EIB. (2013). "Investment and Investment Finance in Europe 2013". Luxembourg: European Investment Bank.
- EIB. (2015). "Investment and Investment Finance in Europe 2015: Investing in Competitiveness". Luxembourg: European Investment Bank.
- EIB. (2016). "Investment and Investment Finance in Europe 2016: Financing Productivity Growth". Luxembourg: European Investment Bank.
- EIF. (2017). "European Small Business Finance Outlook." EIF Research & Market Analysis Working Paper 2017/43. European Investment Fund, Luxembourg.
- European Commission. (2016). "Science, Research and Innovation Performance of the EU". Directorate-General for Research and Innovation. Luxembourg: Publications Office of the European Union.
- European Commission. (2017). "European Economic Forecast - Spring 2017." Institutional Paper 053. Directorate-General for Economic and Financial Affairs, Publications Office of the European Union, Luxembourg.
- European Commission. (2018). "Science, Research and Innovation Performance of the EU." Directorate-General for Research and Innovation, Publications Office of the European Union, Luxembourg.

Gordon, R. (2012). "Is U.S. Economic Growth Over? Faltering Innovation Confronts the Six Headwinds." NBER Working Paper No. 18315. National Bureau of Economic Research, Cambridge, MA.

Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., and Tatham, R.L. (1998). *Multivariate Data Analysis*. Upper Saddle River, NJ: Prentice Hall.

IMF. (2017). "World Economic Outlook 2017: Gaining Momentum?" Washington, DC: International Monetary Fund, April.

Melitz, M.J. and Redding S.J. (2014). "Heterogeneous Firms and Trade." In *Handbook of International Economics*, Volume 4, edited by Gopinath, G., Helpman, E. and Rogoff, K. Elsevier.

National Science Board. (2016). "Science and Engineering Indicators 2016". Arlington, VA: National Science Foundation.

OECD. (2013). "Supporting Investment in Knowledge Capital, Growth and Innovation". Paris: OECD Publishing.

OECD. (2014). "OECD Science, Technology and Industry Outlook 2014". Paris: OECD Publishing.

OECD. (2015a). "Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development. The Measurement of Scientific, Technological and Innovation Activities". Paris: OECD Publishing.

OECD. (2015b). "OECD Science, Technology and Industry Scoreboard 2015: Innovation for Growth and Society". Paris: OECD Publishing.

OECD. (2016). "OECD Science, Technology and Innovation Outlook 2016". Paris: OECD Publishing.

OECD. (2017). "Economic Policy Reforms 2017: Going for Growth". Paris: OECD Publishing.

Ognyanova, D. (2017). "R&D Tax Incentives – How to Make them Most Effective?" DG RTD Policy Brief 1-2017. Directorate-General for Research & Innovation, Publications Office of the European Union, Luxembourg.

Straathof et al. (2014). "A Study on R&D Tax Incentives." Taxation Paper 52-2014. Directorate-General for Taxation and Customs Union, Publications Office of the European Union, Luxembourg.

Syverson, C. (2016). "Challenges to Mismeasurement Explanations for the U.S. Productivity Slowdown." NBER Working Paper No. 21974. National Bureau of Economic Research, Cambridge, MA.

The Economist. (2016). "Special Report: Companies." September 17

Thum-Thysen, A., Voigt, P., Bilbao-Osorio, B. Maier, C. and Ognyanova D. (2017). "Unlocking Investment in Intangible Assets." *European Economy Discussion Papers*, 047. Directorate-General for Economic and Financial Affairs, Publications Office of the European Union Luxembourg.

Van Ark, B., Hao, J.X., Corrado, C. and Hulten C. (2009). "Measuring Intangible Capital and Its Contribution to Economic Growth in Europe." *EIB Papers*, 14(1), 63-93.

Veugelers, R. (2013). "The World Innovation Landscape: Asia Rising?" *Bruegel Policy Contribution*, 2013/02.

Ward Jr, J. H. (1963). "Hierarchical Grouping to Optimize an Objective Function." *Journal of the American Statistical Association*, 58 (301), 236-244.

Zastrow, M. (2016). "Why South Korea Is the World's Biggest Investor in Research." *Nature*, 534 (7605), 20-23.

Chapter 4

The evolution of investment in climate change mitigation

Chapter at a glance

- Investment in climate change mitigation (CCM) in the EU is estimated at EUR 175.6bn in 2016, which is equivalent to 1.2% of GDP or 6% of gross fixed capital formation. This is approximately five times the amount invested in fossil fuel production.
- In the power generation sector, investment in renewable energy of EUR 45.5bn in 2016 is more than seven times the amount invested in generation capacity from fossil fuels. Also including the associated investments in electricity networks, renewables account for 74% of investment in power generation.
- CCM investment in the EU in 2016 was at its lowest level over the last five years. As a percentage of GDP, 2016 CCM decreased from 1.6% in 2012 to 1.2% in 2016. As a percentage of gross fixed capital formation, it fell from 8.3% to 6.0% in the same period. However, this decline is not as extreme as the figures suggest due to the following factors:
 - First, the renewable generation data are recorded in the year that the project starts production. A number of large offshore windfarms that were already investing in 2016 will appear in the data over the next few years as they start production.
 - Second, costs have come down significantly, particularly in renewable energy generation. As a result, a given level of investment represents more generation capacity.
 - Third, the high level of investment in the past was due to the overheating of the market in some countries, particularly in the solar photovoltaic segment. The current lower level of investment therefore represents a return to more normal market conditions.
- Private investment is the largest component in overall CCM expenditure, but public intervention, particularly in research and development (R&D), has underwritten the development of an active and growing renewable energy market.
- The substantial amount of investment to date appears sufficient to meet the 2020 target for greenhouse gases at the EU level, but the future targets present new challenges: making the right level of investment, investing efficiently, getting the right balance between different types of CCM investment, and achieving an efficient sequencing of investment over time. Energy efficiency in particular presents diverse challenges to provide incentives for investments that are spread across many sectors.
- Reaching the EU's 2030 environmental targets appears to require substantial additional CCM investment not only after 2020, but also today. Investment in power generation and in grids is broadly on track with the long-term investment needs, but investment in energy efficiency (EE) seems to be more problematic. The current investment trends in EE measures imply that a significant increase is required both in terms of amounts and percentage changes.

Climate change mitigation as a policy priority

How much is currently invested in climate change mitigation (CCM) and how has this changed over recent years? Investment in CCM is key to achieving policy objectives for greenhouse gas abatement and control of global warming. But as yet, no unified data source for CCM investment exists. Therefore, the first objective of this chapter is to draw together available data from different sources and to estimate how much is currently invested in CCM in the EU and how this has changed over time.

Are the European targets for greenhouse gases achievable at the current investment rate? And what are the implications for future investment? Existing studies estimate how much investment will be needed in the future to reach the EU targets.¹ However, without a consistent historical data series it has been hard to say whether the current level of investment is sufficient.² Therefore, the second objective of this chapter is to make comparisons between the historical data and the existing scenarios for future investment needs. These comparisons offer a new way to address the questions of whether or not the EU is on track to meet its targets and where investment activity needs to be stepped up.

Investment in CCM includes many different types of expenditures across many sectors. In some sectors, such as renewable energy and forestry, it is relatively straightforward to identify which expenditures qualify as CCM, or carbon sequestration investments. However, in others, such as electricity networks or energy efficiency in vehicles, some judgement is required to estimate what proportion of a given expenditure should be counted as CCM.³ This chapter draws on analysis and estimates in existing studies and makes additional assumptions to identify CCM investment.

Economic activity and greenhouse gas emissions

Emission of greenhouse gases (GHG) by the EU Member States has been declining since 1990. In 2015, the latest year when official data are available, total emissions stood at 4.5 billion tonnes of CO₂ equivalent. This is 22% below the 1990 level and corresponds to an annual average decline of 1.0% per year. Combustion of fossil fuels for the production of electricity and heat is the largest contributor to total EU emissions, accounting for 55% of total emissions.⁴ The transport sector is the next largest contributor (23%), followed by agriculture (10%), manufacturing processes (8%), and waste management (3%).

Since 1990 emissions from power generation and other static uses have decreased by approximately 30%, while emissions from transport have increased by approximately 20%. Differences in substitution opportunities provide part of the explanation. Power generation over the last two decades has seen a shift from coal to gas, and from fossil fuels to renewable energy sources. However, the use of alternatives to petrol and diesel in the transport sector have been comparatively limited. Biofuels and electric vehicles still have only a small share of the market, and improvements in vehicle efficiency have been to some extent offset by demand growth. In addition, the changing structure of the economy has led to decreasing demand for energy, particularly for heavy industry.

1 Notably EC SWP(2016) 405 (European Commission 2016b).

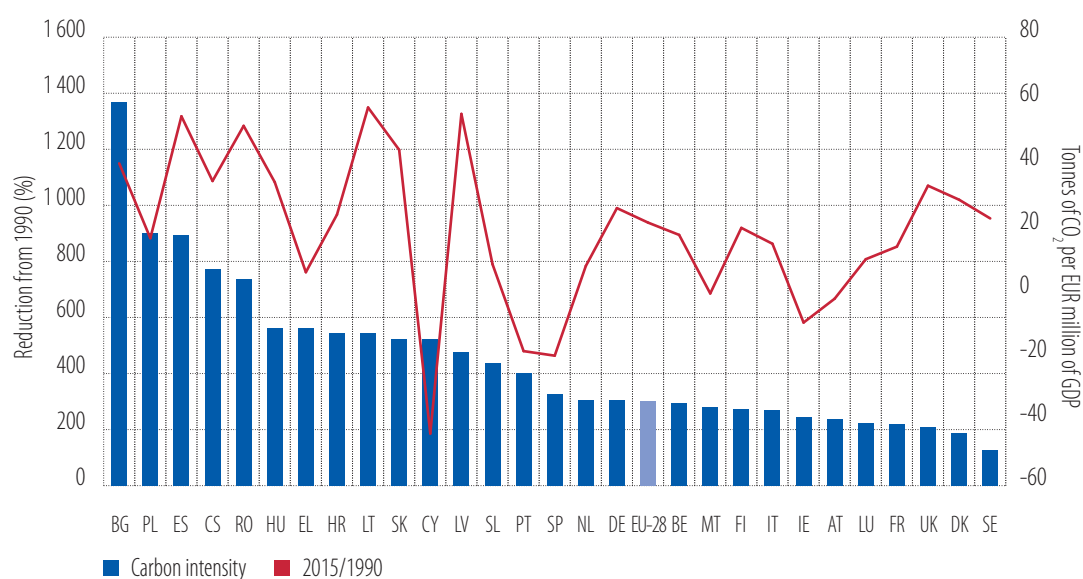
2 As EC SWP(2016) 405, notes: “[It is..] difficult to compare with the investment volumes that are currently being incurred to promote energy efficiency (and are delivering energy savings) as there are no complete data on investments..” (European Commission 2016b, 64).

3 The 2015 *Joint Report on Multilateral Development Bank's Climate Finance* (IDB et al. 2015) provides a methodology for classifying investment finance, but this does not provide a comprehensive classification for all CCM investment expenditures.

4 In the statistics, the power sector is under the category “fuel combustion and fugitive emissions from fuels (without transport).”

On a geographical basis, the reduction in GHG emissions has been highly diverse. On the one hand, some of the new Member States of Eastern Europe have achieved reductions in GHG emissions in the order of 50% (Figure 1). On the other hand, Spain, which had rates of economic growth well above the EU average from 1990 until the global financial crisis, increased GHG emissions by 19% from 1990 to 2015. In some of the island economies and smaller economies at the EU periphery, where opportunities to switch away from fossil fuels are limited, GHG emissions have remained at the 1990 level or in some cases have increased.

Figure 1 Carbon intensity and CO₂ emissions/GDP in the EU, 2015 versus 1990



Sources: Eurostat.

The size of the economy is a significant driver of a country's contribution to EU GHG emissions. The largest economies, by and large, contribute the most to EU GHG emissions: Germany (20.8%), UK (12.1%), France (10.7%), Italy (9.9%), and so on (see Table 1). However, there is some variation in the CO₂ intensity of economic activity. Some countries have gone further with energy efficiency measures. In addition, those that specialise in services or high value-added industrial sectors tend to be less CO₂-intensive than those that specialise in heavy industry. Therefore, economies including Denmark, France, Luxembourg, Sweden and the UK are less GHG-intensive than the EU average while Bulgaria, Poland, Romania, Estonia, Lithuania and Croatia are above average.

Table 1 Greenhouse gas emissions, EU-28

	1990	2015	Share in EU-28	Change 2015/1990	GDP 2015	Share in EU-28 GDP	Carbon intensity
	Mt CO ₂ equiv.	Mt CO ₂ equiv.	%	%	EUR trillion	%	CO ₂ /MEUR
EU-28	5,716.4	4,451.8	100.0	78	14.7	100.0	303
Germany	1,263.0	926.5	20.8	73	3.0	20.6	305
UK	809.1	536.9	12.1	66	2.6	17.5	208
France	555.8	474.6	10.7	85	2.2	14.8	218
Italy	524.1	442.8	9.9	84	1.6	11.2	269
Poland	468.5	387.7	8.7	83	0.4	2.9	902
Spain	293.4	350.4	7.9	119	1.1	7.3	326
Rest of EU	1,802.5	1,332.9	29.9	74	3.8	25.6	354

Source: Eurostat.

Note: Mt = million tonnes, MEUR = million euros.

Box 1 EU commitments

Investment in climate change mitigation (CCM) is essential to the achievement of EU climate targets and commitments, but there are no explicit targets for investment itself. Investment is a means to an end, whether it is the transformation of the economy to a less carbon-intensive structure, or the production of more renewable energy. How much investment is ultimately required to reach a given target will depend on many factors, including technology and costs as well as the economic efficiency of the investments in total. The policy challenge is to provide incentives to achieve the climate objectives at least cost. Direct public investment has a key role to play, particularly in R&D, but private investment remains the largest component in overall CCM expenditure.

EU objectives for reduction of greenhouse gas (GHG) emissions were set out in the 2020 Climate and Energy Package, the 2030 Climate and Energy Framework, and the 2050 Low-Carbon Economy Roadmap. In addition, with ratification of the Paris Agreement, the EU confirmed the commitment to reduce EU-wide GHG emission by 2030 to 40% below the 1990 level.

The EU is on track to meet its GHG reduction target of 20% below the 1990 level set out in the 2020 Climate and Energy Package. The package is a set of binding legislation at the Member State level to ensure the EU meets its targets of a 20% cut in greenhouse gas emissions (from 1990 levels), as well as delivering 20% of EU energy from renewables, and achieving a 20% improvement in energy efficiency. With total EU CO₂ emissions already 22% below their 1990 level in 2015, the aggregate CO₂ target is likely to be met, although not all Member States are on track to meet their 2020 targets for renewable energy.

With the 2020 deadline drawing closer and the necessary investments already largely in place, the EU adopted the 2030 Climate and Energy Framework in 2014. The framework sets three key binding targets at the EU level for the year 2030: at least 40% cuts in greenhouse gas emissions (from 1990 levels), at least a 27% share for renewable energy, at least a 27% improvement in energy efficiency (Table 2).

Table 2 Target reductions in EU-28 GHG emissions

	2015	2020	2030	2040	2050
CO ₂ equivalent	4,452	4,573	3,430	2,287	1,143
% change vs 1990	-22	-20	-40	-60	-80
Annual % change from 1990	-1.0	-0.7	-1.3	-1.8	-2.6
GDP EUR trillion (2015)	15	16	18	21	25
CO ₂ intensity	303	287	188	107	46

Source: Eurostat, EU Reference Scenario.

In addition, the European Commission has developed the Low-carbon Economy Roadmap as an anchor for longer-term expectations. The roadmap examines cost-efficient ways to make the European economy more climate-friendly and less energy-consuming in the long term. It suggests that by 2050, the EU should cut greenhouse gas emissions to 80% below 1990 levels, with milestones of 40% emissions cuts by 2030 and 60% by 2040.

EU commitment to the Paris Accord gave further confirmation of these targets and accepted a binding commitment to the EU-wide reduction of 40% by 2030 against the 1990 baseline. The Accord was ratified at the EU level in October 2016. Uncertainties remain about how the EU limit should be divided among the Member States, but the majority of the Member States had ratified by the end of the first quarter 2017. Furthermore, the EU has re-confirmed its commitment to the Accord despite the uncertainties arising from Brexit and the announced withdrawal by the US.

Drivers of investment

Investment in CCM must be seen in the context of the general investment climate, which has been challenging in the EU since the global financial crisis of 2008. Although interest rates have remained low, and in real terms have been negative for extended periods, there has not been a broad-based recovery in investment. Government budget constraints and deleveraging by the private sector have coincided with low growth expectations and a slow economic recovery in many EU countries.

Investment conditions for renewable energy and energy efficiency have been made more challenging by low world energy prices and the supply and demand conditions in EU energy markets. The price of oil declined from over USD 100 per barrel in 2013 and remained at USD 44 in 2016. Gas prices followed oil prices down in EU markets, as oil remains a key gas hub price-setter despite the current decline of oil-indexation in long-term gas supply contracts. Coal prices also declined as the US produced more shale gas and Chinese demand for coal imports fell. As a consequence, investment projects that reduce energy consumption or substitute for fossil fuels became less profitable and more difficult to finance than they would otherwise have been. Furthermore, with plentiful capacity and low growth or declining demand in many of the mature European energy markets, the incentives for investment are low.

Technology-driven cost reductions, on the other hand, have had a positive impact on project economics. Costs for photovoltaics (PV) and offshore wind have declined dramatically over recent years and the trend continued in 2016. The global average levelised cost of PV declined to EUR 93 per MWh, which is down 18% over the last 12 months and 37% over the last five years.⁵ The cost of offshore wind

⁵ The decline in levelised costs reflects declines in both capital and operating expenditures. In 2016, for example, the average capital cost per MW of installed solar photovoltaics, onshore and offshore wind decreased by 10% (Frankfurt School-UNEP Collaborating Centre, UN Environment, and Bloomberg New Energy Finance (2017)).

also continues to decline substantially (see Table 3), whereas costs are more stable for the more mature onshore wind technology. Three factors, in particular, are affecting the cost declines: (1) lower risk premiums, and investor and lender willingness to accept lower returns, particularly in the offshore wind sector, where there has been growing confidence in the capacity to manage construction and maintenance risks; (2) low interest rates and therefore low cost of finance for projects, which typically carry high levels of debt finance (75–80% for onshore wind and for 65–70% offshore wind; and (3) better equipment resulting in higher efficiency.

Market forces are also playing a part in driving down costs through the supply chain. This is evident from the outcomes of licensing auctions in many markets. Winning bids per MWh have been as low as EUR 72/MWh for offshore wind in the Netherlands in July 2016, and EUR 50/MWh for offshore wind in Denmark in November 2016.⁶ Similarly, large-scale solar PV procured at an average price of EUR 65/MWh in Germany's and France's most recent solar auctions – a price that is well below the feed-in-tariff (FiT) rates received in the previous years for supporting investment in PV installations. By contrast, cost reductions have not been so evident for other forms of renewable energy, such as biomass incineration, parabolic solar, and storage.

Table 3 Levelised cost of electricity (EUR/MWh)

	2014 Q4	2015 Q4	2016 Q4	2016 Q4	2016 Q4	2016 Q4	5-year decline	12-month decline
Onshore	56	77	73	72	62	65	17	-15
Offshore	163	160	145	142	113	117	-28	-27
PV	147	113	91	89	90	93	-37	-18

Source: Frankfurt School-UNEP Collaborating Centre, UN Environment, and Bloomberg New Energy Finance (2017).

Government incentives and regulations have been vital in supporting private CCM investment. In energy efficiency, regulation has been the key driver, with wider coverage and stricter standards applying to buildings and appliances. In renewable energy, financial incentives remain an important driver in some segments, although the level and structure of incentives is changing. Subsidies for renewables have been scaled back as the costs and risks have declined and the technologies have become increasingly competitive against conventional energy sources. In Germany, for example, the feed-in tariff for small PV (less than 10 kW) was EUR 127 per MWh at the end of 2016, in comparison to EUR 518 per MWh in 2006 and EUR 287 per MWh in 2011.

In this context, many countries have revised their support schemes to ensure that financial support complies with changing economic and market conditions. This has often resulted in reductions of FiT rates, especially for new photovoltaic (PV), where the production costs have declined considerably. In some cases, where an electricity tariff deficit was observed (European Commission 2014), these changes had a retroactive perspective and influenced the attractiveness of investment in clean energy technologies. For instance, in Greece, support for RE was reduced as a result of a number of readjustments in the FiT rates, as well as of the additional financial levies imposed on RES producers retroactively to compensate for high FiT rates. Similarly, Spain imposed an annual cap on the number of hours that PV projects could sell at the FiT in order to deal with the increasing cost of support schemes. All these measures were aimed at controlling energy costs and at addressing the electricity tariff deficits occurring in these countries.

⁶ Frankfurt School-UNEP Collaborating Centre, UN Environment, and Bloomberg New Energy Finance. (2017).

There has been a general trend towards auctions and away from feed-in tariffs as the means of allocating renewable energy capacity.⁷ As the technologies have matured, markets are better placed to evaluate the risks. Auction schemes are now a requirement under state-aid compliance. Though the details of the auctions vary across countries, all of them require suppliers to bid their lowest offer in terms of the tariff per MWh required to bring the project to financial close. Early experience with the bids under these schemes indicates that they provide good incentives to control costs, though it is too early to tell how much investment will eventually be delivered.

The price of carbon under the EU emissions trading scheme (ETS)⁸ has until now provided only limited incentives for investment in CCM.⁹ This instrument failed to deliver the right price levels to act as a driver to reduce the use of fossil fuels and to switch to low-carbon technologies. The oversupply of the ETS allowances, mainly during the second phase, along with the collapse of energy demand resulting from the financial crisis, have played an important role in this failure. To tighten the supply of EU allowances, several measures have been taken in the third phase of the ETS. One is the adoption of auctions instead of free allocation as the default method of allocating allowances. By 2020 emissions under ETS will be 21% lower than in 2005, and the Commission's proposal for 2030 is a reduction of 43% versus 2005. As the cap tightens, the price of carbon is expected to be an increasingly important driver of investment decisions.

Investment in climate change mitigation

CCM investments are spread across many economic sectors; they have diverse impacts on greenhouse gas emissions and the data sources have varying degrees of accuracy and consistency. The estimates drawn together in this section are organised under the headings renewable energy¹⁰ and energy networks, energy efficiency, transport infrastructure, agriculture forestry and land use, and R&D. The results are summarised in Table 4. The underlying sector developments and data issues are examined in further detail in the discussion that follows.

Investment in CCM in the EU is estimated at EUR 175.6bn in 2016, which is equivalent to 1.2% of GDP or 6% of gross fixed capital formation. This is approximately five times the amount invested in fossil fuel production.

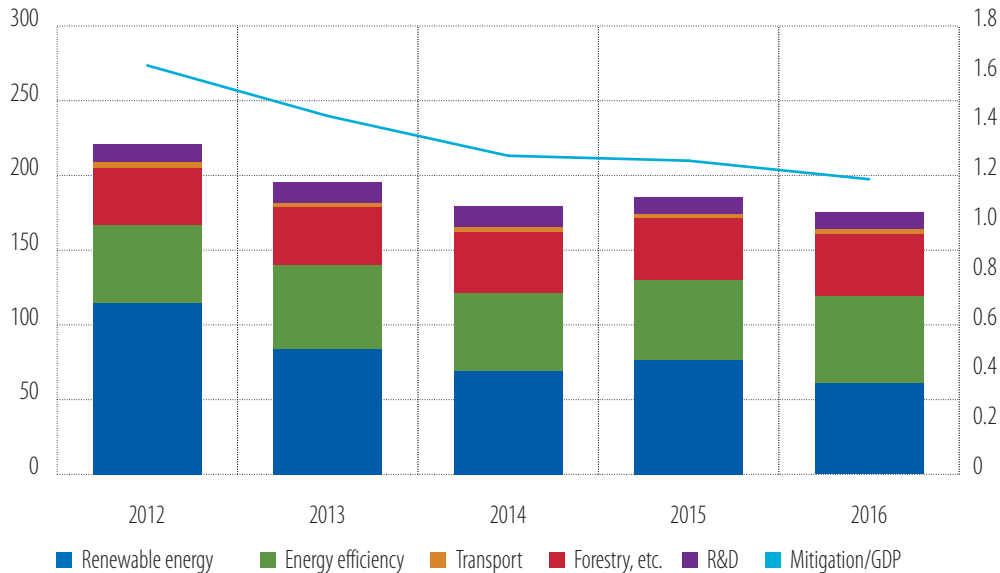
European CCM investment in 2016 was at its lowest level over the last five years (see Figure 2). As a percentage of GDP, CCM was down from 1.6% in 2012 to 1.2% in 2016 and as a percentage of gross fixed capital formation it was down from 8.3% to 6.0%. However, this decline is not as extreme as the figures suggest for several reasons. First, the renewable generation data are based on project commissioning and a number of large offshore windfarms that reached financial close in 2016 are due to come on stream in the coming years. Second, costs have come down significantly, particularly in renewable energy generation. As a result, a given level of investment represents more generation capacity. Third, the high level of investment in 2012 reflects the overheating of the market in some countries, particularly in the solar photovoltaic segment. The subsequent decline was therefore a return to more normal market conditions.

7 Feed-in tariffs were the method adopted by Germany, France and Spain and proved effective in providing strong incentives for early deployment of renewable energy when markets faced high levels of technological uncertainty. Green certificates were favored in the UK and Sweden, where windfarms received a certificate per MWh of energy produced and the value of the certificate was determined by the market.

8 The scheme covers 45% of the EU greenhouse gas emissions that are due to power generation, the energy-intensive industries and commercial aviation. A cap is set on the amount of greenhouse gases that can be emitted by participating installations and the cap is reduced over time so that emissions fall. Companies can trade allowances. They may also buy international credits from emission-saving projects outside the EU.

9 <http://www.reuters.com/article/us-eu-carbon/analysts-trim-eu-carbon-price-forecasts-as-supply-swells-idUSKBN14T190>

10 Renewable energy includes electricity generation and biofuels used in transport and heating.

Figure 2 Composition of EU-28 climate change mitigation investment


Source: See Table 4.

The different kinds of CCM investment have diverse consequences for future greenhouse gas emissions. Renewable energy is the largest component, making up 35% of the total in 2016, followed by energy efficiency (33%), transport infrastructure (24%), R&D (6%), and forestry (2%) (Table 4). Renewable energy, to the extent that it replaces fossil fuels, directly reduces greenhouse gas emissions. Energy efficiency acts primarily through control of demand. CCM investment in transport infrastructure allows substitution of electricity for fossil fuels, as traffic is switched from oil-based road transport to electric trains, for example. Research, development and innovation (RDI) and demonstration projects open up new investment opportunities and new means of reducing emissions. Investment in forestry has the possibility to act through greenhouse gas sequestration.

Table 4 Climate change mitigation investment in the EU, 2012–16 (EUR billion)

	2012	2013	2014	2015	2016	% of total 2016
Mitigation	220.8	195.1	179.1	185.3	175.6	100.0
Renewable energy	114.8	84.3	69.2	76.7	61.4	35.0
Generation	102.6	70.6	55.6	61.1	45.5	25.9
Networks	12.2	13.7	13.6	15.5	15.9	9.1
Energy efficiency	51.8	55.8	52.0	53.2	57.7	32.9
Transport	38.8	38.7	41.2	41.4	42.1	24.0
Forestry, etc.	3.6	2.9	3.0	3.2	3.2	1.8
R&D	11.7	13.4	13.7	10.8	11.2	6.4
Government	3.2	3.3	2.9	2.8	3.2	1.8
Corporate	8.5	10.1	10.8	8.0	8.0	4.6
Mitigation/GDP	1.6%	1.4%	1.3%	1.3%	1.2%	
Mitigation/GFCF	8.3%	7.5%	6.6%	6.4%	6.0%	

Source: IEA, BNEF, OECD, Eurostat, and author's calculations.

Note: Renewable energy generation includes biofuels and renewable heat (EUR 0.7 bn in 2016).

Renewable Energy and Networks

In the power generation sector, investment in renewable energy of EUR 45.5bn in 2016 is over seven times the amount invested in fossil fuel generation capacity. Expansion of renewable energy requires investment in both generation capacity and reinforcement of electricity networks to accommodate intermittent sources of supply. Including the associated investments in electricity networks, the total investment of EUR 61.4bn accounts for 74% of investment in power generation.

Generation

Investment in renewable generation is dominated by wind, biomass and solar. Wind is the largest component, making up 55% of the 2016 total. Biomass is the next largest with 20%, followed by solar with 18%.

Movements from one year to the next have been driven by the timing of large offshore wind projects. The data in Table 5, where the investment is allocated to the year of project commissioning, show a decline in 2016 of -26% for renewable generation and -21% for wind. However, the underlying activity in the wind segment has remained relatively stable and a number of projects (detailed below) were under construction in 2016 but had not yet reached commissioning. Table 6 shows that on the basis of financial commitments, as opposed to project commissioning, the level of 2016 investment in the wind segment increased by 14%.¹¹

The decline in investment over the last five years has been largely due to activity in the solar segment. Over the period 2012 to 2016 investment in solar declined from EUR 57.9bn to EUR 8bn, a decline of EUR 49.9bn which accounts for 97% of the overall decline in renewable generation investment. High levels of activity in the past, notably in the solar sector in many EU countries, including Italy, Germany, Spain, Portugal and Greece, were driven by generous support schemes. The high cost of these schemes induced many Member States to undertake reforms to make them more cost-efficient. As the level of support was scaled back, investment in the solar segment returned to more normal levels.

Declining costs have meant that additions to renewable generation capacity have held up well over the last five years despite the decline in investment. Wind has consistently added between 11 and 12 GW of new capacity per year (see Table 5). Solar and other renewable energy sources have continued to add capacity but at a declining annual rate. In total, renewable generation capacity has continued to grow while non-renewable capacity has declined with the decommissioning of old plants. The total net capacity addition in 2016, estimated at 12.0 GW¹², was made up of 20.5 GW of new renewable capacity¹³ and net decommissioning of 8.4 GW of fossil fuels.

Aggregate investment per unit of renewable generation capacity came down from EUR 2,938/kW in 2012 to EUR 2,192/kW in 2016. Average solar investment costs declined over this period by over 60% while the average cost in the wind segment declined by 1%. Global competition in the supply of solar panels at a time when technology was advancing rapidly had a major impact on driving down costs. In wind generation, onshore costs are relatively low and stable in comparison to the offshore sector, where costs are higher but are declining more rapidly. The decline in aggregate wind costs has therefore been slow as the focus of investment has shifted towards the offshore sector.

¹¹ In addition to the differences in assumptions about the timing of projects, IEA and BNEF make their own estimates of project costs.

¹² Eurostat data.

¹³ Net capacity expansion. Given the age profile of renewable capacity, decommissioning is a very small proportion of the net total, estimated by WindEurope at less than 2.5% of gross renewable capacity additions in 2016.

Table 5 Renewable generation investment (EUR billion), capacity (GW) and costs (EUR/kW)

	2012	2013	2014	2015	2016	%	2016/2015 (%)
Investment							
Total renewable electricity	99.1	67.4	52.7	58.2	44.8	99	-23
Biomass	13.5	11.0	10.2	8.6	9.2	20	8
Solar	57.9	28.6	16.1	13.3	8.0	18	-40
Hydro	2.3	3.9	2.8	4.9	2.6	6	-47
Wind	25.4	23.9	23.5	31.4	24.9	55	-21
Other renewable electricity	0.0	0.0	0.1	0.0	0.1	0	196
Renewable transport and heating	3.5	3.2	2.8	2.9	0.7	1	-77
Total electricity, transport and heating	102.6	70.6	55.6	61.1	45.5	100	-26
Power capacity net installations							
Total capacity	25.7	10.2	16.5	6.9	12.0	100	74
Renewables	33.7	23.6	20.2	23.5	20.5	170	-13
Wind	12.2	11.7	11.0	12.4	12.0	100	-3
Solar	18.4	10.6	7.4	8.0	6.7	56	-17
Others	3.2	1.3	1.9	3.1	1.8	15	-44
Nuclear and fossil fuels	-8.0	-13.4	-3.8	-16.6	-8.4	-70	-49
Investment/Capacity							
Total renewables	2.938	2.857	2.604	2.475	2.192	n/a	-11
Wind	2.094	2.035	2.128	2.539	2.077	n/a	-18
Solar	3.152	2.703	2.191	1.654	1.192	n/a	-28

Source: IEA investment data; Eurostat capacity 2012-2015; WindEurope 2016 capacity estimates; cost estimates are calculated as the ratio of investment to net installations.

Note: Investment is on the basis of date of commissioning. Power capacity is net of decommissioning.

Investment is relatively concentrated; the top five countries make up 80% of the EU total. On the basis of financial commitments, the UK was the largest EU investor in renewables, with EUR 23.4bn committed in 2016 as a number of major offshore projects reached financial close. Four projects – Hornsea (1.2 GW), Beatrice Cape (588 MW), East Anglia One (714 MW), and Burbo Bank Extension (258 MW) – amounted to a total investment of EUR 12.9bn. These projects were supported by the renewable obligation certificate scheme or the new contract-for-differences programme. In addition, the UK approved the Tees project, which is the world's largest dedicated biomass plant, with a capacity of 299 MW.

Investment of EUR 13.8bn in Germany in 2016 was also predominantly in the wind sector. Three major investment projects came to close: Borkum Riffgrund (450 MW), Merkur (396 MW), and Arkona Becken Südost (385 MW). Uncertainty relating to the regulatory switch from feed-in tariffs to auctions may have delayed some projects, which are now likely to come through under subsequent auction rounds in 2017.

Table 6 Investment commitments (EUR billion)

	Renewable energy			Wind		
	2015	2016	2016/2015	2015	2016	2016/2015
United Kingdom	23.0	23.4	2	13.7	17.5	27
Germany	16.3	13.8	-15	11.3	9.7	-14
Belgium	1.0	2.7	181	0.8	2.5	198
France	3.4	3.2	-5	1.2	1.3	12
Denmark	1.2	2.4	104	0.4	1.3	220
Italy	1.8	2.0	11	0.5	0.9	75
Sweden	1.0	1.8	86	0.5	1.0	84
Netherlands	2.2	2.1	-5	0.3	0.0	-92
Sub-total	49.9	51.4	3	28.8	34.2	19
Total EU-28	55.4	57.2	3	32.0	36.3	14

Source: Bloomberg New Energy Finance (BNEF).

Note: BNEF estimates of investment cost at date of financial close.

Box 2 Investment in renewable energy and decarbonisation

Over the last decade, there has been no clear relationship between investment in renewable energy and aggregate carbon intensity. Over the ten years from 2005 to 2015, the EU invested a cumulative total of 4% of GDP in renewable energy and over the same period the carbon intensity of GDP declined by 25%. However, countries that invested more in renewable energy did not necessarily achieve greater reductions in carbon intensity. These countries are in the upper right quadrant of Figure 3, with notable examples highlighted in red. Germany, for example, invested 6% of GDP but only had a 20% reduction in carbon intensity. On the other hand, countries in the lower left quadrant of the figure (with examples highlighted in green) invested less but experienced a greater reduction in CO₂ intensity. The UK, for example, was a relatively late entrant to the renewable energy market but has experienced a relatively high reduction in carbon intensity.

Access to low-cost renewable energy resources explains only part of the differences in investment across countries (see Figure 4). Denmark, the UK and the Netherlands, which have relatively high-cost resources with a large share of offshore wind, invested less than the EU average. However, despite relatively unfavourable resource endowments in Germany, it has made a proportionately larger investment in low-cost solar PV and onshore wind, and Germany has invested substantially more than the EU average. Spain has also invested heavily. Although the solar and wind resources are favourable, average investment costs in Spain have been relatively high.

Figure 3 Carbon intensity versus renewable energy investment, 2005–15

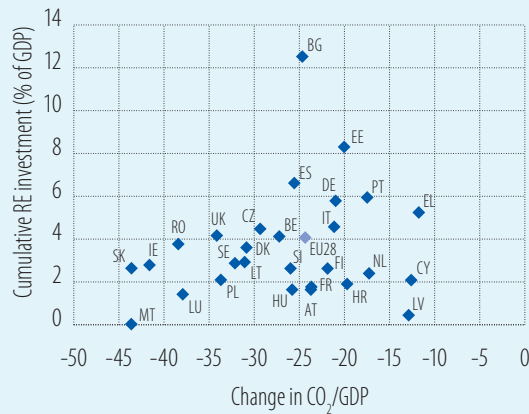
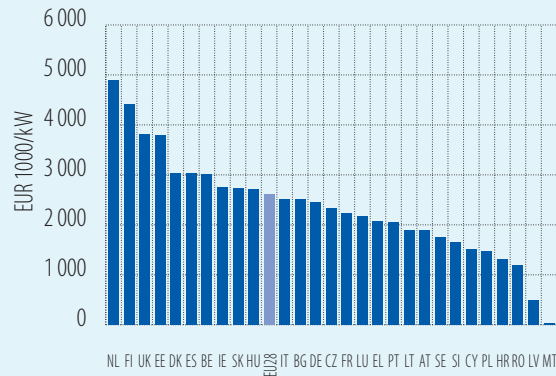


Figure 4 Investment/capacity, 2005–15



Source: Eurostat and EIB estimates.

To better explain why countries that invested most in RE did not always have the biggest reduction in carbon intensity, it is useful to look in more detail at what makes up carbon intensity. First, the carbon intensity of economic activity can be broken down into the carbon intensity of energy consumption and the energy intensity of GDP:

$$CO_2/GDP = CO_2/Energy * Energy/GDP \quad (1)$$

Although non-energy carbon emissions (from agriculture, land use change, and so on) are also included, this decomposition is a valid approximation because of the high share of carbon emissions coming from energy consumption.

Figure 5 Energy intensity versus CO₂/energy, 2005–15

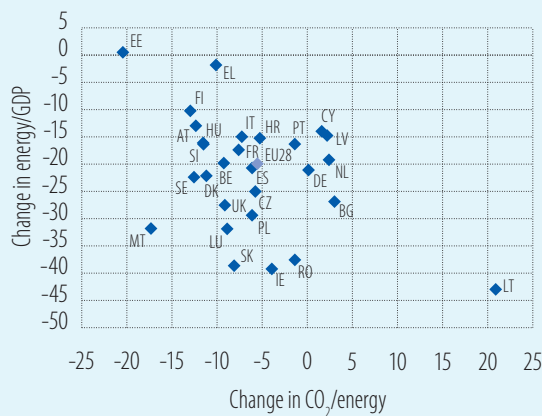
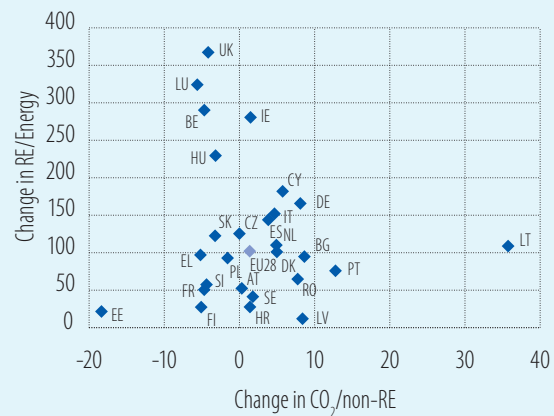


Figure 6 Share of renewable energy versus CO₂ intensity of non-renewable energy, 2005–15



Source: See Table 4.
Note: RE = Renewable energy.

For most EU countries, improvements in carbon intensity have been the result of both a reduction in CO₂ emissions per unit of energy and a reduction in the amount of energy consumed per unit of GDP (see Figure 5). However, there are some notable exceptions, including some countries that invested heavily in RE. In Germany, for example, CO₂ emissions per unit of energy consumption were virtually unchanged and the reduction in carbon intensity was driven only by a reduction in energy intensity. In other words, Germany decarbonised by reducing the amount of energy consumed per unit of GDP, while the amount of carbon emissions per unit of energy continued to increase in spite of the investment in renewable energy.

The carbon intensity of energy consumption can be further broken down by disaggregating energy into RE and non-RE:

$$\text{CO}_2/\text{Energy} = \text{CO}_2/\text{non-RE} * (1 - \text{RE}/\text{Energy}) \quad (2)$$

Non-RE includes both fossil fuels and nuclear energy. In a cross-section of countries differences in CO₂/non-RE will therefore reflect differences in the contribution of nuclear energy.

The decomposition of the carbon intensity of energy consumption in equation (2) is shown in Figure 6. The countries to the right of the y-axis all experienced an increase in the ratio of carbon emissions to non-RE consumption. One factor at work was the decommissioning of old nuclear plants. Lithuania closed its entire nuclear capacity and Germany closed nearly half. Another factor was the increase in the share of coal in electricity generation. As new sources of gas supply became available in the US, coal that previously went to the US power sector became available on the world markets at a time when China's demand for imports was declining. There was downward pressure on the price of internationally traded coal. In the European power market, coal took market share from natural gas. In these circumstances, the production of more renewable energy and lower demand in the European market tended to put coal at an advantage over gas.

Therefore, although many European countries substantially increased their share of renewable energy, the benefits for greenhouse gas abatement were partially offset by deterioration in the carbon intensity of the non-renewable energy sector.

Other large EU projects in 2016 include the Norther and Rentel offshore windfarms (370 MW) in Belgium, Horns Rev 3 (406 MW) in Denmark and the Amagervaerket biomass plant (150 MW) also in Denmark.

The biofuels sector has not attracted major new investment in recent years and as a result renewable transport and heating declined in 2016 to EUR 0.7bn from EUR 3.5bn in 2012. Investments in the refining sector to allow handling and processing of biofuels have already been made and the technology to allow production of biofuels from non-food sources is still at an early stage.

Networks

Investment attributed to CCM makes up approximately 50% of total network investment and has been growing steadily at an average of almost 7% per year since 2012. CCM investment in electricity networks was EUR 15.9bn in 2016. This was made up of EUR 9.1bn for expansion of networks, integration of renewable generation, and investment in smart grids, and an allocation of EUR 6.8bn for replacement of old transmission and distribution equipment.

Renewable energy is virtually the only source of new generation capacity in the EU; thus all additions to the capacity of the grid are attributable to CCM. Grid connection costs, such as spur lines linking new windfarms to the grid, are clearly identified as CCM investments. However, due to the intermittent nature of many renewable energy sources, the integration of these projects places greater demands on the transmission system and requires deeper reinforcement of the network which is also counted as CCM investment.

Smart grids – investment in digital grid infrastructure – is a rapidly growing segment that made up approximately 10% of network investment in 2016. These technologies cover a wide range of digital-based solutions. Several are aimed at improving operating efficiency and preparing the system for future growth in distributed technologies (such as roof-top solar, battery storage, demand-side flexibility, and electric vehicles) and the detailed data flows to support the related tariff and control systems. Many of these technologies are closely related to renewable energy and energy efficiency investments. All are included in this study as CCM investments.

Replacement of old transmission and distribution equipment is the largest component of network investments, accounting for approximately 70% of total network expenditure in 2016. These investments comprise mostly traditional equipment such as wires and transformers. Given the integrated nature of the system, there is no straightforward way to identify what proportion of these investments is due to renewable energy. Indeed, some of the interconnectors are driven by European policy objectives to complete the internal energy market, and integration of renewable energy is only one of the underlying objectives.¹⁴ Therefore, some judgement is required to attribute a proportion of network investment to CCM. For the purpose of this analysis, replacement investments in the transmission and distribution system are allocated to renewable energy according to the share of renewables in annual electricity generation (see Table 7).

Table 7 Investment in networks (EUR billion)

	2012	2013	2014	2015	2016	%	2016/2015
Electricity networks	27.5	28.7	27.8	31.8	31.7	100	-0.4
Integration of RE and smart-grids	7.5	8.5	8.3	8.9	9.1	29	1.6
Transmission and distribution replacement	20.0	20.1	19.6	22.9	22.6	71	-1.2
Non-renewable	15.3	15.0	14.2	16.3	15.8	50	-3.1
Renewable	4.7	5.1	5.4	6.6	6.8	22	3.5
Total attributed to mitigation	12.2	13.7	13.6	15.5	15.9	50	2.4

Source: IEA, Eurostat, EIB calculations.

Note: EIB calculations on the basis of IEA and Eurostat data. Total attributed to mitigation = integration of RE and smart-grids PLUS renewable share of transmission and distribution replacement. RE = renewable electricity.

¹⁴ The European Council has set targets for interconnection capacity of at least 10% of the production capacity of Member States by 2020 and 15% by 2030. The required investments (estimated by the Commission at around EUR 40bn) will improve competition and economic efficiency as well as facilitating integration of renewable energy and CCM.

Box 3 Challenges and opportunities for financing renewable investments in Europe

Approximately two-thirds of utility-scale renewable investments were internally financed by corporations on their own balance sheets in 2016, but project finance structures, which depend on third-party sources, have risen in absolute terms. Going forward, sustained renewable financing hinges on progress in electricity market design, appropriate policy support, new business and financial models, and enhanced system integration of solar photovoltaics (PV) and wind energy.

Europe's power market creates challenging conditions for investment, given that it is characterised by slow demand growth, rising shares of low marginal cost renewables and weak wholesale pricing levels. Since 2011, European utilities have written down over EUR 120bn in assets, in large part due to unprofitable thermal generation. New capacity from final investment decisions for large-scale dispatchable generation is now exceeded by retiring plants. Power company strategies increasingly focus on investing and acquiring networks and renewables with contracted remuneration that reduces exposure to wholesale-market risks. Meanwhile, governments face pressure to keep electricity prices affordable for consumers and foster a competitive and credible enabling environment to meet long-term decarbonisation goals.

In general, where backed by stable policies, the cost of financing renewable projects has fallen with low interest rates, good availability of debt and sharply reduced project risk premiums, benefiting from the maturation of solar PV and wind technologies. This helps reduce the cost of renewable generation. However, the financing environment is not uniform across the continent. A 2016 study by DiaCore¹⁵ found that in northern European countries with less regulatory risk, the cost of capital for onshore wind remains lower than in eastern and southern European countries with weaker demand growth and greater policy risks. This difference largely represents country risk priced into debt, but also reflects divergent regulations and fragmented renewable market conditions.

Implementation of the EU clean energy package and national policy design will shape the future financing situation. While the EU target of 27% renewables in energy consumption by 2030 signals to investors a long-term commitment, policy proposals also seek a more integrated, flexible electricity market, which will be important to managing physical and financial risks in the uptake of new solar PV and wind that would no longer benefit from priority dispatch. However, with no binding targets proposed after 2020 at the Member State level, uncertainties over the evolution of national level policy design and fiscal decisions may increase the risks of attracting sufficient investment to meet the EU goal.

Governments around the world are increasingly shifting from administratively determined feed-in tariffs towards greater competition in determining renewable remuneration. This is helping to drive down costs. Several European countries have introduced auctions, with EU state aid rules prescribing their use for most new renewable generators from 2017 onwards. The contracts awarded by such competitive mechanisms largely insulate generators from market pricing risks. But they also increasingly seek to incentivise system-friendly deployment and expose projects to balancing risks. The shift towards auctions, with higher upfront developer costs, may give an advantage to larger industry players with capabilities for more complex transactions. Still, in the first German onshore wind tender, community-owned projects, long an important source of investment, dominated the awards.

¹⁵ <http://diacore.eu/results/item/enhancing-res-investments-final-report>

As policies evolve, newer business and financing models are playing an important role in facilitating investment. In the United Kingdom, Norway, Sweden and the Netherlands, non-energy corporations – which see value in contracting directly with renewable generators – are emerging as an alternative source of power purchase. In 2016, corporate power purchase agreements (PPAs) accounted for EUR 1.8bn of renewable final investment decisions in Europe.

Competitive industry pressures are particularly impacting offshore wind financing. Developers are carrying projects on balance sheet through the development phase and refinancing with project finance at a later stage, which can reduce overall financing costs. In Germany's first offshore wind tender in 2017, bidders secured awards based solely on the wholesale price, though project viability will depend on future power prices, availability of larger, advanced turbines, and the funding of the grid connection by the system operator.

Newer mechanisms for raising equity and debt are also enabling developers to tap into larger financing pools from institutional investors. Europe has emerged as one of the largest sources of green bond issuance, topping EUR 18bn in 2016, and proceeds are playing an important role in refinancing renewables, and other clean energy assets, with lower costs of capital. At over EUR 6bn, the government of France issued one of the largest such bonds to date in early 2017. The continued development of a market-governance structure for labelling and verification is important to supporting their attraction for investors.

Ultimately, financing will hinge on progress to physically integrate higher shares of variable renewables through grid expansion and price incentives for flexibility, including from storage and demand response. Favourable financing, through the Projects of Common Interest scheme, and regulatory frameworks, such as the UK cap-and-floor model, are helping to attract investment in large-scale interconnectors. However, some 30% of transmission projects experience delays, due to permitting and local concerns, which can exacerbate imbalances between areas rich in renewables and demand centres, such as the north-south corridor in Germany.

Meanwhile, the distribution sector is increasingly taking centre stage in grid modernisation efforts. European utilities are increasingly investing in digital technologies, such as smart grids, battery storage and virtual power plant businesses, which can enhance the value of distributed assets, such as solar PV, and optimise grid operations to integrate large-scale solar and wind. However, continued reform of the regulatory framework to incentivise digital grid infrastructure remains a key factor in this process.

Energy efficiency

CCM investment in energy efficiency in the EU is estimated at EUR 57.7bn in 2016. Over three-quarters of this investment was in buildings, with the remainder relating to transport vehicles¹⁶ and industry (see Table 8). It includes both public and private investment, though the public sector accounts for a relatively small proportion of the total.

Private investment in energy efficiency follows the economic cycle. Investments in energy efficiency are typically one component in a more complex decision to replace capital equipment or appliances. Investment decisions by households are closely related to aggregate consumers' expenditure, while decisions by industry follow the investment cycle. The energy-intensive industries are an exception. The cost of energy is a fundamental driver of profitability, and investment decisions are more sensitive to energy prices and technological developments affecting energy costs.

Table 8 Incremental investment in energy efficiency, EU-28

	2015 (EUR billion)	2016	%	2016/2015 (%)
EU28 EUR bn	53.2	57.7	100	8
Buildings	40.5	45.2	78	12
Transport	9.6	9.4	16	-2
Industry	3.2	3.1	5	-1

Source: IEA, author's calculations.

Investment in buildings includes the building envelope (walls, windows, and so on), heating and cooling systems, control systems, appliances¹⁷ and lighting. The buildings envelope accounts for the majority of efficiency investment in this category, mostly involving improvements in insulation and windows.

The EU has taken significant steps in recent years to raise energy performance standards and improve consumer awareness with energy labelling and compulsory energy audits. The recent EU legislative measures included the Ecodesign Directive, the Energy Efficiency Directive, and the Energy Performance of Buildings Directive. Under the Ecodesign Directive, the proportion of appliances covered by energy efficiency standards increased to 73% in 2015 from only 4% in 2000. Improved energy labelling is also having an impact. In the UK, for example, refrigerators and washing machines rated A+ or greater have grown from 1% of the market to 23% in the last ten years and consumption per appliance has fallen by 3% per year.

The EU has taken the lead in nearly zero emissions buildings that have very high energy performance with limited energy requirements that come mostly from renewable sources. The Energy Performance of Buildings Directive requires all new buildings to be nearly zero-energy by the end of 2020. All new public buildings must be nearly zero-energy by 2018. Approximately EUR 12.5bn was invested in this class of buildings in 2015.

¹⁶ Energy efficiency in the transport sector includes efficiency improvements in cars, trucks, planes and boats. Railway rolling stock is included in transport infrastructure.

¹⁷ Consumer durables (goods that can be repeatedly or continuously used over a period of more than a year, for example a washing machine) are categorised as final consumption and not gross fixed capital formation in the national accounts. However, for the purposes of this study, energy efficiency investments in consumer durables are counted as mitigation investment.

Minimum energy performance standards have been raised significantly over the last decade and further improvements are in the pipeline. 2015 EU standards for space cooling equipment, space heating and water heating are all slightly below 40% of the best available technology (IEA 2016b, Chapter 5). In particular, the current minimum EU standards for space heating and water heating compare with 2005 standards of less than 10% of best available technology. New standards for water heating in 2017 will make further improvements.

The buildings sector faces particular challenges in many EU markets. Unlike emerging and developing markets where urbanisation is still taking place, the layout of cities in the more mature EU markets is already established and the stock of buildings is relatively old. Retro-fitting energy efficiency in old buildings is more expensive and difficult than including it in new designs. Moreover, the split incentives due to the separation of ownership from occupancy in many markets means that financial mechanisms are required to reconcile the landlord's responsibility for investment with the tenant's responsibility for running costs.

Investment in energy efficiency in transport vehicles in 2016 was EUR 9.4bn. The efficiency of light duty vehicles is well documented, with detailed data available on vehicle sales and the fuel consumption of each car model/engine combination. For a given model of car, smaller engines are less powerful, consume less fuel and are cheaper. However, comparison between cars of equivalent size and power shows that, other things being equal, more efficient engines are more expensive. The estimate of energy efficiency investment (Table 9) is based on an estimate of the incremental cost of the most efficient vehicles above the average cost for cars of a given size and horsepower.¹⁸

Cars with electric drive components, including hybrids, plug-in electric or battery electric vehicles, offer lower consumption of liquid fuels. These vehicles are significantly more expensive than the internal-combustion engine equivalent. This difference in cost forms the basis for the estimate of energy efficiency investment, using the same methodology as for efficient petrol and diesel vehicles. There was a 55% increase in sales of electric vehicles in 2016 (Frankfurt School-UNEP Collaborating Centre, UN Environment, and Bloomberg New Energy Finance 2017), but they still account for only 1% of annual vehicle sales and their contribution to fuel savings is estimated at less than 0.01% of the total oil consumption of the transport sector (IEA 2016b).

Data on efficiency in aviation and marine transport is not as readily available and the estimates of investment in these segments are based on top-down methodology.

Table 9 Incremental energy efficiency investment in transport vehicles 2015

	EUR billion	%
Total transport	9.6	100
Light duty vehicles	5.1	53
Small cars	2.9	30
Large cars	0.2	3
Light trucks	1.9	20
Freight	0.3	3
Other transport	4.2	44

Source: EIB calculations based on IEA data.

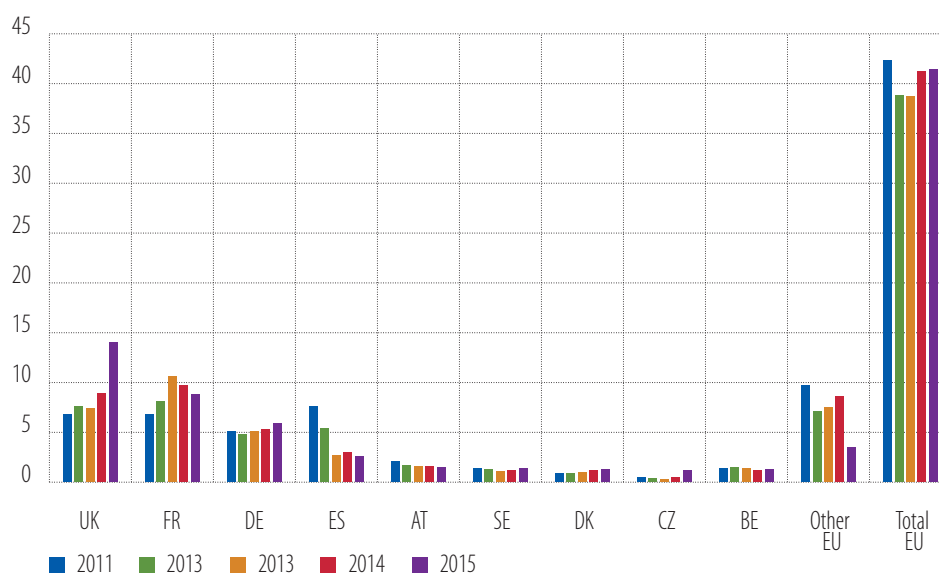
¹⁸ More details of the methodology are in IEA Definitions and Methodology 2017.

Transport infrastructure

Progress with greenhouse gas abatement in the transport sector has been relatively slow due to the dominant position of oil in road transport. Investment in infrastructure to facilitate the shift to less carbon-intensive forms of transport is complementary to the energy efficiency measures discussed in the previous section. Urban mass transit systems and infrastructure to shift freight from road to rail are two examples of transport investments that have benefits for climate mitigation. They emit less CO₂ per passenger kilometre, or per tonne kilometre, and they also offer the possibility of substituting away from oil.

All investments in inland waterways, and virtually all rail infrastructure investments, count as CCM.¹⁹ Many of the major transport infrastructure projects in the EU involve railways and rolling stock, as well as infrastructure to facilitate modal shift. Extensions and upgrades to metro systems, such as those in the UK and France, are major items in this category.

Figure 7 Infrastructure investment in rail and inland waterways, 2011–15 (EUR billion)



Source: OECD.

EU investment in rail and inland waterways was EUR 41.5bn in 2015, which is equivalent to 1.4% of gross fixed capital formation (see Figure 7). This is a significant contributor to total mitigation investments, amounting to 24% of the total. Even so, it is probably an underestimate because it does not include all transport mitigation projects. Transport integration and city planning, transport demand management and intermodal terminals would also have positive CCM impacts.

¹⁹ The only exception would be transport links with the purpose of transporting coal.

Agriculture, forestry and land use

The land use, land use change, and forestry sector is in aggregate a carbon sink for the EU. This sector has on average been sequestering more than 300 Mt CO₂ equivalent over the last ten years,²⁰ which is 6.7% of current emissions. Forestry is by far the largest contributor. In 2015 forests sequestered a little under 360 Mt, while the rest of the sector, including croplands, settlements, wetlands and grasslands, emitted a total of approximately 50 Mt.²¹

Emissions from deforestation are decreasing while carbon sequestration from afforested areas is on a rising trend as new forests are established and recently established forests reach maturity. Investment in forestry is responding to both the increase in demand for bioenergy to reach the renewable energy targets and the demand for material use. These trends are putting upward pressure on wood prices, which increases the value of forest areas and supports investment economics.

The latest Eurostat data indicate that forestry accounts for approximately 0.1% of total gross fixed capital formation (see Table 10). Assuming that this ratio has remained constant over recent years, the implied level of investment in forestry in 2016 would be slightly over EUR 3bn, or 1.8% of the estimated total investment in CCM.

Table 10 Climate change mitigation investment in forestry (EUR billion and %)

	2007	2008	2009	2010	2011	2012	2013	2014p	2015p	2016p
EU-28	2.3	2.5	2.1	2.1	2.6	3.6	2.9	3.0	3.2	3.2
Sweden	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.7	0.8	0.8
Finland	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Germany	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3
Poland	n/a	0.2	n/a	n/a	0.2	0.3	0.3	0.3	0.3	0.3
France	0.4	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3
Other EU	0.6	0.6	0.6	0.5	0.6	1.6	1.0	1.0	1.1	1.1
EU-28/GFCF	0.08%	0.08%	0.08%	0.08%	0.10%	0.14%	0.11%	0.11%	0.11%	0.11%

Source: Eurostat.

Note: Projection assumes constant share of GFCF; p = projection.

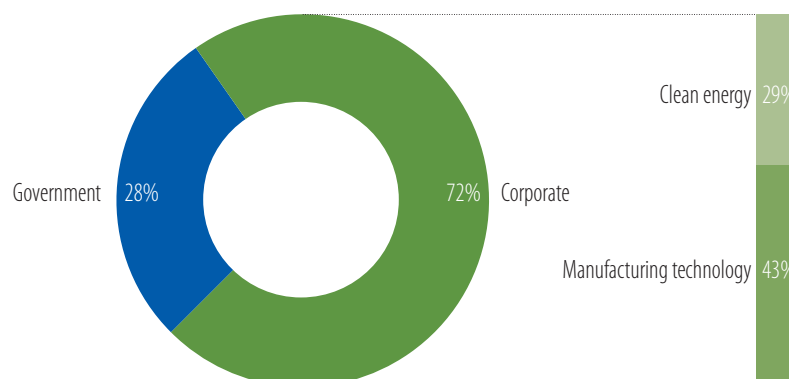
Research and development

Climate-related R&D of EUR 11.2bn in 2016 is made up of 28% government and 72% corporate expenditure. Corporate expenditure includes both clean energy technologies and investment to reduce emissions by auto, chemical and other manufacturing companies.

Europe has played a leading role in climate-related R&D, and there has been a rapid ramp-up in activity since 2000. Total R&D expenditure by government and corporate entities reached a peak of EUR 13.7bn in 2014. Following a decline in 2015, 2016 saw growth of 3.4% to reach EUR 11.2bn, which is made up of 28% government and 72% corporate expenditure (see Figure 8).

²⁰ United Nations Framework Convention on Climate Change (UNFCCC) inventory data.

²¹ EU Reference Scenario, Annex 4.

Figure 8 Infrastructure investment in rail and inland waterways, 2011–15 (EUR billion)

Source: BNEF and EIB estimates.

Note: Total investment = EUR 11.2bn.

Corporate R&D includes not only research into clean energy technologies but also research to improve efficiency and reduce emissions by companies in the automotive, chemical and other manufacturing sectors. In 2016, corporate spending on clean energy declined by 37% as European manufacturers in the solar and wind sectors cut costs and reduced their operations (see Table 11). However, this decline was offset by increased R&D in manufacturing sectors, including automotive technology, and the overall level of corporate R&D spending remained flat. Government spending in 2016 increased by 12.7%.

R&D in the solar and wind sectors is focusing on key frontier technologies. In the solar sector, the new technologies include: diamond wire saws to cut thinner wafers and reduce the amount of silicon used in solar panels; fluidised bed reactors to cut the cost of silicon production; reduced use of silver in electrical components; passive emitter rear contact technology to increase the efficiency of crystalline solar cells; and development of new materials that could have cost advantages in manufacturing and efficiency advantages, capturing a broader spectrum of sunlight.

Table 11 Investment in R&D (EUR billion and %)

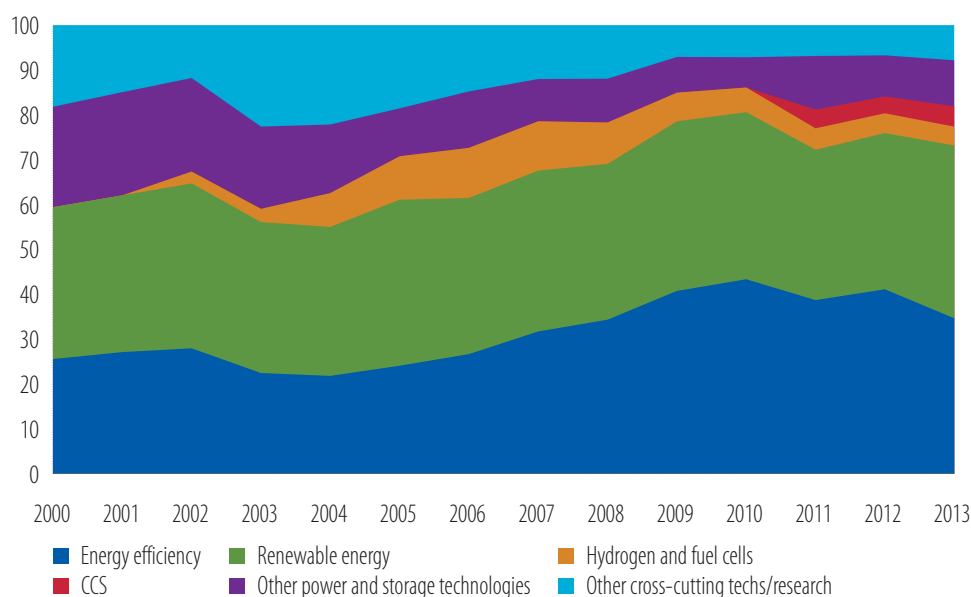
	2012	2013	2014	2015	2016	%	2016/15 (%)
R&D	11.7	13.4	13.7	10.8	11.2	100	3.4
Government	3.2	3.3	2.9	2.8	3.2	28	12.7
Corporate	8.5	10.1	10.8	8.0	8.0	72	0.1
Clean energy	4.5	4.7	4.3	5.1	3.2	28	-37.5
Manufacturing technology	4.0	5.4	6.5	2.9	4.8	43	65.9

Source: BNEF and EIB.

Onshore wind is a relatively mature sector, but offshore technological developments include: larger turbines and improvements in control systems; offshore foundation systems, such as suction buckets to reduce costs and environmental impacts; floating turbines applicable in deeper water; and wind panels – small modular units that could be distributed as widely in the community as solar panels.

Government climate-related R&D is concentrated on renewable energy and energy efficiency technologies. A more detailed analysis of the composition of government R&D is reported in Table 12 on the basis of the latest survey data. Over the last five years for which data are available, approximately 80% of climate-related R&D expenditure by EU national governments was allocated to research in energy efficiency and renewable energy (see Figure 9). The remaining 20% went to hydrogen and fuel cells, carbon capture and storage, and other power and storage technologies, as well as cross-cutting technologies and research.

Figure 9 Composition of government climate-related R&D (%)



Source: OECD.

Note: CCS: Carbon capture and storage.

The EU governments spend on average 0.02% of GDP on climate-related R&D, with considerable variations according to national priorities. France and Germany each account for approximately 20% of EU government expenditure on climate-related R&D, followed by the UK (15%), and Italy and Finland (10% each). As a proportion of GDP, Finland and Denmark spend more than the EU average, while Spain spends less. The nine countries in Table 12 account for 85% of the EU total.

Table 12 Government climate-related R&D, major economies (EUR million – 2014 prices)

	2010	2011	2012	2013	2014	2010-14 avg	%	Share of GDP (%)
EU-28	3.21	3.24	2.68	2.55	1.04	2.54	100	0.02
Finland	0.27	0.24	0.22	0.22	n.a.	0.24	9	0.11
Denmark	0.18	0.17	0.14	0.16	0.15	0.16	6	0.06
Sweden	0.17	0.14	0.14	0.16	0.16	0.15	6	0.03
Netherlands	0.34	0.14	0.18	0.17	n.a.	0.21	8	0.03
France	0.48	0.59	0.50	0.50	n.a.	0.52	20	0.02
UK	0.59	0.39	0.32	0.38	n.a.	0.42	16	0.02
Germany	0.43	0.49	0.51	0.59	0.64	0.53	21	0.02
Italy	0.22	0.30	n.a.	n.a.	n.a.	0.26	10	0.02
Spain	0.15	0.28	0.13	0.05	n.a.	0.15	6	0.01

Source: OECD.

Conclusion and policy implications

The magnitude of European endeavour in CCM is evident from the investment data. Investment of EUR 175.6bn in 2016 is equivalent to 1.2% of GDP or 6% of gross fixed capital formation. This is approximately five times the amount invested in fossil fuel production. In the power generation sector, investment in renewable energy of EUR 45.5bn in 2016 is over seven times the amount invested in generation capacity from fossil fuels. Including the associated investments in electricity networks, renewables account for 74% of investment in power generation.

CCM investment in the EU in 2016 was at its lowest level over the last five years. As a percentage of GDP, 2016 investment declined from 1.6% in 2012 to 1.2% in 2016, and as a percentage of gross fixed capital formation it decreased from 8.3% to 6.0%. However, this decline is not as extreme as the figures suggest for several reasons. First, the renewable generation data are based on project commissioning and a number of large offshore windfarms that reached financial close in 2016 are due to come on stream in the coming years. Second, costs have come down significantly, particularly in renewable energy generation. As a result, a given level of investment represents more generation capacity. Third, the high level of investment in the past was due to the overheating of the market in some countries, particularly in the solar photovoltaic segment. With several Member States already on track to reach their 2020 targets for renewable energy, the current lower level of investment represents a return to more normal market conditions.

The substantial amount of investment to date appears sufficient to meet the EU's 2020 target, but CCM investment will need to increase considerably to reach the 2030 targets, particularly in the area of energy efficiency. The European Commission has developed a number of scenarios estimating investment needs in different sectors in order to reach EU policy goals, including the 2030 climate and energy goals. Direct comparison between the investment amounts envisaged in these scenarios and the estimates provided in this chapter is difficult because of differences in definition and methodology, with the estimates provided in this chapter representing a generally stricter focus on climate change mitigation. Commission scenarios suggest that a very substantial increase in investment may be needed to attain 2030 goals, over and above that needed to reach 2020 targets. This investment is overwhelmingly foreseen in the area of energy efficiency improvements. Caveats aside, the CCM investment estimates provided in this chapter suggest that investment in renewables and grid infrastructure are broadly in line with estimated investment requirements to reach 2020 and 2030 goals. By contrast, investments in energy efficiency appear lower even than estimated investment requirements to meet the 2020 goals. The findings of this chapter thus provide support to the view that annual investments in climate change mitigation in the EU need to increase substantially, particularly with regard to energy efficiency improvements.

The challenge for future investment is not just to make sufficient investment, but also to invest efficiently and achieve a good balance of investment across sectors and an efficient sequencing of investment over time. The amount of investment expenditure is not the end of the story as far as CCM is concerned. Investment opportunities are limited, and it would be a mistake to assume that any degree of mitigation could be achieved by scaling up investment according to a fixed ratio. Over the medium to long term, maintaining the quality and economic efficiency of a growing volume of CCM investments will be an important challenge. Energy efficiency is a particular priority, and presents diverse challenges to incentivise investments by many parties that are spread across many sectors.

References

European Commission. (2014). "Electricity Tariff Deficit: Temporary or Permanent Problem in the EU?" European Economy, Economic Papers 543, October.

European Commission. (2016a). "EU Reference Scenario 2016 Energy, Transport and GHG Emissions Trends to 2050". https://ec.europa.eu/clima/sites/clima/files/strategies/analysis/models/docs/full_referencescenario2016report_en.pdf

European Commission. (2016b). "Impact Assessment Accompanying the Document Proposal for a Directive of the European Parliament and of the Council Amending Directive 2012/27/EU on Energy Efficiency." EC SWD(2016) 405.

European Commission. "2020 Climate and Energy Package". https://ec.europa.eu/clima/policies/strategies/2020_en.

European Commission. "2030 Climate and Energy Framework". https://ec.europa.eu/clima/policies/strategies/2030_en

European Commission. "2050 Low-carbon Economy". https://ec.europa.eu/clima/policies/strategies/2050_en

European Commission. "Forestry Staff Working Paper". https://ec.europa.eu/agriculture/sites/agriculture/files/forest/strategy/staff-working-doc_en.pdf

Eurostat. (2017). "Greenhouse Gas Emission Statistics, June". http://ec.europa.eu/eurostat/statistics-explained/index.php/Greenhouse_gas_emission_statistics

Frankfurt School-UNEP Collaborating Centre, UN Environment, and Bloomberg New Energy Finance. (2017). "Global Trends in Renewable Energy Investment 2017".

IDB (Inter-American Development Bank), WB (World Bank), EIB (European Investment Bank), EBRD (European Bank for Reconstruction and Development, ADB (Asian Development Bank), and AfDB (African Development Bank) (2016). "Joint Report on Multilateral Development Banks' Climate Finance".

IEA. (2016a). "World Energy Investment 2016". International Energy Agency.

IEA. (2016b). "Energy Efficiency Market Report 2016". International Energy Agency.

IEA. (2016c). "Energy Technology Perspectives 2016". International Energy Agency.

Annex A. Adaptation investment

Adaptation investment is highly diffuse across many economic sectors. The only consistent data relate to EUR 1bn of financing by multilateral development banks in 2016, which provides a lower bound to the actual amount.

Adaptation is already affecting investment decisions in many sectors of the economy, but there is as yet no comprehensive source collating adaptation data on a consistent basis. Climate change affects project risks and project designs are being amended in many sectors, notably manufacturing, agriculture, energy, and transport infrastructure. However, there are still many uncertainties about climate impact and its implications for project economics. In some sectors, there is an overlap between adaptation and climate change mitigation (CCM). Afforestation, for example, has positive impacts on both CCM and adaptation.

The water sector is a key avenue for transmission of climate impacts to the economy. Climate change scenarios point to an increase in the occurrence of droughts and floods. However, vulnerability to water scarcity depends not only on climate change but also on many other factors connected to land and water use. Availability of water is a key driver for many economic decisions, not just in agriculture and urban development but also the location of power stations and other industrial facilities that depend on water for cooling. There is a lack of comprehensive information on the actual impact of economic activity on water resources, and conversely the vulnerability of different economic sectors to changes in resource availability. Integration of water management with other sector policies such as agriculture, energy and health is a key challenge for successful adaptation.

One area where the data are collected on a consistent basis is the investment projects of the multilateral development banks. Adaptation investment by the European Investment Bank (EIB) and other multilaterals was over EUR 1bn in 2016 (see Table A1). This figure represents the small proportion of adaptation investments due to specific interventions that can be identified with a good degree of certainty. It provides the lower bound of the total investment in adaptation in the EU. The EUR 1bn of finance in 2016 went to projects with a total investment cost of EUR 7bn (the finance provided only covered 15% of the total project cost). However, climate adaptation was only one component of these projects.

Table A1 Investment in climate adaptation by the EU and multilateral development banks (EUR billion)

	2012	2013	2014	2015	2016
EU11, EU13					
MDB finance	0.1	0.1	0.1	0.1	n.a.
EU28					
EIB finance	0.9	1.1	0.3	0.7	1.1
EIB share of project cost	30	21	33	17	15
EIB finance/share of project cost	2.9	5.2	1.0	4.5	7.2

Source: 2015 Joint Report on Multilateral Development Banks' Climate Finance (IDB et al. 2016).

Note: Data for 2015 pertain to the EU11. Data for other years pertain to the EU13.

Current account surpluses reflect export of domestic savings (notably also from periphery and cohesion regions)

Equity share in EU cross border liabilities

at **50%**

and rising as debt share drops

Finance constrained firms

6%

Non-performing loans are declining slowly.

10 EU

countries still have ratios **above 10%**

SMEs 2x

more **dissatisfied with the cost of finance** than large firms

Less than **1%**

of firms would prefer **more equity finance**

PART II

Investment finance

Chapter 5

Financial integration and shock absorption capacity within the European Union

Chapter at a glance

Since the global financial crisis and the rebound in economic activity in Europe, there have been profound changes in international capital flows, not only in terms of magnitude, but also in the geographical distribution and composition of types of flows. This chapter reviews these main changes in order to assess whether they constitute a stigma from the crisis or a shift towards a sounder and more efficient financial system.

- *The EU financial system is overcoming its fragmentation. In both core and periphery economies, government bond yields, costs of corporate bank borrowing and, more widely, access to external finance are now moving in tandem across the euro area. Still, some stigma effects remain; for example, capital flows in the cohesion economies have not yet recovered to pre-crisis levels.*
- *The EU recorded a major correction in its current account balance from a deficit of 4% of GDP in 2008 to a surplus of 2% in 2016. The rebalancing was mostly achieved through a decline in investment. Both the magnitude of the changes in the current account and the driver of the changes were very different across the three main groups of countries that make up the EU.*
- *Lower gross financial flows are likely to be more than a temporary phenomenon. A historical comparison shows that the current recovery in cross-border financial flows is associated with a slower recovery of other investment, lower debt portfolio inflows but stronger equity portfolio inflows in the periphery, and a stronger rebound in direct investment, except in the cohesion economies.*
- *Banks have retrenched from foreign holdings and tilted their investments more towards domestic assets. For investment funds, there was a switch towards non-EU debt and equity. Overall, a synthetic indicator suggests that the degree of financial integration is partly back to its level at the start of the previous recovery, but only in terms of quantity, while for prices the dispersion is wider than before the euro came into force.*
- *European financial markets are underdeveloped and not well integrated. The crisis showed the need to further develop the European debt and capital markets as an alternative source of finance for European firms. The deepening of the corporate debt market is especially important to free up bottlenecks in the distribution of bank credit.*
- *Overall, the stability of the system that has been achieved will be tested as the extraordinary monetary policies instituted to reintegrate the transmission mechanism begin to fade. In this context, the implementation of the CMU agenda, as well as considerations on macroeconomic fiscal stabilisers, become crucial.*

Major current account rebalancing and financing of investment in Europe ¹

From a historical perspective, the current account rebalancing that has occurred within Europe since the global financial crisis reflects the emergence of a “new normal” with substantially lower growth of international capital flows. The decade preceding the crisis was one of financial globalisation: in the years prior to 2008, gross international financial flows were substantial, hovering around 8% of global GDP from 2005 to 2007. Since the end of the crisis, cross-border financial flows have rebounded but have not returned to the buoyancy of the pre-crisis period, settling at a “new average” of around 4% of GDP since 2015 (Bussière, Schmidt and Valla, 2016). This muted revival could reflect the fact that the global economy is becoming more fragmented than it used to be, after decades of increasing globalisation. Alternatively, it could reflect better integration after a period of exuberance not necessarily supported by fundamentals. In Europe, the two drivers coexist as a major rebalancing is taking place.

The EU recorded a major correction in its current account balance from a deficit of 4% of GDP in 2008 to a surplus of 2% in 2016 (Figure 1). The rebalancing was mostly achieved through a decline in investment, with a saving ratio now back to pre-crisis levels. Looking at private sector balances, it appears that the change in investment was mostly due to private investment that declined even more strongly than total investment. Conversely, the private saving rate remained mostly unchanged in the post-crisis period compared to the pre-crisis period. Following the crisis, however, the public saving rate varied widely, with a public deficit reaching very high rates after the Lehman Brothers bankruptcy and adjusting slowly during the sovereign debt crisis (Figure 1).

Persistent current account imbalances result in changes in net wealth, with the accumulation of debt for some and assets for others. Since savings always correspond to debt, the debtor problem is also the saver problem, and current account imbalances are two-sided. A persistently high current account deficit is as much a concern as a persistently high surplus. This explains why current account balances are part of the set of indicators monitored by the European Commission to assess macroeconomic imbalances (European Commission, 2011).

¹ International financial flows suffer from measurement problems, partly due to the role of the currency used to convert the flows, as well the difficulty in grasping and analysing some sources of finance, such as those emanating from the shadow banking sector. The financial and current accounts should in principle match each other, but in practice they do not, owing to substantial net errors and omissions. The measurement issue is even more accentuated for stocks. This section alternatively relies on the International Monetary Fund's Balance of Payments database and Eurostat. When decomposing the financial flows, errors and omissions and changes in international reserves are not taken into account. Country aggregates presented are compiled internally, sometimes using back-casting techniques and outlier corrections to circumvent the imperfect data reporting.

Figure 1 Saving, investment and current account balance in the EU (% of GDP)

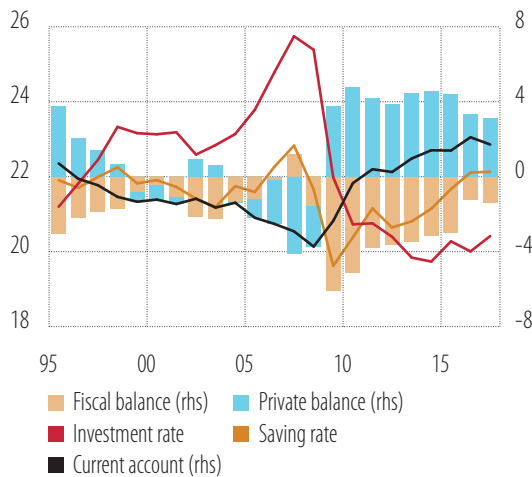
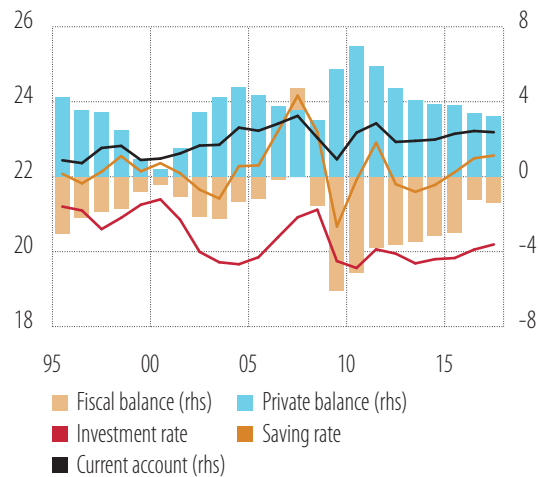


Figure 2 Saving, investment and current account balance in the “other economies” group of the EU (% of GDP)



Source: *ECON calculations.*

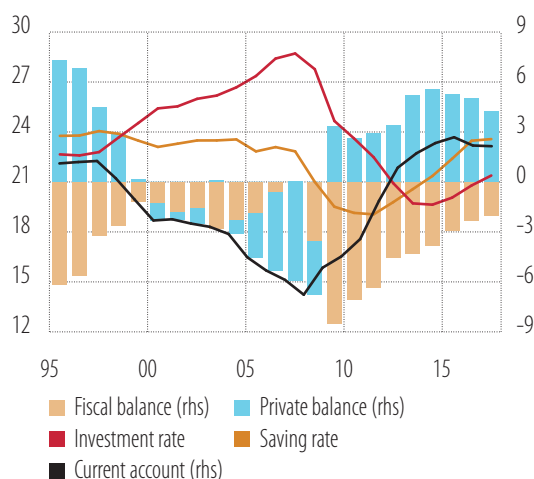
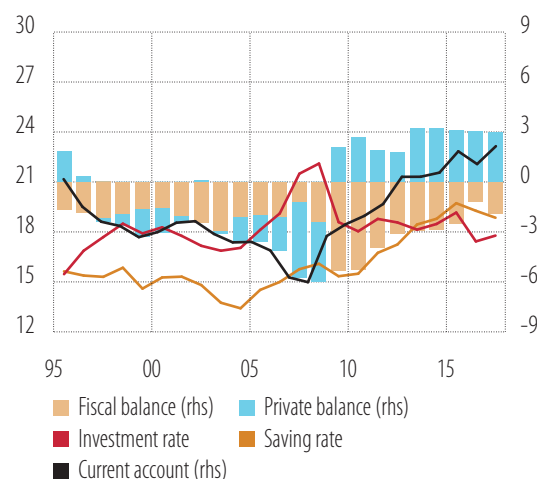
Note: *Annual data up to 2017 based on the European Commission’s spring forecast. Private balance stands for the private saving minus private investment balance.*

Countries are unevenly affected

Both the magnitude of the changes in the current account and the driver of the changes were very different across the three main groups of countries that make up the EU.

The other economies group remains a net exporter of savings, mostly due to Germany and in spite of the UK. For other economies, the current account balance has barely been affected since the crisis (Figure 2). Since at least the mid-1990s, domestic investment has been below domestic savings. Domestic savings are, on balance, exported, and over the period starting in the mid-1990s for this group of countries the current account has remained in surplus at between 1% and 4% of GDP. It declined marginally after the Lehman bankruptcy, in 2008 and 2009, then recovered and was barely affected by the sovereign debt crisis.

It should be mentioned that the UK economy is running an increasing deficit that, given the size of the country’s economy, drags down the surplus of the other countries significantly. Removing the UK, the surplus of the remaining countries would increase substantially and would appear to be on a slight increasing trend. This is mostly due to the surpluses recorded by the German economy. Germany is running a current account surplus of about 8% of GDP, which means that about one-third of all its savings (equal to 24% of GDP) have to be invested abroad every year (Bundesbank, 2017).

Figure 3 Saving, investment and current account balance in periphery economies (% of GDP)**Figure 4** Saving, investment and current account balance in cohesion economies (% of GDP)

Source: ECON calculations based on Eurostat.

Note: Annual data up to 2017 based on the European Commission's spring forecast. Private balance stands for the private saving minus private investment balance.

A major correction has emerged in the periphery, with private investment remaining far below pre-crisis levels as countries become net exporters of savings. The swing in current account balances of the periphery countries was unprecedented: on average, the current account deficit was around 6% of GDP in 2008. The current account reached a surplus in 2013 and was around 3% of GDP in 2016. Hence, in eight years the current account balance for periphery countries shifted by around 9% of GDP (Figure 3). Most of the adjustment took place in private sector balances, reflecting a sharp decline in private investment, with the saving rate declining during the crisis period and returning to its 1995-2007 average as of 2015. Conversely, at the end of 2016, more than three years after the end of the sovereign debt crisis, the investment rate was still well below its pre-crisis level and recovering very slowly. To some extent, this reflects the slow resorption of the excess supply in the housing sector, after several years of a construction boom. However, corporate and public investments also remain below their pre-crisis rate (see Chapters 1 and 6). As a share of GDP, the public sector deficit, which played a major role in explaining the current account deficit in the years after the crisis, was in 2016 comparable to its pre-crisis average.

The fact that cohesion economies also turned into net exporters reveals a possible fragmentation gap. In periphery economies, the financing of domestic investment required capital inflows up to the start of the sovereign debt crisis. Since then, investment has declined, domestic savings have increased, and these countries have become overall net exporters of savings (Figure 4). This possibly reflects a return to a more sustainable investment path after the post-enlargement boom, but may also be indicative of remaining frictions in the European financial system.

The existence of stigma effects in the European financial system is offset by the trend decline in the net inflows to cohesion economies. Given their lower level of development, these countries should be expected to offer many investment opportunities and therefore attract a large share of European investment. Overall, cohesion economies experienced a rebalancing in current accounts of a magnitude similar to that of the periphery economies. In contrast to them, however, the rebalancing resulted from both a decline in investment and an increase in savings. The fact that, against the historical trend, the current account in cohesion economies is in surplus may indicate a fragmentation of the European financial system.

Is there evidence of investment having been affected by the financial retrenchment in part of Europe?

The rebalancing has led to a change in financial flows and investment positions, somehow constraining private investment. Given the important changes recorded in the EU financial system since the beginning of 2000, it is legitimate to ask whether the bursting of the credit boom and the subsequent sovereign debt crisis have not constrained local investment by limiting access to foreign capital. This may be the case in periphery economies, where the decline in investment has been substantial and protracted, and in cohesion economies, which were major recipients of capital inflows prior to the crisis.

It is very challenging to gauge the extent to which the major rebalancing described has been detrimental to corporate investment as, indeed, financial demand and supply factors all contribute to explaining investment dynamics. As shown, investments and savings seem to be correlated to a different degree across time and groups of economies (Figures 1-4). Ideally, interpreting this correlation would involve a structural analysis taking into account the interdependency between international flows, investment and savings through a general equilibrium approach. While such an approach is beyond the scope of this chapter, some evidence can be provided by means of simple but robust estimations.

The analysis for this chapter finds evidence that in the periphery and cohesion economies, as a consequence of financial market fragmentation, investment became constrained by the availability of domestic savings throughout the crisis. Feldstein and Horioka (1980) provided a first rough indicator of capital mobility in their seminal paper: under perfect capital mobility, there should be no correlation between domestic investment and domestic savings. In a set of perfectly financially-integrated economies, investment should depend only on the marginal product of capital and, across countries, changes in investment should be independent from changes in savings. Conversely, when projecting the investment rate on the saving rate, a positive and significant saving retention rate – the sensitivity of investment to the saving rate – indicates imperfect capital mobility. The closer to one the coefficient is, the less integrated the local economy is in the global financial system.

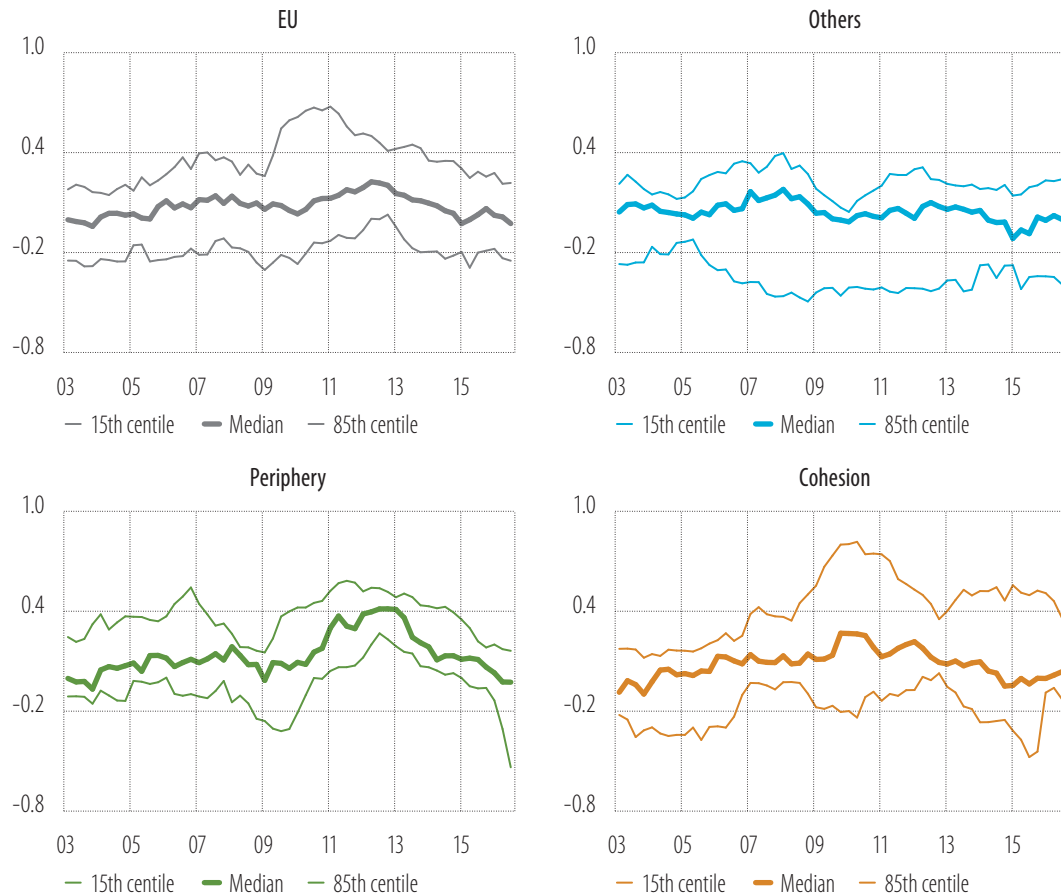
The analysis here is drawn from that proposition. We use a cross-sectional regression for the different groups of countries introduced above in order to estimate the correlation between savings and investment. To take into consideration possible delays in the adjustment, we incorporate lags in the regression and estimate equation (1) separately for each country j :

$$\left(\frac{I}{Y}\right)_{j,t} = \alpha + \beta_j \left(\frac{S}{Y}\right)_{j,t} + \gamma_j \left(\frac{S}{Y}\right)_{j,t-1} + \mu_j \left(\frac{I}{Y}\right)_{j,t-1} + \varepsilon_{j,t}, \quad (1)$$

where I is gross fixed capital formation, S is gross savings and Y is the gross domestic product at market prices. From the equation estimated for each country j , the long-run sensitivity of investment to saving, slope or retention rate, can be derived:

$$\text{slope}_j = \left(\frac{\beta_j + \gamma_j}{1 - \mu_j}\right). \quad (2)$$

To take into account a possible time-varying pattern in the degree of capital mobility, we estimate the equation over a rolling window of eight years, a duration that corresponds to that of the business cycle. In order to illustrate possible asymmetries in the degree of financial integration across countries, the results of each equation (estimated for each EU country for which the data are available) are pooled across the EU as a whole and the three country groups considered. The results are therefore time-dependent and cross-sectional dependent. Figure 5 reports the dispersion of the slopes, the 15th percentile, the median, and the 85th percentile over the estimation period.

Figure 5 Estimated distribution of the long-run retention rate (annual)

Source: Authors' calculations based on the 2016 EIBIS.

Note: Shares of total investment defined as the sum of the four types of investment: land, buildings and infrastructure, machinery and equipment, research and development (R&D), and software and databases (including IT, information technology). SMEs: small and medium-sized enterprises.

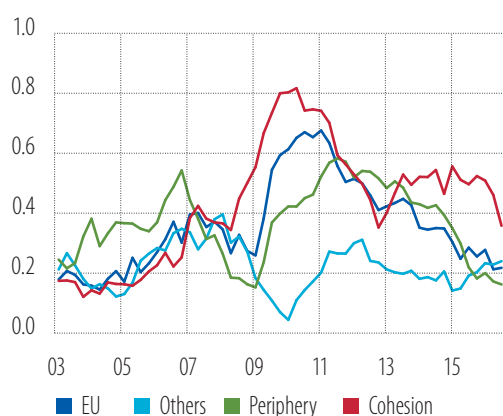
The results emphasise important changes over the period starting in 2003. For the EU and the three country groups, the retention rate is not significantly different from zero at 70% most of the time. At this confidence level, it is never significantly different from zero for other countries. Hence, for the other economies group, capital mobility has remained relatively high even in the wake of the Lehman bankruptcy, when capital markets froze. For periphery economies, the coefficient becomes significant at the onset of the sovereign debt crisis, remaining at well above 70% for more than three years. This is also the case, in a more transitory manner, for the cohesion economies.

Somehow the periphery economies were more affected than the cohesion economies. The simple analysis does not provide strong support for a fragmented financial system hampering investment in Europe over the recent period. It shows, however, how strong and protracted the sovereign debt crisis has been for the periphery economies. For them, the analysis suggests that domestic savings have been constraining domestic investment for several years. At the peak of the sovereign debt crisis, these countries suffered from redenomination risk², which drastically reduced their access to international

² This risk relates to the likelihood that in one jurisdiction, assets become redenominated in one devalued legacy currency, reflecting the possibility that the country would decide to leave the euro area.

capital markets and to some extent forced the current account adjustment (Figure 3). Overall, the decline in capital mobility estimated during the sovereign debt crisis has mostly reflected the situation in the periphery economies, with less evidence for the cohesion economies. Indeed, the results suggest that, in terms of access to external financing, not all European countries were affected by the sovereign debt crisis. During this period, the estimated retention rates were above 0.3 for 15 countries in the other economies group, whereas for the periphery economies, the coefficient reached a level of 0.6 or more for the same number of economies. Moreover, for the latter, it became significant at the level above 70%.

Figure 6 85th percentile of the retention coefficient in different pools of countries



This analysis is confronted by the evolution of the gap to the theoretical situation of perfect capital mobility, portrayed by the 85th percentile: the higher the percentile, the lower the capital mobility and the more constrained the investment (Figure 6). Again, we see that the Lehman crisis affected all European countries, whereas the sovereign debt crisis had a more important impact on the response of domestic investment to domestic saving in the periphery or cohesion countries.

Source: ECON estimations based on EC/AMECO.

Note: Estimated bound of the retention rate at 85%.

The changing composition of financial stocks and flows

The collapse of gross financial flows is common to other developed economies, but the recovery has been slower in the EU than in the rest of the world. Since, by construction, financial flows mirror current account flows, the sharp rebalancing in current accounts analysed above has had a bearing on financial flows. Reflecting changes in the current account balances, EU gross financial flows have fallen substantially (Figure 7).³ While the sharp decline was also recorded in other developed economies, the recovery of capital flows in the aftermath of the crisis has been weaker in the EU than in other world regions (Bussière, Schmidt and Valla, 2016). Until recently at least, this was partly due to the slower pace of economic recovery in Europe.

Lower gross financial flows are likely to be more than a temporary phenomenon. In the EU, the collapse in gross financial flows was shared by all country groups but was most pronounced for the other economies, which typically record higher levels of gross flows, reflecting their role in financial intermediation.⁴ Both the periphery and the cohesion groups recorded considerable drops, too. Notably, developments of gross flows have been very uneven since then. While gross flows for other economies had already started to recover by around 2010, they remained subdued for the cohesion and

³ Gross flows are calculated as the average of the assets/liabilities of direct investment, portfolio investment and other investment. Note that for "gross" flows, both assets and liabilities can be negative, which means disposing of earlier cross-border investments. Net flows correspond to the net financial account. Four-quarter moving average capital flows are divided by the four-quarter moving average GDP level.

⁴ A problem with the analysis of gross flows is that the intra-group positions cannot be netted out and inflate numbers when the countries are grouped. In this group, several countries record very high gross flows.

periphery groups. The latter group was severely hit by the sovereign debt crisis and the former affected by the subsequent confidence crisis affecting Europe and by the financial retrenchment. Since the end of the sovereign debt crisis in 2013, gross flows have picked up for the periphery economies group but continue at historically low levels for cohesion economies. On balance, developments in past years suggest that lower gross capital flows in Europe are more than a temporary phenomenon.

In the wake of the crisis, net flows also sharply contracted. Turning to net flows, Figure 8 shows similar lower magnitudes in the EU, even though changes are less pronounced due to the correlation of inward and outward gross flows (Lane and Milesi-Ferretti, 2017). However, in contrast to gross flows, net flows sharply recovered, especially in the other economies, where net outflows of capital in terms of GDP are now comparable to pre-crisis levels. The EU has recorded significantly lower net flows since the eruption of the crisis. In 2008, net flows declined by more than 2% of GDP (Figure 8). In other economies, the retrenchment was such in the wake of the Lehman crisis that these countries recorded a substantial net repatriation of savings. In terms of financial flows, the situation has changed significantly for periphery and cohesion economies. While these economies were recording increasing net capital inflows from the beginning of 2002 until the crisis, since then they have been recording diminishing net inflows.⁵ Since the recovery, periphery economies have started to become net exporters of capital, while cohesion economies have reached a balanced position.

Figure 7 Average gross financial flows (% of GDP, four-quarter moving average)

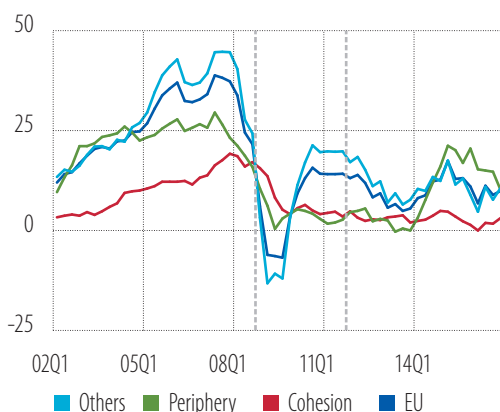
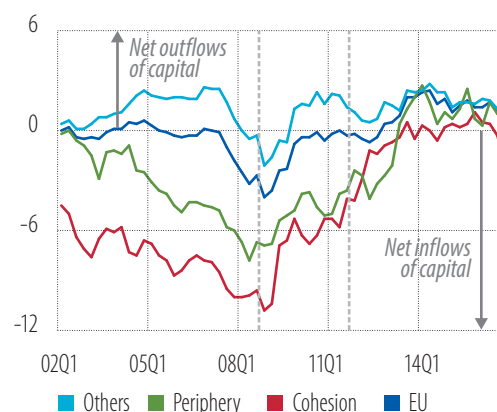


Figure 8 Net financial flows (% of GDP, four-quarter moving sum)



Source: ECON calculations based on IMF and EUROSTAT.

Note: The dotted lines mark the start of the two most recent financial crises, the Lehman bankruptcy and the sovereign debt crisis. Gross capital flows equal the sum of inflows and outflows of direct, portfolio and other investments. Net capital flows equal the difference between outflows and inflows. Hence, a positive (negative) figure indicates net exports (imports) of capital.

Among different instruments, foreign direct investment (FDI) and portfolio equity flows have proved to be more resilient. The aggregated developments of international financial flows described above mask different developments across investment categories: FDI, equity and debt instruments in international portfolios, and "other investment" (encompassing mostly bank flows). Although all types of flows have been affected by the slowdown, some (FDI and portfolio equity) have proved more resilient than others (portfolio debt and other investment). This has resulted in a marked change in the composition of financial flows (EIB, 2016; Bussière, Schmidt and Valla, 2016; Lane and Milesi-Ferretti, 2017).

⁵ Figures for 2016 for cohesion economies are also affected by the EU Structural Funds cycle.

A decomposition of structural and cyclical factors reveals three patterns: slower recovery of investment in the other group of countries, lower portfolio inflows in the periphery associated with more equity flows, and a stronger rebound in FDI, except in the cohesion countries. To some extent, this reflects the asymmetric sensitivity of the component of financial flows to the business cycle. For example, FDI is traditionally considered to be more structural in nature and therefore less pro-cyclical.⁶ In order to dissociate the two components, trend and cycle, we take a historical perspective and compare the current rebound in financial flows to what happened in the previous recovery in the middle of the first decade of the 2000s. For each component, each side of the financial account, and the balance, we compare the pick-up in a recent six-quarter period (2015:Q3 to 2016:Q4) and the last six quarters of recession identified by the Centre for Economic Policy Research (2011:Q4 to 2013:Q1) to the pick-up recorded between 2006:Q1 and 2007:Q2 and the recession period (2002:Q1 to 2003:Q2).⁷ To facilitate the comparison, the limits of the two periods are separated by the same span, that is, ten quarters. The results are reported as differences in shares of flows as percentage points of GDP in Table 1.

Overall, three stylised facts emerge from the comparison: other investments recover at a slower pace, the nature of portfolio flows is tilted more towards equity, and FDI rebounds quickly in the other economies and periphery groups but not in the cohesion group. These stylised facts are detailed in Table 1.

Table 1 Historical perspective on the rebound of gross and net capital flows in the current recovery (% of GDP)

Country	Outflows				Average				Net			
	Others	Periphery	Cohesion	EU	Others	Periphery	Cohesion	EU	Others	Periphery	Cohesion	EU
Portfolio	-3.3	4.2	0.7	-1.2	1.7	-8.7	2.8	-0.8	-5.1	12.8	-2.1	-0.5
of which Equity	-0.8	2.1	0.2	0.0	1.0	5.7	0.3	-1.9	0.1	-3.6	-0.1	-2.1
of which Debt	-2.5	2.0	0.5	-1.2	0.7	-14.4	2.5	-3.2	-0.9	16.4	-2.0	1.7
Direct investment	9.6	6.6	-4.1	7.9	9.9	8.4	-0.2	8.9	-0.3	-1.9	-3.9	-0.9
Other investment	-6.0	0.0	-1.1	-4.1	-12.2	8.9	-7.1	-6.7	6.1	-8.9	6.0	2.6
Total	0.3	10.7	-4.5	2.6	-0.5	8.7	-4.4	1.5	0.8	2.1	-0.1	1.2

Source: EIB/ECON computations based on IMF.

Note: Gross flows in a recent six-quarter period (2015:Q3 to 2016:Q4) and the last six quarters of recession identified by the Centre for Economic Policy Research (2011:Q4 to 2013:Q1) are compared with the pick-up between 2006:Q1 and 2007:Q2 and the recession period (2002:Q1 to 2003:Q2). The periods are separated by the same span, ten quarters. Values around zero indicate greater similarities between the current and the previous recovery. A negative (positive) value indicates that the steepening in this recovery is less (more) pronounced than in the previous one, suggesting a possible structural change in the composition of flows towards (away) from this type.

⁶ In this regard, it should be borne in mind that for each group, gross flows reflect both intra-EU flows and flows with the rest of the world. To the extent that business cycles, policies and financial conditions differ across the two zones, one would need to distinguish between the two types of flows to analyse the evolution of total flows, especially as the two components can move in different directions. This may be very important over the period of the sovereign debt crisis, which was primarily a European crisis. However, the statistics published do not provide this decomposition. This chapter relies on the assumption that the drivers of EU gross financial flows are mostly of a European nature. This may be a reasonable assumption given that the share of intra-EU exchanges in total exchanges is around two-thirds.

⁷ While comparison with further recession/recovery periods would be informative, the availability of national data for financial flows deteriorates going back in history and therefore limits the possibilities for further historic comparison.

Slower recovery of other investment explained by global deleveraging in the other economies and a change in the banking model towards self-sustained growth in the cohesion economies

The historical comparison indicates that other investment flows have contributed much less to the current rebound, especially for the other economies and cohesion groups. In the other economies, this could be related to the confidence crisis faced by the banking sectors, which involved a prolonged restructuring period and business model reorientation that led them to undertake a deleveraging process, predominantly through the use of external assets. This lowered cross-border lending by banks to other financial institutions. In this regard, the changing composition of international financial flows may reflect, partly at least, the disintermediation process that characterises the global economy. In the cohesion economies, this reflects a substantial change in the local banking sector model, which was traditionally characterised by strong foreign ownership. In fact, prior to the crisis, the international banks active in the region used to fund their own subsidiaries via intra-group debt. The crisis led to a substantial downscaling of local growth opportunities, particularly related to the real estate and consumer credit business, and a shift of the local banking model towards self-sustainability. Cross-border intra-group funding has been replaced by domestic funding, via deposits or local bond issuances.⁸

Lower portfolio inflows in the periphery associated with more equity flows, possibly due to the European Central Bank's Asset Purchase Programme

For the other economies and periphery groups, the recovery of portfolio flows on average also lags behind the previous cycle, most notably for the periphery. Also, developments differ across components. While equity flows recover at a stronger pace, the recovery in debt flows is less pronounced than during the previous pick-up. Indeed, over the same period of ten quarters, the increase in the share of equity inflows in GDP is 2 percentage points stronger in the EU as a whole and 1 and 6 percentage points stronger in the other and periphery economies, respectively. Conversely, the recovery in debt inflows as a share of GDP is 3 percentage points in the EU, mostly on account of the periphery, where it lags 14 percentage points behind the increase in the previous recovery.

Avdjiev, Hardy and Kalemli-Ozcan (2017) focus on gross flows and decompose debt inflows by borrower type, banks, firms and sovereigns. They show that inferring the drivers behind aggregate capital flows is difficult. Capital inflows respond to global and host-country business cycle conditions asymmetrically, across types of countries (emerging markets and advanced economies), and types of sectors (firms, banks and sovereigns). This conclusion is supported by Heipertz et al. (2017), who show that even among investors, the sensitivity of cross-border investment to risk, expected returns and business cycle conditions varies substantially. Avdjiev, Hardy and Kalemli-Ozcan (2017) show that for emerging markets, lower risk appetite reduces all inflows into banks, firms and sovereigns for emerging markets, while for advanced economies it reduces inflows into banks and firms but inflows into sovereigns are not affected because their borrowing cost does not change with risk appetite. However, the authors find that bank and business borrowing is pro-cyclical, so the lower rebound in debt flows may reflect the weakness of the current recovery. Alternatively, that lower rebound might also indicate a reallocation of savings towards less debt in periphery economies.

⁸ According to the European Investment Bank's 2017:H1 Central, Eastern and South-Eastern Europe Bank Lending Survey conducted in May 2017 and various documents produced by the Vienna Initiative (see www.vienna-initiative.com).

The credit-easing package launched by the European Central Bank (ECB) in the middle of 2014 has triggered substantial capital flows across borders. Since then, net portfolio outflows of long-term debt securities have been very substantial, reaching a ratio close to 5% of GDP in 2016. On the one hand, the policy package has contributed to compressing bond yields inside the euro area. The associated yield differential with respect to economies outside the euro area has made it less attractive for foreign investors to hold euro area sovereign bonds. Hence, the policy package explains part of the reduction in EU cross-border holdings of debt securities by non-residents. On the other hand, the ECB Asset Purchase Programme launched at the beginning of 2015 helps to explain the much-less-pronounced recovery in debt inflows in the periphery compared to the previous episode. To the extent that the sales of government bonds to the ECB are mostly driven by foreign investors (ECB, 2017b), they enter as negative inflows. Overall, the recent policy packages launched by the ECB partly explain why, in net terms, since the beginning of 2015 foreign investors have been neither large sellers nor large buyers of euro area securities overall, while at the same time they have been sellers of euro area bonds and large buyers of euro area equity (Coeuré, 2017).

Figure 9 Other investment average gross flows (% of GDP, four-quarter moving sum)

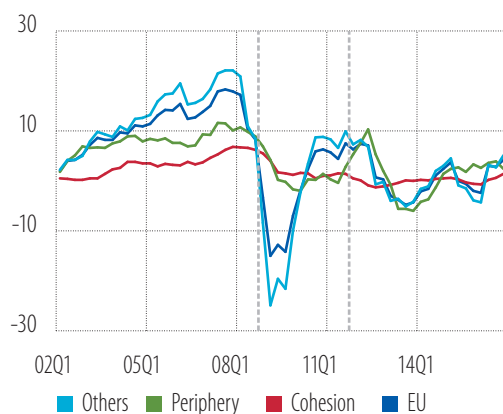
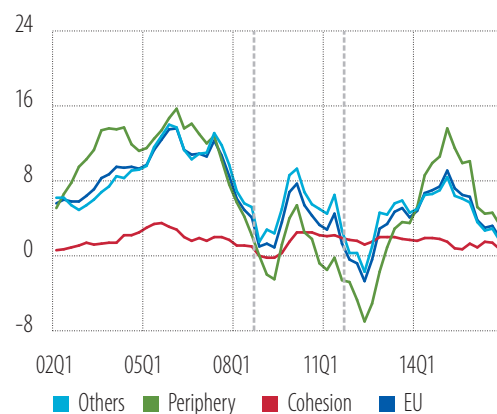


Figure 10 Portfolio investment average gross flows (% of GDP, four-quarter moving sum)



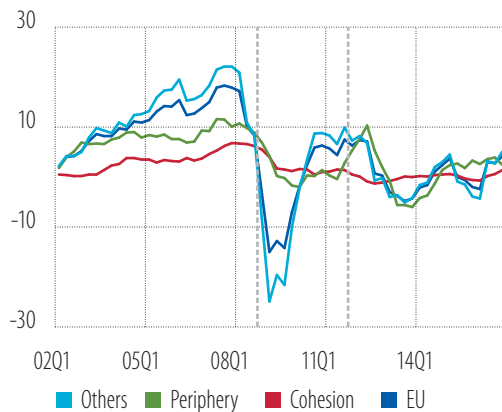
Source: ECON calculations based on IMF.

Note: The dotted lines mark the start of the two most recent financial crises, the Lehman bankruptcy and the sovereign debt crisis.

Stronger rebound in direct investment except in the cohesion economies

Compared to other categories, FDI flows were fairly resilient during the crisis. Also, both FDI inflows and outflows from other countries have developed at a relatively stronger pace compared to the previous recovery. The cohesion group remains the exception here, although for these economies it can be argued that in the wake of the enlargement, FDI was catching up at an abnormally strong pace and therefore should not be considered as a benchmark.

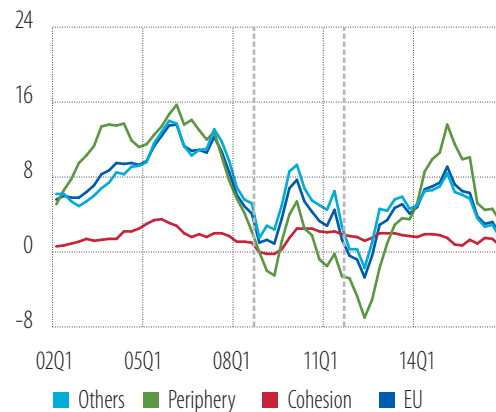
Figure 11 Foreign direct investment average gross flows (% of GDP, four-quarter moving sum)



Source: ECON calculations based on IMF.

Note: The dotted lines mark the start of the two most recent financial crises, the Lehman bankruptcy and the sovereign debt crisis.

Figure 12 Foreign direct investment net flows (% of GDP, four-quarter moving sum)



Source: ECON calculations based on IMF.

Note: Net flows are equal to the difference between outflows and inflows. Hence, a positive (negative) figure indicates net outward (inward) investments.

Recent years have resulted in changes to the composition of capital flows. The consequences of these changes for the financing of investment are not clear at this stage. On the one hand, the decline in other investment, driven by banking flows, corresponds to a simple normalisation after “exuberant” times in the pre-crisis period, during which part of local savings deposited in banks were exported and used to finance asset price bubbles. On the other hand, in the absence of properly integrated financial markets and in the diverse legal environment characterising EU countries, the intermediary role of banks in allocating savings across borders is crucial. Banks have expertise in collecting savings, making cross-border transactions and monitoring investment projects. In the EU, they are the first collectors of private savings and the first providers of credit.⁹ One risk is that the vacuum created by banks’ retrenchment might not be filled by other types of financial institutions, at least in the short to medium terms.

⁹ Again, given data limitations, it is impossible to separate the EU component from that of the rest of the world (see footnote 6). The view taken is that this reflects mostly an EU phenomenon.

Implications for the international investment position of the EU and its groups of countries

International investment positions show the rebalancing in terms of stocks from the cohesion and periphery towards the other economies and a shift towards equity. Developments in international investment positions have attracted more attention since the start of the crisis.¹⁰ They can serve as an additional indicator of dependencies and potential contagion channels, all the more so since positions have grown considerably over past decades. Accordingly, in the EU they are included in the regular assessment of macroeconomic imbalances conducted by the European Commission (2011).

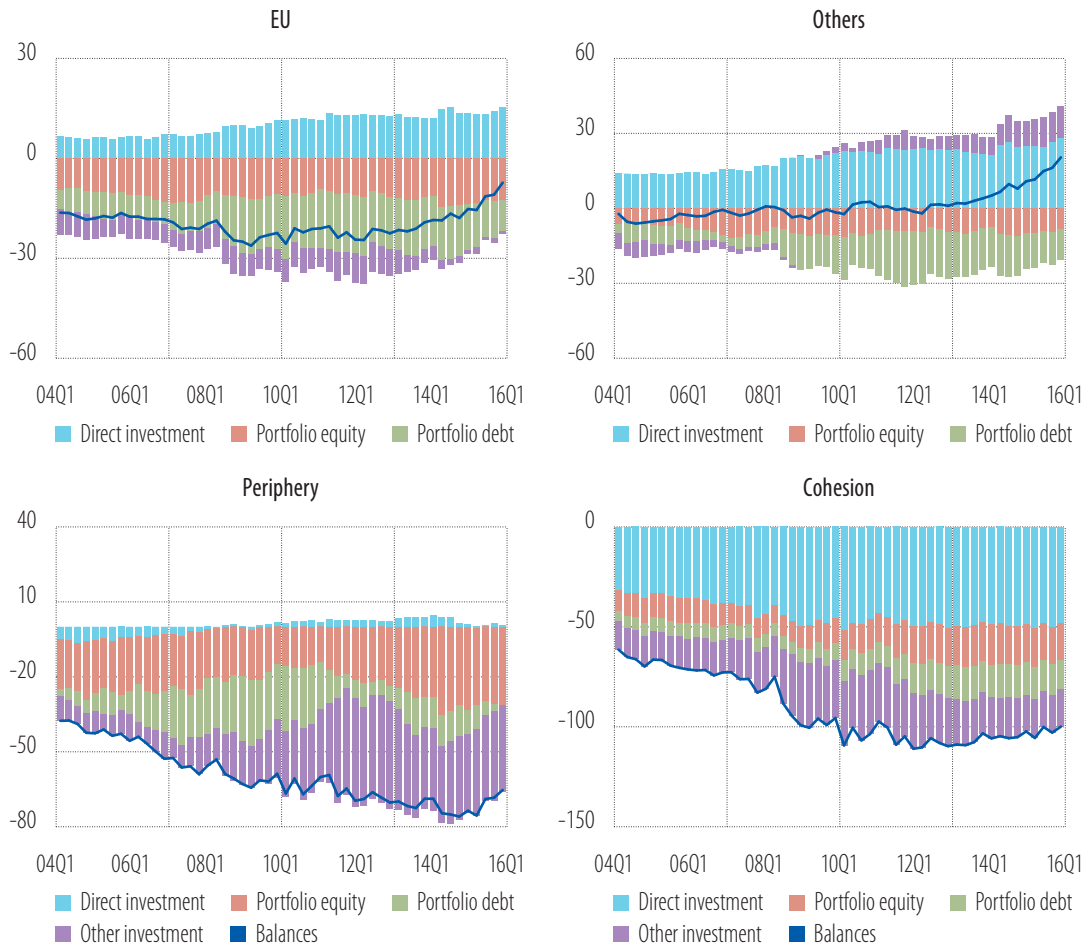
The evolution of the stocks of external assets and liabilities shows that the slowdown in gross flows since the crisis was accompanied by a reduction in the magnitude of the net positions for cohesion and periphery economies together with an increase in the net external position of the other economies. In terms of composition, there is some evidence of a shift from less debt and bank credit towards more equity:

- **The EU net negative position is lower.** On balance, at the end of 2016 the EU had a marginally negative net foreign assets position, being a net debtor towards the rest of the world.¹¹ The deficit vis-à-vis the rest of the world has been shrinking since 2014 (Figure 13). Looking at the two sides of the balance sheet, it appears that since 2012, the reduction in net indebtedness reflects an increase in external assets more than external liabilities. This has mostly reflected the evolution of cross-border flows of debt securities as well as FDI. The net external liability in other investment also declined over the period and, at the end of 2016, the position in other investment was almost balanced.
- **The net investment position differs across groups of countries.** The other economies increased their net asset position from an almost balanced position in 2004 to a net asset position close to 20% of GDP in 2016. This reflected increases in (net) stocks of FDI and other investment partly offset by increases in net liabilities of portfolio debt.¹² The increasingly negative net portfolio position recorded from 2009 until 2013 reflected the “safe haven” effect, which in this case refers to the diversion of portfolio investment from the periphery to countries perceived as safer during the sovereign debt crisis. From 2004 until 2016, the increase in net other investment was accompanied by a reduction of both asset and liability positions. This reflected the shrinking of international bank operations, the general reduction in cross-border activities, and the deleveraging of external assets for regulatory reasons but also out of risk considerations. From 2004 until 2014, the periphery economies increased their net indebtedness by around 50% of GDP. More recently, however, their net indebtedness declined (by around 15% of GDP from the beginning of 2015 until the end of 2016). This mostly reflected a reduction of net portfolio liability, and in 2016, in terms of portfolio debt, the position of periphery economies was balanced. During the same period, from the beginning of 2015 until the end of 2016, the net negative position in equity and FDI remained relatively balanced for periphery economies. Cohesion economies also reduced an increasingly negative liability position from 2004 until 2010, but have had a stable position since then.

¹⁰ The international investment position is an economy's financial statement, compiled at a specified date (such as by the end of the year or the end of the quarter). It shows the value and composition of the economy's positions in external assets and liabilities with the rest of the world. When external assets exceed liabilities, the net international investment position is positive, and when liabilities exceed assets it is negative. A change in the international investment position reflects the net flows recorded in the financial accounts. The position can be measured in gross or net terms.

¹¹ The net position is computed as the sum of net assets minus the sum of net liabilities. The computation excludes external reserves and assumes that intra-positions cancel out. In practice, errors and omissions are substantial. It should be noted that there has been considerable discussion about the quality of international investment position statistics and the presence of data gaps in assets due to underreporting of assets held in offshore financial centres. Some researchers have raised doubts about the net negative international investment position of the EU (Zucman, 2013).

¹² It should be noted that over the last couple of years, debt portfolios have been subject to a massive positive valuation effect associated with the decline in yields. This could explain part of the increase in net liability of debt if the gross international investment position of foreigners is more tilted towards debt than the position of residents abroad.

Figure 13 Net international investment position (% of GDP, four-quarter moving sum)

Source: ECON calculations based on IMF.

Multiple factors need to be taken into account in interpreting the persistence of large imbalances. On the one hand, from a financial stability perspective, long-term negative international investment positions – absolute and relative to GDP – can be a source of concern.¹³ However, most EU Member States show fairly persistent net positions over a longer period, being either net lenders or borrowers over the period since 2003.¹⁴ However, since the crisis, for many of the economies in the periphery and cohesion groups, which often have both long-standing and pronounced negative net international investment positions, the trend seems to suggest a slow reduction in net balances – that is, still (strongly) negative on balance but (somewhat) less negative than during the peak of the financial crisis. On the other hand, cross-border financial flows are beneficial to both the country exporting capital and the recipient country: as a result of the gap in the productivity of capital between the two countries, the flows contribute to equating returns on investment across economies. In Europe, cross-border capital flows are especially important, as differences in standards of living across Member States are substantial and international labour mobility is relatively low. In the euro area, cross-border financial flows are even more important, although productivity differentials are less elevated. This is because, in the absence of

¹³ A proper assessment of financial stability risk requires evaluation of the potential contagion effects through network analysis. See Heipertz et al. (2017).

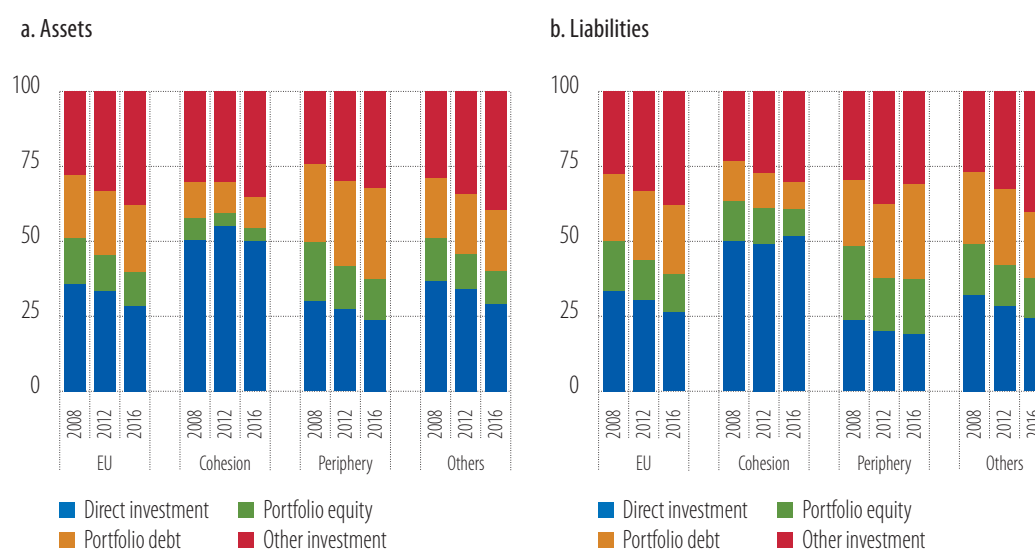
¹⁴ Sweden and Austria are two exceptions, as these countries became net borrowers over the period.

changes in exchange rates, the bulk of the adjustment following asymmetric shocks relies on inflation differential and capital mobility. Prior to the crisis, the rapid expansion of intra-EU cross-border capital flows was seen as a success factor behind European integration. Looking forward, the reduction in outflows from other economies to the periphery and cohesion economies is likely to slow the convergence process within Europe.

Towards higher-quality capital flows? A shift from debt to equity

Shifts can be observed in the composition of countries' investment positions (gross) in recent years (Figure 14).¹⁵ In the other economies and periphery groups, the other investment category used to account for slightly less than 50% and 40%, respectively, before the crisis.¹⁶ In 2016, they made up shares that were smaller by 8 and 10 percentage points, respectively. Conversely, the share of FDI substantially increased. The trend in cohesion economies is different, however, as the decline in the share of other investment was not matched by an increase in the share of FDI flows, but rather mostly reflected a shift towards portfolio investment. Within the portfolio category, the different paths described above have also led to a considerable reallocation. Before the crisis, portfolio debt used to be about twice the size of equity flows in the other economies and periphery groups, while they are now approaching roughly equal magnitudes in the former and opposite proportions in the latter. In contrast, in cohesion economies portfolio debt surpassed equity flows after the crisis.

Figure 14 The changing composition of gross international investment positions (%)



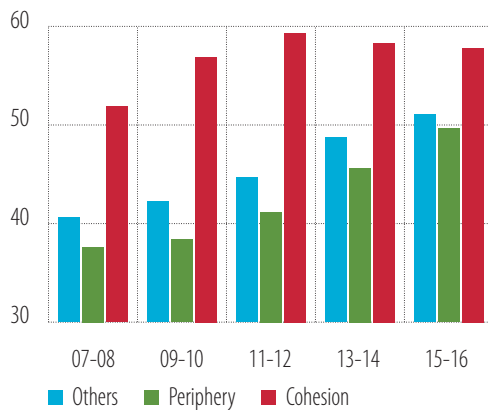
Source: EIB/ECON computations based on IMF.

To some extent, the breakdown between FDI and equity is arbitrary, and one should look at the sum.¹⁷ Summing the two components to get a more robust assessment, the conclusion is confirmed, with the increase being even more pronounced (Figure 15).

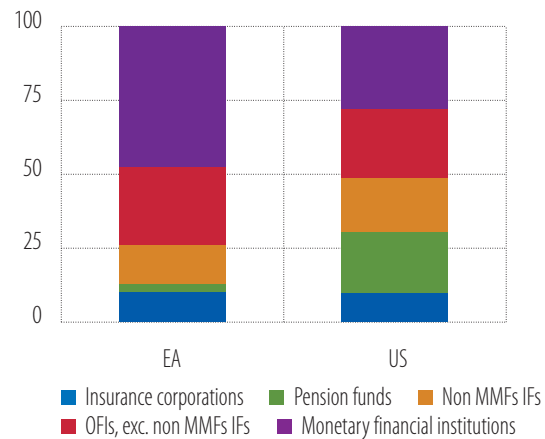
¹⁵ See Lane and Milesi-Ferretti (2017) for global trends.

¹⁶ Considering the average of assets and liabilities.

¹⁷ If the investor assumes control (usually a share in the capital of more than 10%), the investment is classified as FDI. If the investor acquires less than 10% of the capital, the investment is classified as portfolio investment.

Figure 15 Share of equity in foreign assets (% of external assets, average over two years)

Source: ECON calculations.
Note: Sum of foreign direct investment and portfolio outflows of equity.

Figure 16 Composition of the financial sector (% of total assets)

Source: ECON calculations based on OECD.
Note: Non-consolidated financial balance sheets by economic sector, average over 2013-16. OFIs stands for other financial institutions, IFs for investment funds and MMFs for money market funds.

More analysis is needed to investigate who is bearing the risks. The general trends that can be observed in terms of lower flows and shifts in composition potentially have a number of implications from a financial stability perspective and in terms of the financing of investment in Europe. However, as balance of payment figures are highly aggregated, they need to be complemented with further information (for example, directional statistics or figures on who holds claims) to assess potential risks. Indeed, several empirical analyses suggest the need to examine disaggregated data by type of investment as well as by sector (Heipertz et al., 2017). However, such data are not available over a long time span.

In addition, the relatively greater importance of FDI warrants a closer look. On the one hand, FDI is traditionally perceived as a more stable source of financing and associated with other benefits such as technology transfers or improvements in corporate governance. On the other, FDI activities are influenced by factors such as taxation and corporate organisation (Blanchard and Acalin, 2016; Koroknai and Lenart-Odorán, 2011). These factors blur the causes behind the FDI flows recorded and make it difficult to properly interpret their effects for financial stability and the real economy.¹⁸

Measuring integration in the EU financial system

Some attempts have been made to develop a fully-fledged view of the degree of integration of the European financial system. Given the system's multifaceted structure, it is very difficult to reach comprehensive agreement, as the various sectors can move in different and sometimes opposite directions (Valiante, 2016). This section first analyses statistics characterising two major actors in the EU financial system for which a geographical breakdown of investment is available over a relatively long

¹⁸ Since 2012, the Organisation for Economic Co-operation and Development has decomposed FDI statistics to distinguish the two sources of FDI, those recorded for fiscal reasons and those for economic reasons.

period of time: banks and investment funds. We then show how difficult it is to infer a conclusion on the drivers of the observed trends in a partial framework. The section then tries to assemble most of the information available and build a synthetic indicator to provide an agnostic and balanced measure of the evolution of financial integration in the EU. The indicator is then shown to be correlated with estimates of the degree of risk-sharing as well as with the share of intra-EU exchanges in total external trade.

An illustration based on the geographical asset composition of major euro area investors

How much integration is reflected in the composition of assets of major financial sector players? A first attempt to illustrate the changes in the degree of integration of the EU financial system can be provided by looking at the geographical composition of assets invested by its main types of institutions. However, despite a lot of work conducted since the crisis (Financial Stability Board, 2016), data are difficult to obtain on a consistent basis, and when available, those data are difficult to interpret without access to granular information. More generally, within components of the financial system, availability of both consolidated and non-consolidated data is critical to gain a better understanding.

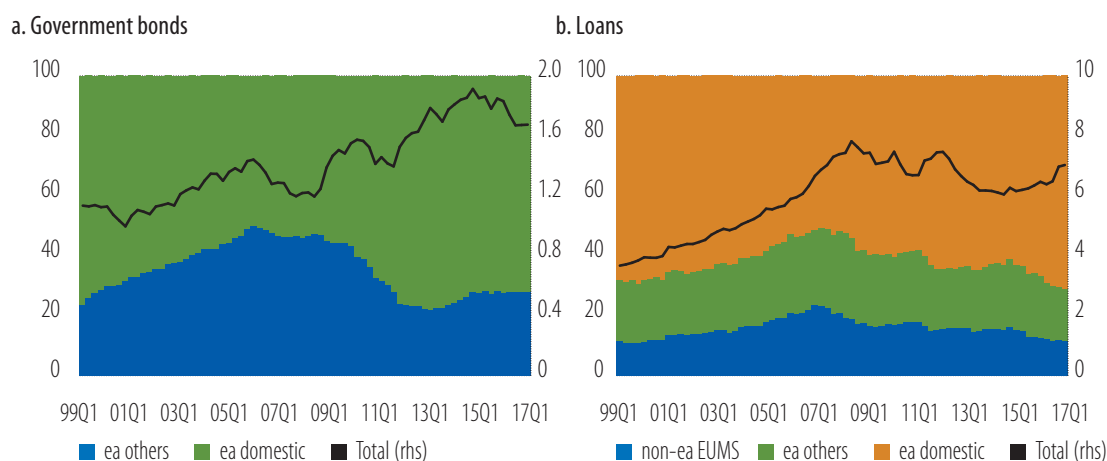
Banks and asset mutual funds represent some 85% of the assets held by the euro area financial sector (ECB, 2016b). A bird's-eye view of the EU financial system can be provided by data from the Organisation for Economic Co-operation and Development (OECD) that show the total liabilities of the major sub-components of the financial system. Figure 16 shows that in the EU, in non-consolidated terms, banks and investment funds account for around two-thirds of the assets managed by the financial sector. Looking at the geographical breakdown of their investments, available in official statistics for the euro area, can therefore provide relevant information on financial integration.

Banks have retrenched from foreign holdings and directed their investments more towards domestic assets. Starting with banks, Figure 17 shows on the left-hand side that government bond holdings became more and more tilted towards local government in the wake of the Lehman crisis. They have not returned to their pre-crisis geographical composition since then and, indeed, the tepid recovery was interrupted by the sovereign debt crisis. These statistics have nonetheless become more difficult to interpret since the start of the ECB's Asset Purchase Programme, a period associated with a decline in the stock of government bonds held by banks. Under the programme, it is indeed likely that banks dispose first of non-domestic government bond securities to the central bank, therefore preventing their share from returning to its pre-crisis value despite the normalisation of the government bond market. In fact, the composition has plateaued since the beginning of 2015, the start of the Asset Purchase Programme.

The picture that emerges from the geographical breakdown of loans is also difficult to interpret (Figure 17, right-hand side). Since the beginning of 2008, it is clear that the share of domestic loans has increased continuously. By the middle of 2017 it reached a rate above that at the start of 2000. While this resulted from a decline in loans both in other euro area countries and non-euro area EU Member States, the decline was more pronounced for the latter. At first view, the fact that the share of domestic loans at the end of the sample is above that at the beginning suggests that the integration of lending activity since the end of the 1990s has been reversed.

However, the retrenchment of loan activity towards the domestic market can result from several factors. On the demand side, this may reflect better demand conditions in the two major euro area economies that recorded higher domestic loan growth. On the supply side, the increased concentration on the domestic market could reflect banks' cross-border deleveraging, partly as a reaction to regulatory pressures. In this regard, the establishment of the Single Supervisory Mechanism in the euro area may ultimately provide an incentive for banks not only to reduce their activities in non-euro area jurisdictions but also to foster activities outside of their home market inside the euro area.

Figure 17 Geographical breakdown of the main assets held by euro area banks
(%, left-hand scale; total in trillions of euros, right-hand scale)



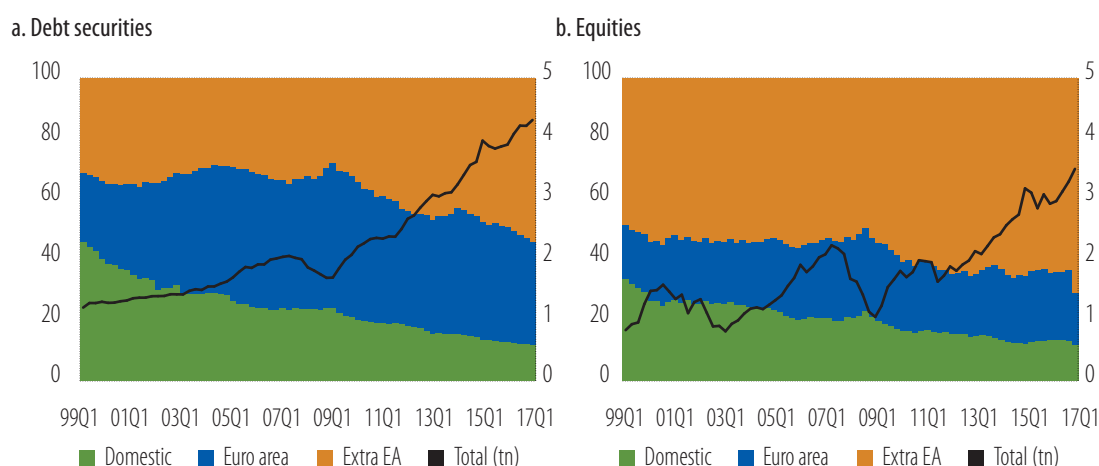
Source: EIB/ECON based on ECB.

Note: Data up to 2017:Q2. Non-ea EUMS refers to non-euro area EU Member States.

For investment funds, there was a switch towards non-EU debt and equity. As shown in Figure 18, investment funds are also a major component of the euro area financial system, with a balance sheet of around 100% of GDP in 2016. The geographical breakdown of their investment shows increasing investment towards non-euro area assets, both for debt and equities (Figure 18). Equity holdings have more than tripled since the Lehman crisis, an increase that was stronger than that recorded for debt securities. The change in the geographical composition is remarkable and comparable to that of debt: a lower share of domestic equities, and a moderate increase in the share of other euro area equities up to the Lehman crisis. Thereafter, this was followed by stabilisation in the share of euro area equities and a continuation of the decline in the share of domestic equities, offset by an increase in the share of non-euro area equities (Figure 18).

Since the breakdown between EU and non-EU assets is not available, non-euro area investments include assets originated in non-euro area EU Member States and outside the EU. Increased investments in assets originated outside the EU could be a sign of increased fragmentation, but could also reflect the necessity to reinvest the current account surpluses outside the EU. The fact that the share of the assets held outside the euro area increased mostly after 2009 would support this interpretation, as the EU has been recording a current account surplus since then. At the same time, the share of domestic assets in the total declined. Overall, investment fund statistics suggest important changes in the investment structure, both geographically and by type of securities. However, without more detailed statistics, it is difficult to draw any conclusions from the geographical breakdown for the degree of financial integration in the EU.

Figure 18 Geographical breakdown of the main assets held by euro area investment funds (% , left-hand scale; total in trillions of euros, right-hand scale)



Source: EIB/ECON based on ECB.

Note: Change in the statistical collection in 2008. The statistics are back-cast with the series collected previously on a non-harmonised basis. Data up to 2017:Q1.

Building a synthetic indicator of financial integration from a wide range of variables

The synthetic indicator of financial integration shows both price and quantity components. Considering a large set of indicators simultaneously can help estimate a robust measure of the common component, the composite indicator of financial integration (ECB, 2016a). We develop such an indicator, which makes it possible to measure the degree of integration in Europe by capturing the evolution in four different components of financial markets: banking, equity, money, and bonds. The methodology is similar to that put forward by Hoffmann, Kremer and Zaharia (2012), which is briefly reviewed in Box 1. We consider two indicators for each component: a quantity-based indicator and a price-based indicator, which can then be aggregated using unweighted sums, as done by the ECB. As a cross-check, we also implement an approach based on principal common analysis to extract the common component of the large dataset (Bai, 2003).

The quantity-based indicator goes back to the degree of integration at the start of the previous recovery. Figure 19 shows the estimated level of EU financial integration based on the two methodologies. Overall, the results obtained for the price-based, quantity-based and composite indicators are very similar to those obtained by the ECB for the euro area only (ECB, 2017a). They suggest that the EU is recovering from a lower degree of financial integration after the dual shocks caused by the Lehman bankruptcy and the sovereign debt crisis. For the quantity-based and composite indicator of financial integration, the levels at the beginning of 2016 are comparable to those prior to the previous upturn in 2005. In contrast, the level of the price-based composite indicator is still below the level reached in 2000, when the euro was introduced.

Box 1 Building a financial integration indicator for the EU financial system

The analysis conducted in the main text shows how difficult it is to construct a methodology to examine the degree of integration even in the very specific partial cases surveyed. This box develops a synthetic indicator of financial integration that simultaneously considers two dimensions: quantities and prices. The indicator also includes, when available, a series on the non-euro area EU economies. However, the statistical coverage for these countries is much less developed.

The quantity-based indicator is based on the share of intra-euro area, cross-border holdings in the total amount of holdings for 11 countries (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain) over the four markets (banks, corporate bonds, loans and government bonds). As a result, we used 44 raw indicators, the share of cross-border holdings, to estimate the quantity-based indicator. Given that the series are also shares, they range from zero to one and can be treated symmetrically.

In contrast, the estimation of the price-based financial indicator is based on manipulations specific to the market considered. For the banking market, we compute the standard deviation of the banking interest rates of the loans to households and businesses for nine countries (the countries listed above minus Belgium and Italy). The procedure with the bond market is the same, based on 10-year government bond yields for 12 countries (Germany, Spain, France, Greece, Ireland, Italy, the Netherlands, Austria, Portugal, Sweden, Switzerland and the United Kingdom). Regarding the equity sub-index, we compute the standard deviation of the valuation ratios based on the price-to-book ratio of the financial corporations and non-financial firms for 14 countries (Germany, France, Italy, Spain, Belgium, the Netherlands, Austria, Portugal, the United Kingdom, Sweden, Denmark, Poland, the Czech Republic, Slovakia and Hungary). Overall, we obtain 58 raw indicators for the price-based indicator. In order to synthesize them, we apply an empirical distribution function to get a uniform distribution ranging between [0,1]:

$$F_T(x) = \begin{cases} 0 & \text{for } x < x_{[1]} \\ \frac{r}{n} & \text{for } x_{[r]} \leq x < x_{[r+1]}, \quad r = 1, 2, \dots, T-1 \\ 1 & \text{for } x \geq x_{[T]} \end{cases}$$

For the price-based indicator, since we used standard deviations, the higher the value of the standard deviation, the less markets are integrated. However, we want the opposite in order to compare all the indicators; so we subsequently applied $1 - F_T(x)$.

Perfect integration exists only in theory, which is why we applied a scaling factor to all 102 price- and quantity-based indicators:

$$\Theta^q(x) = \frac{\max(x) - \min(x)}{\max(x) - BM_t^q} = \frac{\max(x) - \min(x)}{\max(x)},$$

and

$$\Theta^p(x) = \frac{\max(x)}{BM_t^p}.$$

Finally, we obtained the following new indicators:

$$z^p = (1 - F(x)) \Theta^p(x),$$

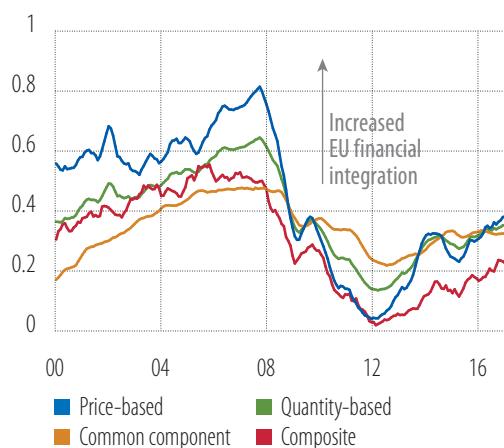
and

$$z^q = F(x) \Theta^p(x).$$

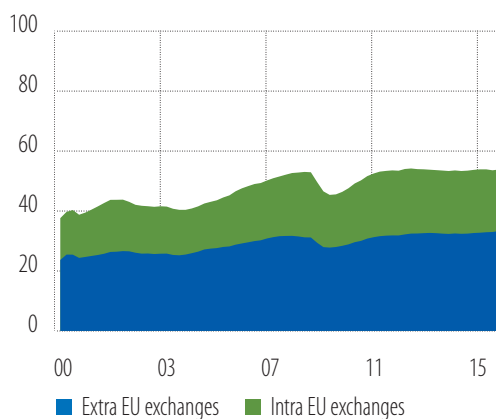
The final indicators are computed taking the weighted average of all the sub-indices for both quantity (17% money, 36% bond, 15% equity and 32% banking) and price (54% bond, 23% equity, and 23% banking). The results for the price-based and quantity-based indicators are plotted in Figure 19 in the main text. The composite fragmentation indicator is an average of these two indicators.

Hence, the Lehman bankruptcy and the sovereign debt crisis had a large impact on the degree of financial integration in Europe, and, to some extent, their effect is ongoing. Indeed, these two shocks tend to increase the dispersion of cross-country asset returns, particularly in the equity market. Since the beginning of the recovery, the spreads within the EU have compressed, but remain above their pre-euro level, reflecting to some extent more awareness about the specific risk of each asset. The years from 2003 until 2007 appear to have been a period of increased integration for both the price and quantity indicators. This is reflected in the unweighted average. At the start of 2017, the level of financial integration was still 15 percentage points below the pre-crisis level for the quantity-based indicator and 30 percentage points below the pre-crisis level for the price-based indicator (Figure 19). However, the price-based indicator tends to display a more pronounced cyclical component, especially in the years prior to the crisis. This may overestimate the structural component that is assimilated as the integration indicator. Indeed, during this period, the business cycle was favourable in Europe. This contributed to reducing risk premia and therefore to raising the convergence between financial prices.

Therefore, we also implement an approach that is agnostic regarding the weighting of the price and quantity indicators. We apply a Principal Component Analysis (PCA) to the entire dataset comprised of the 102 series. The results of the PCA appear to be less cyclical and smoother, since the level of integration does not increase so much prior to the Lehman crisis, does not decline so much during the crises, and recovers more moderately after the end of 2013. Interestingly as well, the indicator stagnates at the end of the period, while the unweighted indicator increases. The common component indicator shows that the EU financial system reintegrates, although the pre-crisis level has not been reached yet.

Figure 19 Estimated financial integration indicator (monthly, indicator bound between 0 and 1)

Source: EIB/ECON based on EC/AMECO.
Note: See Box 1. Data up to March 2017.

Figure 20 EU current account flows (% of GDP, credits, four-quarter moving average)

Source: EIB/ECON based on Eurostat.
Note: Data up to 2016:Q4.

Risk-sharing and fragmentation indicator

Changes in the degree of financial integration have a bearing on the real economy in terms of risk-sharing. Indeed, theory predicts that in complete and perfect financial markets there is perfect risk-sharing.¹⁹ In each country, consumption growth should depend on world consumption growth and be unaffected by specific domestic factors. In general, the tests of this proposition, in various forms, have led to the rejection of market completeness. Given this result, a weaker theoretical form has been tested: the greater the integration, the lower the dependence of domestic consumption on domestic income. For instance, Becker and Hoffmann (2006) find that an increase in financial integration is associated with lower consumption growth volatility and lower volatility of consumption over GDP.

Hence, financial integration and risk-sharing are linked: if financial markets are not integrated in the EU, the level of risk-sharing across countries is low and thus asymmetric shocks across EU countries are not absorbed. We test this proposition by projecting two indicators of risk-sharing on the financial integration indicator estimated above (Box 2).

¹⁹ The Arrow-Debreu one-good benchmark model of consumers with an identical Constant Relative Risk Aversion utility function.

Box 2 The financial integration indicator and risk-sharing

This box examines the correlation between the financial integration indicator detailed in Box 1 and indicators of risk-sharing intensity. First, we use the estimated elasticity of domestic consumption to domestic production. Second, we use the share of intra-EU external trade in GDP. The results are reported in Table 2 in the main text.

The first step estimates the degree of risk-sharing using the elasticity of private domestic consumption to domestic production. Equation (1) is estimated for a panel of EU economies:

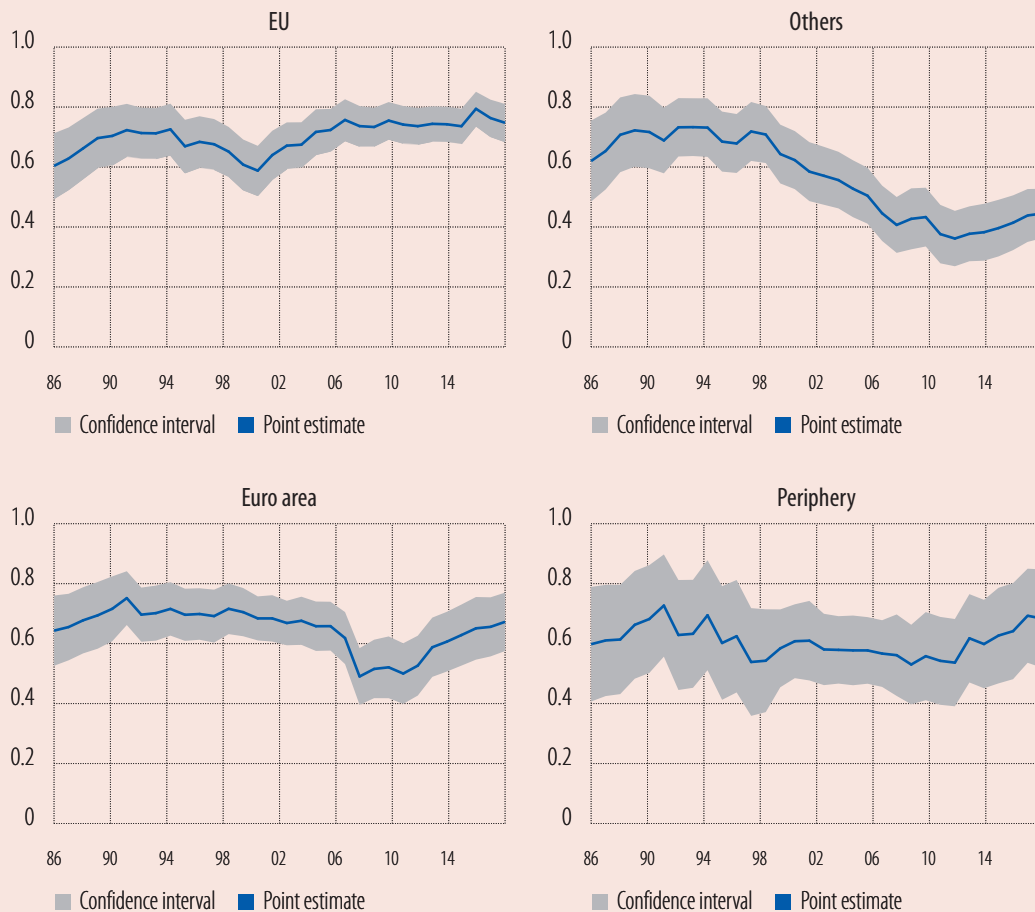
$$\Delta c_{i,t} = \mu_i + \beta \Delta y_{i,t} + \gamma \Delta c_{EU,t} + \gamma_P (\Delta p_{EU,t}) + \varepsilon_{i,t}, \quad (1)$$

where C denotes private consumption, Y nominal GDP and P the price level. The country is denoted by i and EU denotes the EU as a whole. Subscript letters denote the log of these variables, so that the equation refers to the annual growth rate. Under perfect risk-sharing, β is null and γ is one. The higher the slope, γ , the higher the distance to perfect integration and the lower the level of risk-sharing (Asdrubali and Kim, 2008).

Equation (1) is estimated over a rolling window of 16 years starting from 1970 and ending in 2017 (the last year is based on the European Commission's 2017 spring forecast). The equation is estimated using generalised least squares with a correction from cross-section correlation. The results are reported in Figure 1 for the entire EU, the other economies group, the euro area and the periphery economies. Given the very short time span over which the equation could be estimated for cohesion economies (four years), the results are not reported for this group.

For each group of countries considered, consumption elasticity to GDP growth is significantly above zero during the entire period. Interestingly, the coefficients tend to evolve differently across two periods. First, from the late 1980s to the Lehman crisis, they decline by around 30 basis points in the other economies, 20 basis points in the euro area, and less than 10 basis points in periphery economies. Thereafter, from post-Lehman to the end of the period, they tend to increase moderately for other economies, and more strongly for the euro area, possibly reflecting what happens in periphery economies that belong to the euro area. For periphery economies, the coefficient at the end of the sample stands around the value at the beginning of the 1990s. As with many other partial analyses developed in this chapter, this analysis suggests that European integration is imperfect and that the degree of integration is evolving. The findings are also common to a wider strand of the empirical literature covering developed economies (Asdrubali and Kim, 2008; Rangvid, Santa-Clara and Schmelling, 2017). The most recent studies show that in the aftermath of the financial crisis, there has been a partial reversal towards less integration in Europe.

Figure 1 Consumption elasticity to GDP growth in the EU and groups of countries (annual, % of GDP)



Source: EIB/ECON based on EC/AMECO.

Note: The Figure shows a coefficient of the cross-section projection of the annual change in private consumption on annual GDP growth, EU annual private consumption growth, inflation differential, a constant, and an autoregressive term (see equation 1). The equation is estimated with generalised least squares with a correction from cross-section correlation. A rolling window of 16 years is used. The data are in national currency divided by population per capita. The band reports the centred 95% interval surrounding the point estimates. Data are up to 2017 based on the European Commission's 2017 spring forecast. The results obtained for a specification without autoregressive term with least-squares are very similar.

The second step shows that greater financial integration, a decline in the consumption elasticity to GDP, leads to greater risk-sharing. We regress the consumption risk-sharing estimated above on the financial integration indicator as follows:

$$\text{Risk Sharing}_t = \alpha + \beta \cdot \text{Financial Integration}_{t-k} + \varepsilon_t, \quad (2)$$

where Risk sharing_t is the coefficient of the regression of GDP growth on consumption growth as estimated in equation (1). The greater the dependency of a country's GDP growth on consumption growth, the less it is correlated with other countries' consumption and thus the lower the risk-sharing and the higher the coefficient. Risk-sharing may not react contemporaneously to the

evolution of financial integration, and equation (2) is a static relationship of a process that can be delayed and involve lagged adjustment. To consider this possibility, we also estimate dynamic specifications with one-, two- and three-year lags.

In parallel to the estimation of the relation estimated with consumption elasticity to GDP, we also estimate the relation between the financial integration index and the share in GDP of intra-area exchanges of goods and services in the euro area and the EU:

$$\frac{\text{IntraCA}}{\text{GDP}} = \alpha + \beta \text{Financial Integrator}_{t-k} + \varepsilon_t. \quad (3)$$

The estimated breakdown of EU current account flows into intra and extra flows is plotted in Figure 20 in the main text.²⁰

²⁰ Those flows are constructed as the difference between the sum of the debits and credits of all the countries belonging to the EU and the average of the sum of the debits and credits of the economies belonging to the EU, as reported by Eurostat. Given the statistics available, such a breakdown is feasible for the EU and the euro area only, but not for the groups of countries considered throughout the report (other, periphery and cohesion economies).

We find evidence supporting the hypothesis that greater financial integration leads to greater risk-sharing (Table 2). In the euro area, the other economies and periphery economies, an increase in the financial integration indicator is associated with a decline in the sensitivity of domestic consumption to GDP and thus with an increase in risk-sharing intensity. The significance of the coefficients on the regressions with lags indicates that increased integration takes time to materialise in risk-sharing increases. The response of the risk-sharing to market integration with a three-year lag is broadly better than without any lag (more or less a coefficient of two). This suggests that the shared relationship is more of a long-term nature.

Table 2 Co-movements between risk-sharing measures and financial integration

	OLS without lag		1-year lag		2-year lag		3-year lag	
Results with the sensitivity of domestic consumption reaction to domestic production (EQ. 4)								
EA	-0.33	9	-0.59	32	-0.79	53	-0.88	67
	[24.91]		[22.60]***		[18.96]***		[16.62]***	
Others	-0.26	11	-0.35	24	-0.41	43	-0.47	63
	[18.01]		[15.48]**		[12.29]***		[16.62]***	
Periphery	-0.19	10	-0.3	25	-0.36	36	-0.38	37
	[13.66]		[12.85]**		[12.26]***		[12.63]***	
Results with the share of intra-EU exchanges (EQ. 5)								
EU	0.07	6.7	0.08	11.7	0.08	14.1	0.11	26.1
	[2.96]**		[2.72]***		[2.58]***		[2.42]***	
EA	0.03	4.8	0.04	10.0	0.04	13.5	0.06	25.9
	[1.54]*		[1.45]***		[1.42]***		[13.46]***	

Source: EIB/ECON based on EC/AMECO.

Note: See equations (2) and (3) in Box 2. EA: euro area; EU: European Union; OLS: ordinary least squares.

The results using the current account flows also suggest that intra-euro area exchanges as a percentage of GDP co-moves with financial integration. Historically, real and financial integration appear to move in tandem. The higher the integration level, the higher the share of external trade transactions within both the euro area and the EU. The time lag effect is similar to the results obtained for consumption: the impact of market integration on the intra-euro area exchanges is more significant after a three-year lag. Again, this suggests that, beyond short-term volatility, financial integration and trade integration tend to co-move in the long run.

Evolution of the shock absorption capacity within the EU

The previous section showed that risk-sharing and financial integration are limited in the EU and have declined somewhat since the crisis. The capacity of a group of countries to share risks and absorb idiosyncratic shocks relies upon several mechanisms, so it is worth developing a more structural analysis to assess each mechanism separately in order to better understand the spillovers inside the EU. This is especially important in Europe and, in particular, the euro area, given that, across members, the exchange rate is fixed and cannot play any role in the absorption process.

This section analyses the evolution of the three main types of risk-sharing mechanisms considered in the literature: cross-border capital flows or net factor income, international transfers and structural

funds, and domestic savings, both private and public. We extend the methodology initiated by Sorensen and Yosha (1998) and take into account possible interdependencies and lagged adjustment in the component of shock absorption (Asdrubali and Kim, 2008). Moreover, given that EU countries have faced asymmetric shocks in the wake of the sovereign debt crisis, we consider time-variation in the absorption mechanisms. We allow for changes in financial integration, and separately study the periphery and other economies groups (Box 3).

The literature confirms that risk-sharing within the EU is far from complete. The effectiveness of risk-sharing in the euro area and the EU is much lower than in existing federations like the US and Germany. In the euro area, 70% of GDP fluctuations are not smoothed, while in Germany and the US the shares of unsmoothed state-specific shocks are much lower. For Germany, they are estimated to have ranged between 14% prior to reunification and 39.5% after it (Hepp and Von Hagen, 2010). For the US, they are estimated to amount to 25% (Asdrubali, Sorensen and Yosha, 1996) and to have varied between 14% and 23% from 1998 to 2013 (Alcidi, D'Imperio and Thirion, 2017). It is also important to note that smoothing intensity and smoothing channels change across time. Indeed, over the last 20 years, the empirical literature has noted important changes in the US and Germany. For Germany, Hepp and von Hagen (2010) show that the shock absorption mechanisms have changed drastically since German reunification. Before, more than half of shocks were smoothed by the government sector, compared to 11% after reunification. Since then, the capital markets have provided more than 50% of the smoothing absorption capacity.

The empirical literature finds that risk absorption increased in the EU prior to the crisis and collapsed in its aftermath (Alcidi and Thirion, 2016; Alcidi, D'Imperio and Thirion, 2017). The literature also finds that savings, called the credit channel, provide the bulk of the shock absorption. This partly reflects the counter-cyclical fiscal policy stance.

Box 3 Estimating the evolution of the risk absorption capacity within the EU

This box follows Sorensen and Yosha (1998) to perform an accounting-based decomposition from GDP to consumption. The following equation is considered:

$$GDP = \frac{GDP}{NI} \frac{NI}{DNI} \frac{DNI}{(C+G)} (C+G), \quad (1)$$

where GDP is gross domestic product, NI is net national income, DNI is disposable income, C is private consumption, and G is public consumption. NI , net national income, is equal to GDP plus net factor income from abroad (gross national product) diminished by depreciation. DNI , net disposable income, is equal to net national income plus net transfers from abroad. Total consumption, the sum of private and public consumption, is net disposable income minus savings.

After dividing per capita, taking logs and first differences, multiplying both sides of equation (1) by $\Delta \log GDP$ in deviation from its mean, and removing the cross-sectional average from both sides, Sorensen and Yosha (1998) obtain a variance decomposition formula:

$$\begin{aligned} \text{var} \{ \Delta \log GDP \} = & \text{cov} \{ \Delta \log GDP - \Delta \log NI, \Delta \log GDP \} \\ & + \text{cov} \{ \Delta \log NI - \Delta \log DNI, \Delta \log GDP \} \\ & + \text{cov} \{ \Delta \log DNI - \Delta \log (C+G), \Delta \log GDP \} \\ & + \text{cov} \{ \Delta \log (C+G), \Delta \log GDP \}, \end{aligned} \quad (2)$$

where *Var* and *Cov* respectively denote variance and covariance. Dividing both terms of equation (2) by $\text{var} \{ \Delta \log GDP \}$, we obtain:

$$\beta_{\text{capital}} + \beta_{\text{fiscal}} + \beta_{\text{credit}} + \beta_{\text{unsmoothed}} = 1. \quad (3)$$

The coefficient β represents the slope of the regression of GDP on each of its components separately. It reflects the shares of the shocks smoothed by each channel: capital is comprised of depreciation and net factor income, fiscal consists of international transfers, and smoothing reflects private saving and domestic fiscal spending.²¹ The remainder, $1 - (\beta_{\text{capital}} + \beta_{\text{fiscal}} + \beta_{\text{credit}})$, is the unsmoothed part:

$$\begin{aligned} \Delta \log GDP - \Delta \log NI &= \mu_{\text{capital},t} + \beta_{\text{capital}} \Delta \log GDP + \varepsilon_{\text{capital},t} \\ \Delta \log NI - \Delta \log DNI &= \mu_{\text{fiscal},t} + \beta_{\text{fiscal}} \Delta \log GDP + \varepsilon_{\text{fiscal},t} \\ \Delta \log DNI - \Delta \log (C + G) &= \mu_{\text{credit},t} + \beta_{\text{credit}} \Delta \log GDP + \varepsilon_{\text{credit},t} \end{aligned} \quad (4)$$

where $\mu_{i,t}$ are time fixed effects. In the estimation, we add an AR(1) process in the error term to take into account the correlation between the data. Assuming there is no full risk-sharing, $\beta_{\text{unsmoothed}}$ is above zero and the coefficient measures the contribution of each channel.

In contrast to the literature (Alcidi and Thirion, 2016; Alcidi, D'Imperio and Thirion, 2017), we do not use a period dummy to consider possible changes in the regression or a country-specific dummy to allow for country diversity.²² Instead, we implement estimations of equation (4) over a rolling window of 24 years starting in 1970. Since risk absorption mechanisms are more of a structural nature, the length of the window is chosen to cover at least three business cycles (eight years is traditionally estimated as the upper bound of business cycles in Europe).

As shown by Asdrubali and Kim (2004), the estimation of risk-sharing using static equations misses the possibility of spillovers across channels and second-round effects through delayed adjustment. Therefore, we also implement a vector autoregression (VAR) analysis in which the channels are identified with a Choleski decomposition. The impulse response function represents the response of the channel to this shock. The intensity of the channel can be measured as the share of the response normalised after several years (four years in the results reported in estimations in Figure 21 in the main text). The VAR is estimated with two lags and using a flat prior implemented with Bayesian techniques. In the core text, we report the results obtained with both methodologies.

21 In some analyses, the capital channel is further decomposed into amortisation and net factor income. However, given that the statistical methodology is implemented to estimate depreciation, its share mechanically declines when GDP goes up and vice versa. Trying to estimate its contribution to risk absorption is therefore of limited interest.

22 As shown by Asdrubali, Sorensen and Yosha (1996), the panel regression with time fixed effects equals the weighted average of the coefficients of the year-by-year cross-sectional regression.

Figure 21 reports the contribution of each channel to shock absorption in other and periphery economies. Given the limited data availability, the analysis could not be carried out for cohesion countries.²³ For each group of countries, the results are very similar across the two methodologies and therefore appear to be robust.

Figure 21 Evolution of risk-absorption channels (%)



Source: EIB/ECON estimations based on EC/AMECO.

Note: Each component reflects the share of the shock absorbed by the channel. By construction, the estimated components add up to 100%. Estimations are based on annual data over a 24-year rolling backward-looking window. The upper panels report the results based on the univariate approach of Sorensen and Yosha (1998). The lower panels report the results based on the Asdrubali and Kim (2004) multivariate methodology.

23 Reducing the length of the estimation windows could have been an option, but given the sensitivity of the results to the length of the windows observed for the other groups of countries, this possibility was rejected.

Most of the shocks are not smoothed across countries, the proportion being even stronger in the periphery economies. In the other economies group, around half of the shocks are unsmoothed. Hence, risk absorption is estimated to be somewhat higher than generally found in the literature for the EU as a whole. This component changes only slightly: it declines by less than 10 percentage points from the beginning of the 2000s until the Lehman crisis, then increases by less than 5 percentage points before decreasing again towards the end of the period.

In periphery economies, the share of unsmoothed shocks ranges between 55% and 80%. Differently from the other economies, shock absorption has varied substantially since the end of the 1990s. It rose substantially up to the start of the Lehman crisis by 15 to 20 percentage points, then plateaued from then until the beginning of the sovereign debt crisis, declining by around 10 percentage points. It reached values above 60% during the sovereign debt crisis and has only declined very marginally since the end of the crisis.

The limited risk absorption capacity is mostly provided by the credit channel. In terms of components, most of the risk absorption capacity is provided by the credit channel, which integrates both fiscal and private saving behaviour (Furceri and Zdzienicka, 2015; Kalemli-Ozcan, Luttini and Sorensen, 2014; Allard et al., 2013). This channel is estimated to have strengthened substantially in other economies across the period. In periphery economies, the channel weakened significantly during the sovereign debt crisis and has recovered only moderately since then.

The weaker absorption capacity of the credit channel during the crisis is both a side effect of the adjustment programmes and a consequence of the adverse bank credit supply conditions. Furceri and Zdzienicka (2015) show that during the sovereign debt crisis, risk-sharing mechanisms were even less effective, as the banking crisis hampered the capacity of the private component of the credit channel to react. Credit provision dried up in certain countries during the crisis at precisely the moment when it was needed to smooth income shocks. This episode showed that the Banking Union can contribute to increasing the resilience of the credit channel and maintain shock absorption capacity in times of crisis.

In our analysis, this credit channel encompasses both the private and the public channel. However, the distinction matters, especially for periphery economies during the period of the sovereign debt crisis. Kalemli-Ozcan, Luttini and Sorensen (2014) show how, in the absence of other absorption mechanisms, the pro-cyclical fiscal adjustment reduced risk-sharing in Europe during the crisis. Prior to 2009, risk-sharing in the euro area was mainly due to pro-cyclical government savings, which turned negative in the second stage of the sovereign debt crisis when savings increased at the same time that GDP decreased. In the absence of Ricardian equivalence, the consumption smoothing of the private sector's behaviour did not fully upset that of the public sector, and the crisis lasted longer.

Given the low level of cross-border equity holdings, the capital channel plays a minor role. The capital channel absorbs up to 20% of the shocks (absorbing a higher share in the other economies than in the periphery). This suggests that cross-border holdings of equity are relatively more developed in other economies than in the periphery economies, as confirmed in Figure 15 earlier in the chapter. Indeed, during the crisis, the sovereigns in the periphery saw increased borrowing costs owing to rising risk premia. Given the limited equity ownership, this drove down net factor income flows, as high public debt repayments were made on foreign holdings. This resulted in a net outflow of capital income during the recession when the financing was required to continue supporting consumption. In turn, this reduced shock absorption and was reflected in the declining intensity of this channel compared to the beginning of the 2000s. However, together with the reduction in the net liability cross-border position in debt holdings, the post-crisis increase in the net liability cross-border position in equity holdings (Figure 13) should strengthen the intensity of the capital channel in the periphery economies.

Finally, as expected given the relatively limited share of international transfers in the other economies and the periphery, the fiscal channel plays almost no role. In the EU, the size of international transfers, which also contain structural funds, is not substantial enough to play an important role, possibly apart from in cohesion economies. Even in this case, the transfers are not of a cyclical nature. Hence savings provided the bulk of the adjustment.

It should be stressed that a greater degree of risk absorption does not have to derive from federal fiscal transfers, but can also be achieved through credit and financial channels. Indeed, in Europe, in the absence of fiscal union and given the relatively limited size of public transfers in the EU, maintaining the strength of the credit channel and increased foreign investment are necessary to act as shock absorbers. Indeed, developing cross-border savings in the EU would increase risk absorption. This is especially true if savings are invested in equity because, differently from debt, equity is contingent on the business cycle. Through returns on investment abroad, two-way cross-border equity investment can be very useful as a shock absorber. The better-performing economies pay more to their foreign investors, and the countries with stagnant economies pay less. With inward equity positions worth between 50% and 80% of GDP, even for the larger euro area economies this effect can become significant.

In this context, it is critical to promote conditions for increased cross-border holdings of financial assets, particularly equity. The post-crisis increase in the cross-border holdings of equity bodes well for increasing risk absorption (Figure 15). The creation of a genuine Capital Markets Union (CMU) could accelerate this trend (Buti, Leando and Nikolov, 2016).

The long road towards the Capital Markets Union

The development of the European Union has been accompanied by a long-run trend of financial integration. However, according to the analysis developed in this chapter, the two major crises experienced in the EU since 2008 have stopped and partly reversed this process. Given that even after the two crises have ended EU financial integration has not returned to its pre-crisis level, one can conclude that stigma effects prevent autonomous reintegration. Indeed, the crises have shed light on weaknesses in the EU's financial infrastructure, and quicker and better integration needs to be accompanied by several institutional changes. That is the essence of the Capital Markets Union.

This initiative has many facets and will thus take time to implement. On the one hand, it is now well recognised that a lot of work needs to be done in the judiciary in order to reduce divergences in the insolvency and bankruptcy regime across EU countries. This will provide investors with a level playing field (European Commission, 2016b). Together with legal protection, a clear and efficient legal process will enable investors to better estimate risks. On the other hand, it is also acknowledged that some components of financial markets need to be developed further.

Market and capital: the two pillars of the Capital Markets Union

Financial markets are much less developed in the EU than in the US. As a share of GDP, equities in Europe are below that in the US by around 10 percentage points of GDP (Figure 22). The difference is even more pronounced for listed equities, as in the EU a large share of equities is unlisted (Figure 23). Therefore, in comparison to the US, while equity finance is less developed in the EU, EU equity markets are even less developed. Markets for corporate debt securities are also substantially underdeveloped, with a share of GDP less than half that in the US.

The EU financial system is more bank-based. In fact, in contrast to the US, where debt is almost equally split between securities traded on a market and loans, most corporate debt in Europe consists of bank loans. The banking sector plays a major role, and financial markets, both for debt and equities, are less

developed in the EU (ESRB, 2014). Looking across country groups, the predominance of bank loans is confirmed and remains a structural characteristic of the EU financial system. While the gap is larger in the cohesion and periphery economies, it remains important for the other economies as well (Figure 22).

Figure 22 Main liabilities of non-financial firms (% of GDP)

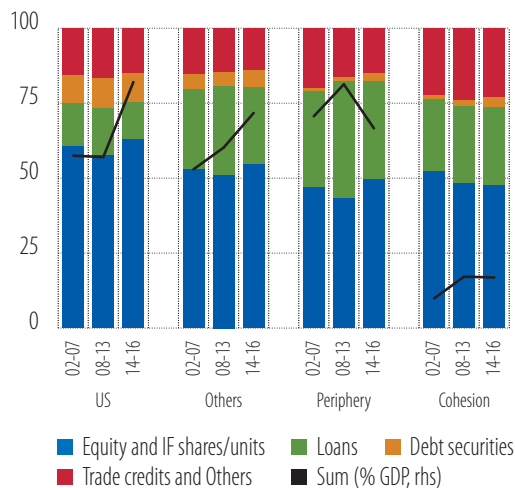
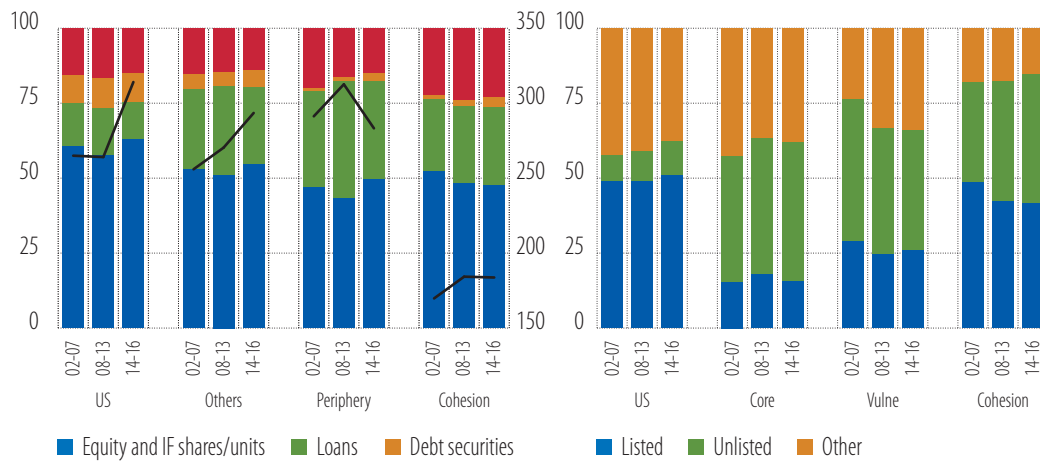


Figure 23 Breakdown of equities (%)



Source: European Investment Bank calculations based on data from the Organisation for Economic Co-operation and Development.

Note: Unconsolidated data. Shares of the components add up to 100%. IFs stands for investment funds.

Stronger capital markets enhance financing options for firms and opportunities to invest for households, and can contribute to strengthening the European Monetary Union by supporting economic convergence and helping to absorb economic shocks, as explained above. However, changing a financial system requires time. Moreover, the financial system is a product of history, and events contributing to the set-up of a market can condition the financing structure of the economy years later, partly because agents may be somewhat conservative in the way they adjust their financing. Indeed, the prominence of bank finance has to be tempered by the fact that, in the short to medium run, firms tend to maintain their financial liability structure and are sluggish to react to changes in market conditions (EIB, 2016). This is a major conclusion drawn from the European Investment Bank Investment Survey: firms tend to be content with the structure of their financing and aim to reproduce it.

On the one hand, the limited short-term flexibility to changes in the financing structure impedes the development of alternative funding solutions, as demand reaction tends to be sluggish, especially when the changes in the relative cost of external financing sources are perceived as transitory. On the other hand, as shown by the sovereign debt crisis, this reliance is also a source of vulnerability and therefore requires policy intervention, since the underdevelopment of several segments of the European financial system prevents businesses from optimising their financial structure.

An efficient strategy to develop capital markets may leverage the financial expertise concentrated in the banking sector. In the EU, a large part of the financial expertise is located in the banking sector. Given the dominant position of banks in terms of access to information – a position that enables them to better assess the creditworthiness of borrowers – banks will remain a key node of the EU financial system for some time. In this regard, asset-backed securities offer a very promising opportunity to develop EU securities markets, and the development of single and transparent securitisation has become a cornerstone of the CMU (Box 4).

Box 4 **New securitisation regulation framework**

In general, a well-functioning securitisation market can provide strong support to help financial intermediaries broaden their funding base, achieve capital relief, and increase their lending activities, including lending to small and medium-sized enterprises (see Box 3 in Chapter 6). Originators and investors need certainty and clarity about the regulatory framework, and regulatory uncertainty in past years was one of the impediments of the market. In this context, the European Commission recently proposed a framework after starting a legislative process. The “Trilogue Negotiations” between the European Commission, European Council and European Parliament led to an agreement (30 May 2017) on a securitisation package that included simple and transparent securitisation (STS) and a revised framework for capital charges for credit institutions and investment firms originating, sponsoring or investing in securitisation products. Following the agreement, the related regulations are expected to be formally endorsed by the Council and the Parliament soon (Council of the EU, 2017; European Commission, 2017b).

The agreement covers two (draft) regulations. The first brings together rules that apply to all securitisations, including STS, which are currently scattered among different legal acts. It aims to ensure “consistency and convergence across sectors (such as banking, asset management and insurance), and streamlines and simplifies existing rules” (Council of the EU, 2017). In addition, it establishes a general and cross-sector regime to define and set rules related to STS. It is important to highlight that the STS concept does not refer to the quality of the underlying assets involved, but to the process by which the securitisation is structured (Council of the EU, 2017).

The other part of the agreement amends Regulation 575/2013 (Capital Requirements Regulation – CRR) on bank capital requirements. It sets out capital requirements for positions in securitisation that aim to provide for more risk-sensitive regulatory treatment for STS (Council of the EU, 2017).

One of the main political issues resolved relates to the risk retention requirement. All in all, the agreement brings out important features of the future STS market segment. Uncertainty regarding the design of the future regulation has been reduced considerably. The requirements of the STS regulation consist of a “light” set of high-quality criteria, which in turn translates into a marginal (rather than substantial) reduction in the risk weights.

When interpreting the effects of the new legislation, it has to be borne in mind that the proposed risk weights for STS will still result in increased capital requirements for banks using an internal ratings-based approach. Moreover, another perspective regarding STS mentioned by some market participants is that it can even circumvent a proper securitisation market recovery if “everything but STS” is still seen as being toxic.

Implementation of the new rules will still take time. There are even concerns in the market that implementation by mid-2018 might be too fast, as this would not leave sufficient time for regulators to develop and consult on the large number of technical standards required to flesh out key details of the new rules. Hence many market participants expect implementation in 2019.

Private equity and venture capital in the European Union²⁴

Equity financing plays a much smaller role in new external financing in Europe than in the United States. In some small market segments, this prevents the development of new activities that, being highly risky, tend to be financed through venture capital. Private equity is a form of equity investment into private companies not listed on the stock exchange.²⁵ It is a medium to long-term investment, characterised by active ownership, for example by strengthening management expertise, delivering operational improvements and helping companies access new markets. Venture capital is a type of private equity that is focused on start-up companies with high growth potential. Venture capital funds back entrepreneurs with innovative ideas for a product or service who need investment and expert help in growing their companies.

Over the past 20 years, European private equity activity has exhibited booms and busts. The most famous peak periods were in 2000 and 2006, when the total amounts raised by private equity funds located in Europe reached EUR 48bn and EUR 112bn, respectively (Figure 24).²⁶ In the same years, overall private equity investment levels were at EUR 35bn and EUR 71bn. Both booms were followed by significant downturns: the “dotcom crisis” in the early 2000s and the financial and economic crisis from 2007 onward. Although the severe crash of European private equity activity in 2008/09 was followed by a partial rebound, investments and divestments have not reached their pre-crisis levels. In 2016, private equity funds located in Europe invested EUR 53bn (-1% compared to the year before), raised a total amount of EUR 74bn (+38%), and divested companies for a total value of EUR 40bn (-13%).²⁷

Investment activity

The breakdown provides information, inter alia, on venture capital.²⁸ In 2016, total venture capital investments were still far below their pre-crisis highs. During that year, buyout and growth capital investments declined, while venture capital investments increased by 2% to EUR 4bn (Figure 25).²⁹ Within the venture capital market segment, investments with a focus on the seed stage surged by 54%, although they totalled less than EUR 500m. Later-stage venture activities increased by 4% to EUR 2bn. Following their continuous improvement over the previous three years, start-up investments decreased by 6% to EUR 2bn. Before the crisis, later-stage ventures had been the driver of venture capital investment. In 2016, this component was still 43% below its 2007 level. Indeed, since 2009, investments at the start-up stage have become the largest component of venture capital investments. Total venture capital investments are still far below their pre-crisis highs.

24 This section was prepared by Helmut Kraemer-Eis, Frank Lang, Wouter Torfs and Salome Gvetadze of the EIF Research & Market Analysis Division. The section is based on the chapter on private equity and venture capital, in the European Small Business Finance Outlook (ESBFO), a bi-annual publication produced by the European Investment Fund's Research & Market Analysis Division. For more information, see Kraemer-Eis et al. (2017).

25 See Invest Europe at <https://www.investeurope.eu/about-private-equity/private-equity-explained/>.

26 These figures and those that follow are based on statistics from Invest Europe, the association representing Europe's private equity, venture capital and infrastructure sectors, as well as their investors. See Invest Europe (2017), the Invest Europe website www.investeurope.eu and Kraemer-Eis et al. (2017) for more information on Invest Europe private equity activity statistics.

27 Invest Europe statistics show divestment amounts at cost, that is, the total amount divested is shown as the total amount that had been previously invested, hence not including any profit on the investment.

28 The breakdown by investment and funding stage focus has been available since 2007.

29 Note that the equity investment activities of “business angels” are not included in the Invest Europe statistics. Business angels are, however, important for the financing of SMEs and for innovation. See Kraemer-Eis et al. (2017) for a general overview of this market segment and recent developments.

Figure 24 Fundraising, investment and divestment amounts by private equity firms located in Europe (EUR billion)

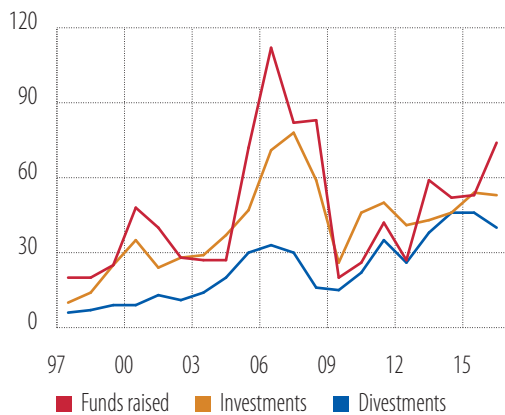
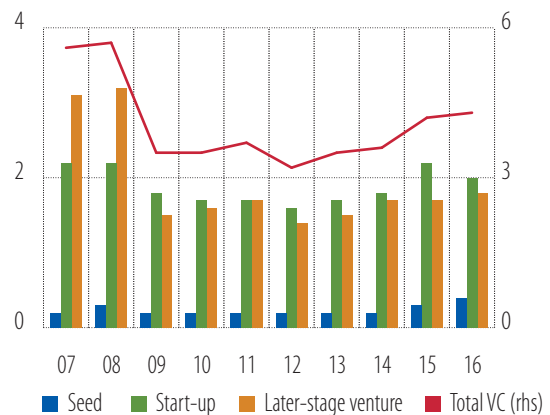


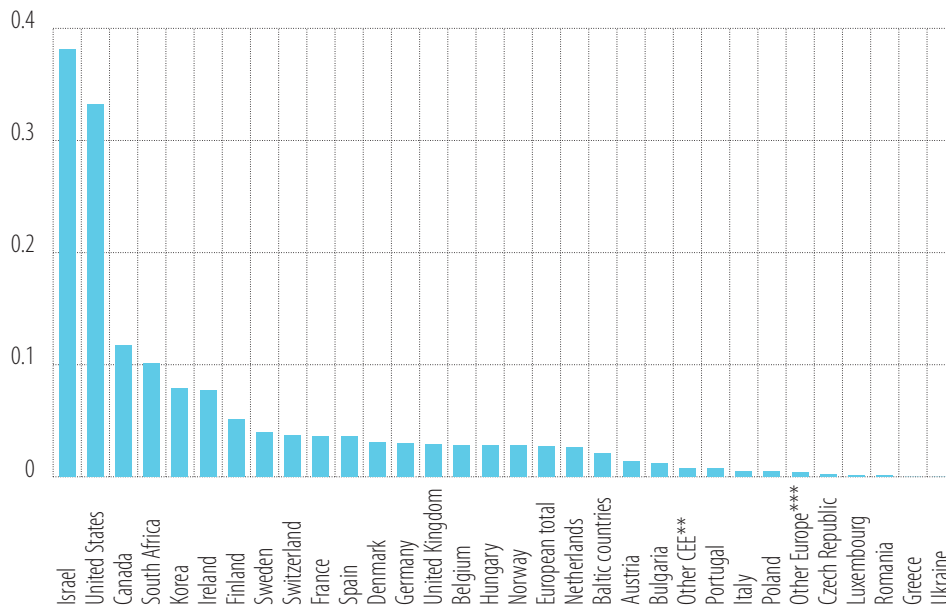
Figure 25 Venture capital investment amounts by stage (EUR billion)



Source: Authors' calculations based on data from Invest Europe.

The European venture capital market remains fragmented and is geographically far less homogeneous than its US counterpart. Figure 26 provides an overview of venture capital investments as a share of GDP for European and selected OECD countries, as well as the European average. While the traditional core markets in Europe (Ireland, the UK and Scandinavia) still had relatively high market activity after the crisis and others have recently caught up (Hungary), the countries in the periphery economies group continue to struggle with the size of their domestic venture capital market, which bears no relation to their share of the aggregate GDP of the EU. Overall, there are sizeable differences in the development of venture capital markets, as some markets not only suffer from their small size but also from the EU's very fragmented institutional investor base.

Venture capital investors tend to target tech "hubs" rather than certain regions based on the expertise developed in those hubs. When looking at the geographic dispersion of European venture capital activity in more detail, the picture becomes more complex. However, recent EIF research has shown that European hubs, and in particular those backed by EIF investments, are at the core of a complex network of national and international investments. This claim is supported by data on investment amounts originated by hubs: 23% of these investments remain in the hub, 40% reach out to other in-country locations, and the remaining 37% travel beyond the national frontier (Kraemer-Eis, Signore and Prencipe, 2016). Since higher cross-border investments can be interpreted as a signal of deeper integration of the European venture capital market, the EIF investments may have fostered the consolidation of a Europe-wide venture capital ecosystem.

Figure 26 Venture capital investments by country of the portfolio company, 2016 or latest available year (% of GDP)

Source: Invest Europe and OECD (2016).

Note: Europe = European average. Europe as covered by Invest Europe (that is, EU minus Cyprus and Malta, but plus Norway, Switzerland, Ukraine, and those former Yugoslavian countries that are not part of the EU).

** Other Central and Eastern Europe (CEE): Bosnia-Herzegovina, Croatia, FYROM, Moldova, Montenegro, Serbia, Slovakia, Slovenia.

***Other Europe: Cyprus, Iceland, Liechtenstein, Malta, San Marino, Vatican City.

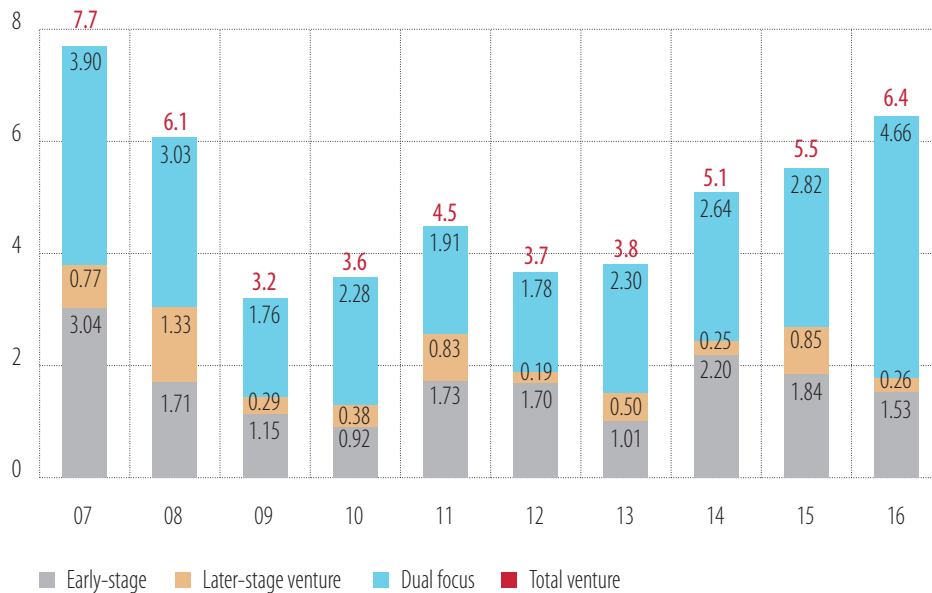
Fundraising activity

In 2016, total funds raised by private equity firms located in Europe rose to EUR 74bn, an increase of 38% from the previous year. This constitutes the highest value since 2008. In the venture capital segment, fundraising increased by 17% to EUR 6bn (Figure 27). This was also the highest amount since 2008.

A sign of investors' cautious sentiment regarding venture capital as a consequence of the crisis has been the shift in the investor base (Figure 28). According to Invest Europe, government agencies accounted for 25% of total investments into venture capital funds in 2016. This share had increased from 13% in 2007 to 36% in 2011, before it came down again in the most recent years. However, even if the high share of government agencies is unsatisfying for the long term, it is noteworthy that government agencies have played their role and supported the market in a counter-cyclical way, particularly during a time of economic and financial crisis when total venture capital fundraising levels declined by more than half. This led almost naturally to an increased share of government agency fund investors. Moreover, the contributions of public investors to venture capital funds increased not only in relative terms but also in absolute terms, that is, from an average of around EUR 500m annually over 2007-09 to EUR 1bn thereafter.³⁰

³⁰ It remains to be seen if the percentages reported for government agencies in 2015 and 2016 will be confirmed in later issues of the Invest Europe statistics, when the relatively high shares of as yet unclassified fund investors will be more properly identified.

Figure 27 Funds raised by venture capital funds located in Europe (EUR billion; incremental amounts raised during each year)



Source: Authors' calculations based on data from Invest Europe.

Theoretical evidence and the EIF's own research suggest that public venture capital support is relatively well targeted and achieving positive effects in Europe. In a study of investment patterns of different venture capital investor types, Bertoni, Colombo and Quas (2015) find that governmental venture capital investors in Europe specialise in investments that do not attract private investors due to high information asymmetries and high failure risk. Such investments particularly benefit young and small seed-stage companies in certain sectors such as biotechnology and pharmaceuticals in which time-to-market is long and new product development is very costly. This indicates that in Europe, governmental venture capital has filled the entrepreneurial financing gap left by private venture capital investors.

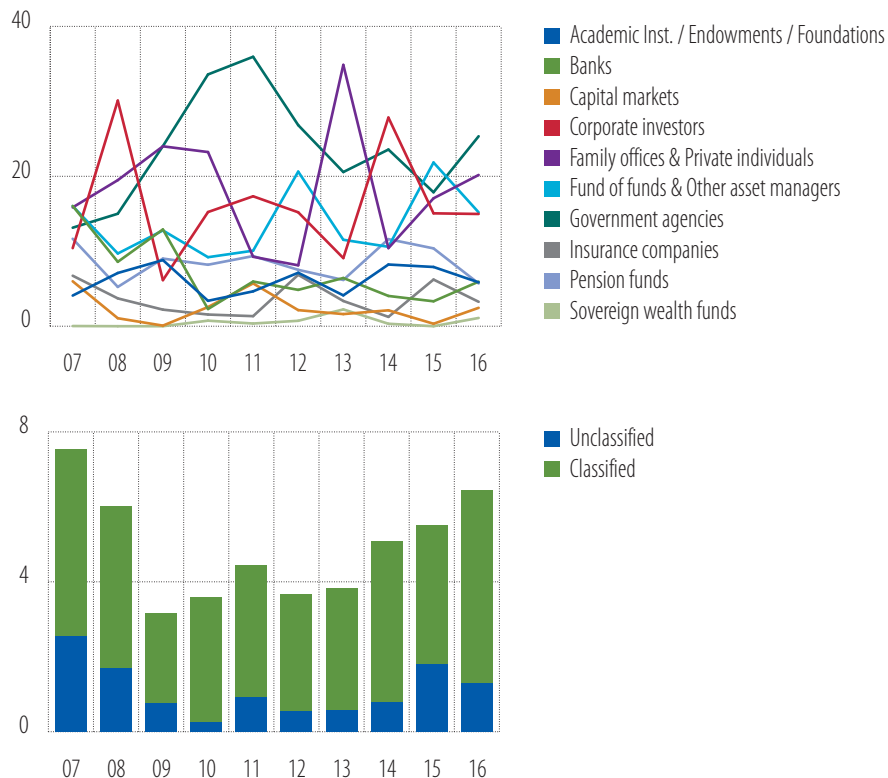
European start-up and scale-up financing: recent findings

Venture capital is not a financing instrument for all types of companies, but rather a financing instrument that targets a group of young and innovative enterprises with very high growth potential (Kraemer-Eis and Lang, 2017). However, Europe has a shortage of risk capital for small, early-stage growing businesses that is holding back the development of high-growth sectors essential for economic competitiveness (AFME, 2017). Moreover, limited financing opportunities are not only prevalent at the seed and start-up stages of a company's life cycle, but also when innovative companies' seek financing to realise their growth ambitions.

Indeed, even as the gap between the venture capital markets in the US and Europe is visible at all development stages, it is particularly high at the later stage (AFME, 2017). In the growth capital segment, the amounts invested in the US still exceed those in Europe by three times over. These differences are also reflected by substantial distinctions in fund and deal sizes. While at the start-up stage there is relatively little difference in terms of fund size (US versus Europe), US companies are financed by significantly larger funds at the scale-up stage. Furthermore, in the period 2007-15, the average venture capital-backed US company received five times higher amounts than its EU counterpart,

that is, EUR 6m compared to EUR 1m (AFME, 2017). Larger investment rounds can be achieved by having more investors (syndicate size) and/or by having larger investment amounts per investor (ticket size). Both syndicate sizes and ticket sizes are bigger in the US than in Europe. For example, looking across all fund vintages from 2005-15, 28% of the US funds were larger than USD 250m, in contrast to only 10% in Europe (Duruflé, Hellmann and Wilson, 2017).

Figure 28 Investor base in venture capital fundraising



Source: Authors' calculations based on data from Invest Europe.

Note: Based on incremental amounts raised during the year (in contrast to final closings only). The data in this figure (as well as in others) may differ from those in previous publications because Invest Europe released its statistics for the first time based on a new database in 2017. All data since 2007 were restated and complemented with additional information.

This "growth stage trap" phenomenon means that Europe is not reaping the benefits of the most promising young companies it has nurtured once they graduate from the seed, start-up and early-expansion stages and embark on an ambitious, global growth path for which they need higher investment ticket sizes. In the process, Europe loses much-needed entrepreneurship, technological know-how and jobs. During the period 2003 to 2015, on average, 44% of the venture capital companies backed by EIF investee funds that were sold were acquired by non-European buyers, particularly from the US, which mainly targeted start-ups in the same industry by vertical integration (Prencipe 2017; Kraemer-Eis et al., 2017).

Progress achieved

Because the process resulting in a changing financial system is slow, it is important to provide impetus from the policy side. This is the aim of the Capital Markets Union, but it is a slow and multi-dimensional process. Building the CMU is a piecemeal process involving a mix of regulatory and non-regulatory measures. In September 2015, the European Commission put forward its action plan for a CMU setting out 33 steps to foster a more integrated capital market by 2019 (Table 3) (European Commission, 2015a). Midway through the time period set under that action plan, about two-thirds of those steps have been taken.³¹ Notably, this includes an agreement on a new prospectus regime, the securitisation package and a reform of venture capital funds.³² The main new legislative initiatives under discussion are the proposal for a pan-European personal pension product launched in June 2017 and a September 2017 proposal to further strengthen and integrate EU financial market supervision.

The mid-term review of the action plan pointed to several persistent as well as new challenges, leading to a recalibration of priorities and several new envisaged actions. In particular, the supervisory dimension of the CMU, FinTech, and the promotion of long-term and sustainable investments are expected to take a more prominent role in the next two years.

³¹ Also see European Commission (2017a) COM(2017)292 for the detailed mid-term review.

³² The TARGET2-Securities (T2S) platform that went live in June 2015 has also become a cornerstone of the CMU, creating harmonised, integrated and efficient euro payments and securities post-trade services (ECB, 2016b).

Table 2 A roadmap towards the Capital Markets Union

2015
Key Challenges
<ul style="list-style-type: none"> • Investment heavily reliant on banks • Differences in financing conditions between EU countries • Many small and medium-sized enterprises with limited access to finance • Different rules and market practices, for example for securitised instruments and private placements • Less developed financing options for specific market segments, notably start-ups, non-listed and innovative firms • Shareholders and buyers of corporate debt rarely go beyond national borders when investing
Objectives
<ul style="list-style-type: none"> • Build more diversified financial systems to complement bank financing with capital markets • Unlock frozen capital in Europe and put it to work for the economy, giving savers more investment choices and offering businesses greater choice of funding at lower costs • Establish a genuine single market for capital in the EU where businesses can raise required funds from diverse sources, irrespective of location, and investors are able to invest across borders without hindrance
2017
Key Challenges
<ul style="list-style-type: none"> • Prospectus regulation: New prospectus rules to apply from mid-2019 to facilitate entering and raising capital on public markets for companies by streamlining registration and information requirements and new online EU prospectus database • Venture capital: New EuVECA and European Social Entrepreneurship Funds Regulation to make it easier for investors to invest in small and medium-sized enterprises by opening up the regulation to fund managers of all sizes and expanding the range of companies that can be invested in • Securitisation: New rules for simple, transparent and standardised securitisation and review of capital requirements regulation to promote quality securitisation market in Europe
Recently Proposed or Upcoming
<ul style="list-style-type: none"> • Pan-European personal pension product • Strengthening European Securities and Markets Authority to promote effective and consistent supervision to support the Capital Markets Union • Clearer rules on ownership of securities and claims • New covered bonds framework
2019
Priority Actions Planned
<ul style="list-style-type: none"> • Promote more proportionate regulatory environment for listing of small and medium-sized enterprises on public markets • Review proportionality of prudential rules for investment firms • Assess the case for an EU licensing and passport regime for FinTechs • Measures to support secondary markets for non-performing loans; analysis and potentially legislative initiative to strengthen the ability of secured creditors to recover value from secured loans to corporates and entrepreneurs • Follow-up to recommendations on sustainable finance • Facilitate cross-border distribution of Undertakings for Collective Investment in Transferable Securities (UCITS) and Alternative Investment Funds • Additional guidance on existing EU rules for the treatment of cross-border EU investments • Propose a strategy to explore measures for local and regional capital market development
Remaining and New Challenges
<ul style="list-style-type: none"> • UK due to leave Single Market • FinTech is transforming capital markets • EU faces environmental and social challenges • Not enough long-term investment • Capital market heterogeneity

Source: Prepared by the European Investment Bank based on information from the European Commission.

Note: As of October 2017.

Conclusion and policy implications

The level of risk-sharing in Europe is deeply sub-optimal. Low intra-European financial flows limit the scope to benefit from risk-sharing as well as the potential to enhance economic growth with an efficient allocation of savings.

The length of the crisis and the tepid recovery since then have shown that changes are needed for EU citizens to better benefit from their financial system. It is not possible to pin down the optimal financial system, and in this regard empirical analysis must be handled cautiously. However, international comparisons can be useful, and they suggest several steps that could be taken to improve the EU financial system.

As reiterated throughout this chapter, diversification reduces risks, and cross-border flows are a source of shock absorption as well as convergence. Therefore, increased stable and well-informed cross-border flows, together with more diversification of financing sources, would be steps in the right direction.

On the one hand, signs of recovery are accompanied by persistent fragmentation, especially for the European Union's cohesion countries. A more polarised EU financial system would be sub-optimal and would hamper European convergence by limiting the allocation of savings to their most productive use.

On the other hand, there are signs that the change in the nature of capital flows towards more equity-like financial instruments supports more balanced growth. In both cases, more structural policies need to be developed to ensure that Europe can reap the benefits of a properly integrated financial system.

In this context, further progress on the Capital Markets Union is needed. Finalising the Banking Union is also important to reignite cross-border banking flows, especially as the financial markets are underdeveloped in Europe. The building of the two unions should be considered in parallel to benefit from the synergies between them.

References

- AFME. (2017). "The Shortage of Risk Capital for Europe's High Growth Businesses." Association for Financial Markets in Europe, Frankfurt. March.
- Alcidi, C. and Thirion, G. (2016). "Assessing the Euro Area's Shock Absorption Capacity." CEPS Working Paper No. 2016/146. Centre for Economic Policy Studies, Brussels.
- Alcidi, C., D'Imperio, P. and Thirion, G. (2017). "Risk-sharing and Consumption-smoothing Patterns in the US and the Euro Area." CEPS Working Paper No. 2017/04. Centre for Economic Policy Studies, Brussels.
- Allard, C., Brooks, P.K., Bluedorn, J., Bornhorst, F., Christopherson, K., Ohnsorge, F., Poghosyan, T. and an IMF staff team. (2013). "Toward a Fiscal Union for the Euro Area." IMF Staff Discussion Note 13/09. International Monetary Fund, Washington, DC.
- Asdrubali, P. and Kim, S. (2004). "Dynamic Risk Sharing in the United States and in Europe." *Journal of Monetary Economics*, 51, 809–836.
- Asdrubali, P. and Kim, S. (2008). "On the Empirics of International Smoothing." *Journal of Banking and Finance*, 32, 374–381.

- Asdrubali, P. and Kim S. (2009). "Consumption Smoothing Channels in Open Economies." *Journal of Banking and Finance*, 33, 2293–2300.
- Asdrubali, P., Sorensen, B.E. and Yosha, O. (1996). "Channel of Interstate Risk Sharing: United States 1963-1990." *Quarterly Journal of Economics*, 111, 1081–1110.
- Athanasoulis, S.G. and Van Wincoop, E. (2001). "Risk Sharing within the US: What Do Financial Markets and Fiscal Federalism Accomplish?" *Review of Economics and Statistics*, 83(4), 688–698.
- Avdjiev, S., Hardy B. and Kalemli-Ozcan, S. (2017). "Gross Capital Inflows to Banks, Corporates and Sovereigns." CEPR Discussion Paper No. 11806. Centre for Economic Policy Research, London.
- Bai J. (2003). "Inferential Theory for Factor Models of Large Dimensions." *Econometrica*, 71(1), 135–171.
- Becker, S. and Hoffmann, M. (2006). "Intra and International Risk-sharing in the Short Run and the Long Run." *European Economic Review*, 50, 777–806.
- Bertoni, F., Colombo, M.G. and Quas, A. (2015). "The Patterns of Venture Capital Investment in Europe." *Small Business Economics*, 45(3), 543–560.
- Blanchard, O. and Acalin, J. (2016). "What Does Measured FDI Actually Measure?" Policy Brief 16-17. Peterson Institute for International Economics, Washington, DC.
- Borio, C. and Disyatat, P. (2016). "Capital Flows and the Current Account: Taking Financing (More) Seriously." PIER Discussion Paper No. 14. Puey Ungphakorn Institute for Economic Research.
- Bundesbank. (2017). "German Balance of Payments in 2016." Monthly Report, March.
- Bussière, M., Schmidt, J. and Valla, N. (2016). "International Financial Flows in the New Normal: Key Patterns (and Why We Should Care)." EIB Working Paper, 2016/02. European Investment Bank, Luxembourg.
- Buti, M., Leandro J. and Nikolov, P. (2016). "Smoothing Economic Shocks in the Eurozone: The Untapped Potential of the Financial Union." VOX, 25 August.
- Cerutti, E., Claessens, S. and Rose, A.K. (2017). "How Important Is the Global Financial Cycle: Evidence from Capital Flows." BIS Working Paper 661. Bank for International Settlements, Basel.
- Cœuré, B. (2017). "The International Dimension of the ECB's Asset Purchase Programme." Speech at the Foreign Exchange Contact Group Meeting, 11 July.
- Constâncio, V. (2017a). "Effectiveness of Monetary Union and the Capital Market Union." Speech at the EUROFI Conference, Malta, 6 April.
- Constâncio, V. (2017b). "Synergies between Banking Union and Capital Markets Union." Presentation at the Joint Conference of the European Commission and European Central Bank on European Financial Integration, Brussels, 19 May.
- Council of the EU (2017). "Capital Markets Union: Agreement Reached on Securitisation." Press Release 314/17.
- Durufié, G., Hellmann, T. and Wilson, K. (2016). "From Start-up to Scale-up: Examining Public Policies for the Financing of High-Growth Ventures." Presentation prepared for the CEPR/Assonime Programme on "Restarting European Long Term Investment Finance." Unpublished.
- ECB. (2016a). "Financial Integration in Europe." European Central Bank, Frankfurt, April.
- ECB. (2016b). "Report on Financial Structure." European Central Bank, Frankfurt, October.
- ECB. (2017a). "Financial Integration in Europe." European Central Bank, Frankfurt, May.

- ECB. (2017b). "Which Sectors Sold the Government Securities Purchased by the Eurosystem?" Economic Bulletin Issue 4. European Central Bank, Frankfurt.
- EIB. (2016). "Investment and Investment Finance in Europe: Financing Productivity Growth." European Investment Bank Report. Available at: http://www.eib.org/attachments/efs/investment_and_investment_finance_in_europe_2016_en.pdf.
- ESRB. (2014). "Is Europe Overbanked?" Report to the Advisory Scientific Committee No. 4. European Systemic Risk Board.
- European Commission. (2011). "Scoreboard for the Surveillance of Macroeconomic Imbalances: Envisaged Initial Design." European Commission Staff Working Paper 8. Available at: https://ec.europa.eu/info/sites/info/files/swp_scoreboard_08_11_2011_en.pdf.
- European Commission. (2015a). "Action Plan on Building a Capital Markets Union." Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Document COM(2015) 468 Final. Available at: <http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52015DC0468&from=EN>.
- European Commission. (2016a). "Cross-border Risk Sharing after Asymmetric Shocks: Evidence from the Euro Area and the United States." *Quarterly Report on the Euro Area*, 15(2).
- European Commission. (2016b). "Proposal for a Directive on Insolvency, Restructuring and Second Change." Press Release, 22 November.
- European Commission. (2017a). "European Financial Stability and Integration Review." Commission Staff Working Document No. 171.
- European Commission. (2017b). "Capital Markets Union: EU Reaches Agreement on Reviving Securitisation Market." Press Release. IP/17/1480, 30 May.
- Feldstein, M S, and C Y Horioka (1980) "Domestic saving and international capital flows," *Economic Journal*, 90: 314-329.
- Financial Stability Board. (2016). "Second Phase of the G20 Data Gaps Initiative: First Progress Report." Report by the Financial Stability Board and the International Monetary Fund.
- Furceri, D. and Zdzienicka, A. (2015). "The Euro Area Crisis: Need for a Supranational Fiscal Risk Sharing Mechanism?" *Open Economic Review*, 26, 683-710.
- Heipertz, J., Ouazad, A., Ranci re, R. and Valla, N. (2017). "Balance-Sheet Diversification in General Equilibrium: Identification and Network Effects." CEPR Working Paper 12134. Centre for Economic Policy Research, London.
- Hepp, R. and von Hagen, J. (2010). "Interstate Risk Sharing in Germany 1970-2006." *Oxford Economic Paper* 65(1).
- Hoffmann, P., Kremer, M. and Zaharia, S. (2015). "Financial Integration in Europe through the Lens of Composite Indicators." Unpublished. May.
- Hollo, D., Kremer, M. and Lo Duca, M. (2012). "CISS – A Composite Indicator of Systemic Stress in the Financial System." ECB Working Paper No. 142. European Central Bank, Frankfurt.
- Invest Europe. (2017). "2016 European Private Equity Activity. Statistics on Fundraising, Investments and Divestments." May 15.
- Kalemli-Ozcan, S., Luttini, E. and Sorensen, B. (2014). "Debt Crisis and Risk-sharing: The Role of Market vs. Sovereigns." *Scandinavian Journal of Economics*, 116(1), 253–274.

Koroknai, P. and Lenart-Odorán, R. (2011). "The Role of Special Purpose Entities in the Hungarian Economy and in Statistics." MNB Bulletin (October). Magyar Nemzeti Bank.

Kraemer-Eis, H. and Lang, F. (2017). "Access to Funds: How Could CMU Support SME Financing?" In *EU Capital Markets Union – Alluring Opportunity or Blind Alley?* edited by Kotz, H.-H. and Schäfer, D.

Kraemer-Eis, H., Signore, S. and Prencipe, D. (2016). "The European Venture Capital Landscape: An EIF Perspective. Volume I: The Impact of EIF on the VC Ecosystem." EIF Working Paper 2016/34. European Investment Fund, Luxembourg.

Kraemer-Eis, H., Lang, F., Torfs, W. and Gvetadze, S. (2017). "European Small Business Finance Outlook: June 2017." EIF Working Paper No. 2017/43. European Investment Fund, Luxembourg.

Lane P. (2014). "Capital Flows in the Euro Area." CEPR Discussion Paper No. 9493. Centre for Economic Policy Research, London.

Lane, P. and Milesi-Ferretti, G.M. (2017). "International Financial Integration in the Aftermath of the Global Financial Crisis." IMF Working Paper 17/115. International Monetary Fund, Washington, DC.

Milesi-Ferretti, G.M. and Tille, C. (2011). "The Great Retrenchment: International Capital Flows during the Global Financial Crisis." *Economic Policy*, 26(66), 285–342.

OECD (2016). *Entrepreneurship at a Glance 2016*. Paris: OECD Publishing.

Poncela, P., Pericoli, F., Manta, A.R. and Nardo, M. (2016). "Risk Sharing in Europe." European Commission JRC Science for Policy Report. December.

Praet, P. (2016). "Remarks at the BNYM 20th Anniversary Dinner on the Dynamics of TARGET2 Balances and Monetary Policy Implementation." Bank of New York Mellon 20th Anniversary, Brussels, 15 September. Available at: <https://www.ecb.europa.eu/press/key/date/2016/html/sp160915.en.html>

Prencipe, D. (2017). "Liquidity Events and Returns of EIF-backed VC Investments. The European Venture Capital Landscape: An EIF Perspective." EIF Working Paper 2017/41. European Investment Fund, Luxembourg.

Rangvid, J., Santa-Clara, P. and Schmeling, M. (2016). "Capital Market Integration and Consumption Sharing over the Long Run." *Journal of International Economics*, 103(11), 27–43.

Sorensen, B.E. and Yosha, O. (1998). "International Risk Sharing and European Monetary Unification." *Journal of International Economics*, 45, 211–238.

Valiante, D. (2016). "Europe's Untapped Capital Market: Rethinking Financial Integration after the Crisis." London: Rowman & Littlefield International. <https://www.ceps.eu/topics/capital-markets-union>.

Younas, J. and Chakraborty, D. (2011). "Globalization and the Feldstein-Horioka Puzzle." *Applied Economics*, 43, 2089–2096.

Zucman, G. (2013). "The Missing Wealth of Nations: Are Europe and the U.S. Net Debtors or Net Creditors?" Paris School of Economics.

Chapter 6

Credit conditions and corporate investment in Europe

Chapter at a glance

- *This chapter analyses recent developments in credit conditions in the European Union (EU) with a view to understanding the still modest pick-up in non-financial firm investment and in financial flows. In the current recovery, part of the EU economy is still following a deleveraging path, be it for firms or banks. This explains the specificity of the current overall modest rebound in investment, supported by very accommodative monetary policies, an overall slightly supportive fiscal policy, and specific policies to target investment, such as the European Fund for Strategic Investments.*
- *Since the middle of 2016, financial conditions have remained supportive and have even marginally improved. Moreover, the recovery has become more widespread, with the dispersion in real GDP growth decreasing. The asymmetries across groups of countries have decreased as the recovery has become more broad-based and led by some economies in the periphery. During the period, investment by firms has strengthened.*
- *At the end of 2016, the US Federal Reserve Board initiated a monetary policy tightening cycle and since then has raised interest rates three times. With a still very low inflation rate, a move along those lines is not foreseen in the short term in the euro area. However, at the end of October, the European Central Bank announced a reduction in the pace of its Asset Purchase Programme. Overall, compared to a year ago, the prospects of a secular stagnation trap have become less likely as 2017 has progressed and long-term interest rates have started to increase.*
- *Businesses in Europe are still on a deleveraging path, especially in the periphery economies. This partly explains the modest pick-up in external financing flows: bank loans have continued to recover, but at a very slow pace. While the business sector continues to be a net saver, accumulating cash or reducing debt, it is on the way towards reaching its historical position of net investor. During the past year, the decline in financial costs and the recovery in activity have contributed to further reducing firms' financial burden. However, beyond the geographical breakdown, the situation within each EU economy has become more and more difficult to understand separately from the aggregate picture, as firm-specific circumstances add very different dynamics to the mix.*
- *The second wave of the European Investment Bank Investment Survey (EIBIS) (EIB, 2017) provides a picture at the micro level of firms of the impediments to investment arising from financial factors. Overall, financial conditions do not appear to be the main concern, as financial costs are low and liquidity available. But taking account of both access to external finance and the tendency to be content to rely on internal financing capacity, some economies, mostly in the periphery and cohesion groups, still face challenging conditions. These are mostly linked to costs and the availability of collateral.*
- *In addition, some specific types of firms, such as young, innovative and/or small businesses, are confronted with a more adverse financial environment.*
- *Fears of the low interest rate environment affecting financial stability have not materialised and the liquidation of three banks during the year had more to do with elevated exposure to non-performing loans. The ongoing recovery should facilitate a more rapid disposal of impaired assets, further adjustment to the more stringent regulatory environment, and consolidation in the EU banking sector.*

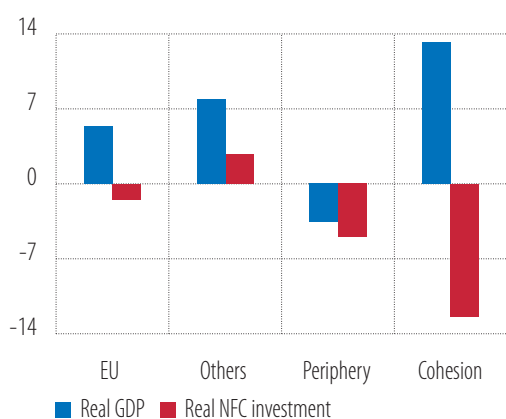
The current macro-financial environment

The pre-crisis versus post-crisis gap in GDP has closed, and the recovery is finally broadly based. Growth of real GDP has been driven by private consumption and, to a lesser extent, real investment (Figure 1, panel a). Government consumption also contributed positively to growth, while net exports contributed negatively, throughout 2016. All EU economies have improved over the past year and a half, despite a large variation in economic conditions across countries. Growth of private consumption was the most important contributor to GDP growth in most members of the EU. The balance sheet adjustment of all institutional sectors of economies has progressed despite low inflation, supported by low interest rates, improving cash flow in the corporate sector, increasing household disposable income, and rigorous fiscal adjustment.

In 2016, eight years after the bankruptcy of Lehman Brothers in the United States, GDP in the European Union was above its 2008 level by around 6% in real terms (Figure 1). During this period, overall real GDP also increased for the categories of other economies and cohesion economies by 8% and 13%, respectively, while in the periphery economies it remained below the pre-crisis level by around 4%. In this latter group however, there is wide diversity, with the gap remaining substantial for Greece and, to a lesser extent, Italy and Cyprus. However, the gap is almost closed for Portugal and Spain, and Ireland's GDP is well above its pre-crisis level. Overall, a large majority of countries in the EU now have a level of activity above the pre-crisis level. The recovery that started in 2013 is expected to continue over the next two years, with GDP projected to grow by 1.9% in both 2017 and 2018, according to the European Commission's Spring 2017 forecast.

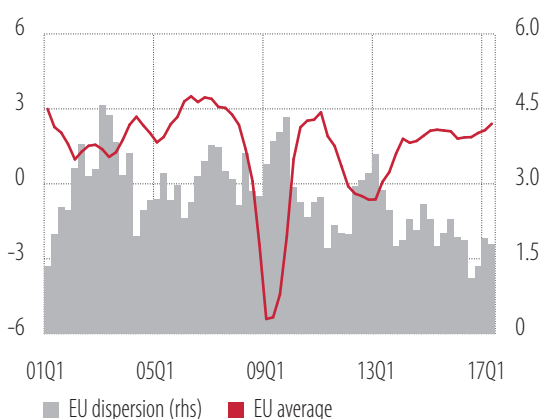
A new feature of the recovery during the past year is that it has become more broadly based in Europe. As shown in Figure 2, from the beginning of the recovery, the dispersion of annual real GDP growth has trended downwards. By the middle of 2017 GDP growth stood close to its level at the beginning of 2005, the previous cyclical upturn.

Figure 1 GDP and corporate investment in 2016 versus 2008 (change %)



Source: ECON calculations based on Eurostat.
Note: Change in real terms compiled using GDP deflator. Owing to data limitations, the cohesion category consists of the Czech Republic, Estonia, Poland and Romania only. NFC: non-financial corporate sector.

Figure 2 GDP growth and dispersion (annual, real terms, %, left-hand side; and percentage points per year, right-hand side)



Source: ECON calculations based on Eurostat.
Note: The dispersion portrays the interquartile range.

Corporate investment lags behind GDP growth in this recovery, most likely due to a long debt-deflation episode. While the corporate sector has been the first to positively contribute to investment recovery, corporate investment still lags behind GDP (Figure 1). It has increased compared to the pre-crisis level in the other economies category, but by less than overall GDP. Conversely, in the cases of the EU as a whole and the periphery and cohesion economies, corporate investment is still below the pre-crisis level. Two main paradigms have been developed to explain the disappointing investment recovery despite low interest rates. First, the muted recovery, after a very severe crisis, is explained by the very strong headwinds resulting from the deleveraging pressure in the context of the burst of the “financial cycle.” The second paradigm reflects structural factors and the adjustment towards “secular stagnation” associated with ageing, a decline in productivity, and the savings glut.

Each analysis has very different implications in terms of the outlook and the policies required. For the latter, the permanent decline in potential output triggers a permanent decline in the neutral rate of interest (Holson, Laubach and Williams, 2016). For the former, the adjustment in the financial sector and the deleveraging of banks, firms and households makes the downturn stronger and longer (EIB, 2016). Until the summer of 2016, views were very much split between secular stagnation and the super-debt-cycle view. In the 2016 investment report, we provided arguments more in favour of the debt-cycle view. One year later, while some analysts continue to advocate the secular stagnation scenario, most of the fears have vanished. Following the start of the hiking phase in the US and, more generally, the steepening of the yield curve in most advanced economies, it now seems most likely that the length and severity of the recession was linked to a major debt deflation episode. This, in turn, explains the moderate rebound, especially in the EU.

The recovery is, however, surrounded by unknowns and risks. Among the unknowns is the “new normal” macro environment with its uncertainty regarding potential growth. Another unknown is why there is a weakness of price pressures at this stage of the recovery (and not only in the euro area). While in the euro area this can be explained by the still substantial slack in the economy, the reasons in the US are more obscure. In addition, the way in which the European financial system will reintegrate is clearly unknown.¹ Risks relate to the tapering, political pressures towards a reversal of the globalisation trend, and, in Europe, a disorderly Brexit. Some of those risks are discussed in more detail in the next section.

Escaping the low interest rate environment?

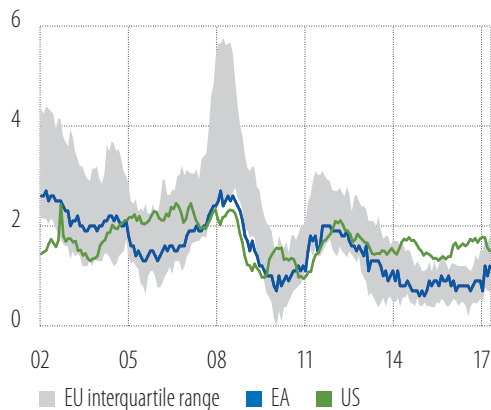
While fears of deflation have mostly disappeared over the last year, inflation to date remains subdued in Europe and in the US (Figure 3). In real terms, in the middle of 2017, US GDP was 19% above the pre-crisis level, while short-term interest rates were slightly above 1% per year and core inflation below 1.8%. The inflation pick-up in the second half of 2016 was mostly driven by the rise in oil prices. To date, second-round effects on core inflation are difficult to observe.

Overall, the acceleration in inflation is not yet self-sustaining, and uncertainty continues to prevail regarding the momentum of underlying inflation. The reasons for this are not well understood. Last year, low oil prices could be blamed; but even when oil prices rebounded somewhat, inflation remained relatively low. Another more structural explanation is that a large part of the goods included in the consumer price index tend to fall over time because they can increasingly be produced efficiently in low-wage countries. In addition, retailers’ margins are being squeezed owing to competition from online shops, while consumers can more easily use web-based engines to track the lowest prices. Overall, the sensitivity of domestic prices to economic activity may have diminished and the Phillips curve may have flattened. Furthermore, the relationship may be non-linear, as prices can stay sticky until a certain inflation level is reached. Indeed, Lopez-Villavicencio and Mignon (2013) show that a static linear model of inflation misses these two dimensions: the flattening

¹ This is discussed in Chapter 5.

of the Phillips curve and its non-linearity. Estimating models for six developed economies, the authors conclude that the slope of the Phillips curve as well as the trend inflation that erodes price rigidity are time-varying.

Figure 3 Harmonised Consumer Price Index inflation excluding food and energy (% per year)



Source: FRED.
Note: Monthly data up to June 2017. EA: euro area.

Figure 4 Output gap estimates (% of GDP)



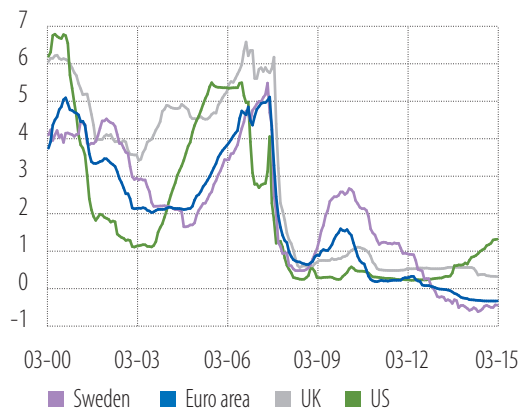
Source: International Monetary Fund, World Economic Outlook.
Note: Last record refers to 2017 (based on April 2017 projections). EA: euro area.

Part of the puzzle disappears, however, when the amount of slack remaining in the EU and, more widely, in the major developed economies is examined (Figure 4). At the start of 2017, output gap estimates were still in negative territory for the US, euro area, Japan and the UK. In the euro area, the output gap is somewhat above that in the US and UK, and it has been narrowing (from around 3% of GDP in 2013 to less than 1% of GDP in the first half of 2017). Therefore, despite the expected continuation of the recovery, inflation pressures should remain contained beyond the near term unless the pick-up in activity strengthens significantly. For the European Central Bank (ECB) to remove the extraordinary support provided by its monetary policy stance, four conditions must be met (Draghi, 2017a): inflation must be close to the target in the medium term, and this return must be durable, self-sustained, and shared across the euro area. In the absence of fiscal space within the euro area, a lot of the convergence towards a self-sustained inflation rate relies on a protracted pick-up in wage inflation. However, evidence corroborates the hypothesis that some degree of backward-looking indexation has returned, especially in some countries, and a protracted period of low inflation is in fact feeding into price and wage setting in a more persistent way (Draghi, 2017b). This evolution creates inertia in the price adjustment and may explain a large part of the inflation conundrum.

Given the low rate of inflation, it is not surprising that short-term interest rates remain exceptionally low (Figure 5). They have been negative in the euro area and Sweden for more than two and a half years, and they are below 50 basis points in the United Kingdom. In contrast, the US Federal Reserve has raised interest rates three times since the end of 2016 and, in September 2017, the effective federal funds rate stood 100 basis points above its historically low level of 10 to 20 basis points recorded over 2009-15.

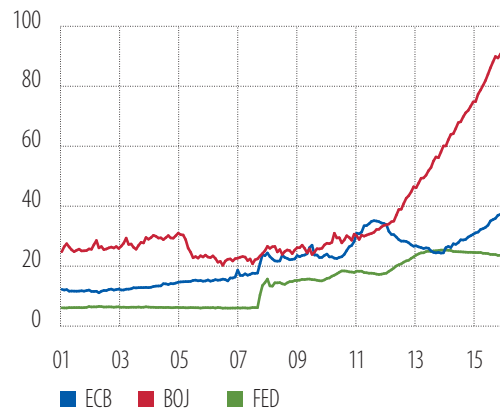
In terms of the implementation of non-standard measures, short-term interest rates have become only one element of the monetary policy toolkit, and it has become increasingly complicated to assess the level of the monetary policy stance. A lot of attention has moved to the parameters of Asset Purchase Programmes. These programmes have resulted in a massive increase in central banks' balance sheets, as shown by Figure 6. Announcement effects surrounding the changes in the key parameters of the programmes have become very important factors triggering changes in expectations associated with asset price movements.

Figure 5 Money market rates in the US and selected EU economies (% , three-month maturity)



Source: Thomson Reuters.
Note: Monthly data up to August 2017.

Figure 6 Central bank balance sheets (total assets over GDP)

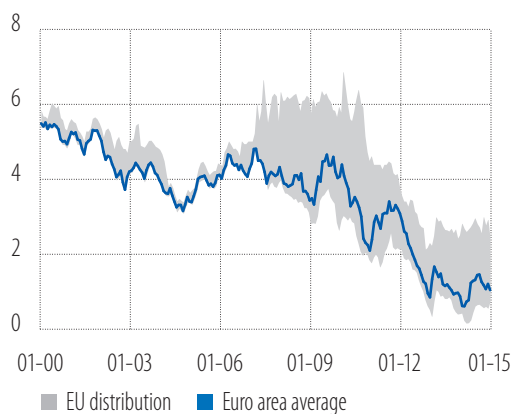


Source: ECON computations based on Bloomberg.
Note: Monthly data up to February 2017. ECB: European Central Bank, BOJ: Bank of Japan, FED: US Federal Reserve.

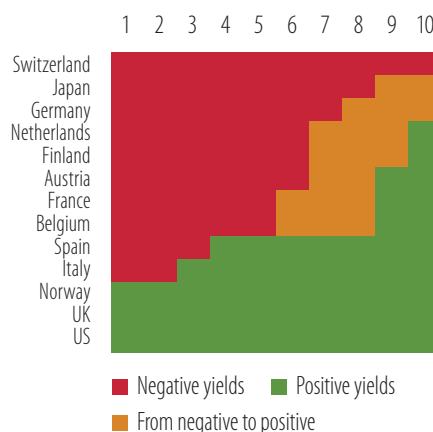
Since the beginning of 2017, the US has embarked on a monetary policy tightening cycle – with large uncertainty concerning its speed and size – while in the euro area such a move is not foreseen in the short term. Some have argued that the desynchronisation of monetary policy across the two sides of the Atlantic could trigger volatility in financial markets and especially in the foreign exchange market. Indeed, the euro-dollar exchange rate has varied widely since the start of the Asset Purchase Programme, with the announcement associated with a substantial depreciation of the euro, and, since the beginning of 2017, expectations of a tapering resulting in a 14% appreciation of its value against the dollar. While the ECB's Asset Purchase Programme has triggered substantial cross-border capital flows, the programme has affected exchange rates basically through the same channels as conventional interest rate policy – that is, through expectations of interest rate differentials (Coœuré, 2017a). Since the start of the Asset Purchase Programme in March 2015, 10-year US Treasuries have been yielding, on average, around 170 basis points more than 10-year Bunds, leading to capital outflows. However, the depreciation of the euro in response to the Asset Purchase Programme announcement occurred mainly through the signalling channel, including the added credibility asset purchases provided to reach the expected path (Andrade et al., 2016). By contrast, the portfolio rebalancing channel played much less of a role (Georgiadis and Gräb, 2016).

The maintenance of non-standard measures in the euro area may put upward pressure on the US dollar and therefore partly prevent the US Federal Reserve from delivering the path of monetary policy tightening expected by market participants. The materialisation of the US Federal Reserve monetary policy scenario priced in by market participants is based on the materialisation of the scenario priced in for the ECB, and vice versa. Hence, on both sides, caution should be taken to reduce uncertainty about unwinding. Indeed, the international implications of following a path of unwinding (or not) non-standard measures not aligned with expectations must be internalised in order to avoid excessive exchange rate volatility.

The policy package implemented by the ECB has contributed to flattening the safe risk yield curve so that a larger portion of it has entered negative rate territory, reaching historically low levels in the summer of 2016 (Figure 7). According to ECB (2017a), the monetary policy measures have contributed to reducing long-term risk-free rates in the euro area by around 80 basis points since June 2014.

Figure 7 Ten-year nominal government bond yields in the EU (% per year)

Source: Thomson Reuters.
Note: Monthly data up to August 2017.

Figure 8 Government bond yield spectrum (maturity in years)

Source: ECON computations based on Bloomberg.
Note: Monthly data up to February 2017. ECB: European Central Bank, BOJ: Bank of Japan, FED: US Federal Reserve.

The rise in long-term bond yields has been one of the most striking features of economic and financial developments over the last 12 months (Figure 7). During the summer of 2016, 10-year yields rose by 50 basis points in the US. The rise in the long end of the curve since last summer has been accompanied by a rise in the short end, so that the steepness of the yield curve has remained largely unaffected. In Europe, since last summer, a portion of the yield spectrum has escaped negative rates, although a significant part remains in negative territory (Figure 8). In contrast to the US, in the euro area the lower rise in the long end of the curve was not accompanied by a rise in the short end that would have steepened the yield curve during the period.

Assessing the current stance of monetary policy is complicated, but estimates suggest that European financial conditions are supportive. Assessment is complicated owing to the many instruments currently used and the need to account for the transmission of the various measures to the real economy. Indeed, while the first step is transmission to the financial sector, the repricing of assets aims to influence the conditions for accessing external finance for the corporate sector. For that matter, the monetary policy stance is one input among others.

In order to extract a signal from financial conditions, we filter a large set of indicators related to external financing and available at high frequency. These indicators are filtered from their reaction to monetary policy and activity, and a principal component analysis is used to summarise them (Darracq-Parries, Maurin and Moccero, 2014). Overall, the signal shows that in Europe, financing conditions are supportive, an assessment shared by most developed economies (IMF, 2017).

In 2017, financing conditions have marginally improved overall, although during the course of the year they have deteriorated slightly amid the uncertainty related to the outcome of the French elections (Figure 9). However, the change was very much contained compared to the swing recorded at the outset of the global financial crisis. The supporting financing conditions have contributed to pushing up activity and compressing bank lending spreads (Figure 10).

Figure 9 Euro area financial condition indicator (index, de-meaned and standardised)

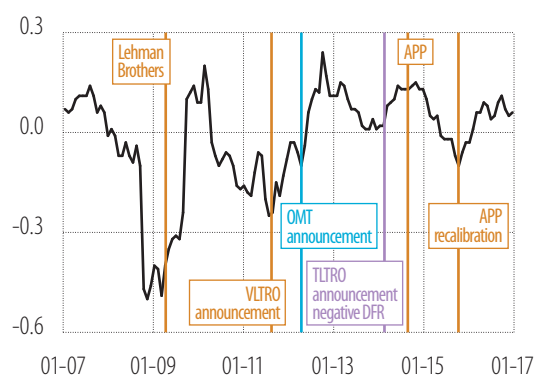
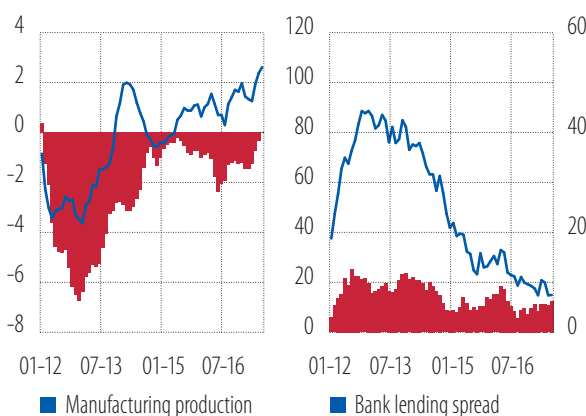


Figure 10 Estimated contribution of financial conditions (% and percentage points, contributions as red bars, right-side scale)



Source: Authors' calculations based on Darracq-Parries, Maurin and Mocero (2014).

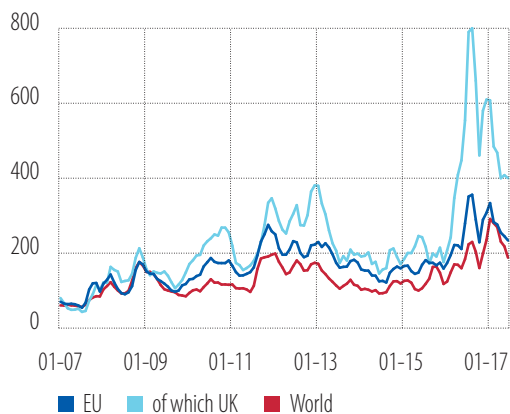
Note: An increase signifies a loosening in financial conditions. Monthly data up to June 2017. APP: Asset Purchase Programme; DFR: Deposit Facility Rate; OMT: Outright Monetary Transactions; VLTRO: Three-Year Long-Term Refinancing Operation; TLTRO: Targeted Long-Term Refinancing Operation.

Unravelling the risk-taking channel of monetary policy

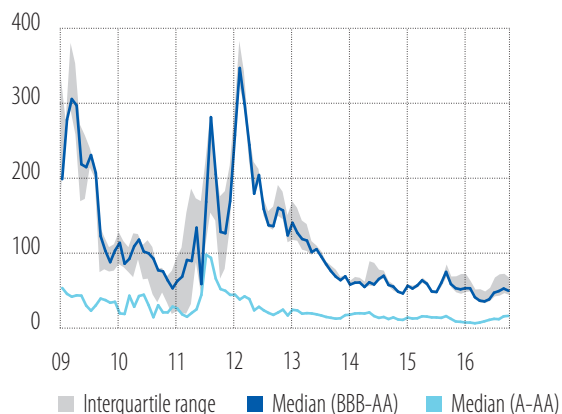
The risk-taking channel of monetary policy is active when changes in interest rates affect incentives to bear risks. For example, low interest rates may lead to a search for higher yields, encouraging banks to soften their credit standards, thereby increasing both the volume and average riskiness of supplied loans. When credit growth and additional risk-taking become excessive, imbalances build up in the economy and endanger the stability of the financial system. Of particular concern is the development of the so-called "credit-fuelled bubbles," which previous experience has shown to be particularly detrimental to financial stability. Such bubbles, which typically plague real estate markets, are characterised by an adverse spiral between asset price and credit growth. Positive growth in the market value of real estate supports credit growth, which at the same time contributes to inflating the value of real estate. When the resulting bubble bursts, the collateral underlying the credit loses value, impairing the lending and borrowing ability of lenders and borrowers, respectively. Another concern relates to asset-price bubbles.

Some have argued that the Asset Purchase Programme contributed to fuelling these bubbles and that consequently the removal of the stimulus could be accompanied by large swings in asset prices. Indeed, the level of priced-in risk, as indicated by volatility indicators, remains very low. Conversely, the indicators of political risk are relatively elevated (Figure 11). While those are estimated and therefore have to be viewed cautiously, it can be easily acknowledged that there are many existing and potential tensions in the world economy at the current juncture. Interestingly, too, in the EIBIS uncertainty is mentioned as a very strong impediment to investment (EIB, 2016; see also Chapter 8 on the impact of uncertainty on corporate investment).

Overall, uncertainty is high in the real economy, while its pricing in the financial markets is at historically low levels. This suggests an under-pricing of risk, possibly reflecting the search for yields in a context of very ample liquidity.

Figure 11 Uncertainty indicators (three-month moving average)

Source: Baker, Bloom, and Davis (2016).
Note: Monthly data up to June 2017.

Figure 12 The relatively low risk-spread dispersion (basis points per year)

Source: ECON calculations based on Eikon Datastream.
Note: Monthly data. The interquartile range refers to the dispersion of spreads across the maturity spectrum between one and 15 years.

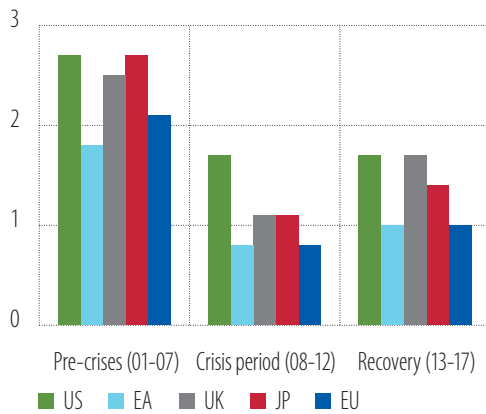
As the timing of the normalisation of monetary policy in Europe is unknown, such normalisation could be accompanied by large volatility when it happens, as occurred during the US Federal Reserve tapering, an episode called the “taper tantrum.” The removal of the central bank purchase programme could be accompanied by a re-opening of the risk spread from a very low level (Figure 12) as well as a substantial portfolio rebalancing away from equities and into safer bonds. Some ECB watchers expect that the bank will soon announce a tapering of its asset purchases, and the US Federal Reserve has already announced a policy to begin reducing the size of its balance sheet. Those twin decisions represent a change in policy direction from the past decade. Some fear that the ECB’s announcement could trigger a market response similar to the FED-inspired taper tantrum of 2013. During that episode, several factors contributed to lower asset prices and inflated volatility. The novelty of tapering may also have been a contributing factor. To the extent that the ECB’s tapering is well anticipated and that tapering is no longer novel, the risk of an adverse market impact may be lower. However, a re-opening of the risk spread spectrum cannot be excluded and, all else being equal, this would prove negative for riskier assets.

Looking forward, where is the “new normal”?

Examining the “new normal” of monetary policy first requires adopting a view on the crisis, possibly restating the rationale for fears of secular stagnation. As discussed, if anything, the past year has showed us that the fears of secular stagnation have been overstated. Indeed, some years after the end of the crisis, potential output is estimated to be recovering somewhat in Europe and Japan, though remaining below its pace at the beginning of the 1990s (Figure 13). Indeed, during the summer of 2016, there was a major turnaround in the bond market, with a rise in 10-year forward yields of 40 to 60 basis points.

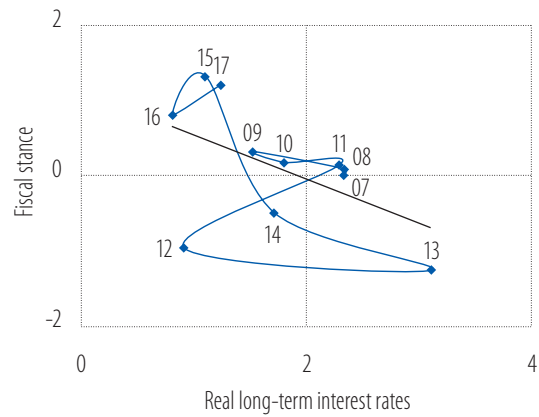
Potential output estimates have been seen as less reliable since the crisis. Because of the capital scrapping and the shifting in the sectoral composition following the very large decline in GDP, output estimates have become very volatile and it has been difficult to predict their shifts. Indeed, Guérin, Maurin and Mohr (2011) estimate multivariate Markov-switching models of the Phillips’ curve to determine at the same time trend growth and inflation reaction to the output gap. The authors find evidence of changes in trend growth around deep recessions. However, in the medium term, potential growth is found to be more predictable and inflation-activity trade-offs materialise.

Figure 13 Potential output growth (% per year)



Source: IMF, World Economic Outlook, and EIB/ECON.
Note: The EU estimates are based on EIB/ECON.

Figure 14 The policy mix in Europe (EU average)



Source: ECON calculations based on AMECO and Thomson Reuters Datastream.
Note: The fiscal stance is measured as the change in the cyclically adjusted net lending or borrowing of the general government as reported in AMECO. Real long-term interest rates are computed by subtracting past annual GDP inflation from the 10-year government bond yield.

Bauer (2017) shows that the longer the horizon, the stronger the reversion of interest rates towards their long-term trend, estimated by structural factors. The most difficult question relates to estimating the long-term trend. Belke and Klose (2017) estimate the unobservable equilibrium real interest rate for 12 euro area countries using the Laubach-Williams (2016) model.² They show that with the exception of Greece, secular stagnation is not a significant threat to most of those countries.

The length of the European crisis suggests that the policy mix in Europe is not efficient and that improved coordination between fiscal and monetary policy is warranted. Indeed, Figure 14 reveals how weakly coordinated the two policies have been since the crisis. The figure shows simple indicators of the policy stance: on the one hand, the change in the cyclically adjusted fiscal balance for fiscal tightness, and on the other hand, the real long-term interest rate as an indication of monetary policy tightness. The higher the indicator, the tougher the stance: when the cyclically adjusted balance (real long-term interest rate) increases, the fiscal (monetary) stance tightens. A coordinated policy mix should result in synchronised stances, whereby the observations would occur in the lower-left or upper-right quadrant of Figure 14. However, it appears from the figure that most of the time since the crisis, policies in Europe have pulled the economy in opposite directions: the tightened fiscal stance, such as that over the last three years, was accompanied by loose monetary policy. Given the time needed to recover from the crisis, it is difficult to support a position that this policy mix in Europe was efficient.

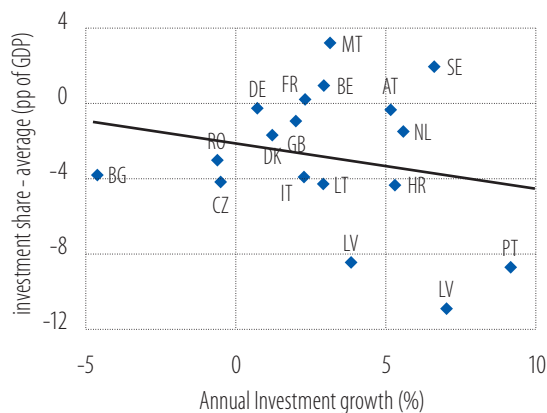
² The model applies the Kalman filter to data on real GDP, inflation and the short-term interest rate to extract highly persistent components of the natural rate of output, its trend rate and the natural rate of interest (Laubach and Williams, 2016).

Corporate balance sheet adjustments and sources of finance

Corporate investment continued accelerating in the first half of 2017, with stronger acceleration in the countries where the gap in the investment share is larger. As can be seen in Figure 15, there is a clear negative correlation between the deviation of investment to GDP from its historical average and the increase in investment. This suggests that investment is catching up to reverting to its long-run trend, which bodes well for longer-term economic prospects.

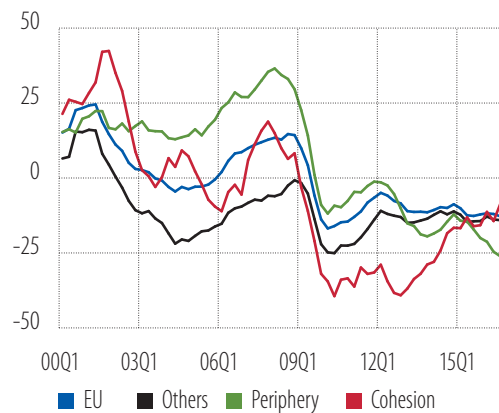
A striking feature of the post-crisis period is that, overall in the EU, the corporate sector has become a net saver, meaning that the amount of investment is below the financing capacity of the corporate sector as a whole (Figure 16), and that this sector now provides savings to the rest of the economy or the rest of the world. With the exception of the category of other economies in Europe, this stands in contrast with historical trends from the end of the 1990s until the end of 2008. More generally, it contrasts with the traditional sectoral view according to which households are net savers while firms are net investors. The shift from net saver to net borrower was especially pronounced for cohesion and periphery economies. However, for both groups of economies, excess savings among firms diminished in 2017. This change was especially pronounced, but not new, for cohesion economies, as the diminishment of excess savings started at the turn of 2012. Conversely, for the periphery, the trend started during 2012.

Figure 15 Investment quadrant:
Real investment growth and
investment share (% and %
points of GDP)



Source: ECON calculations based on Eurostat.
Note: Annual investment growth and investment share in 2016. Average investment share computed over 2000–08. pp: percentage points.

Figure 16 Net borrowing over investment
(%, non-financial corporate
sector only, nominal data)



Source: ECON calculations based on EUROSTAT sectoral accounts.
Note: Four-quarter moving average of non-seasonally adjusted data. Data up to 2016:Q4.

Limited rebound in external financing despite very low financial costs

Possible financing constraints, the impact of the ongoing deleveraging process, and the availability of internal finance are among the factors that can explain the still abnormal situation of excess corporate savings. Regarding the availability of internal finance, it is interesting to note that, during the recovery and in a context of moderate cost increases, stronger demand has enabled companies to increase their

volume of sales as well as their margins. This has resulted in increased gross entrepreneurial income and therefore more internal financing capacity.

Becoming net savers, European firms have improved their financial position partly by reducing debt, and partly by accumulating financial assets. Indeed, some deleveraging has taken place in the EU, mostly in periphery economies (Figure 17). In this group of countries, the ratio of corporate debt over GDP from 2012 until the first quarter of 2017 declined by around 20 percentage points of GDP. This evolution contributed to closing half of the gap with the other economies. In this latter group, the ratio declined marginally from 2013 until the end of 2016 and has marginally increased since then, reflecting opposite changes among countries. In the periphery and in the other economies groups, the debt-to-GDP ratio is now below its level prior to the start of the sovereign debt crisis in late 2010.

The strengthening of economic activity will continue to support the deleveraging process. From a macroeconomic point of view, the end-point of the process is difficult to gauge. At the firm level, the capacity to repay debt is the criterion determining the sustainable level of indebtedness, which therefore depends on productivity, demand and the cost of debt. At the aggregated level, the long-term debt-to-GDP ratio of the non-financial corporate sector also depends on the composition of the economy. Hence sectoral shifts, such as the shrinking of the construction sector, impact the sustainable debt-to-GDP ratio. The decline in the debt ratio when measured against activity, after years of increase, supports the view that corporate deleveraging has taken place in Europe, and that it has been concentrated in a few countries. It is not clear, however, whether this process has come to an end.

Figure 17 Corporate debt over GDP (%)

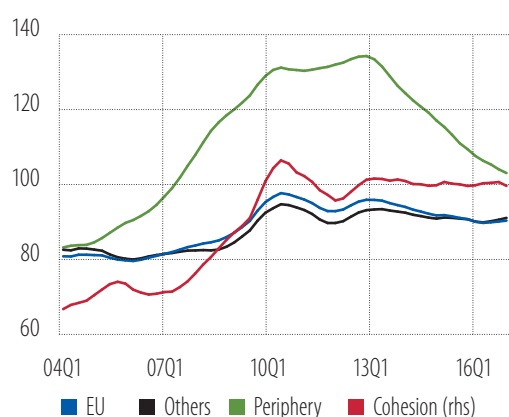
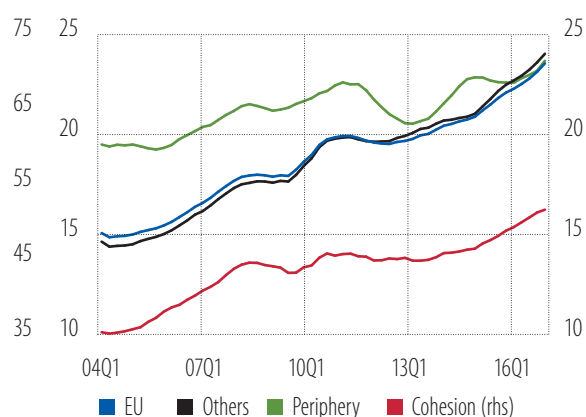


Figure 18 Cash and deposits of firms (ratio to GDP, %)



Source: ECON computation based on Eurostat sectoral accounts.

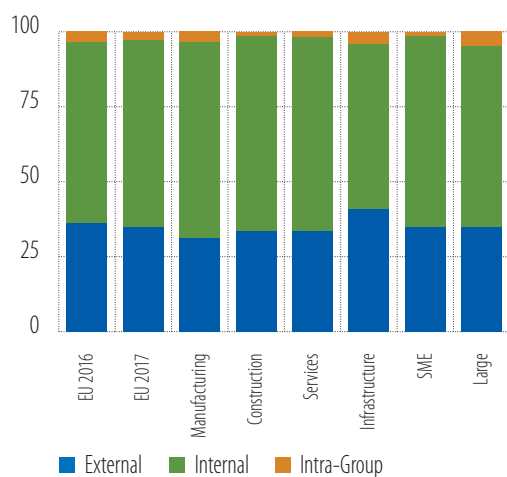
Note: Data up to 2017:Q1. Four-quarter moving average. The debt is comprised of bank loans and debt securities. Italy is not included in the periphery aggregates as data are available over a very short time span.

Since in the periphery economies savings were tilted more towards the reduction of debt, cash accumulation was somewhat less pronounced than in the group of other economies. In the latter group, from the beginning of 2007 until the first quarter of 2017, the ratio of cash and deposits of firms over GDP increased by 7 percentage points of GDP, well above the 3 percentage point increase recorded in the periphery (Figure 18). However, the increase started well before the crisis and is likely to reflect primarily structural improvement in the liquidity management of non-financial firms. Besides, it is difficult to interpret without more granular information, as the overall increase may also mask opposite trends within the corporate sector. Still, given the role of internal resources in the financing of investment, a higher cash position of firms reinforces their capacity to adjust capital expenditures to a stronger acceleration in demand, especially since a large part of investment is financed through internal resources.

According to the latest EIBIS results, firms across the EU finance most of their investment (62%) via internal financing (Figure 19). Among sectors, infrastructure firms use the lowest proportion of external finance. Across countries, firms in Greece (81%), Cyprus (79%) and Slovenia (78%) are more likely to use a higher share of internal finance, while firms in France (51%), Italy (44%) and Belgium (43%) use the highest share of external finance.

Bank loans accounted for the highest share of external finance (56%), followed by leasing (21%) (Figure 20). This is largely consistent with the previous survey wave of the EIBIS. Across sectors, manufacturing (60%) and service (62%) firms are more likely to use bank loans than other sectors, while construction (27%) and infrastructure (26%) are relatively more reliant on leasing compared to other sectors. In the EU, firms in Malta (82%) and Cyprus (81%) are the most likely among EU countries to use bank loans.

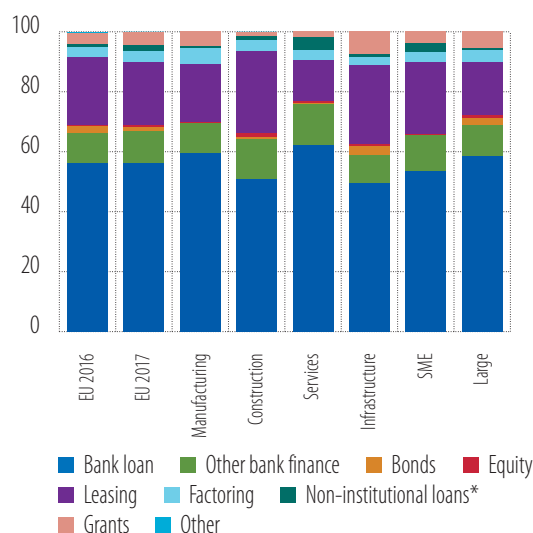
Figure 19 Source of internal finance (%)



Source: EIBIS2016 and EIBIS2017.

Note: Base: All firms that invested in the last financial year (excluding don't know/refused responses).
Q: What proportion of your investment was financed by each of the following?

Figure 20 Type of external finance used for investment activities (%)



Source: EIBIS2016 and EIBIS2017.

Note: SME: small and medium-sized enterprises. Base: All firms that used external finance in the last financial year (excluding don't know/refused responses). Q: What proportion of your investment was financed by each of the following?

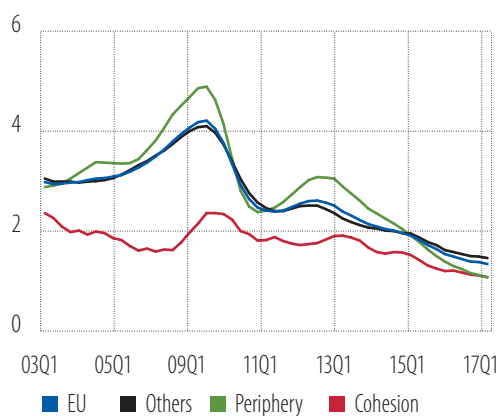
* Loans from family, friends or business partners.

Bruno, D'Onofrio and Marino (2017) explored the differential impact of leverage and debt maturity structure on investment in a large sample of European firms during the financial and sovereign crisis period. They found that during the crisis, leverage exerted a strong and negative effect on the level of investment, and firms with more debt invested less. Conditional on the level of leverage and maturity, small firms located in the periphery reduced investment by more. Moreover, firms able to generate internal resources and firms engaged in multiple banking relationships were able to alleviate financial frictions and shield investment. Conversely, the authors did not find evidence of a positive nexus between cash and investment, and they found only little evidence of a positive effect on investment of access to capital markets that would have mitigated the negative impact of debt in crisis years. Chapter 7 revisits the impact of internal and external finance on firms' different types of investment using a novel database that matches EIBIS responses to accounting data. The results show a more complex dynamic where a pecking order theory of financing investment emerges.

The decline in the composite cost of nominal debt, and the recovery in gross operating surplus fuelled by better demand conditions, have helped alleviate the debt burden, which is the share of gross interest payments over GDP. This ratio has been decreasing since the middle of 2012 for all the groups of economies (Figure 21). From the peak at the start of 2009 since the level at the start of 2017, the decline was especially pronounced in the periphery economies, reaching 4 percentage points above the change recorded in other economies (2.5 percentage points) and cohesion economies (around 1.5 percentage points). Starting from a much higher ratio in the periphery and a lower one in the cohesion economies due to the much lower level of corporate debt, the situation has become relatively similar for firms in the three country groups. At the beginning of 2017, firms' debt payment burdens were well below their historical average since the beginning of 2003, especially for the other economies and the periphery. Changes in the cost of debt were a major factor behind this trend. Figure 22 shows the decline in the composite nominal cost of debt financing for EU firms. From around 6% on an annual basis at the start of 2009, the cost declined to around 2% in mid-2017 in the EU. This is mostly due to the decline in bank lending rates, which are also at historically low levels for both long- and short-term loans. The cost of debt securities is also at a very low level, as a result of the exceptionally low level of monetary policy rates (Figure 5).

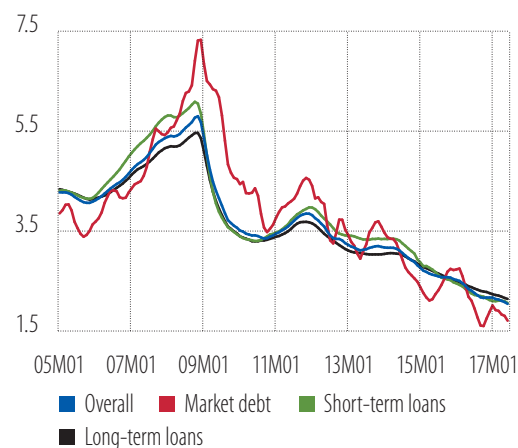
Besides continuing to benefit from the reduction in both long- and short-term bank lending rates, companies have continued to increase the average maturity of their indebtedness. Indeed, the share of short-term loans and debt in the total has declined to historically low levels. The decline was especially pronounced in periphery economies (EIB, 2016). To some extent, this reflects the fact that short-term debt, being by nature more frequently renewed, is affected more quickly when the total volume of external financing flows is reduced. But it is also a reflection of the flat yield curve that gives firms an opportunity to strengthen their funding structure by substituting long-term financing resources for short-term ones.

Figure 21 Corporate gross interest payments (% of nominal GDP, four-quarter moving average)



Source: ECON calculations based on Eurostat.
Note: Four-quarter moving average. Data up to 2017:Q1.

Figure 22 Composite nominal cost of debt financing for firms in the EU (% per year, three-month moving average)



Source: ECON calculations based on ECB and Thomson Reuters.
Note: The overall cost of financing is calculated as a weighted average of the cost of bank lending and the cost of market-based debt, based on their respective outstanding amounts. Monthly data up to June 2017.

When asked in the 2017 EIBIS about the sources of their dissatisfaction with the external finance received, firms cited collaterals as the first source of dissatisfaction, just above the cost (Figure 23). Indeed, a small share of EU firms that used external finance was dissatisfied overall with the amount, cost, maturity, collateral or type of financing received. Looking into details, collateral requirements and the cost of funding remained the main areas of concern, with EU firms most dissatisfied with the associated collateral (8%) and cost (6%) of securing external finance. The type of finance, its maturity and the amount, on the other hand, mattered much less.

Figure 23 Dissatisfaction of firms with type of finance offered and received (% of respondents)

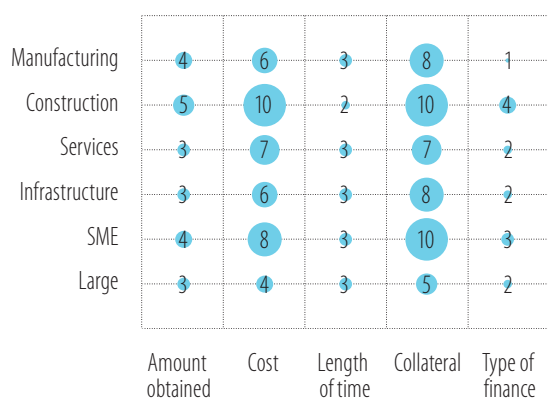
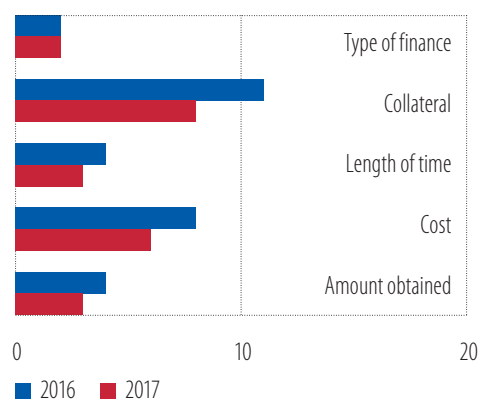


Figure 24 Trends in dissatisfaction of firms with type of finance offered and received (% of respondents)



Source: EIBIS2016 and EIBIS2017.

Note: All firms that used external finance in the last financial year (excluding don't know/refused responses). Answer to the question: "How satisfied are you with...? The size of the bubbles and the numbers within them in Figure 23 signify the share of firms that are dissatisfied (fairly or very) with a particular feature of the finance that they received or were offered.

However, 8% of small and medium-sized enterprises (SMEs) were dissatisfied with the cost of external finance, double the percentage of large firms dissatisfied with that cost. Construction firms generally showed higher levels of dissatisfaction compared to other firms, particularly with cost (10%) and collateral (10%). Moreover, SMEs were more likely than larger firms to be dissatisfied with the collateral required to secure external finance (10% versus 5%). Across economies, there was a relatively larger share of firms unhappy with the cost of obtaining external finance, particularly in Greece, Ireland, the Netherlands, Portugal and Slovakia – economies that mostly stand in the higher part of the distribution of finance-constrained firms across the EU.

Overall, firms are most dissatisfied with the collateral requirements associated with obtaining funding. This is most true for firms in Croatia, Cyprus, Greece and Lithuania (with about one in five companies saying that they are either fairly or very dissatisfied with the collateral requirements linked to their funding in these countries), and least the case in Estonia, France, Luxembourg and Sweden. Like all the other sources of possible dissatisfaction, however, the proportion of firms dissatisfied with collateral and cost has fallen since the previous wave of the EIBIS in 2016 (Figure 24).

Bank loans and market-based finance

On the back of the non-standard measures implemented in the euro area, the cost of short-term bank borrowing has continued to decline since the middle of 2016 all across Europe. In June 2017, the cost of short-term bank borrowing stood 9 basis points below its level in June 2016. The decline was stronger

in periphery economies, where the non-standard measures implemented by the ECB contributed to restoring the transmission of monetary policy (EIB, 2016). For this group of countries, the bank lending rate on short-term loans declined by 44 basis points from June 2016 to June 2017 (Figure 25).

Figure 25 Bank lending rate on short-term business loans (% per year, three-month moving average)

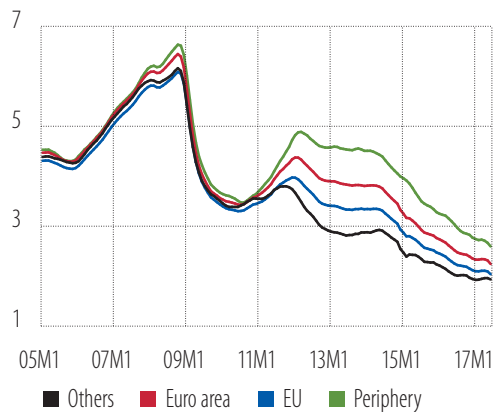
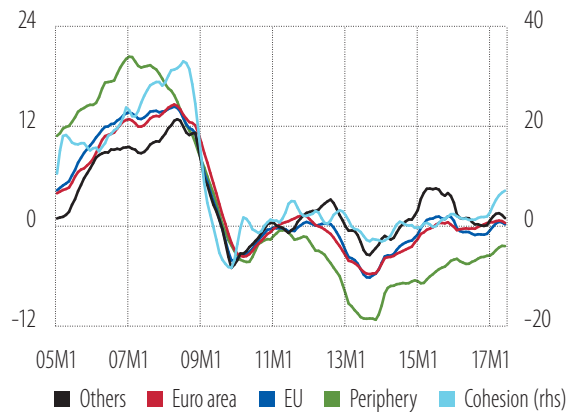


Figure 26 Bank loans (annual growth rate, %)



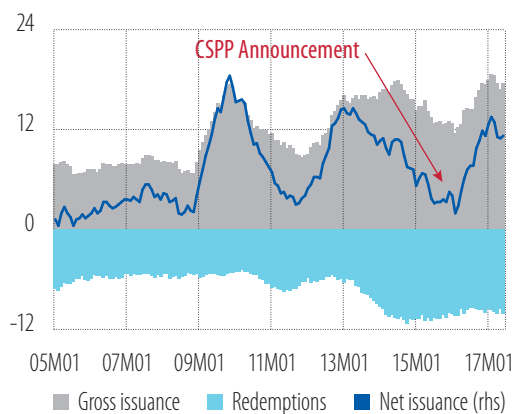
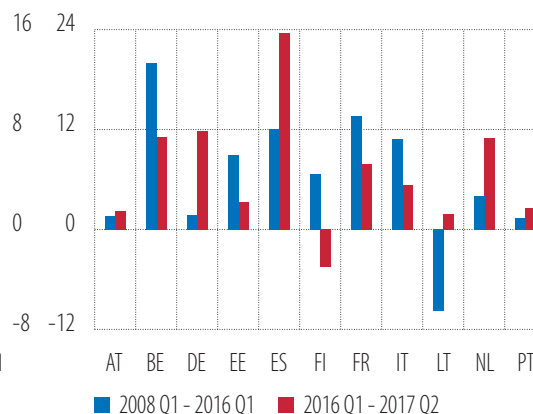
Source: ECON estimations based on ECB and Eurostat.
Note: Data up to June 2017.

The decline in bank lending rates was associated with the continuation of the very subdued recovery in bank loans, the most important source of external finance for firms in the EU (Figure 20), with outstanding amounts close to 50% of GDP. During the past year, the recovery was more pronounced in cohesion economies and the periphery (Figure 26). However, the recovery in bank loans continues to remain very subdued across the EU apart from in the cohesion economies.

The stock of outstanding non-financial corporate debt securities, which amounted to EUR 1.9tn at the end of 2016, represents 13% of GDP, a share well below that of corporate bank loans. The European corporate debt market remains concentrated across countries and firms, with a few issuers located in a few countries having a large market share (EIB, 2016).

To some extent, the corporate debt market is catching up in the EU and has been growing faster than GDP for a long time. There is also evidence that the ECB Corporate Sector Purchase Programme (CSPP) launched at the beginning of 2016 has been accompanied by an acceleration of debt issuance activity, as shown in Figure 27.³ By the middle of 2017, the ECB had purchased around EUR 110bn of corporate bonds from approximately 200 issuers in various sectors. Besides the impact of the ECB programme, country-specific factors are also at play. Figure 28 decomposes the period starting in 2008 into two sub-periods, the first up to the start of the CSPP in the first quarter of 2016 and the second since then. The average annual growth rate over each period is reported. It appears that in most euro area countries, the issuance of debt securities accelerated, especially in Germany, Spain and the Netherlands. There was also an acceleration in countries in the periphery. Being spread out geographically, the stronger activity was nonetheless focused on large corporations, since, by their nature, they are more inclined to issue debt securities. However, stronger debt market activity can also indirectly benefit SMEs if it is accompanied by stronger market activity fostering the issuance of asset-backed securities. Moreover, by reducing the demand for bank loans, debt issuance liberates resources for the banking sector to lend to SMEs.

3 The CSPP was announced in March 2016. In June 2016, investment-grade, euro-denominated bonds issued by non-bank corporations established in the euro area became eligible for the Asset Purchase Programme. The purchases can be conducted in the primary and secondary markets for ratings above BBB- and maturities of six months to 30 years.

Figure 27 Issuance of longer-term non-financial corporate debt (% per year)**Figure 28** Net issuance of non-financial corporate debt (% per year, average over the period)

Source: ECON calculations based on ECB.

Note: Calculations based on outstanding amounts. Monthly data up to June 2017. CSPP: Corporate Sector Purchase Programme.

Besides supporting investment, the current low interest rate environment may favour the optimisation of firms' financial liability structure. To explain why the low interest rate environment is not associated with stronger investment growth, Blundell-Wignall and Roulet (2013) analyse the financial decisions of 4,000 global corporations. They show that capital expenditure decisions depend on the cost of equity, the accelerator and uncertainty. In contrast, buybacks are mostly driven by the spread between the cost of debt and the cost of equity. The authors conclude that, the cost of equity being high, the situation is not favourable to long-term investment. However, as it is associated with a substantial spread with the cost of debt, partly resulting from low interest rates, the environment provides an incentive for borrowing to buy back shares.

The rebound in equity issuance since the beginning of 2014 continued in late 2016 and into the first half of 2017. The relatively strong issuance activity is to some extent explained by the higher stock price, which contributes to lowering the cost of equity (Figure 29). However, analysis conducted in the framework of the EIBIS2017 suggests that firms are somewhat reluctant to issue equities, probably fearing a dilution of existing shareholders as well as a loss of control (Box 1). Thus, creating the right incentive is key.

Box 1 Corporate financing choices: Results from an experiment

Based on the results obtained from an experimental exercise, this box sheds some light on the reasons behind the large share of debt financing in Europe (see Figure 20 in the main text).

The system is more resilient with more equity-based finance.

Recent experience shows that strong reliance on debt can negatively affect firms' resilience in times of crisis. Following the financial crisis, companies in Europe suffered from severe debt overhang that depressed corporate investment. In addition, as investments in intangible goods have become ever more important in the asset mix of firms (Chapter 3), a heavy reliance on debt finance is likely to stifle investment activities going forward because of a lack of collateral associated with this type of asset, making access to debt finance more difficult.

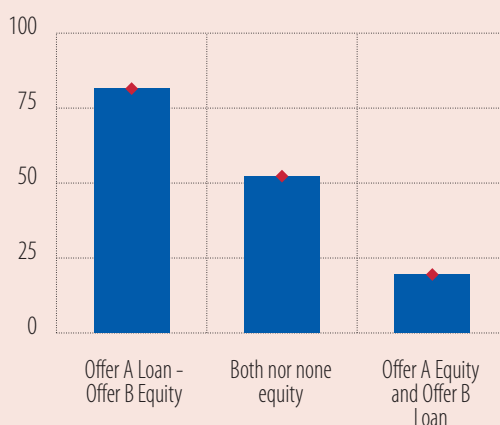
This box presents the results of a randomised online experiment to better understand why firms continue to rely so much on debt and so little on external equity for their investment activities, despite the problematic aspects of debt finance.

The experiment worked as follows: First, firms had to state which amount they wanted to finance externally (either in euros or their local currency) and which maturity this financing should ideally have. Second, based on the desired amount and maturity as well as the funding situation in the firm's country, a sequence of pairs of hypothetical loan offers was generated through independent random draws from uniform distributions over the various financing characteristics. One of these characteristics was whether the financing offer was an equity participation or a loan offer. Firms were then asked which offer they preferred.⁴ In total, 973 firms participated in the experiment.

Firms don't consider equity attractive.

Using firms' choices between the two offers, we can estimate how they prioritise among different financing characteristics.⁵ The results suggest that firms generally prefer debt financing over equity financing. Figure 1 shows that if a firm is presented with an equity offer and a loan offer, the firm will take the loan offer eight out of ten times.

Figure 1 Decision of firms between different external finance offers (probability of choosing Offer A, %)



Source: ECON calculations based on ECB.

Note: Calculations based on outstanding amounts. Monthly data up to June 2017. CSPP: Corporate Sector Purchase Programme.

4 Loan offers varied in terms of their maturity, amount, collateral requirement, interest rate, amortisation period, fees, and whether or not the interest rate was fixed. Equity offers varied in their amount, voting rights options, and participation share.

5 The equity participation shares are calculated using past profits and costs of equity that deliver realistic shares in the company.

Figure 1 shows that even after controlling for differences in terms of the different financing offers (including, for example, the cost of financing or control rights), equity offers are rejected more often than debt offers.

To give an illustration of this, consider a firm with an annual net income of EUR 1m that wants to finance a project of EUR 2m using external finance. Our experimental set-up suggests that this company is indifferent between:

1. A loan that is offered at the desired amount, with a floating interest rate of 9.2%, no collateral requirement, no fees, no amortisation period and a maturity above the desired one (questioned in a first step); and
2. An equity participation that offers the same amount and voting rights in return for a share of 10% in the company.

Taking the firm's past profits as an indicator of future earnings, this implies that the firm is indifferent between a loan with an interest rate of 9.2% and comparable equity participation with a cost of equity of 5%.

If the company is offered preferred equity (equity without voting rights), the interest rate on the loan that makes the company indifferent is reduced to 7.9% – that is, equity financing becomes relatively more attractive if it comes without voting rights.

To rule out our results being driven by firms with a high growth perspective, we analysed firms with positive growth expectations separately. In line with the literature (such as Rajan and Zingales, 1995), the analysis finds that firms with better growth prospects are more likely to accept equity offers than firms with poor growth prospects. However, even for firms with positive growth prospects, loans remain generally more desirable than equity.

Figure 2 shows how break-even interest rates differ by firm characteristics – that is, the figure shows the interest rates that make firms indifferent between a debt offer and an equity participation of 10% (at a cost of 5%).

The figure shows that large companies are generally willing to pay higher interest rates to avoid equity finance than smaller firms. On the other hand, firms in countries with a French and socialist legal origin, as well as firms that undertake large investment projects, are less willing to pay to avoid equity financing. The interest rates that make firms indifferent between a loan offer and our benchmark equity offer is, however, in all cases higher than the cost of equity, reflecting a general aversion towards the use of external equity.

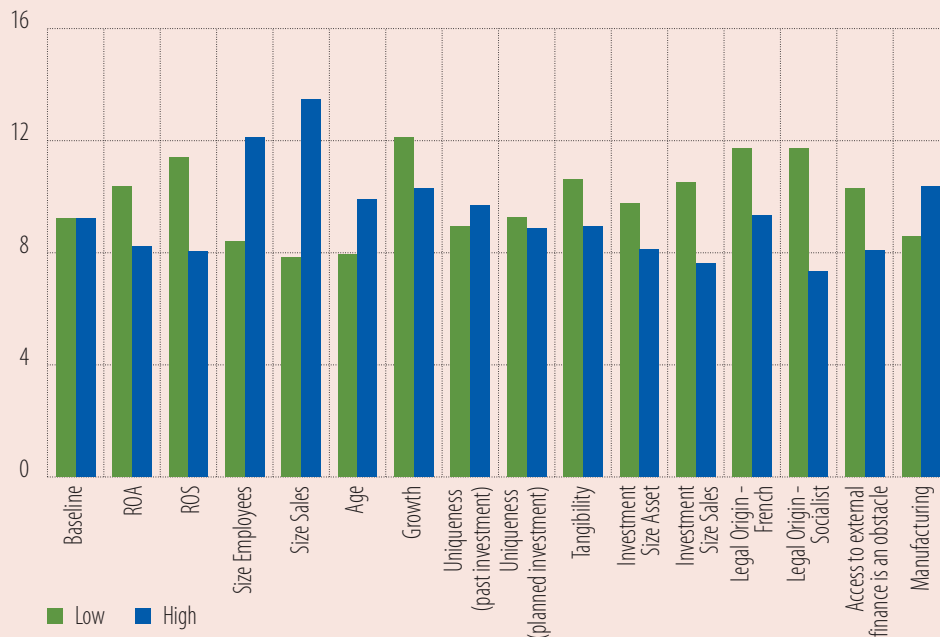
As more equity finance supports the stability of the system, equity investments should be made more attractive through proper incentives.

Even if we account for the fact that companies have a desire to keep voting rights to themselves and that equity is often more expensive than debt (that is, having a higher required return), firms tend to prefer debt over equity. The two reasons – the wish to keep voting rights and to minimise funding cost – reinforce the choice of debt over equity. Part of this may be due to tax codes that favour debt financing over equity financing, as interest rate payments are tax deductible. To spur equity financing, governments might, therefore, want to consider equalising the tax treatment of equity and debt. This makes equity more favourable for firms.

In addition, governments could consider the treatment of venture capital in a more favourable way. Venture capital investments tend to be riskier because the return is heavily skewed: that is, average returns are high only because some investments generate astronomic returns. Tax codes should

take this risk into account, as high taxes on the earnings might hinder investment by risk-averse investors, and highly risky investments in start-ups bring positive externalities once these companies grow.

Figure 2 Break-even interest rate on loan offers (% per year)



Source: EIBIS2016.

Note: The figure compares firms' break-even interest rate in terms of interest rate percentage points for the above-mentioned loan offer compared to the above-mentioned equity offer for different firm characteristics. ROA: return on assets; ROS: return on sales.

Finally, reconsidering business regulation at the European level (for example, disclosure requirements) might incentivise small and medium-sized enterprises to issue more external equity and thereby boost their investment. The EU has taken the first steps towards harmonising disclosure requirements through Directive 2013/34/EU. However, the thresholds regarding firm size have not been adjusted since 2013. Increasing these thresholds might reduce administrative burdens. On the other hand, it needs to be kept in mind that the disclosure of company information is helpful for investors to collect information.

Table 1 Results of logit regressions on firm preferences between A and B financing offers on different financing offer characteristics

	(1)	(2)	(3)	(4)
	Baseline	Above maturity and amount	Above maturity	No voting
Equity participation	-82.37***	-76.50***	-79.79***	-94.01***
	-11.04	-11.14	-10.85	-9.626
Interest or return rate	-19.07***	-19.28***	-19.24***	-19.13***
	-0.923	-0.926	-0.926	-0.924
Amount	0.980***	0.981***	0.983***	0.991***
	-0.071	-0.0995	-0.071	-0.071
Maturity	0.249***	-0.144		
	-0.0528	-0.11		
Amortisation	-0.0626	-0.0559	-0.0551	-0.0601
	-0.0485	-0.0487	-0.0486	-0.0485
Interest type	-20.64***	-21.84***	-21.66***	-21.27***
	-4.463	-4.516	-4.482	-4.477
Voting rights	-25.83***	-24.44***	-24.81***	
	-8.928	-9.017	-8.934	
Collateral	-0.790***	-0.787***	-0.786***	-0.783***
	-0.0439	-0.044	-0.044	-0.0439
Fee	-3.327	-6.408	-5.564	-5.46
	-5.506	-5.587	-5.526	-5.522
Above desired maturity		33.18***	23.81***	24.13***
		-8.132	-3.911	-3.909
Desired amount		0.342		
		-6.035		
Observations	7,237	7,237	7,237	7,237
LR Chi ²	1206	1214	1213	1208

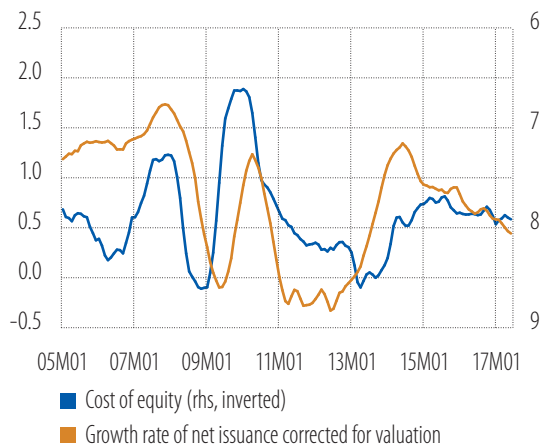
Source: Authors' estimations.

Note: Column (1) presents the baseline specification; column (2) tests for asymmetries at the desired amount and maturity; column (3) presents the results for asymmetries for the desired maturity only; and column (4) presents the results without voting rights. Standard errors in parentheses. *, **, *** denote significance at the 1%, 5% and 10% level, respectively.

TF for more details, see Brutscher, Heipertz and Hols (2017).

While some analysts have argued that EU equities look expensive, the risk of a possible re-pricing for corporate investment should be contained. The earning yields provide a gauge of the relative attractiveness of equity versus bonds.⁶ As shown in Figure 30, using this measure, in absolute terms, equities are historically very expensive. But in relative terms, they still look attractive compared to bonds that yield a very low return. Indeed, expected earnings incorporate a recovery while long-term yields are kept low given structural factors, ample liquidity, and high savings. This suggests that there may be reasons to explain the price level of equity at the current juncture that reduce the likelihood of a major correction in the wake of normalisation. But more fundamental factors can play a role: compared to the historical average, the value-added decomposition is directed towards profits, with a relatively low labour share. A reversion from the historically high profit share would erode margins. At the same time, it could also increase demand and activity. Overall, the effect on equity valuation is unclear.

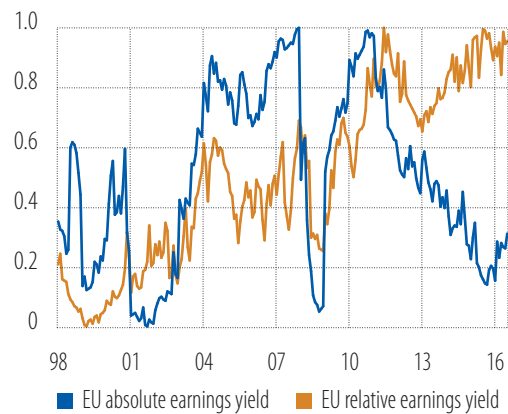
Figure 29 Equity issuance and cost of equity (annual growth rate, %, left-hand side; and % per year, right-hand side)



Source: ECON computations based on ECB data and Thomson Reuters Datastream.

Note: The cost of equity is derived from a dividend discount model using information from the Datastream non-financial stock market index. Monthly data up to June 2016.

Figure 30 Relative attractiveness of equities in a low-yield environment (2005 = 100, left-hand-side; and % per year)



Source: ECON computation based on Thomson Reuters Datastream.

Note: The MSCI index is used. Absolute earnings yields are based on the inverse of the 12-month-forward price-to-earnings ratio. For the relative yield, the average real 10-year EU sovereign yield is subtracted. In both cases, the figure reported is the probability associated with the cumulative density function estimated in the sample. For example, the current relative earning yield is close to historical highs.

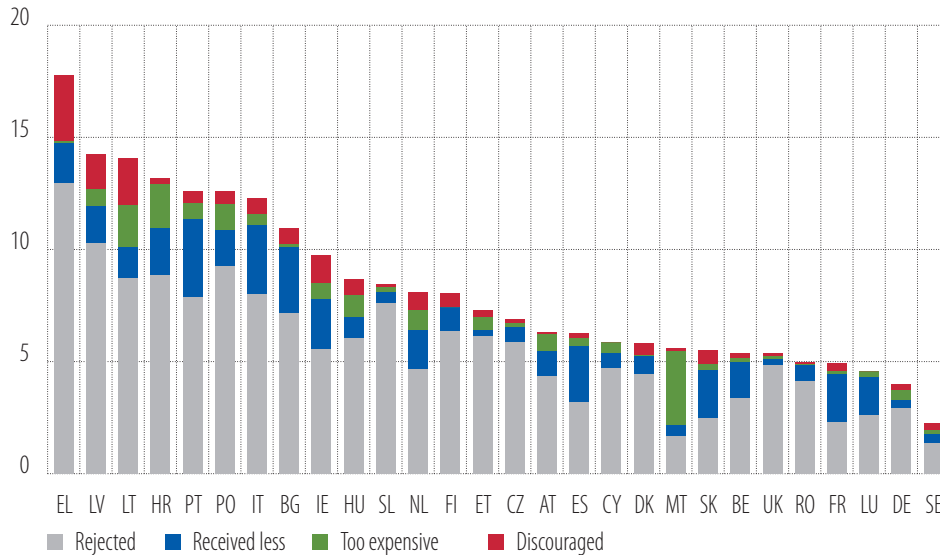
Access to finance not a major concern overall, but it is a concern for some types of firms

While overall access to finance is not among the most prominent impediments to firm investment overall in the EU (Figure 10 in Chapter 1), clear bottlenecks remain, particularly in some countries and for certain segments of firms (including smaller and younger firms as well as innovative firms and those with a higher investment share in intangibles; see Figure 18 in Chapter 3). As shown in Figure 31, there

⁶ This is obtained as the earning per share divided by the share price. It corresponds to the inverse of the price-earnings ratio.

are still noticeable differences in terms of financing conditions across countries, with several cohesion and periphery countries at the higher end of the distribution in terms of finance constraints.

Figure 31 Share of finance-constrained firms by country (%)



Source: EBIS2017.

Note: Base: All firms.

However, looking at the external finance constraints alone can be misleading because, by construction, this indicator is derived from firms investing and using external finance. In the 2017 EIBIS, 16% of firms across the EU reported that their main reason for not applying for external finance was because they were content to use internal funds or did not have a need for external finance. SMEs were notably more likely to be content with relying on internal finance than large businesses (19% compared with 12%).

Therefore, we analyse external finance in relation to internal finance, which is known as the financing cross. Figure 32 plots the share of firms that were constrained in terms of external finance against the share of firms that did not seek external finance because they felt that they had enough internal funds to finance their investment activities.⁷ The figure shows significant differences in financing conditions across countries (both in terms of access to external funds and internal-cash-generating capabilities), with as few as 2% of firms constrained in terms of external financing in Sweden and as many as 17% in Greece. Similarly, the highest share of firms content to rely exclusively on internal funds to finance their investment activities is 33% in Ireland, which stands in sharp contrast to only 6% of firms in Estonia.

Financing conditions (for investment activities) remain problematic in some countries, particularly Greece, Lithuania, Croatia, Italy and Portugal. These countries are located in the bottom right quadrant of Figure 32, which includes all those instances in which the share of financing-constrained firms is above the EU average. The share of firms content to rely on internal funds to finance their investment activities, in contrast, is below the EU average.

In Ireland, Finland, Hungary and the Netherlands, the financing situation appears polarised. On the one hand, there are relatively large segments of companies that are cash rich and content to fund their investment activities without reverting to external funding. On the other hand, a large group of firms in

⁷ That is, firms that applied for external finance for their investment activities and were rejected; received less than what they asked for; did not take up the offer because they felt that it was too expensive; or did not apply in the first place because they were afraid of getting rejected. For a detailed description of the definition of external finance constraints, please see Chapter 7.

these countries depends on external finance but struggles to access it, strongly suggesting two polar worlds in terms of firms' access to finance.

Low investment and high profitability make access to finance less of an issue for firms' investment activities in Germany, Sweden, Luxembourg and Austria. In these countries, the share of firms that are constrained in terms of external finance is below 4%. At the same time, more than 15% of firms in these countries are so cash rich that they do not need external funds to finance their investment activities. Further analyses suggest that the latter phenomenon is driven both by relatively low investment activities and high profit margins. If we regress whether an investing firm is financially autarkic in its investment intensity, profit margin and a series of controls, we find that both variables are significantly correlated with financial autarky. The relative importance of profit is particularly high in the UK and Denmark, whereas low investment plays an important role in Malta and Sweden. In Germany and Austria, both factors weigh similarly (regardless of whether firms are financially autonomous).

Figure 32 Financing cross – level (% of firms)

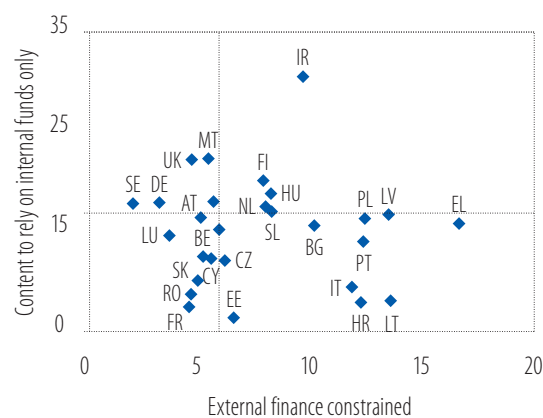
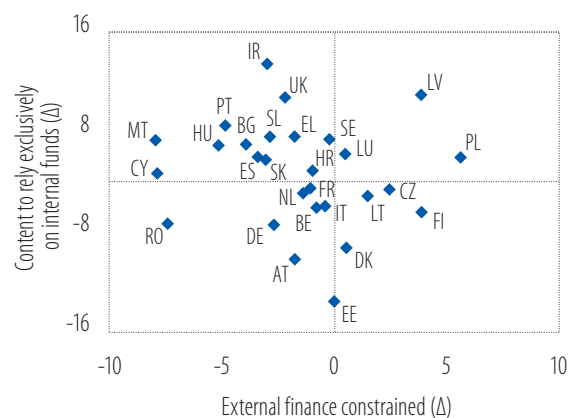


Figure 33 Financing cross – change



Source: EIBIS2016 and EIBIS2017.

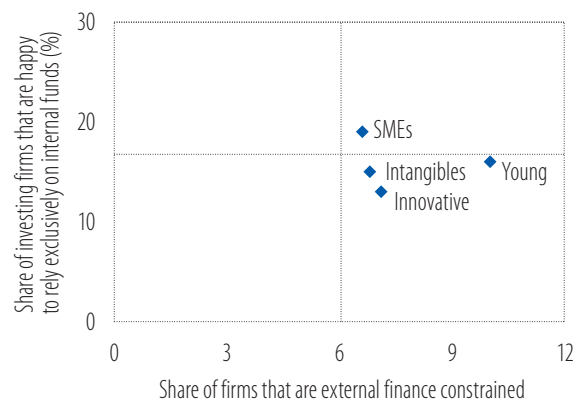
Note: Base: All firms. Data derived from the financial constraint indicator and from firms indicating that the main reason for not applying for external finance was that they were "happy to use internal finance/didn't need finance." The financial constraint indicator includes firms dissatisfied with the amount of finance obtained (received less), firms that sought external finance but did not receive it (rejected) and firms that did not seek external finance because they thought borrowing costs would be too high (too expensive) or they would be turned down (discouraged).

Nonetheless, **over the last year, access to external financing improved in most countries.** Figure 33 shows how the share of firms that are finance-constrained evolved over the past year. For most countries, access to external finance became easier, with the biggest change in Malta (-8 percentage points), Cyprus (-8 percentage points) and Romania (-7 percentage points). The only countries where access to finance remained largely unchanged or worsened were Poland (+5 percentage points), Finland (+4 percentage points) and Latvia (+3 percentage points). Somewhat surprisingly, over the same period that access to external finance became easier, the share of firms content to rely exclusively on internal funds to finance their investment activities increased in most countries, with the biggest jumps in Ireland (+12 percentage points), Latvia (+11 percentage points) and the UK (+11 percentage points). Conversely, Estonia (-16 percentage points), Austria (-10 percentage points) and Denmark (-9 percentage points) were the countries where the share of firms content to rely exclusively on internal funds to finance their investment activities decreased most from the previous year.

The changes in opposite directions (in terms of access to external finance and reliance on internal sources of finance) can be explained by the general improvement in the economic climate, which helps bring down barriers to accessing external funds and, at the same time, boosts firms' own capabilities to generate cash.

Despite improvements in financing conditions and better access to finance in some parts of Europe, there are segments where access to finance remains difficult. Figure 34 plots the share of finance-constrained firms against the share of firms that are content to rely exclusively on internal sources of finance to fund their investment activities separately for smaller firms; for firms that allocated more than one-third of their investment to the development and introduction of new products, processes and services; for firms that are younger than five years old; and for firms that allocated a relatively large share (+50%) of their investment to intangibles.

Figure 34 Financing cross by type of firms (% of firms)



Source: EIBIS2017.

Note: The red cross indicates the EU average. SMEs: small and medium-sized enterprises.

In line with a large body of literature that argues that all of these segments are susceptible to market failures that entail financial frictions, the figure shows that for innovative firms, firms investing relatively more in intangibles, young firms and SMEs, access to external finance tends to be worse than for the average firm in Europe. In addition, their capacity to generate sufficient internal funds to finance investment activities is poor(er). SMEs are a slight exception to the latter observation, most probably because of generally more modest investment activities in the last financial year.

Financial and financing conditions of SMEs

Small and medium-sized enterprises contribute significantly to job creation and economic growth.⁸ In 2015, nearly 23 million SMEs in the European Union made up 99.8% of all non-financial enterprises, employed around 91 million people (66.8% of total employment), and generated 57.4% of total value added (European Commission, 2016).

Given their nature, SMEs are structurally more exposed to market incompleteness and financial frictions. Their financial structure is more rigid than that of large companies as they are more dependent on banks, and their capacity to substitute among external financing sources is more limited. SMEs are perceived as more risky because they have a higher exposure to idiosyncratic shocks and tend to have less collateral. Moreover, estimating their creditworthiness is more challenging, as they are younger and subject to fewer reporting obligations. Finally, they are relatively more costly to monitor because the “fixed” cost to amortise is distributed over a smaller loan.

⁸ 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 (European Commission Recommendation 2003/361).

Most of the assessments of SMEs' access to external finance are based on survey data, as hard data disaggregated by firm size are rarely available. The next section presents evidence from the EU Craft and SME Barometer Survey as well as the European Central Bank's Survey on the Access to Finance of Enterprises (SAFE). These two surveys provide information on financial and financing conditions of SMEs since 2009, which provides a time dimension on the perceptions of SMEs' business environment.

Demand, constraints and external financing gaps

The SME business climate in Europe continued its gradual path to recovery during the second semester of 2016, an evolution that is expected to have continued into the first semester of 2017 (Figure 35). This trend is observed in both the north/central region of the EU and the periphery regions, with the gap between the two regions remaining constant.⁹

Figure 35 SME Business Climate Index (%)

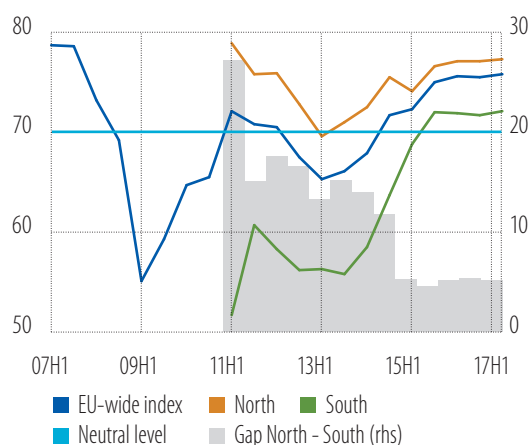
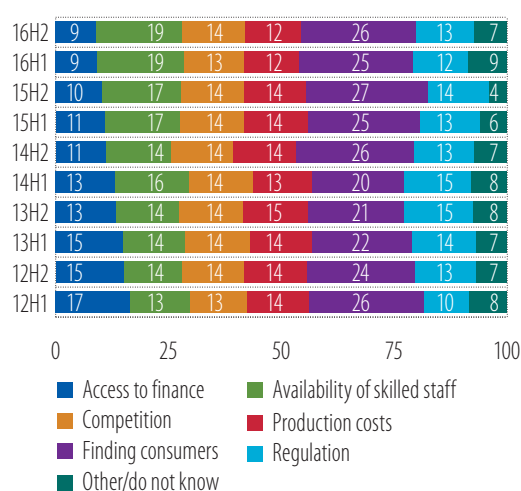


Figure 36 The most important problems facing euro area SMEs (%)



Source: Prepared by the authors based on the semi-annual EU Craft and SME Barometer (2017:H1) of the European Association of Craft, Small, and Medium-sized Enterprises (UPEAME 2017).

Note: The index is calculated as the sum of positive and neutral answers with regard to the overall climate for business, averaged over the current climate and the expectations for the next period. It is based on the results of surveys conducted by UEAPME member organisations two to four times a year in different regions across Europe. SMEs: small and medium-sized enterprises.

Source: Prepared by the authors based on the European Central Bank's Survey on the Access to Finance of Enterprises (SAFE) (ECB, 2017a).

Note: SMEs: small and medium-sized enterprises.

Figure 36 lists the most important problems faced by SMEs in the euro area and illustrates how the relative importance of the different problems has changed over time. In line with the results of the EIBIS, during the most recent semester, access to finance has not been the most important concern for SMEs. As in the previous period (2016:H1), only 9% of SMEs rank it as their most important issue. Finding consumers remains SMEs' primary concern, with 26% of respondents ranking it as their most

⁹ The north/central group is comprised of Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, Romania, Slovakia, Sweden and the UK. The periphery region is comprised of Croatia, Cyprus, Greece, Ireland, Italy, Malta, Portugal, Slovenia and Spain.

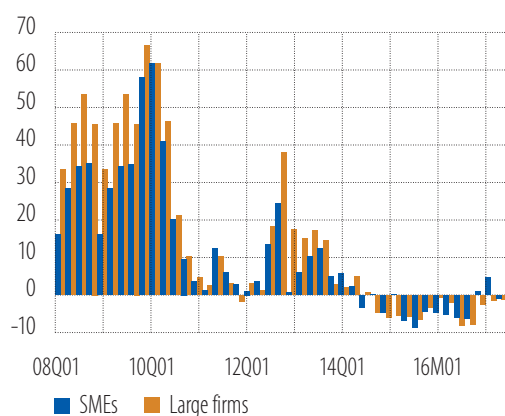
important problem, an increase of 1 percentage point from the first half of 2016. In addition, 19% of SMEs report difficulties in finding skilled staff as their most important concern.

The euro area aggregate conceals a significant amount of heterogeneity among countries. The percentage of SMEs that consider access to finance a highly important problem varies significantly by country, with Greece leading the ranking (57%) during the second half of 2016, even though the situation there improved considerably compared to the first half. In general, the financing situation of SMEs improved or stayed constant in most countries, with the exception of Germany, France and the Netherlands, where it deteriorated slightly (ECB, 2017b).

The ECB's latest Bank Lending Survey (ECB, 2017c) provides an overview of the current state of the SME lending market from the perspective of the banks. Figure 37 plots the quarterly net change in credit standards and illustrates how banks' perception of credit standards for firms has changed since the beginning of the financial crisis.¹⁰

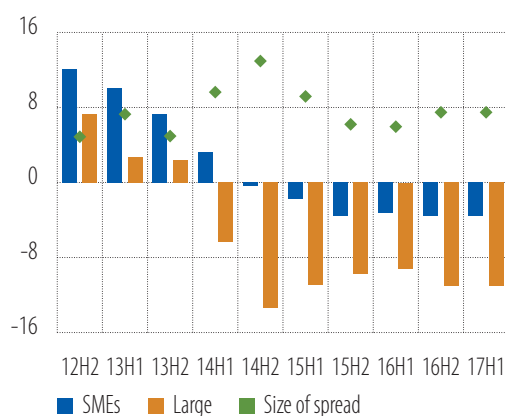
While credit standards continued to ease during the third quarter of 2016 for both SMEs and large firms, they again started to tighten for SMEs during the final quarter of 2016 as well as the first quarter of 2017. In contrast, credit standards for loans to large firms continued to ease. Over the second quarter of 2017, credit standards for both SMEs and large firms remained roughly constant. The upswing in the tightening credit standards was caused by a reduction in banks' risk tolerance and, in a related development, cautiousness about their capital position. Furthermore, the supply of credit to SMEs was negatively impacted by economic conditions, as banks pointed to industry- or firm-specific circumstances as the most important driving factor behind the tightening of credit in the first quarter of 2017. Interestingly, while all these factors were considered less important during the second quarter of 2017, the risk in terms of SMEs' collateral seemed to have increased. This was not enough to offset the factors driving the easing of credit, which resulted in a minor positive trend over that period (ECB, 2017c).

Figure 37 Net changes in credit standards applied to the approval of loans or credit lines to enterprises (SMEs versus large enterprises) (%)



Source: Prepared by the authors based on the European Central Bank's Bank Lending Survey (ECB, 2017b).

Figure 38 Perceived change in the external financing gap according to SMEs and large firms (%)



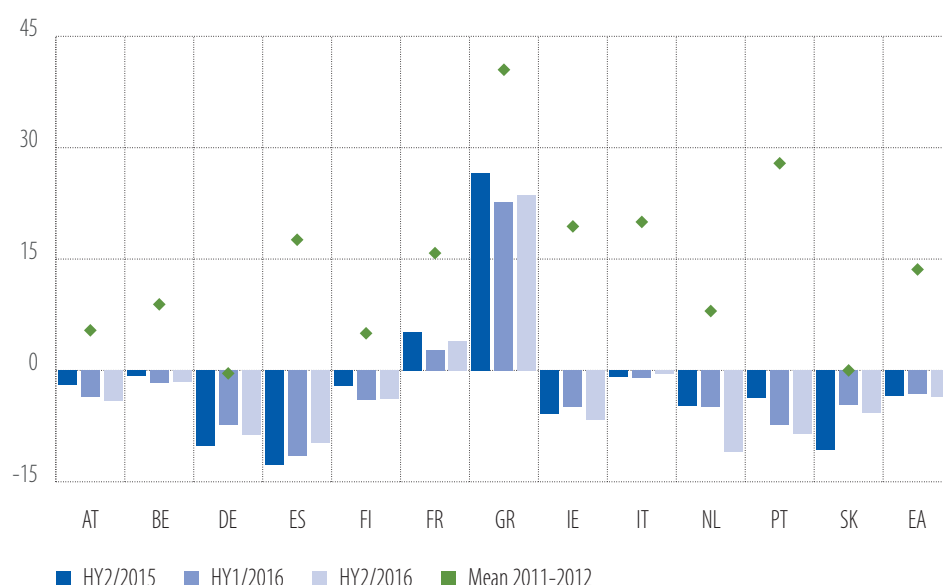
Source: Prepared by the authors based on the European Central Bank's Survey on the Access to Finance of Enterprises (SAFE) (ECB, 2017a).

10 The net change is calculated as the difference between the sum of the percentages of banks responding "tightened considerably" and "tightened somewhat," and the sum of the percentages of banks responding "eased somewhat" and "eased considerably" for loans to firms from different size classes. Banks were asked to answer the following question: "Over the past three months how have your bank's credit standards as applied to the approval of loans or credit lines to enterprises changed?"

Figure 38 illustrates how SMEs' perceptions of the external financing gap have evolved over the past five years and compares this to the perception of that gap among large firms. The external financing gap is a composite indicator constructed by the ECB, based on perceived changes in the needs and availability of external financing for firms. During the second half of 2016, both SMEs and large firms perceived the financing gap to be shrinking for the fifth consecutive semester. **Clearly, SMEs consistently experience more difficulties in accessing external finance vis-à-vis large firms, as evidenced by the positive size-spread depicted in Figure 40 and also in Figure 42.**

Figure 39 illustrates the heterogeneity among countries in SMEs' perception of the (change in the) financing gap. In general, the situation on external financing markets for SMEs has improved dramatically compared to the 2011-12 period, particularly in Ireland, Spain, Italy and Portugal. During the second semester of 2016, France and Greece remained the only two countries where SMEs perceived the financing gap to be growing. The rate at which the perception of the gap increased remained roughly constant compared to the previous semester. In all other countries for which data are available, negative values were reported, implying that SMEs believed the gap between the supply of and demand for external finance was decreasing.

Figure 39 Perceived change in the external financing gap by SMEs at the country level (%)



Source: Prepared by the authors based on European Central Bank's Survey on the Access to Finance of Enterprises (ECB, 2017a).
Note: The horizontal black marks denote the average level of the index throughout the four semesters of 2011 and 2012, the period in the aftermath of the crisis when SMEs reported the highest values of the perceived change in the financing gap. HY1 and HY2 respectively refer to the first and second half of the year.

In addition, worries about the general economic outlook weighed on firms' investment decisions, and in many countries there is a low-growth trap. In other words, findings from the EIBIS show signs of an investment gap in which approximately 15% of the surveyed firms reported that their investment activities over the past three years were too low to ensure the future success of their business. In the short term, the political and regulatory climate negatively affected corporate capital expenditure, while in the longer term uncertainty and a lack of skilled staff were identified as the main barriers to investment (EIB, 2017).

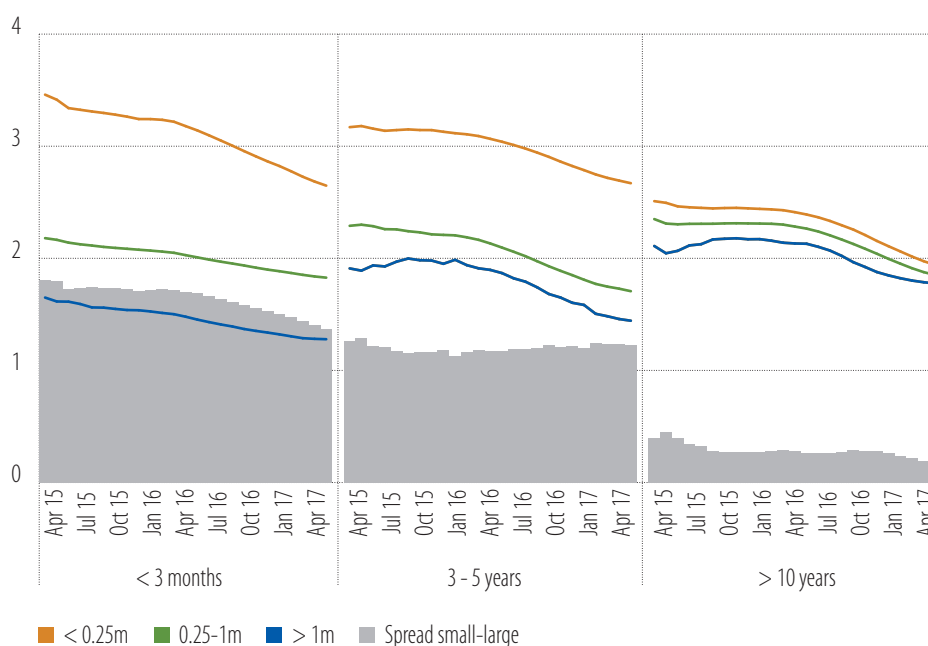
Access to bank finance

Although monetary policy continues to drive down borrowing costs for non-financial corporates to record lows, the interest rate spread between small and large loans remains significant and varies strongly across economies.¹¹ Figure 40 illustrates the evolution of interest rate levels for different loan sizes, by maturity, over the past two years. The figure highlights several interesting findings. First, in the latest period for which data are available, from October 2016 to April 2017, the effects of the ECB's Asset Purchase Programme have continued to trickle down, resulting in declining interest rates for corporate loans of all size classes and all maturities.

Second, regardless of maturity, small loans are burdened with higher interest rates. There is, however, evidence that the situation has normalised overall for SMEs in Europe, as the spread has returned to its pre-crisis historical average.

It is interesting to note that the spread for loans with short-term maturities is wider than the spread on loans with long maturities (of above five years). This tends to support the assumption that small loans are mostly obtained by SMEs, as, indeed, SMEs tend to be more short-term-debt oriented (Figure 41).

Figure 40 Interest rates by loan size and maturity, and the interest rate size spread (%)



Source: Prepared by the authors based on data from the European Central Bank.

Note: The figure depicts the 12-month backward moving average floating interest rates charged by banks on loans to non-financial corporations (other than revolving loans and overdrafts).

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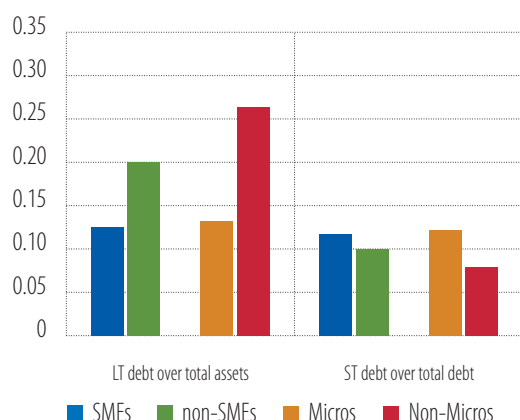
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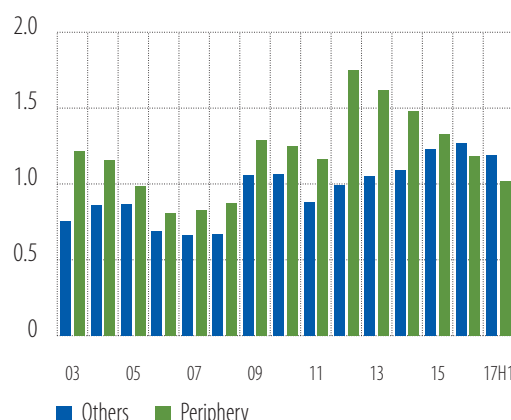
The spread between bank lending rates on small and large loans in the periphery was structurally above that in the other economies group from 2003 until 2015, and then narrowed (Figure 42). The difference widened in the wake of the Lehman crisis and even more during the sovereign debt crisis, reaching 80 basis points in 2013. After that the difference narrowed to below 15 basis points in 2016. In the first half of 2017, while smaller firms continued to face tighter access to credit, short-term borrowing costs were comparable for SMEs in the periphery and in the other economies.

Figure 41 Specificity in the debt maturity structure (share, between 0 and 1)



Source: Calculations by the European Parliament's Committee on Economic and Monetary Affairs (ECON) based on ORBIS.
 Note: Period covering 2009-14. Small and medium-size enterprises (SMEs) have fewer than 250 employees and more than EUR 30,000 of assets. Micros have fewer than 10 employees and more than EUR 2,000 of assets. LT: long-term; ST: short term.

Figure 42 Bank lending spread between small and large corporate loans of short-term maturity (% points per year)



Source: Calculations by the European Parliament's Committee on Economic and Monetary Affairs (ECON) based on data from the European Central Bank.

Policy support in favour of SMEs

SMEs cannot access corporate debt markets – much less the stock market – and must borrow from banks at more expensive rates. Various actors target SME lending as a policy goal, on the assumption that asymmetric information generates sub-optimal provision of loans to SMEs. Among these are national promotional banks and international financial institutions, including the EIB Group (the EIB and its sub-holding, the European Investment Fund, EIF). Various incentives have been set up to support SMEs' access to finance, including favourable lending conditions, credit guarantee schemes, guarantees on issuances of mini-bonds, and various forms of incentivised venture capital and private equity funding.

Credit guarantees are extensively used by financial institutions in Western Europe, as they provide incentives for banks to lend to SMEs on more favourable terms by insuring part of the credit risk. Those instruments have turned out to be particularly relevant in the aftermath of the crisis, especially when they provide capital relief to the banks (Box 2).

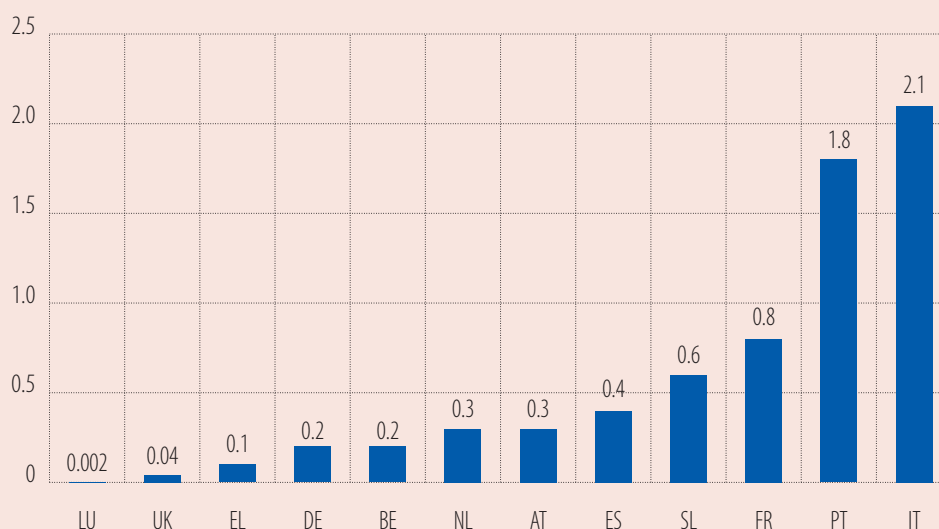
Box 2 A new study on SME credit guarantees

In 2017, the European Investment Fund and the European Investment Bank, which together form the EIB Group, published a report on the use of credit guarantee schemes (CGSs) for lending to small and medium-sized enterprises (SMEs) in Western European countries. The report complements an earlier study on the use of CGSs for SME lending in Central, Eastern and South Eastern Europe (CESEE), which was published by the European Bank Coordination “Vienna Initiative” Working Group on CGSs (EBCI, 2014).

The new report discusses the activity of CGSs and the use of these guarantees by banks in Western Europe.¹³ It is largely based on the results of two surveys conducted by the EIB Group, one of national and regional CGSs and the other of large commercial banks. The surveys were distributed with the help of the European Association of Guarantee Institutions (AECM) and the Institute of International Finance (IIF).

Credit guarantees are extensively used by financial institutions in Western Europe (Figure 1). The national/regional guarantee institutions are currently the main suppliers that meet demand for credit from SMEs, but multinational providers such as the EIF also play an important role. Following the crisis, nearly all credit guarantee schemes increased their operations, most notably by guaranteeing loans for working capital.

Figure 1 Outstanding volume of credit guarantees in 2016 (% of GDP)



Source: European Association of Guarantee Institutions (AECM) and Eurostat.

¹³ The country coverage of the study goes beyond the traditional boundaries of Western Europe. This is due to the fact that the preceding report on the CESEE covered mainly the member countries of the Vienna Initiative. Thus the new report covers all EU Member States that were not covered or only partially covered in EBCI (2014): Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, Slovenia, Spain, Sweden and the UK.

The report provides insight into the institutional framework, driving motives, and operational mechanisms of CGSs and the financial intermediaries that use them. The survey results reveal that, although the national frameworks of CGSs vary greatly by country, CGSs in Western Europe are typically publicly owned and are almost exclusively active only in their home country. In most cases they are non-profit, but they have an obligation to be self-sustained. Furthermore, they are capitalised up front. Their risk management toolkit includes the use of government and EU counter-guarantees, for example from the EIF.

Providers and users of credit guarantees are confronted with a complex regulatory environment. One key aspect involves the prudential regulation of financial institutions. The capacity of providers of these guarantees to provide capital relief for banks is regulated by the Capital Requirements Directive/Capital Requirements Regulation (CRD IV/CRR). Another important component is the legal framework of state aid, which governs the provision and pricing of guarantees provided by public entities. Guarantees bring about capital relief, and nearly half of banks reported this to be an important consideration in their use of CGSs (Figure 2).

Interestingly, only one in two surveyed bank institutions was of the opinion that the EU regulations on capital relief are completely transparent (Figure 3). More than one-third (36%) of banks replied that they have had issues with capital relief regulation in some jurisdictions, while 12% of respondents said differences in the national legal framework rendered capital relief legislation non-transparent.

Figure 2 Q: How important is it for your bank to obtaining capital relief for SME credit guarantees? (%)

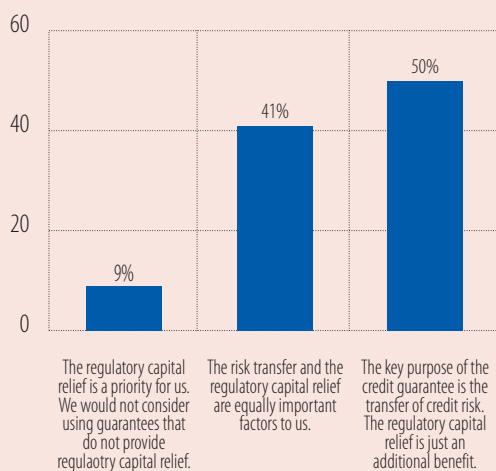
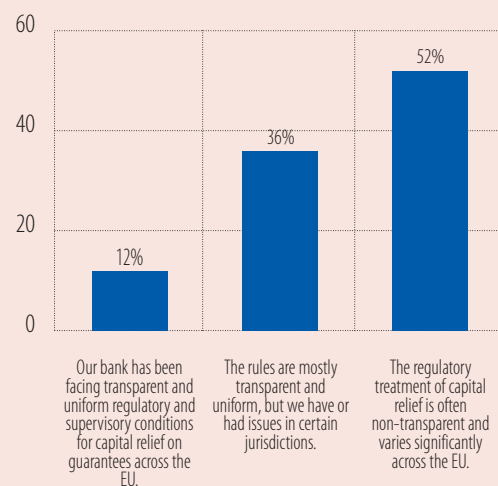


Figure 3 Q: In your experience, how transparent and uniform is the treatment of SME credit guarantees from the viewpoint of regulatory capital relief within the EU? (%)



Source: European Investment Bank Group, Credit Guarantee Scheme Survey.

For banks as well as for CGSs, the most important rationale for offering credit guarantees is to enable collateral-constrained SMEs to borrow (Figure 4). While addressing SMEs' lack of collateral is an important *raison d'être* for CGSs, full collateral relief is generally not a binding requirement in the contractual arrangements between the CGSs and the banks (Figure 5). For banks and CGSs alike, the main constraint hindering more extensive use of credit guarantees is the lack of credit demand by SMEs. Restrictive EU state-aid laws, on the one hand, and cumbersome administrative duties, on the

other, are identified by CGSs and banks, respectively, as other impediments to the expansion of credit guarantee activity.

Figure 4 Q: Did your institution's supply of guarantees increase as a response to the financial crisis? (in %)

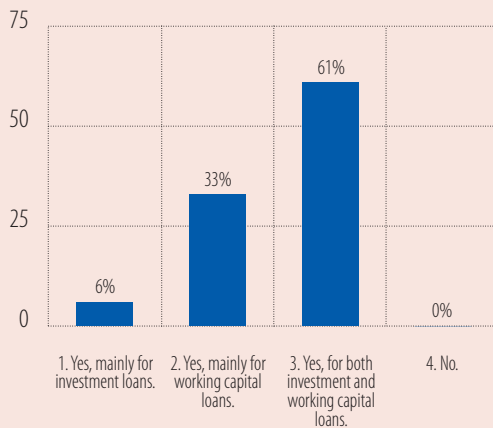
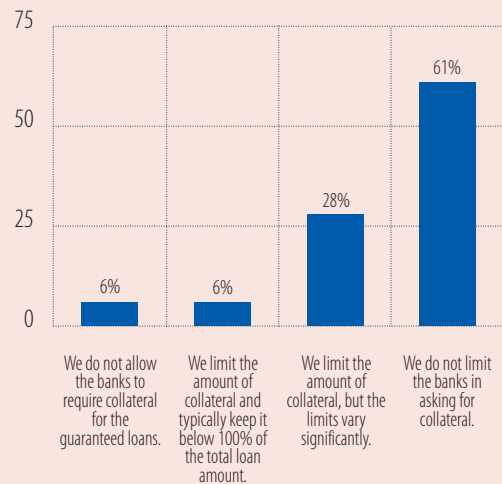


Figure 5 Q: Does your bank typically ask for any collateral for loans covered by SME credit guarantees? (in %)



Source: European Investment Bank Group, Credit Guarantee Scheme Survey.

Note: For more details, see Chatzouz et al. (2017).

Given that SMEs have almost no direct access to the capital markets and that (particularly in Europe) they rely heavily on bank lending, a functioning securitisation market can transform illiquid loans to SMEs into an asset class with adequate market liquidity and can as such provide indirect access to capital markets for SMEs (Box 3).

Box 3 SME securitisation in Europe: A brief summary

The term SME securitisation (SMESec) includes transactions backed by SME loans, leases, and other products. It is important not only to look at bank lending when analysing SMESec, but also at leasing companies, which form part of the securitisation market. Given that bank financing has been less available for leasing companies post-crisis, it can be expected that SMESec has been particularly relevant in the leasing area.¹⁴

Empirical literature shows that securitisation can strengthen the capacity of banks to supply new loans (Altunbas, Gambarcota and Marques, 2007). Since it can mitigate credit supply frictions, securitisation has the potential to have positive real effects on investment, sales and employment (Berg, Streitz and Wedow, 2015). Securitisation per se is neither good nor bad, it is simply a toolbox, instrument and technique. As such it is value free. However, the general perception of this instrument has been negatively affected by its aggressive, opaque and overly complex use by some market participants, as well as by an overly simplified discussion where everything related to structured finance is lumped together and sometimes dismissed or branded as “toxic”. The instrument is not “toxic”, and neither is the underlying asset (SME loans/leases, in the case of SME securitisation) “toxic waste”.

On the contrary, loans to SMEs are a key driver for the functioning of the economy. Properly applied, the securitisation technique is a replicable tool that can enhance access to finance for SMEs. Therefore, the revival of the SME securitisation market is also one of the focus areas of the Capital Markets Union (European Commission, 2015a).

Through the use of this instrument in developed capital markets, public sector support for SMEs (for example, guaranteeing mezzanine tranches) can create multiplier effects. As stated in Kaya (2014), “Taken together, strengthening SME securitisation may be one of the most effective ways to facilitate the flow of funds to the real economy, while not creating too much distortion”.¹⁵ This support can also help to develop new market segments. For example, in 2016 the European Investment Fund (EIF) supported the first European SMESec transaction based on loans originated by Funding Circle, the largest European market-based lender.

The European securitisation market had grown steadily from the early 2000s until the outbreak of the global financial crisis. During the crisis, issuance initially remained at high levels (compared to pre-crisis values), but these volumes were almost exclusively driven by the eligibility of asset-backed securities as collateral for the European Central Bank’s (ECB) liquidity operations.¹⁶ Overall market activity then decreased to 2003/04 levels.¹⁷ Since the outbreak of the crisis, only a very small fraction of the issuance has been placed with investors (Figure 1). The nature of the market changed from a developing market (pre-crisis, with most transactions placed in the primary market) to a retained/ECB repo-driven market (with almost no placement on the primary market).

Issuance of SMESec is still suffering from stigma effects of the crisis and remains at low levels (Figure 2). The overall issued volume of SME deals in 2016 (EUR 19.8bn) was well below the 2015 values (EUR 27.1bn), and in the first quarter of 2017 SME issuance was only around EUR 2bn, significantly lower than during the same period in 2016 (EUR 4.6bn).

14 For more information on the importance of leasing for SMEs’ finance, see Kraemer-Eis and Lang (2012).

15 For more information on public support for SMESec, see Kraemer-Eis, Schaber, and Tappi (2010), Kraemer-Eis, Passaris, and Tappi (2013), and Kraemer-Eis, et al. (2015).

16 The ECB’s asset repurchase or “repo” facility allows asset-backed securities, among other assets, to be used as collateral for funding.

17 The source for market activity data in this box is AFME (2017).

The market share of SMESec in overall securitisation issuance rose (with some volatility) from 6% of total yearly issuance in 2001 to 18% in 2012, the highest value ever recorded in Europe (Figure 2). This, however, came about due to the base effect, as overall activity went down (while SMESec activity decreased slightly less). In 2016, the share of SMESec was 8.3%, significantly lower than the year before (12.7%).

Figure 1 European SME securitisation by retention (EUR billion, left-hand side; and %, right-hand side)

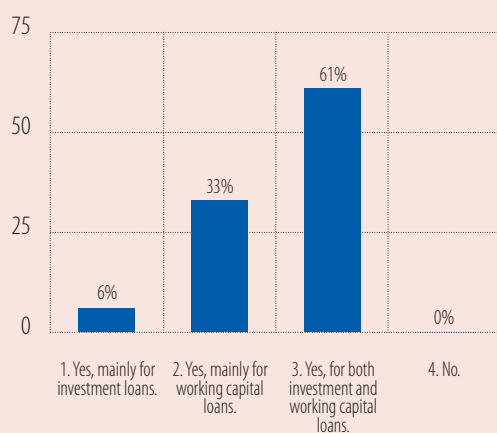
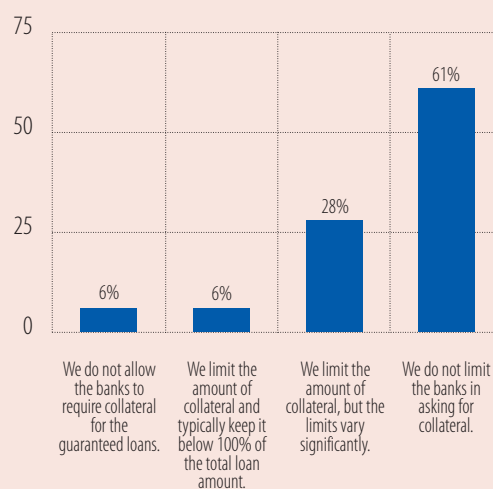


Figure 2 Issuance of SME securities in Europe: volume and share of total securitisation (EUR billion, left-hand-side; and %, right-hand-side)



Source: Prepared by the authors based on data from the Association for Financial Markets in Europe (AFME).

Note: SMESec: securitisation of transactions for small and medium-sized enterprises.

Typical originators are large banks or banking groups – some of which, such as UniCredit, Raiffeisen, and ING Group, are active as originators in several countries – as well as mid-sized banks. Particularly in the field of leasing, non-bank asset finance providers are active as originators.

SME-related issuance in 2016 occurred mainly in Italy (EUR 9bn, 46% of SME issuance) and Spain (EUR 8bn, 39%). Minor activity happened as well in Greece (6%), Portugal (4%), Germany (2%) and Ireland and the UK (1% each).

Despite the financial and sovereign crisis and a prolonged negative economic cycle, the European securitisation market in general has performed relatively well, with comparatively low default rates. However, as indicated, the European SMESec market has still not recovered many years after the crisis. Resolving this problem could be helped by developing short- and medium-term perspectives as well as reasonably defined criteria for simple, transparent, and standardised securitisations (STS) that should receive preferential regulatory treatment (Box 4 in Chapter 5).¹⁸

¹⁸ We use the term STS in the current discussion, but other terminologies are used in the same context, including: HQS (high-quality securitisation) and STC (simple, transparent and comparable securitisation), which are used by the Basel Committee on Banking Supervision and the International Organization of Securities Commissions (BCBS-IOSCO); and SST (simple, standard and transparent securitisation), which is used by the European Banking Authority. The STS acronym is expected to prevail in European regulation.

The banking sector's capacity to finance capital expenditure

From mid-2016 through to mid-2017, EU banks continued strengthening their balance sheets overall. Fears of the negative impact of the very low interest rate environment have not materialised (Borio, Gambacorta and Hofmann, 2015). Alongside the acceleration in economic activity, EU banks have made progress in restructuring their lending operations so as to make them more profitable. Moreover, the intensity of impaired assets has been reduced, albeit to a limited extent. Together, these developments have enabled banks to continue passing through the very low level of funding costs to firms.

However, the European banking sector is still going through a period of structural adjustment, and the quality of bank assets remains very diverse across European jurisdictions. Moreover, banks have advanced differently in terms of adjustment to the more stringent regulatory environment. In parallel, the Banking Union is still not completed, as an important element, the European Deposit Insurance Scheme, is still absent.

EU banks are overall stronger

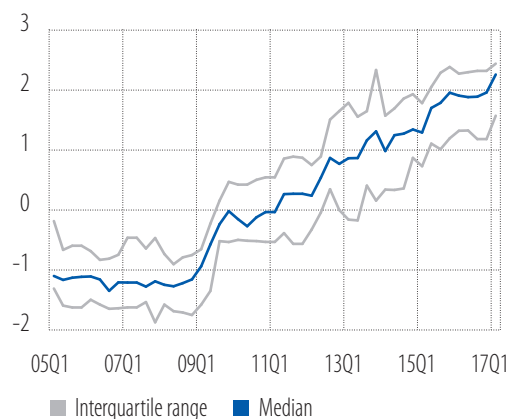
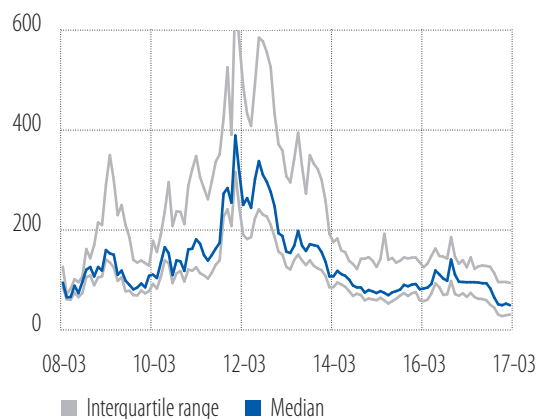
Since the crisis, EU banks have increased their capital positions in an unprecedented manner. At the end of 2016, the total average Common Equity Tier 1 (CET1) ratio of the EU banking sector stood at 13.4%, an increase over the 12.8% ratio in mid-2016 (EBA, 2017) and more than 4 percentage points above its level in 2010, when the Basel III package was endorsed.¹⁹

A large part of the adjustment has occurred through equity issuance and capital retention. Indeed, the increase in the CET1 capital base is estimated to have accounted for almost all of the increase in the CET1 ratio since the beginning of 2010. This was accompanied by a rise in assets, offset by de-risking, that marked a change in the asset composition of banks towards relatively less risky components. There are some concerns that this may have been overestimated. Indeed, European banks implementing an internal-risk-based approach have benefited from lower risk weights, and this may not fully reflect the genuine change in risk. The Basel Committee is indeed working on a proposal to limit the role of internal models in lowering risk weights, the so-called Basel IV agreement (BIS, 2015).

However, other measures of capital strength have also strengthened, such as leverage ratios. This section therefore complements risk-weighted capital measures by utilising a measure that provides a more comprehensive view of the strength of banks' balance sheets. Such a measure is obtained by computing the principal component of a broad set of measures, such as the total capital ratio, risk-weighted capital ratio, leverage ratio, and loan-to-deposit ratio (Galiay and Maurin, 2015). For each bank, an increase in the indicator suggests that the balance sheet structure has made the bank more resilient and that its capacity to withstand adverse shocks has improved. In Figure 43, the increase in the median (the blue line) and the quartiles (the red lines) confirms that EU banks have strengthened the resilience of their balance sheets and their overall solvency since the end of 2009. The process started before the adoption of the Basel III package, as banks had anticipated the more stringent regulatory environment and frontloaded part of it, increasing capital ratios and reducing leverage.²⁰

¹⁹ This estimate assumes full implementation of the Capital Requirements Directive/Capital Requirements Regulation (CRD IV-CRR) in the Basel III framework.

²⁰ It should be noted that, by construction, the indicator depicts a rosier picture of the trend. The most problematic banks are excluded from the distribution since, being liquidated, absorbed or merged, their individual reporting was interrupted during the period.

Figure 43 Factor-based measure of the capital and leverage ratios of EU banks**Figure 44** Five-year bank credit default swap spread (monthly average, in basis points)

Source: ECON computations based on Thomson Reuters Datastream.

Note: Figure 43 is based on 33 listed EU banks located in Austria, Denmark, Estonia, France, Germany, Italy, Sweden, and the United Kingdom. For each bank, the principal component of a set of indicators is computed and de-meaned over 2003:Q1–2017:Q2. The blue line in between the two red lines portrays the median of the indicator across the sample of banks, while the two red lines represent the 25% and 75% quartiles (Galiay and Maurin, 2015). In Figure 44, the sample consists of 27 EU banks where credit default swaps have been issued.

In parallel to the strengthening of banks' balance sheets, the cost of funding of banks has remained stable at low levels (Figure 44), with the credit default swap spread vis-à-vis the underlying reference rate having declined since the crisis peak and evolved in a narrow range since the beginning of 2014.

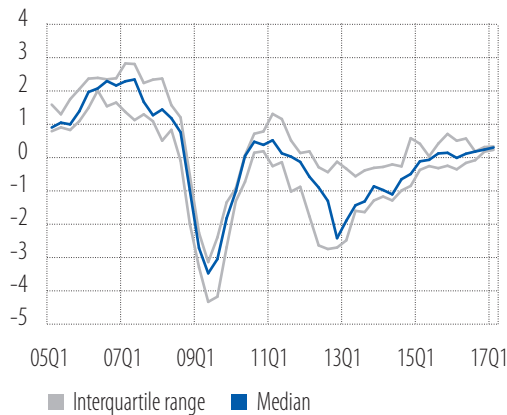
Hence, so far, the benefits of stronger banks have not materialised. There is some evidence in the literature that the capital adjustment towards a more resilient banking sector has been detrimental to the provision of credit on the adjustment path. Indeed, part of the stronger capital base that resulted from higher earnings retention was achieved through a higher bank lending margin. For example, Slovik and Cournède (2011) estimate that a 1 percentage point increase in the capital requirement increases the bank lending rate by 14 basis points, and reduces GDP by between 0.05 and 0.15 percentage points (see also BIS, 2010, Bridges et al., 2014, Fraise, Lé and Thesmar, 2017, and Maurin and Toivanen, 2015).

However, by and large, the expected benefits outweigh the short-term costs. Martin et al. (2017) develop a Bayesian vector autoregression model to illustrate the short-term cost and the long-term benefits of a more stringent capital ratio. The authors show that, had the capital ratio not declined during the pre-crisis period, the increase in the lending spread would have been less pronounced, while the decline in bank loans and activity would have been more muted. Now that banks have increased their capital ratio, the benefits should materialise during the recovery.

EU banks operate in a more conducive environment

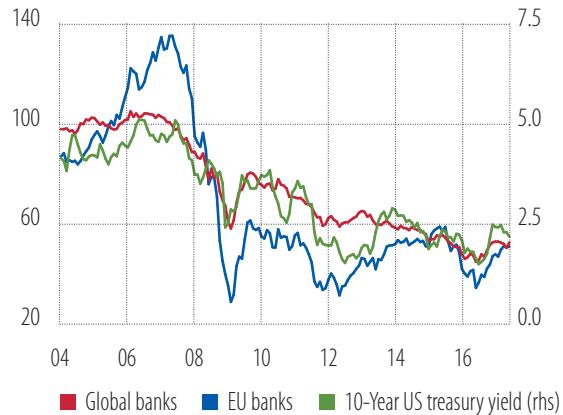
Over the last year, fears of the low rate environment for banks have not materialised, as the negative impact of the very low term spread on the banks' net interest margins has remained contained. While three banks in the EU were liquidated in 2017, their insolvency had more to do with the high level of non-performing loans (NPLs). Indeed, during the year, the environment of banks improved significantly. This improvement was associated with an increase in the distribution of the return of equity of the banking sector, which nonetheless continues to stand below the pre-crisis level.

Figure 45 Indicator of EU banks' operating environment



Source: *ECON* computations based on Thomson Reuters Datastream.
 Note: See note to Figure 43. For each of the 33 banks, the principal component is extracted from 15 indicators comprised of both bank-specific indicators related to profit and loss and the macroeconomic situation of the country where the parent bank is located. Each indicator is then de-meant over 2003:Q1–2017:Q2.

Figure 46 Relative performance of bank stocks (2005 = 100, left-hand side; and % per year, right-hand side)



Source: *ECON* computations based on Thomson Reuters Datastream.
 Note: The MSCI index is used. The relative performance of banks is computed as the ratio between the MSCI index for banks and that for the economy. The ratio is based to 100 in 2005.

In line with the improvement of economic conditions in Europe, many indicators suggest higher bank income. An indication of these improvements is provided in Figure 45. For most of the larger European banks, a dataset mixing indicators of the domestic macroeconomic environment where the bank is domiciled together with key indicators of profit and loss, liquidity, and funding and capital and leverage ratios is set up. Out of it, the common component is extracted. The indicator characterises the bank's operating environment: the higher it is, the more supportive it is to the generation of income and the supply of loans. Figure 45 reports the median common component and the inter-quartile interval for banks operating in the EU covered in the sample. It appears that the indicator has been improving during the recovery, and in mid-2017 it stood at around the historical average. In parallel, the dispersion across banks has decreased.²¹

This recovery is also reflected in banks' valuations. Since the middle of 2016, the relative valuation of bank stocks with respect to the overall stock valuation has rebounded, both worldwide and in the EU (Figure 46). Moreover, the gap between banks' relative valuation in the EU and the rest of the world has diminished. Part of the remaining gap can reflect the position in the business cycle – with banks being more leveraged, their stocks are more cyclical.

While EU banks benefit from the ongoing recovery, structural challenges remain and need to be tackled. These include the large stock of NPLs, as well as possible excess capacity and further regulatory changes.

21 A very similar picture is provided by the systemic risk indicator computed for more than 300 European banks by the Volatility Lab (V-LAB) at New York University's Stern School of Business (available at <http://vlab.stern.nyu.edu/analysis/RISK.WORLDFIN-MR.GMES>). See Acharya et al. (2012).

The environment should help the resolution of non-performing loans, the consolidation as well as any further regulatory adjustment

The resolution of NPLs is progressing, albeit at a slow pace. In 2016, NPL ratios in ten European jurisdictions were above 10% of GDP and declining very slowly. During that year, the volume of transactions in the loan portfolio market amounted to only 10% of the stock of NPLs (Deloitte, 2017). It is widely acknowledged that the current amount of NPLs in several European jurisdictions is hampering the economic recovery and is a potential source of systemic risk in Europe (Constâncio 2017a; Enria, 2017; ESRB, 2017).

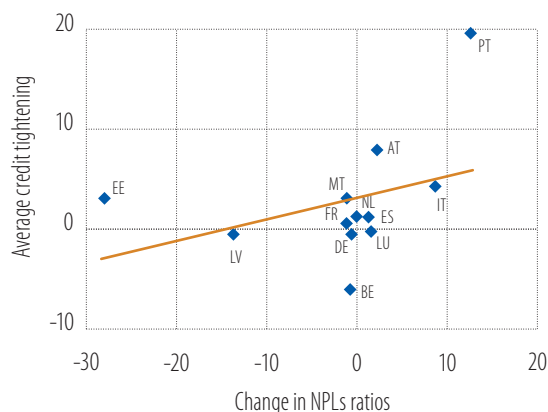
There is little doubt that in economies where the NPL ratio is elevated, banks' profitability is weakened and their funding conditions are tightened. Higher NPLs result in high administrative costs, especially because banks are not usually experienced with monitoring this type of asset. Besides, impaired assets require provisioning, which mechanically weakens banks' net operating income. Finally, being non-performing, NPLs by definition do not generate any return and therefore reduce returns on equity (Aiyar et al., 2014). In a context where banks adjust to more stringent capital requirements and rebuild capital buffers, they are likely to react by tightening credit standards. The credit supply curve of the banking sector shifts upward: for the same economic conditions (in terms of demand and risk), loan origination is lower and/or the lending rate is higher. Given the endogeneity issue and the lack of data available over a long period, proper estimates of the negative relationship between NPLs and loan growth are scarce.

Yet, simple analysis can be illustrative. The ECB Bank Lending Survey reports various dimensions of the supply of and demand for bank credit. Some of the indicators reported, such as changes in credit standards, are less sensitive to endogeneity issues. As illustrated in Figure 47, in recent years in the euro area credit standards have tightened more in jurisdictions where NPL ratios have increased.²²

Besides the effects on banks' supply of credit, NPLs are likely to distort the efficient allocation of savings, resulting in credit misallocation. Indeed, NPLs lock bank capital into backing unproductive assets at the expense of firms that may have more profitable investment projects. Also, SMEs are likely to be more affected, as they are more dependent on banks. Indeed, some econometric analysis conducted across euro area countries suggests that the spread between corporate bank borrowing costs on small loans and large loans increases with the NPL ratio. As shown in Figure 48, in Italy and Portugal up to 40 basis points of the spread since the end of 2015 can be accounted for by the high NPL ratio in the banking sector.

²² A cross-sectional estimation of the relationship between credit standards and the gross NPL ratio still yields a positive relationship, after taking into account annual growth in real GDP as a proxy for remaining demand effects.

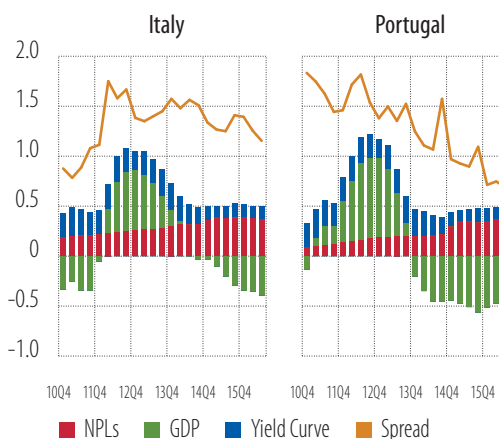
Figure 47 Change in non-performing loan ratios and credit standards on loans to enterprises



Source: Authors' calculations based on the European Central Bank's Bank Lending Survey (BLS) and Consolidated Bank Statistics (CBD2).

Note: The figure associates the change in non-performing loan ratios between 2010:Q2 and 2016:Q2 and the tightening in credit standards on corporate loans recorded over the same period. The line represents the estimated cross-section regression. NPL: non-performing loans.

Figure 48 Estimated contribution of non-performing loans to the spread between bank lending rates on small loans and large loans (percentage points per year)



Source: Authors' calculations based on the European Central Bank's MFI Interest Rate Statistics (MIR) and Consolidated Bank Statistics (CBD2).

Note: The spread between bank lending rates on small and large short-term loans is projected on the non-performing loan (NPL) ratio and its variation, annual GDP growth, and the difference between the 10-year Overnight Indexed Swap rate and the 1-month EURIBOR. The estimation is carried out on a sample of 14 euro area countries between 2010:Q2 and 2016:Q2 based on 295 observations using fixed effects.

The reasons for the slow resolution of NPLs are also well understood. They relate to the asymmetry of information between the investor and the seller.²³ At the beginning of 2017, however, the Single Supervisory Mechanism proposed reporting standards to reduce information asymmetries and incentives for banks to increase their efforts to reduce NPLs (ECB, 2017d). Moreover, several proposals have been developed for public intervention, and European policymakers are working on a blueprint for asset management companies (Fell, Moldovan and O'Brien 2016; Fell et al., 2017). These can prove especially important to kick off the disposal process and/or develop a more liquid secondary market.

The ongoing recovery in economic activity can also help alleviate some of the pain resulting from the resolution of NPLs. As shown in Figure 48, stronger economic activity is estimated to have contributed to the decline in size spread by up to 50 basis points in Italy and Portugal in late 2016. Indeed, stronger economic activity is associated with higher loan volume in the short term. Later, monetary policy normalisation should eventually push up yields and result in a steeper yield curve as inflation expectations are revised upward. This is expected to boost banks' net interest margins, the difference between deposit and lending rates. In turn, this should push up the relative performance of banks and weaken the cost of bank equity, or alternatively raise organic capital accumulation. Overall, the conditions make it easier to dispose of impaired assets.

23 Maurin and Wolski (2017) show that information asymmetry results in the sub-optimal sale of NPLs. To minimise the negative impact of NPLs on profitability, banks have an incentive to overestimate the recovery value of NPLs on their books and to under-provision them. This incentive is well known by investors who, given the lack of information on the "right" pricing of NPLs, tend to require an excess risk premium to fund banks with elevated NPLs. It is likely that, in this case, there will be few deals and they will be at a low price.

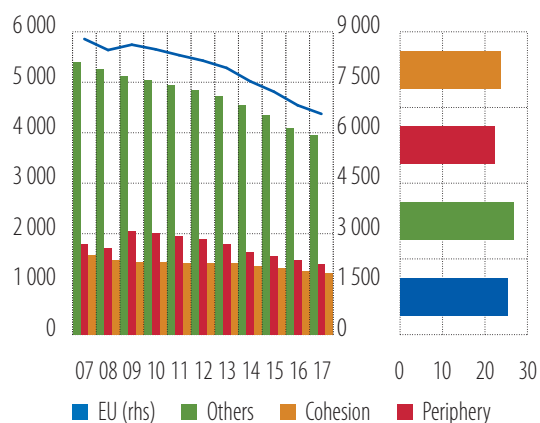
Consolidation in the EU banking sector

Beside legacy assets, the lower relative valuation of EU bank stocks suggests lower earnings expectations. In turn, this may reflect the belief that further adjustments are required in the banking sector, be they for regulatory or economic reasons. A structural readjustment may have occurred that resulted in a persistently lower valuation of bank equity in the sense that, since the financial crisis, investors realise that banks should act with more capital. This can also indicate that the EU banking sector is oversized. In the euro area, the sector is relatively less profitable than its peers (ESRB, 2014, 2016). In this context, bank consolidation can be beneficial (see ECB, 2017e for a detailed analysis of the costs and benefits of bank consolidation).

Indeed, since the crisis, the number of credit institutions in the EU has diminished remarkably, by around 25% (Figure 49). The decline was relatively comparable across the three groups of countries, but somewhat stronger in the other economies group, possibly reflecting the better domestic environment making restructuring easier.

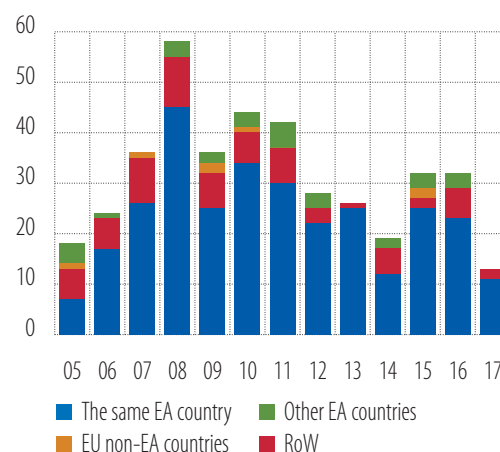
Consolidation achieved via mergers and acquisitions can deliver important cost synergies (for example, lower administrative expenses and rationalisation of branches) as well as revenue synergies (for example, lower funding costs of the merged unit) that might contribute to improving the banking sector's prospects for profitability (Constâncio, 2017b). However, the role of local banks in the financing of the economy should not be underestimated. The benefits of the one-size-fits-all banking model needs to be balanced with the risk of breaking the confidence relationship between small lenders and banks, a risk that could prove especially harmful to part of the EU economy. Moreover, a more concentrated banking system can increase the systemic risk resulting from the failure of larger institutions. As shown by Amiti and Weinstein (2017), adverse shocks to larger banks can be especially detrimental to the economy.

Figure 49 Change in the number of credit institutions (annual average, left-hand scale; and % decline from 2007 to 2017, right-hand scale)



Source: ECON computations based on Thomson Reuters Datastream.
Note: Data up to 2016:Q3.

Figure 50 Number of EA-19 banks acquired by other banks, by buyer's region (annual average, left-hand side; and % decline from 2007 to 2017, right-hand side)



Source: Goncalves Raposo and Wolff (2017).
Note: EA: euro area; RoW: rest of world.

Ideally, consolidation should be accompanied by increased geographical diversification. This would allow banks to achieve economies of scope and scale from cross-border mergers and acquisitions. At the same time, this would increase the shock absorption capacity of the EU financial system, which remains relatively low and limits risk-sharing across economies (Chapter 5). However, as shown in Figure 50, since the crisis the Banking Union has not succeeded in fostering cross-border consolidation of the EU banking sector (ECB, 2017e; Goncalves Raposo and Wolff, 2017). This may reflect the fact that the Banking Union is still incomplete, and work needs to be done especially in the domain of consumer protection and deposit insurance.

Adjustments to further regulatory changes

Despite the overall adjustment to higher capital ratios, EU banks face other regulatory headwinds. Bail-in-able liabilities must be built in to accumulate enough minimum requirements of eligible assets and total loss-absorbing capacity in the cases of systemic banks. Banks also stand at different stages in terms of their adjustment-to-liquidity, net-stable-funding, and liquidity-coverage ratios. Besides, some dimensions of the new regulatory landscape are still uncertain. The too-big-to-fail concept, as embodied by the US Dodd-Frank Act, has recently been challenged, and some disagreement prevails regarding the so-called Basel IV. Despite the uncertainty surrounding the final contours of the post-crisis regulatory framework, and even though it is difficult to precisely evaluate where EU banks stand, part of the adjustment remains to be accomplished.

Conclusion and policy implications

Since the middle of 2016, the macroeconomic and financial situation has continued to improve in the European Union, and more recently some indicators have pointed to an acceleration in corporate investment. Fears of secular stagnation have diminished over the last 12 months. Financial conditions are very supportive, and to a large extent the current recovery still hinges on the very accommodative monetary policy stance. Given the low level of inflation and the absence of a self-sustained, durable and shared pick-up in inflation foreseen in the short term, this accommodative support should remain in place for some time.

However, external financing flows such as bank loans remain subdued despite low financial costs, as companies continue deleveraging. Across the EU, firms' balance sheets are stronger and in many ways they no longer differ between the periphery and the other economies group.

In parallel, the overall picture has become more and more complex, the post-crisis "new normal" is very uncertain, and more granular analysis is required. Indeed, while financial conditions have loosened and access to external finance is not a major source of concern for non-financial corporations, some enterprises still have difficulties accessing external finance. This is a source of concern for those firms that do not generate enough internal financing because of their size, age, or innovative profile.

In the short-to medium term, it is key to continue supporting corporations facing more adverse access to external finance for reasons outside of their scope. This becomes even more urgent to prevent possible bottlenecks in the distribution of loans as external financing needs expand during the recovery. The European Fund for Strategic Investments is a key element in this regard. The instruments developed under its umbrella make it possible to address friction in very specific segments of the financial markets.

In the longer-term, it is important to continue working on the integration of the EU financial system and put in place the conditions for the flows of savings to reach their most efficient use within Europe. It is also important to increase the resilience of the corporate sector to financial shocks, by fostering the diversity of financial sources, not only-bank finance but also market finance. Progress accomplished under the Capital Market Union are key in this regard.

References

- AFME. (2017). "Securitisation Data Report Q4/2016." Association for Financial Markets in Europe.
- Aiyar, S., Bergthaler, W., Garrido, J., Ilyina, A., Jobst, A., Kang, K., Kovtun, D., Liu, Y., Monaghan, D. and Moretti, M. (2015). "A Strategy for Resolving Europe's Problem Loans." IMF Staff Discussion Note No 15/19, International Monetary Fund, Washington, DC.
- Altunbas, Y., Gambacorta, L. and Marques, D. (2007). "Securitisation and the Bank Lending Channel." ECB Working Paper Series No. 838. December. European Central Bank, Frankfurt.
- Amiti M. and Weinstein, D. (2017). "How Much Do Idiosyncratic Bank Shocks Affect Investment? Evidence from Matched Bank-Firm Level Data." *Journal of Political Economy*.
- Andersson, M., Maurin, L. and Rusinova, D. (2017). "Understanding the Weakness of Euro Area Investment since the Great Recession with a Bayesian FAVAR Model." Unpublished.
- Andrade P., Breckenfelder, J., De Fiore, F., Karadi, P. and Tristani, O. (2016). "The ECB's Asset Purchase Programme: An Early Assessment." ECB Working Paper No. 1956. European Central Bank, Frankfurt.
- Acharya, Viral, Pedersen Lasse, Philippon Thomas and Matthew Richardson (2012). "Measuring Systemic Risk." CEPR Discussion Paper, 8824.
- Backer, Scott R., Bloom, N. and Davis, S.J. (2016). "Measuring Economic Policy Uncertainty." www.PolicyUncertainty.com.
- Bauer, M.D. (2017). "Bridging the Gap: Forecasting Interest Rates with Macro Trend." FRBSF Economic Letter 2017-21. Federal Reserve Bank of San Francisco.
- Belke, A. and Klose, J. (2017). "Equilibrium Real Interest Rates and Secular Stagnation: An Empirical Analysis for Euro-Area Member Countries." CEPS Working Document 2017/09. Centre for European Policy Studies, Brussels.
- Berg, T., Streitz, D. and Wedow, M. (2015). "Real Effects of Securitization." BAFFI CAREFIN Centre Research Paper No. 2015-14.
- BIS. (2010). "Final Report on Assessing the Macroeconomic Impact of the Transition to Stronger Capital and Liquidity Requirements." Macroeconomic Assessment Group. Bank for International Settlements, Basel.
- BIS. (2015). "Revisions to the Standardised Approach for Credit Risk – Second Consultative Document." Bank for International Settlements, Basel. December.
- Blundell-Wignall, A. and Roulet, C. (2013). "Long-term Investment, the Cost of Capital and the Dividend and Buyback Puzzle." OECD Journal Financial and Market Trends, 2013(1).
- Borio, C., Gambacorta L. and Hofmann, B. (2015). "The Influence of Monetary Policy on Bank Profitability." BIS Working Paper 514. Bank for International Settlements, Basel.
- Bridges, J., Gregory, D., Nielsen, M., Pezzini, S., Radia, A. and Spaltro, M. (2014). "The Impact of Capital Requirements on Bank Lending." Bank of England Staff Working Paper No. 486.
- Bruno B., D'Onofrio A. and Marino I. (2017). "Financial Frictions and Corporate Investment in Bad Times. Who Cut Back Most?" CEPR Discussion Paper 12003. Centre for Economic Policy Research, London.
- Brutscher, P.B., Heipertz, J. and Hols, C. (2017). "Loan Characteristics, Firm Preferences and Investment: Evidence from a Unique Experiment." EIB Working Paper 3. European Investment Bank.

- Chatzouz, M., Gereben, A., Lang, F. and W. Torfs, (2017). "Credit Guarantee Schemes for SME Lending in Western Europe." EIB Working Paper 2017/02 and EIF Working Paper 2017/42. European Investment Bank.
- Coeuré, B. (2017a). "The International Dimension of the Asset Purchase Programme." Speech at the Foreign Exchange Contact Group Meeting, 11 July.
- Coeuré, B. (2017b). "Scars or Scratches? Hysteresis in the Euro Area." Speech at the International Center for Monetary and Banking Studies, 19 May.
- Constâncio V. (2017a). "Resolving Europe's NPL Burden: Challenges and Benefits." Speech at the conference on "Tackling Europe's Non-performing Loans Crisis: Restructuring Debt, Reviving Growth," Bruegel, Brussels, 3 February.
- Constâncio V. (2017b). "Challenges Faced by the European Banking Sector." Speech at the Risk and Supervision 2017 Conference, Associazione Bancaria Italiana, Rome, 14 June.
- Darracq-Parries, M., Maurin L. and Moccero, D. (2014). "Financing Condition Index and Identification of Credit Supply Shock for the Euro Area." *International Finance*, 17(3), 297–321.
- Deloitte. (2017). "Uncovering Opportunities in 2017. Deleveraging Europe 2016-2017."
- Draghi, M. (2017a). "Monetary Policy and the Economic Recovery in the Euro Area." Speech at "The ECB and its Watchers XVIII Conference," Frankfurt am Main, 6 April.
- Draghi, M. (2017b). "Accompanying the Economic Recovery." Introductory speech at the European Central Bank Forum on Central Banking, Sintra, 27 June.
- EBA. (2017). "Risk Dashboard, Data as of Q1 2017." European Banking Authority.
- EBA. (2013). "Summary Report on the Comparability and Pro-cyclicality of Capital Requirements under the Internal Ratings Basel Approach in accordance with Article 502 of Capital Requirements Regulation." European Banking Authority. 17 December.
- EBCI. (2014). "Credit Guarantee Schemes for SME Lending in Central, Eastern and South-Eastern Europe." European Bank Coordination Initiative.
- ECB. (2017a). "Impact of the ECB's Non-standard Measures on Financing Conditions: Taking Stock of Recent Evidence." *Economic Bulletin*, Issue 2. European Central Bank, Frankfurt.
- ECB. (2017b). "Survey on the Access to Finance of Enterprises in the Euro Area, October 2016 to March 2017." European Central Bank, Frankfurt. June.
- ECB. (2017c). "The Euro Area Bank Lending Survey. First Quarter 2017." European Central Bank, Frankfurt. April.
- ECB. (2017d). "Guidance to Banks on Tackling Non-performing Loans." European Central Bank, Frankfurt.
- ECB. (2017e). "Financial Integration in Europe." European Central Bank, Frankfurt. May.
- EIB. (2016). "Investment and Investment Finance Report." European Investment Bank.
- EIB. (2017). "EIBIS 2016/2017: Surveying Corporate Investment Activities, Needs and Financing in the EU." European Investment Bank Economics Department.
- Enria, A. (2017). Presentation at the ESM Seminar on European Banks Risks and Recovery. Luxembourg, January.

- ESRB. (2014). "Is Europe Overbanked?" Report to the Advisory Scientific Committee, No. 4. European Systemic Risk Board, Frankfurt.
- ESRB. (2016). "Macprudential Policy Issues Arising from Low Interest Rates and Structural Changes in the EU Financial System." European Systemic Risk Board, Frankfurt. November.
- ESRB. (2017). "Resolving Non-performing Loans in Europe." European Systemic Risk Board, Frankfurt. 11 July.
- European Commission. (2016a). "Annual Report on European SMEs 2015/2016 – SME Recovery Continues." November.
- Fell, J., Moldovan C. and O'Brien, E. (2017). "Resolving Non-performing Loans: A Role for Securitisation and Other Financial Structures?" Special Feature C in ECB Financial Stability Review, May.
- Fell, J., Grodzicki, M. Martin R. and O'Brien, E. (2016). "Addressing Market Failures in the Resolution of Non-performing Loans in the Euro Area." Special Feature B in ECB Financial Stability Review, November.
- Fraisse, H., Lé, M. and Thesmar, D. (2017). "The Real Effects of Bank Capital Requirements." European Systemic Risk Board Working Paper 47.
- Galiay, A., and Maurin, L. (2015). "Drivers of Banks' Cost of Debt and Long-term Benefits of Regulation – An Empirical Analysis Based on EU Banks." European Central Bank Working Paper 1849.
- Georgiadis, G. and Gräß, J. (2016). "Global Financial Market Impact of the Announcement of the ECB's Asset Purchase Programme." *Journal of Financial Stability*, 26, 257–265.
- Goncalves Raposo, I. and Wolff, G. (2017). "How Has Banking Union Changed Mergers and Acquisitions?" Bruegel, September.
- Guérin, P., Maurin, L. and Mohr, M. (2011). "Trend-cycle Decomposition of Output and Euro Area Inflation Forecasts: A Real-time Approach Based on Model Combination." *Macroeconomic Dynamics*, 19(2), 363–393.
- Holston, K., Laubach T. and Williams, J.C. (2016). "Measuring the Natural Rate of Interest: International Trends and Determinants." Federal Reserve Bank of San Francisco Working Paper 2016-11, June.
- IMF. (2017). "Global Financial Stability Report: Measuring Financing Conditions." Washington, DC: International Monetary Fund, April.
- Kaya, O. (2014). "SME Financing in the Euro Area. New Solutions to an Old Problem." EU Monitor – Global Financial Markets. Deutsche Bank Research.
- Kraemer-Eis, H. and Lang, F. (2012). "The Importance of Leasing for SME Finance." EIF Research & Market Analysis Working Paper 2012/15. European Investment Fund.
- Kraemer-Eis, H., Passaris, G., and Tappi, A. (2013). "SME Loan Securitisation 2.0 – Market Assessment and Policy Options." EIF Research & Market Analysis Working Paper 2013/019. European Investment Fund.
- Kraemer-Eis, H., Schaber, M., and Tappi, A. (2010). "SME Loan Securitisation. An Important Tool to Support European SME Lending." EIF Research & Market Analysis Working Paper 2010/007. European Investment Fund.
- Kraemer-Eis, H., Lang, F., Torfs, W. and Gvetadze, S. (2017). "European Small Business Finance Outlook: June 2017." EIF Research & Market Analysis Working Paper 2017/43. European Investment Fund.
- Kraemer-Eis, H., Passaris, G., Tappi, A. and Inglisa, G. (2015). "SME Securitisation – At a Crossroads?" EIF Research & Market Analysis Working Paper 2013/031. European Investment Fund.

- Laubach T. and Williams J.C. (2016). "Measuring the Natural Rate of Interest Redux." *Business Economics*, 51(1), 57–67.
- Lopez-Villavicencio, A. and Mignon, V. (2013). "Nonlinearity of the Inflation-Output Trade-off and Time Varying Price Rigidity." CEPII Working Paper 2013-02. Paris.
- Martin, R., Maurin, L., Moccerro D. and Kanngiesser, D. (2017). "Estimating the Impact of Shocks to Bank Capital in the Euro Area." ECB Working Paper No. 2077. European Central Bank, Frankfurt.
- Masiak, Moritz, A., and Lang, F. (2017). "Financing Patterns of European SMEs Revisited: An Updated Empirical Taxonomy and Determinants of SME Financing Clusters." EIF Research & Market Analysis Working Paper 2017/40. European Investment Fund
- Maurin, L. and Toivanen, M. (2012). "Risk, Capital Buffers and Bank Lending: A Granular Approach to the Adjustment of Euro Area Banks." ECB Working Paper No. 1499, European Central Bank, Frankfurt.
- Maurin, L. and Wolski, M. (2017). "Fostering Sales of Non-performing Loans: The Effects of Capital and Provisioning Policies and the Potential Benefit of Asset Management Companies." Paper presented at the INFINITI Conference, Valencia. Unpublished.
- Rajan, G. and Zingales, L. (1995). "What do we know about capital structure? Some evidence from international data." *The Journal of Finance*, Vol. 50, N° 5, pp. 1421-60.
- Slovik, P. and Cournède, B. (2011). "Macroeconomic Impact of Basel III." OECD Economic Department Working Paper. OECD Publishing, Paris.
- UEAPME. (2017). "The EU Craft and SME Barometer 2017/H1." European Association of Craft, Small, and Medium-sized Enterprises Study Unit. March.

Chapter 7

Firm-level evidence of heterogeneous investment finance and its implications for the sluggish recovery in investment

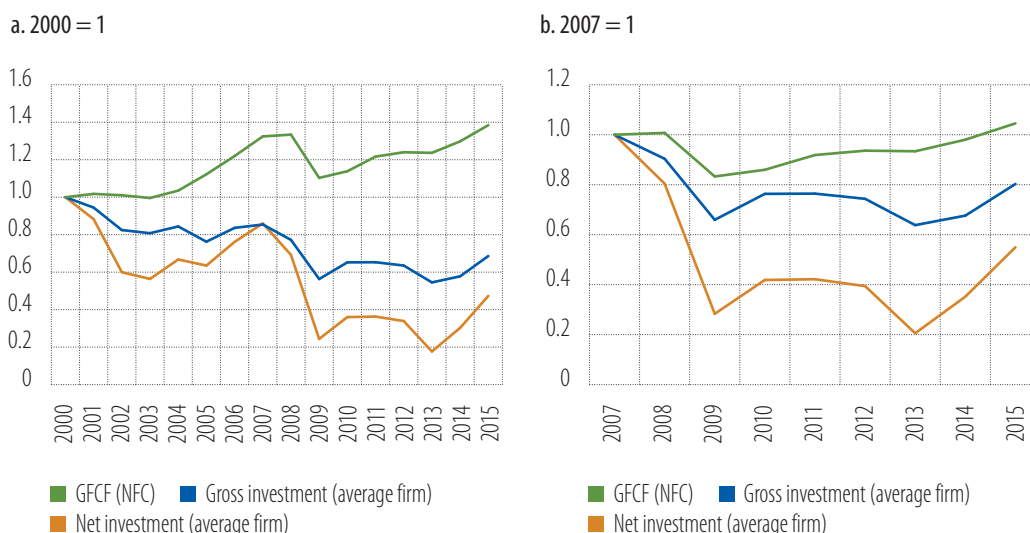
Chapter at a glance

- This chapter examines the effect of access to different forms of external finance on firms' investment in two different types of assets: tangible and intangible. Two different analyses are performed: a dynamic analysis focusing on the 2000–2016 period matches information from the European Investment Bank Investment Survey (EIBIS) with firm-level data from financial statements; and a static analysis focusing on 2016 only and based solely on information derived from the survey.
- While the analysis cannot identify specific relations of causality, it enables the establishment of new facts regarding the impact of investment finance on firms' investment choices including three main findings.
- First, firms have access to external finance mostly to finance tangible assets. In fact, firms whose external finance accounts for more than 50% of their total financing increase tangible investment more – an effect driven by small and medium-sized enterprises (SMEs).
- Second, both SMEs and large enterprises have access to bank debt (short- and long-term), mostly to increase tangible assets. Large firms can also use bank debt to finance intangible assets, while SMEs have to rely on internal finance and trade credit to finance them.
- Third, trade credit financing became important for both SMEs and large firms for tangible investment during the period of recovery from the 2008 global financial crisis.
- The static analysis, using a different approach based on the proportions of investment and sources of finance as reported by firms in the EIBIS, confirms the above results. In particular, firms are signalling the relevance of internal finance to facilitate investment in intangible assets. For SMEs, bank finance is available to support investment in tangible more than for intangible assets.
- Grants are used to a large extent by both large and small enterprises to finance expenditures on land, buildings, and infrastructure, possibly due to policy objectives to enhance energy efficiency that are associated with these grants.
- Grants positively influence SMEs' research and development (R&D), but not investment in software and information technology (IT). This may be because policy objectives behind grants tend to focus on R&D alone, disregarding the strong needs for software and IT upgrades in the current technological transformation phase. For SMEs' R&D investment, market finance and insider finance also play a relevant role.
- Overall, a "pecking order" theory of finance emerges in which internal finance is key to supporting intangible investment, bank finance is more related to tangible assets, and trade finance, market-based finance and grants provide a lifeline to support investment in R&D for SMEs.
- From a policy point of view, issues in the financing of intangible assets that need to be addressed include (1) creating incentives for banks, (2) implementing targeted guarantee schemes and (3) better incentivising firms' own resources and shareholders' equity.

From aggregate business investment to firm-level investment rates

Business investment might be affected by the type of financing available. Although aggregate corporate investment has recovered since the global financial crisis, as documented in the first part of this report, firm-level net and gross investment has still not yet reached its pre-crisis levels (as shown in Figure 1, which compares investment rates levels against 2000 and 2007 levels). This chapter investigates the heterogeneity behind the recovery in business investment, focusing on the heterogeneous effects of investment finance. If access to external finance is key to fuelling investment expenditures during boom years, and if this access varies by firm size, then during the recovery period when this type of finance is scarce one should expect different sizes of firms to recover at different speeds. This process will not only create heterogeneity in investment recovery rates but also slow the aggregate recovery (EIB, 2016, Chapter 7).

Figure 1 Aggregate and average firm-level investment over time



Source: Authors' calculations based on Eurostat, EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: Aggregate gross fixed capital formation (GFCF) at current prices of non-financial corporations (NFCs) in EU28 countries. For firm-level data, averages of net and gross investment are reported. Net investment is defined as the annual change in total fixed assets, while gross investment is the annual change in total fixed assets plus depreciation.

Firm-level financial data combined with survey data provide a unique panel focusing on types of business investments. By relying on the unique dataset that combines the EIBIS with firm-level balance sheet information from Bureau van Dijk's ORBIS database, this chapter focuses for the first time on different types of tangible and intangible investments as a function of their financing before and after the crisis. The ORBIS database entails balance sheets of firms, whereas the EIBIS provides information on the different types of investment by firms. Data from the EIBIS is cross-sectional for 2016 with reference to 2015 financial statements, whereas firm-level financial statements from ORBIS are longitudinal starting in 2000. Once the two datasets are combined,¹ it is possible to run a panel analysis of firms' investment dynamics focusing on different types of investment as a function of their financing before and after the crisis. Hence, it is possible to analyse the time series dimension of the financial condition of firms before and at the time of the collection of the survey responses.

¹ Annex A contains detailed information on the characteristics of the dataset (see Table A1). See also the Data Annex at the end of this report.

The EIBIS provides information about six different types of tangible and intangible assets in which firms have invested (EIB, 2017). For tangible investments, the survey asks about expenditures on (1) land, business buildings and infrastructure and (2) machinery and equipment. For intangible investments, the survey asks about (1) expenditures on R&D (including the acquisition of intellectual property), (2) software, data, IT networks and website activities (software and databases), (3) training of employees and (4) organisation and business process improvements (including restructuring and streamlining).

Survey data include some intangible investments that are not visible in the balance sheet data. The aforementioned six investment types reflect broad coverage of a firm's tangible and intangible investment outlays.² Table 1 shows that not all investment expenditures reported in the survey are capitalised as capital formation in accounting data. Because of the difficulty of measuring future benefits, intangibles such as organisational capital and training are treated as intermediate costs in the financial statements. The expensing of these intangible asset types, rather than the capitalisation, is in contrast to the treatment of tangible assets, which are capitalised initially and then depreciated. Thus, while the tangible asset expenditures on land, buildings and infrastructure or machinery and equipment are captured as investment in firm accounts, only a few intangible asset types, such as R&D and software databases, are captured as such. As a result, information from the survey on investment in training of employees or making organisational and business improvements is not even part of the total investment information provided by the balance sheet data.

Table 1 Investment types according to EIBIS and accounting data

Asset category	Types of asset captured in the EIBIS	Captured as investment in accounts	
Tangible fixed assets	Land, buildings and infrastructure	✓	➤ Tangible assets
	Machinery and equipment	✓	
Computerised information	Software, data, IT networks and website activities	✓	➤ Intangible assets
Innovative property	Research and development	✓	
Economic competency	Training of employees	✗	
	Organisation and business process improvements	✗	

Source: Prepared by the authors based on Corrado, Hulten and Sichel (2005).

Note: EIBIS: European Investment Bank Investment Survey.

A complete consideration of intangible investment in accounting data would require that information on intangible expenditures be collected from profit and loss data, and that some hypotheses be made about their average life span and the amortisation rate necessary to capitalise them. Although difficult, this is the procedure that has been followed in the literature (see Long and Malitz, 1985, for US-listed companies; Hunter, Webster and Wyatt, 2005, for a methodological review; and Andrews and Criscuolo, 2013, for Organisation for Economic Co-operation and Development countries). In our empirical analysis, it was not possible to pursue this avenue due to the lack of availability of information on profit and loss accounts, as very few companies report intangible expenses. Hence, we use the investment types captured in the balance sheet data (shown with ticks in Table 1).

² Especially for intangible investment expenditures, EIBIS data provide information that is in line with the conceptual classification of Corrado, Hulten and Sichel (2005) (see Chapter 3 in this report). Their categorisation of computerised information includes assets of purchased as well as self-created software. This is under the software and databases category in the survey. Innovative property captures assets that may include intellectual property protection such as R&D, design, and artistic originals, as well as new product development that is not necessarily leading to a patent or copyright, which in the survey is represented by R&D. Economic competencies are a range of assets that firms invest in to run their business, such as the value of brand names and other knowledge value in firm-specific human resources and organisational structures. This category is broadly covered in the survey under investment expenditures on training of employees and organisation and business process improvements.

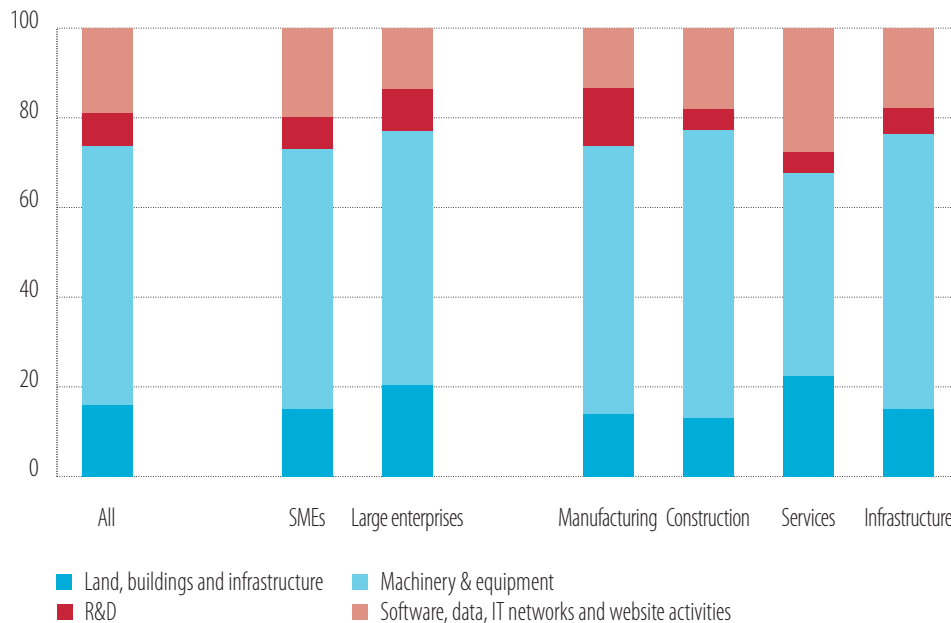
A directly comparable investigation of investment using survey-level and accounting data relates to four categories of investment: (1) land, buildings and infrastructure; (2) machinery and equipment; (3) R&D; and (4) software databases. These four categories represent 83% of total investment reported by the firms in the survey. Of this share, firms have on average invested 73.8% in tangible fixed assets (which include land, business buildings and infrastructure, and machinery and equipment), 7.5% in R&D, and 18.8% in software databases, as shown in Table 2 based on the 2016 EIBIS.

Table 2 Distribution of investment types

Type of investment	Unweighted average (%)	Standard deviation
Land and buildings	16.1	29.5
Machinery and equipment	57.7	38.8
R & D	7.5	19.7
Software and databases	18.8	30.7

Source: Authors' calculations based on EIBIS2016.

SMEs invest less in tangible assets and R&D but more in software and databases than large companies. The breakdown of investment by sector and firm size in Figure 2 largely reflects expected differences between the two size groups and between industry sectors. When considering only the four investment types, the decomposition of investment outlays reveals that large enterprises invest on average a higher share in tangible assets than SMEs (77% versus 73%, respectively), which is largely attributable to a higher share of investment in land, buildings and infrastructure. The higher share of R&D investments by large enterprises compared to SMEs (10% versus 7% for SMEs) is in line with findings in the literature suggesting that larger enterprises have a greater propensity to invest in intangibles, particularly in R&D, because they can better exploit economies of scale and are capable of supporting higher risk (Dierickx and Cool, 1989; Ghosal and Loungani, 2009; Arrighetti, Landini, and Lasagne, 2014). As a consequence, larger enterprises have higher current spending. On the other hand, the average share of investment in software and databases is considerably lower for large enterprises than for SMEs (13% and 20%, respectively).

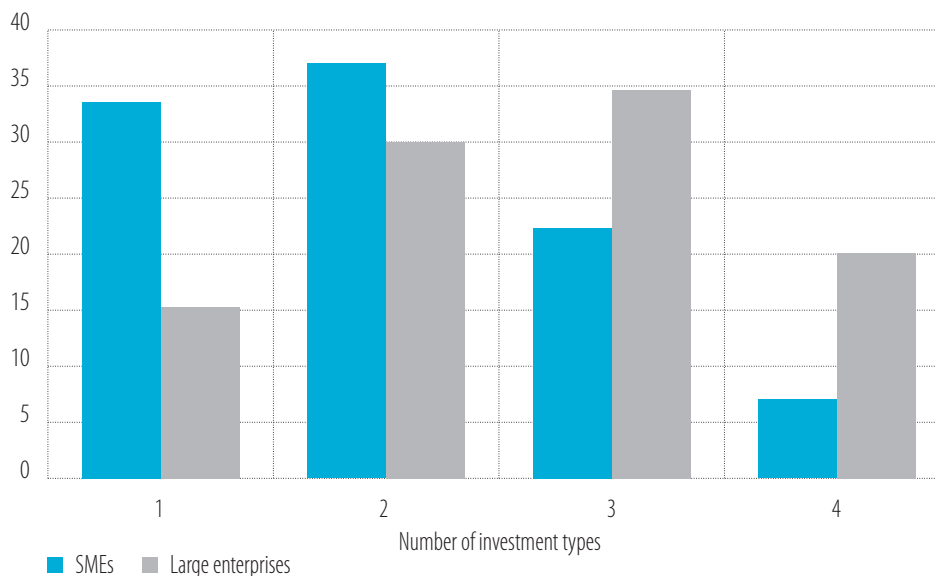
Figure 2 Investment types by firm size and sector (%)

Source: Authors' calculations based on the EIBIS2016.

Note: Shares of total investment defined as the sum of the four types of investment: land, buildings and infrastructure, machinery and equipment, research and development (R&D), and software and databases (including IT, information technology). SMEs: small and medium-sized enterprises.

Furthermore, the breakdown of investment types is heterogeneous across industry sectors. Capital-intensive sectors such as construction and infrastructure industries invest most of their outlays in tangible assets, while the service sector has the smallest share of machinery and equipment outlays but the biggest share of investments in software databases. Unsurprisingly, the manufacturing sector has the largest proportion of R&D outlays (13% compared to 5% in the other sectors).

Differences can also be observed regarding the number of types of investment on which a company relies. Figure 3 shows the percentages of firms that have invested in one or more different types of assets (land and buildings, machinery and equipment, R&D, and software databases) across SMEs and large enterprises. Interestingly, the figure reveals a quite different pattern between SMEs and large enterprises: while most firms overall invest in two different types of assets (43%-45% for both size groups), the distribution for SMEs is skewed towards fewer investment types, and for large enterprises it is skewed towards more investment types. Specifically, only around 17% of SMEs pursued investments in all four asset types, while the figure is almost double for large enterprises. In turn, only 21% of large enterprises invest in only one asset type, while this share is almost double for SMEs. This pattern indicates that large enterprises pursue, on average, a more diversified investment strategy than SMEs.

Figure 3 Frequency of number of investment types by firm size

Source: Authors' calculations based on the EIBIS2016.

Note: SMEs: small and medium-sized enterprises.

A new firm-level investment time series is constructed for the analysis. By assuming the EIBIS cross-sectional picture of the investment choices of firms to be constant over time, it is possible to combine the two datasets and undertake a panel analysis of firms' investment dynamics. In order to exploit the time dimension of the matched dataset, we first construct net investment at the firm level using data on the annual change in total fixed assets from the financial statements. For a robustness check we also calculate gross investment by adding depreciation of existing capital. Second, we apply the cross-sectional survey-derived proportions of the different types of investment to total net and gross investment from the balance sheet data. That means the new firm-level investment time series is constructed as follows:

Type of investment (j) _{it} = proportions EIBIS _{jt} X Total investment _{jit'} (1)

where j denotes the different types of investment for firm i at time t . In this way it is possible to construct a time series for the four types of investment, which vary among firms and over time. The underlying hypothesis is that firms are channelling time-varying amounts of funds to increase time-varying amounts of fixed assets. However, the composition of those fixed assets in terms of different types of investment remains fixed over time. The main idea is that, although the proportions of the different investment types remain fixed for each firm over time, the between-firm variation of investment growth will provide information on how different types of investment behave over time and how the variation can be explained by different financial ratios.

Table 3 reports some descriptive statistics for the constructed gross and net investment variables. Total investment is the annual change in a firm's fixed assets over total fixed assets, while tangible assets (land and buildings, machinery and equipment) and intangible assets (R&D and software databases) are the respective shares of this annual change. We count more observations for net investments (90,436 firm-year observations) due to a lack of data on depreciation in the financial statements in order to calculate gross investment (84,012 firm-year observations). Overall, in terms of the number of firms, out of the 12,468 firms within the matched database, only 8,651 have available information on net investment (corresponding to 90,436 firm-year observations). For gross investment the number of firms is 7,983 (84,012 firm-year observations).

Table 3 Summary statistics for investment

	Observations	Mean	Minimum	Maximum	Standard deviation
Net investment					
Total investment	90,436	0.07	-1	3.84	0.34
Land and buildings	90,436	0.01	-0.92	0.81	0.07
Machinery and equipment	90,436	0.06	-1	1.58	0.26
Research and development	90,436	0	-0.8	1.35	0.05
Software and databases	90,436	0.01	-0.98	1.51	0.1
Gross investment					
Total investment	84,012	0.30	-1	8.05	0.44
Land and buildings	84,012	0.04	-0.91	1.44	0.1
Machinery and equipment	84,012	0.19	-0.92	2.98	0.35
Research and development	84,012	0.02	-0.38	2.53	0.07
Software and databases	84,012	0.05	-0.98	3.44	0.15

Source: Authors' calculations based on EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: Net (gross) investment in land and buildings, machinery and equipment, research and development, and software databases are the amounts of total net (gross) investment in those categories calculated using the shares reported by firms in the EIBIS divided by lagged fixed assets.

Firm-level financing and investment

Firms tend to use mostly internal funds rather than financial debt to finance their investment activity. Nevertheless, trade credit (the provision of credit by suppliers to their customers) also accounts for an important share of investment activity.

In general, firms' investments can be funded by both short- and long-term external finance (debt and equity) as well as by internal finance such as retained earnings and cash and intra-group debts (other current liabilities). Furthermore, firms can also use trade credit, which is an important source of finance, especially when they find it difficult to obtain external funding via credit institutions.

Focusing on the capital structure of firms, panel a in Table 4 shows that a typical firm in the sample reports slightly more total equity than financial debt; in particular, capital represents on average 11% of total assets, while retained earnings count for 27%.³ Financial debt, which is the sum of loans up to one year and long-term debt over total assets, is about 19%. In terms of what constitutes the debt, short-term debt (the combination of loans up to one year and trade credit) represents a large source of external funds, with loans up to one year accounting on average for 13% of total liabilities and trade credit for 28%. Firms tend to use more long-term debt (16%) than short-term loans. Cash and intra-group debt is also widely used by firms as reported by other current liabilities (36%).

³ By construction, most of the 12,661 firms in the survey are present in the matched database and the total number of firm-year observations ranges between 67,000 and 90,000, depending on the availability of the financial ratio data. All variables are checked to ensure balance sheet identities, and some entries were deleted when they were not meaningful from an accounting point of view. Furthermore, all variables are winsorised at the 1% level, like in Kalemli-Ozcan et al. (2015).

Table 4 Summary statistics of firms' liabilities and investment

Panel a. Capital structure							
	Observations	Mean	Standard deviation	Mean (SMEs)	Mean (Large)	Minimum	Maximum
Retained earnings/Total assets	89,702	0.27	0.3	0.27	0.25	-5.09	0.85
Equity/Total assets	89,730	0.11	0.18	0.1	0.14	-0.84	6.42
Financial leverage/Total assets	73,383	0.19	0.21	0.2	0.19	0	1.49
Short-term loans/Total liabilities	82,642	0.13	0.18	0.13	0.14	0	0.77
Trade credit/Total liabilities	82,300	0.28	0.24	0.29	0.26	0	0.91
Other current liabilities/Total liabilities	76,970	0.36	0.29	0.36	0.34	0	1
Long-term debt/Total liabilities	75,040	0.16	0.21	0.17	0.15	0	0.93
Panel b. Regression variables							
	Observations	Mean	Standard deviation	Mean (SMEs)	Mean (Large)	Minimum	Maximum
Total investment	90,436	0.09	0.38	0.09	0.09	-1	4.16
Land and buildings	90,436	0.01	0.07	0.01	0.01	-0.92	0.81
Machinery and equipment	90,436	0.06	0.26	0.06	0.05	-1	1.58
Research and development	90,436	0	0.05	0	0	-0.8	1.35
Software databases	90,436	0.01	0.1	0.01	0.01	-0.98	1.51
Internal finance	89,702	0.27	0.3	0.27	0.25	-5.09	0.85
External finance	73,221	0.36	0.25	0.37	0.35	0	1.52
EXT dummy	72,804	0.57	0.49	0.57	0.6	0	1
EXTWTC dummy	72,804	0.24	0.43	0.24	0.25	0	1
Trade credit/Total assets	83,539	0.17	0.18	0.17	0.16	0	1.75
Sales growth	68,057	0.26	2.14	0.27	0.24	-1	95.99
Size	90,434	14.97	2.08	14.42	17.31	4.45	32.51
Cash flow/Total assets	67,717	0.11	0.14	0.11	0.09	-3.45	2.34

Source: Authors' calculations based on the EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: Financial leverage is the sum of short-term loans and long-term debt. Internal finance is defined as the amount of retained earnings to total assets. External finance includes short-term loans, long-term debt and trade credit over total assets. EXT is a dummy variable equal to 1 if the ratio of short-term debt + long-term debt + trade credit to total liabilities is equal to or greater than 50% in a given year. EXTWTC is a dummy variable equal to 1 if the ratio of short-term debt + long-term debt to total liabilities is equal to or greater than 50% in a given year. Sales growth is defined as the annual percentage change in sales revenues. Size is the logarithm of total assets and cash flow is earnings before interest, taxes, depreciation and amortisation. SMEs: small and medium-sized enterprises.

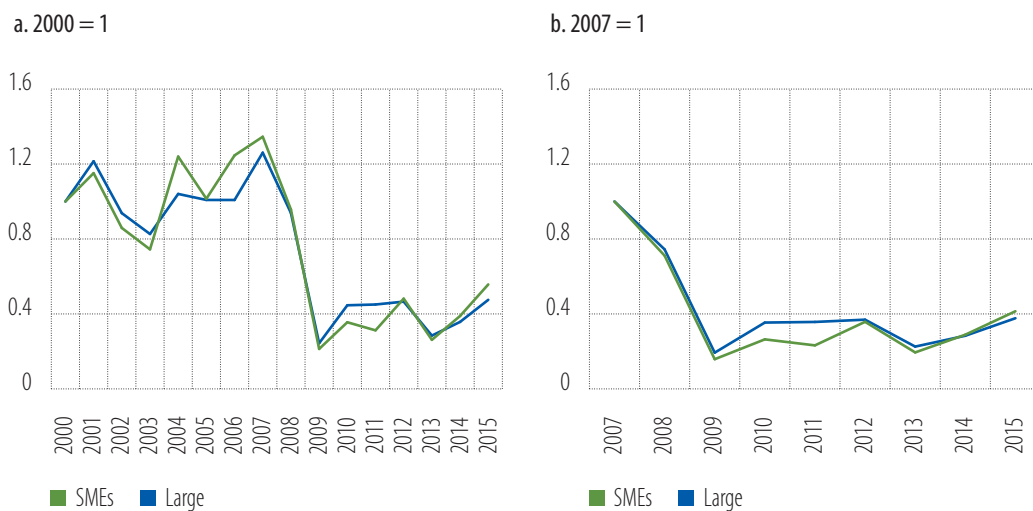
Panel b of Table 4 reports summary statistics for the variables used in the econometric analysis. On average, total net investment covers 9% of capital, whereas most is attributable to fixed tangible investments (7%). Nominal growth of operating revenues (sales growth) is relatively high, although there is quite a large variation across firms, and most firms in the sample are able to generate internal funds and retain cash.

There are intrinsic differences between SMEs and large enterprises in terms of financing and investment behaviour. In contrast to large enterprises, SMEs have a limited scope of available financing sources and face a higher cost of external finance, as they are the most informationally opaque group of firms. Furthermore, the fact that many smaller enterprises are often owner-managed could imply different growth and investment strategies (Cressy and Olafsson, 1997; Berger and Udell, 1998, 2006;

Beck, Demirgüç-Kunt and Maksimovic, 2008). Because the data used here provide a wide spectrum of firm sizes, we investigate the differential effects of financing variables on investment behaviour between SMEs and large enterprises. The capital structure of SMEs tends to have more retained earnings, less capital, more trade credit and other current liabilities.

Figure 4 shows the development of net investment in the two size groups for total net investment. The investment paths for both follow the same trend, with a sharp drop of investment from 2007 until 2009. In the text that follows, the regression analysis will focus on differences in firm size.

Figure 4 Net investment by firm size over time

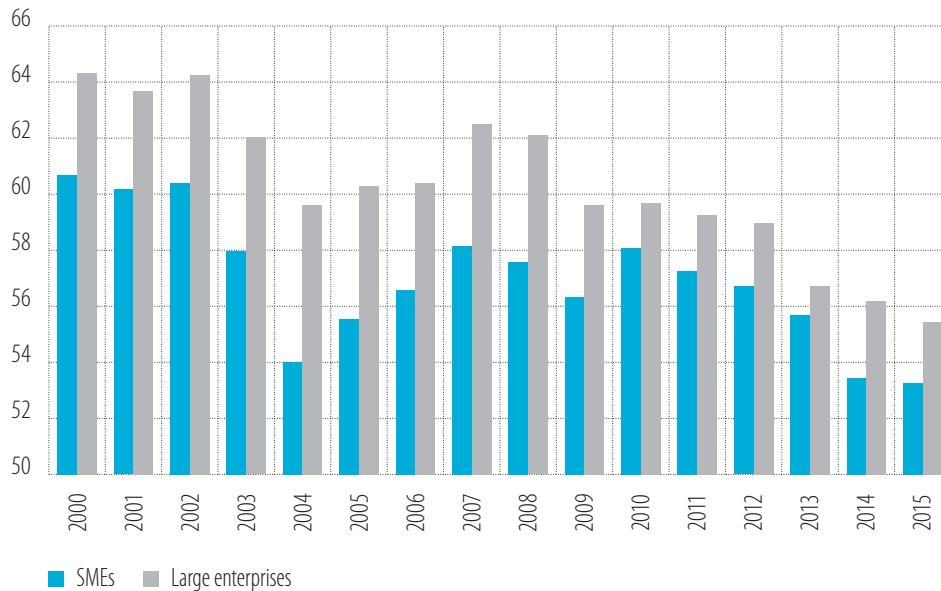


Source: Authors' calculations based on the EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: Small and medium-sized enterprises (SMEs) are firms with fewer than 250 employees, and large companies are firms with more than 250 employees. Average values are reported.

The use of external finance differs across firm size. The total financing volume is defined based on ORBIS data for internal and external sources. Internal finance is defined as the ratio of retained earnings to total assets, while external finance includes the ratio of short- and long-term debt and trade credit to total assets.⁴ In addition, by defining total liabilities as the sum of short- and long-term debt, trade credit and retained earnings, we construct a dummy variable EXT that is equal to 1 if the share of external finance in firms' total liabilities exceeds 50%. This means that when over half of a firm's total financing is from external sources, we assign a dummy of 1 to that firm and 0 otherwise. Notice that this dummy can vary over time at the firm level. Figure 5 shows the percentages of firms with EXT equal to 1 by firm size. On average, 57% of firms make extensive use of external finance. Large firms tend to use more external finance than SMEs.

4 We do not consider intragroup finance, as this type of funding is relevant only for a few subsidiaries in the sample.

Figure 5 External finance by firm size over time (%)

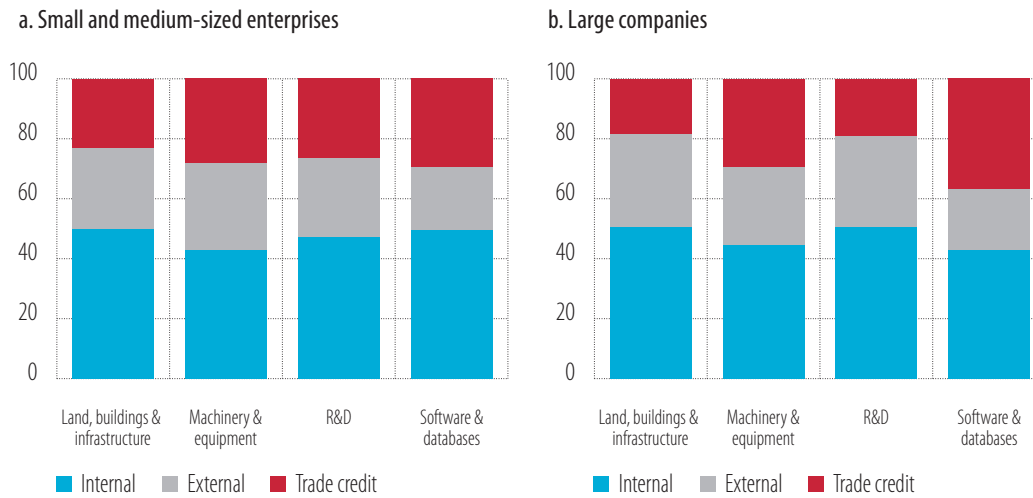
Source: Authors' calculations based on EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: The figure shows the average percentage of firms with $EXT = 1$, that is, the percentage of firms whose external finance is more than 50% of their total borrowing. SMEs: small and medium-sized enterprises.

As EIBIS contains information about the financing behaviour of firms, it is useful for the analysis to check the use of the different financing sources across both datasets. Hence, before turning to the empirical analysis, it is important to highlight the differences in the definition of external and internal finance as derived from the EIBIS and the ORBIS data.

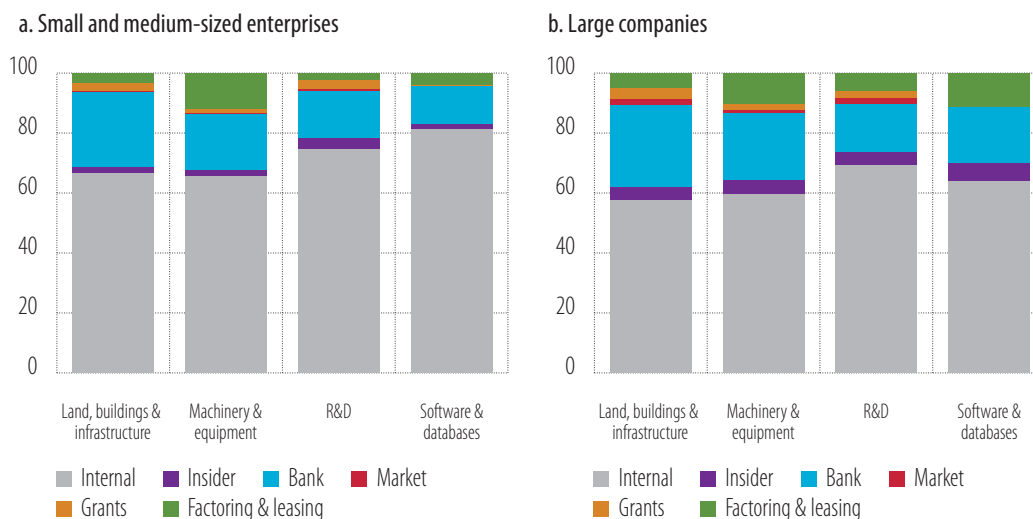
Figure 6 reports shares of investment finance by external finance (short and long-term debt), trade credit and internal finance by investment type and firm size. Based on the investment-type information from the EIBIS and the internal and external finance information from the ORBIS, we see that companies rely more on external finance in particular for their investment in machinery and equipment. At the same time, SMEs rely more on trade credit than large companies, while large companies make more use of trade credit for investment in software and databases.

Figure 6 Sources of finance by firm size and investment type: ORBIS data (%)



Source: Authors' calculations based on the EIBIS2016 and the Bureau van Dijk ORBIS database.
Note: Each bar shows the average use of the different sources of finance for those firms that have invested the most in each specific type of investment. Financing sources are derived from the Bureau van Dijk ORBIS. Internal finance is defined as the ratio of retained earnings to total financing, while external finance is the ratio of short- and long-term debt to total financing (which includes trade credit). Trade credit is the share of total financing. Small and medium-sized enterprises are firms with fewer than 250 employees and large companies are firms with more than 250 employees.

Figure 7 plots static information from the EIBIS for 2016 on the share of firms that finance different types of investment with different forms of financing. This information seems different from what was just plotted in Figure 6 based on the ORBIS data. Based on the EIBIS, most firms finance all types of investment with internal finance, and SMEs in particular fund most of their intangible investment with internal finance. This type of finance involves retained earnings and cash, whereas bank finance is made up of loans and market finance is comprised of newly issued bonds and equity. The insider finance category captures loans from friends.

Figure 7 Sources of finance by firm size and investment type: EIBIS data (%)

Source: Authors' calculations based on the EIBIS2016.

Note: Each bar shows the average use of the different sources of finance for those firms that have invested the most in each specific type of investment. Internal finance is cash and retained earnings. Insider finance consists of intra-group lending and loans from family and friends, bank finance consists of bank loans and other bank finance, and market-based finance consists of issued equity and bonds. Small and medium-sized enterprises are firms with fewer than 250 employees and large companies are firms with more than 250 employees.

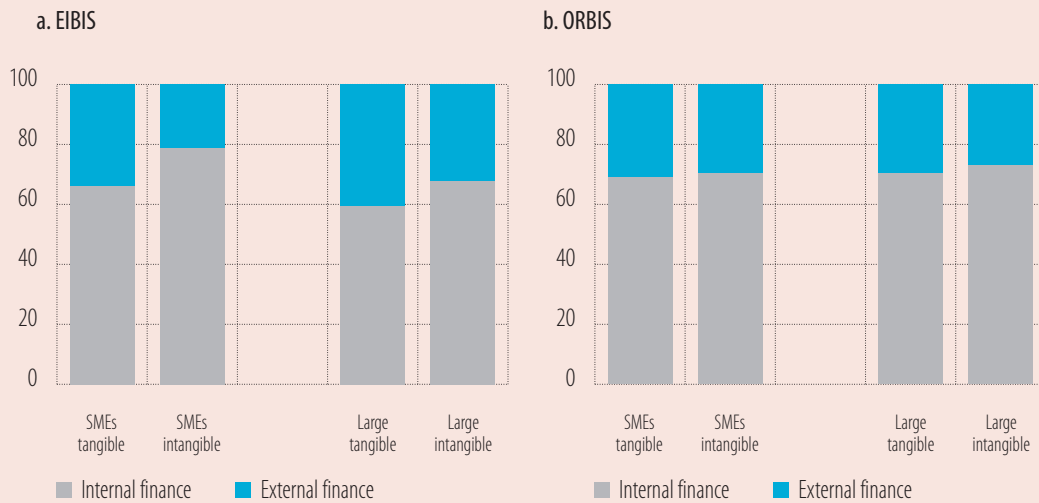
To better understand the origins of the differences in the two datasets, Box 1 provides a detailed comparison of the two definitions and underlines the importance of being aware of the differences when comparing empirical results.

Box 1 Internal and external finance from the EIBIS versus standard balance sheet practice definitions: a comparative exercise

To understand the differences highlighted in the main text on the use of different financial instruments to finance investment, it is important to focus on the definition of internal and external finance derived from the two databases used for the analysis in this chapter.

First, the EIBIS treats the liability and asset sides of the balance sheet together as sources of financing. Perhaps more importantly, the EIBIS does not ask about trade credit, and cash is included in the definition of internal finance. To clarify this issue, we compare internal and external finance as derived from the EIBIS (Figure 1, panel a) with a revised version of the similar definition of internal and external finance from the Bureau van Dijk ORBIS database. That is, we exclude trade credit from total financing in ORBIS data and add cash and cash equivalents (which is under short-term assets) to internal finance.

Figure 8 Internal and external finance by firm size and investment type (%)



Source: Authors' calculations based on EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: Panel b excludes trade credit from external finance and includes cash and cash equivalents in internal finance. Small and medium-sized enterprises (SMEs) are firms with fewer than 250 employees and large companies are firms with more than 250 employees. Average values are reported. Tangible includes all firms that have invested 50% or more in tangible assets. Intangible includes all firms that have invested 50% or more in intangible assets.

As a result, the share of internal finance across all firms in the ORBIS database (Figure 1, panel b) becomes more similar to the average use of internal finance in the EIBIS (around 70%). However, in contrast to the EIBIS, we cannot observe a significantly higher use of internal finance for firms that invest mainly in intangible assets.

To summarise, taking away trade credit from external finance and including cash in internal finance shows a convergence of the shares of internal versus external finance in the ORBIS database towards those in the EIBIS. However, it is important to take into account that in the EIBIS, firms were asked about the amount of finance that was meant exclusively for their investment activity, while the financial data from the balance sheets cannot be assigned to any specific purpose.

Since one aim of the analysis is to consider the role of trade credit, the empirical analysis in the next section will use the definition of external and internal finance based on time series information from the ORBIS data instead of the static information presented from the EIBIS data above. Furthermore, ORBIS data definitions are more in line with standard balance sheet practice that focuses mainly on the liability side of the financial statements for internal and external finance. Most importantly, this will allow us to focus on the special role of trade credit in external finance.

Characterising the role of external finance in firm-level investment

Econometric specification

The various types of investment are regressed on the type of financing and control variables. To analyse the impact of the various sources of finance on the different types of investment, we employ the following specification:

$$\begin{aligned} \text{Type of investment (j)}_{it} = & \alpha_i + \omega_{cst} + \beta_1 \text{EXT}_{i,t-1} + \beta_2 \text{EXT}_{i,t-1} * \text{Size}_{i,t-1} + \\ & + \beta_3 \text{sales growth}_{i,t-1} + \beta_4 \text{Size}_{i,t-1} + \beta_5 \text{cash flow}_{i,t-1} + \varepsilon_{ics,t} \quad (2) \end{aligned}$$

where for each firm i at time t , *Type of investment* is total net investment and its four components: (1) land and buildings; (2) machinery and equipment; (3) R&D (including the acquisition of intellectual property); and (4) software databases. In the baseline specifications the four investment types are grouped under tangible and intangible investment. In other regressions, the four types of investment are considered separately, but results are similar to the grouped tangible and intangible investment categories, which are reported in the next section.

In the equation above, α_i are firm fixed effects, and ω_{cst} country-sector-time fixed effects. The former enables the identification of within-firm variation and the latter controls for demand effects. *EXT* is a dummy that takes the value of 1 if a firm's external finance is more than 50% of its total liabilities in a given year. In a further step, trade credit is disentangled from external finance and included as an additional explanatory variable (trade credit over total assets). In this case, *EXT* is redefined as a new dummy *EXT_WTC*. In addition, the *EXT* and *EXT_WTC* dummies are interacted with firm size to see if the effect of external finance on the various types of investment changes depending on the size of the firms. We further split the sample into SMEs and large firms to analyse the level effect of *EXT* within these groups. Additional ratios are included in the investment function as control variables: (1) sales growth, defined as the annual percentage change in sales revenues; (2) size, which is the logarithm of total assets; and (3) cash flow, which is the ratio of earnings before interest, taxes, depreciation and amortisation (EBITDA) to total assets. Standard errors in all specifications are clustered at the firm level. All control variables are lagged in order to eliminate simultaneity.

External finance has a higher correlation with tangible assets while internal finance has a higher correlation with intangible assets. Annex A reports the correlation matrix of the main variables, which shows that investment is positively correlated with the firms' financial performance, in terms of either growth opportunities or the ability to generate internal funds. External and internal finance are positively correlated with the four types of investment, whereas external finance has a higher correlation with tangible asset investment and internal finance seems to play a relatively more important role in intangible asset investment.

These results add to the scarce literature on how the forms of financing are used for different types of investment. Although there are several papers that examine the impact of financial variables on investment, specific literature on how different forms of finance are used for different types of investment is rather scarce. Contrasting the irrelevance theorem by Modigliani-Miller (1958), which states that a firm's capital structure does not matter for its value, several studies have proved that capital structure influences investment decisions through different theoretical angles, including agency theory (Jensen and Meckling, 1976), static trade-off theory (Myers, 1977; Jensen, 1986) and pecking order considerations (Myers and Majluf, 1984). However, most of the existing studies consider financing and investment choices separately and focus on one instrument or investment type at a time.

More recently, a small empirical literature has investigated the effect of different types of financing on investment, but mainly focuses on the choice between debt and equity financing across firm size (Covas and Den Haan, 2012; Begenau and Salomao, 2016). Assuming that there are differences in funding needs and financial frictions across firms,⁵ it is often found that, in good times, smaller firms respond to increased growth opportunities by investing and raising more funds following a pecking order from internal funds to debt and then equity. Closer to the analysis in this chapter, Grundy and Verwijmeren (2017) find that investment with more volatile cash flows, like R&D investments, tends to be equity-financed. Investment in tangible assets, on the other hand, is mostly debt-financed. However, differently from this chapter, Grundy and Verwijmeren (2017) do not consider either internal financing or financing by bank loans and credit lines, but rather focus primarily on debt and equity securities that are issued to finance new investment.

Link between tangible and intangible investment and external finance

Firms, for which external finance accounts for more than 50% of their total financing, increase tangible investment more. Following much of the investment literature, the main results are based on net instead of gross investment. Table 5 displays the results from the main specification. To start with, all standard determinants come in with the expected sign: firms with greater cash flow and more growth opportunities invest more, while firms invest less as they grow in size. Firms that mostly finance themselves with external finance increase their tangible investment more, conditional on all other determinants of investment. The economic magnitude of this effect is significant: for firms whose external finance share is relatively high, tangible investment is 16 percentage points higher than that of firms with lower shares of external finance. A further investigation within the two different types of tangible investment indicates that the additional investment related to high external finance levels is mainly related to the acquisition of machinery and equipment. The interaction with size shows that this positive effect declines for larger firms, but not much (less than 1 percentage point). In the case of intangible investments, the share of external finance has no significant effect, as shown in column 3 in Table 5.

⁵ First, smaller firms have higher funding needs because they are farther away from their efficiency scale and, second, debt financing is generally more costly to them as they have less pledgeable collateral.

Table 5 Investment and external finance

Variables	(1)	(2)	(3)
	Total	Tangible	Intangible
EXT	0.1793*** (0.0510)	0.1605*** (0.0429)	0.0188 (0.0172)
Size (t-1) * EXT	-0.0093*** (0.0032)	-0.0084*** (0.0027)	-0.0008 (0.0011)
Size (t-1)	-0.1785*** (0.0072)	-0.1467*** (0.0061)	-0.0318*** (0.0025)
Sales growth (t-1)	0.0027** (0.0012)	0.0019** (0.0010)	0.0008** (0.0004)
Cash flow (t-1)	0.2872*** (0.0266)	0.2227*** (0.0228)	0.0645*** (0.0077)
Observations	51,837	51,837	51,837
R-squared	0.0805	0.0757	0.0307
Number of firms	6,120	6,120	6,120
Country-sector-year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Clustered standard errors	Yes	Yes	Yes

Source: Authors' calculations based on the EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: EXT is a dummy variable equal to 1 if the ratio of short-term debt + long-term debt + trade credit to total liabilities is equal to or greater than 50% in a given year. Sales growth is defined as the annual percentage change in sales revenues. Size is the logarithm of total assets, and cash flow is the ratio of earnings before interest, taxes, depreciation and amortisation (EBITDA) to total assets. Standard errors are clustered at the firm level. *** $p < 0.01$. ** $p < 0.05$, * $p < 0.1$.

Looking at the characteristics of firms with high external finance levels, a simple t-test reveals that those firms tend to generate less cash flow and hold less cash than less-leveraged firms. By contrast, they have greater growth opportunities and, in the case of SMEs, more collateral to post, which partly justifies their ability to keep more debt on their balance sheet (see Table A3 in Annex A).

SMEs have access to external finance mostly to finance tangible assets. To understand the role of size better, Table 6 runs the same regression for SMEs and large firms separately. The Table shows that the effect we have found in the previous Table is driven by SMEs' tangible investment, since the share of external finance seems to have no role in investment for large firms. In fact, it can be seen that within the group of SMEs, the effect of external finance on investment also decreases with firm size. But even when this is taken into account, tangible investment of SMEs, which mostly use external finance, is 16 percentage points higher. Interestingly, the significant effect is concentrated on the acquisition of machinery and equipment.

Table 6 Investment and external finance: SMEs and large firms

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	SMEs			Large		
	Total	Tangible	Intangible	Total	Tangible	Intangible
EXT	0.1898*** (0.0687)	0.1724*** (0.0576)	0.0164 (0.0232)	-0.1173 (0.1304)	-0.0892 (0.1082)	-0.0270 (0.0489)
Size (t-1) * EXT	-0.0097** (0.0045)	-0.0090** (0.0038)	-0.0006 (0.0015)	0.0067 (0.0073)	0.0051 (0.0061)	0.0016 (0.0028)
Size (t t-1)	-0.1781*** (0.0088)	-0.1479*** (0.0075)	-0.0301*** (0.0028)	-0.1923*** (0.0132)	-0.1515*** (0.0108)	-0.0406*** (0.0057)
Sales growth (t-1)	0.0027 (0.0017)	0.0018 (0.0014)	0.0009 (0.0006)	0.0029** (0.0014)	0.0023** (0.0011)	0.0006 (0.0004)
Cash flow (t-1)	0.2975*** (0.0304)	0.2325*** (0.0262)	0.0648*** (0.0086)	0.2181*** (0.0490)	0.1625*** (0.0383)	0.0558*** (0.0170)
Observations	39,129	39,129	39,129	12,708	12,708	12,708
R-squared	0.0791	0.0748	0.0306	0.1029	0.0963	0.0505
Number of firms	4,815	4,815	4,815	1,305	1,305	1,305
Country-sector-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Clustered standard errors	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors' calculations based on the EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: EXT is a dummy variable equal to 1 if the ratio of short-term debt + long-term debt + trade credit to total liabilities is equal to or greater than 50% in a given year. Sales growth is defined as the annual percentage change in sales revenues. Size is the logarithm of total assets, and cash flow is the ratio of earnings before interest, taxes, depreciation and amortisation (EBITDA) to total assets. SMEs are firms with fewer than 250 employees and large companies are firms with more than 250 employees. Standard errors are clustered at the firm level. *** $p < 0.01$. ** $p < 0.05$, * $p < 0.1$. SMEs: small and medium-sized enterprises.

Firms, which obtain most of their external finance from financial institutions, increase their tangible investment more. Large firms also use this type of external finance for intangible investment, while SMEs, which rely on trade credit as an alternative source of financing, invest relatively more in intangibles. Trade credit – the provision of credit by suppliers to their customers – is a common business practice in Europe and is regarded as the most important source of financing, especially for small firms (Petersen and Rajan, 1997; Berger and Udell, 1998; Bourgeois, Mateut and Mizen, 2009; Carbo-Valverde, Rodriguez-Fernandez and Udell, 2016; Kalemli-Ozcan, 2016). Most of the literature emphasises that firms, and particularly SMEs, use trade credit when banks are unwilling to provide loans (Boissay and Gropp, 2007; Cunat, 2007). This is particularly true in situations of financial distress such as that experienced by European companies during the financial crisis.

In order to further analyse the role played by trade credit, Table 7 displays the econometric results when trade credit is disentangled from overall external finance. Trade credit has a positive impact on both tangible and intangible investment for SMEs, as expected. The *EXT_WTC* dummy, which takes the value of 1 when firms' external finance in terms of short- and long-term debt exceeds 50% of their total financing, is still positive and significant for tangible investment for SMEs. Interestingly, this dummy is positive and significant for both tangible and intangible investment for large firms, whereas the role of trade credit finance for large firms is insignificant.

Table 7 Investment and external finance: The role of trade credit

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	SMEs			Large		
	Total	Tangible	Intangible	Total	Tangible	Intangible
Trade credit (t-1)	0.1302*** (0.0258)	0.1092*** (0.0226)	0.0330*** (0.0096)	0.0767 (0.0476)	0.0635 (0.0408)	0.0176 (0.0167)
EXT_WTC	0.3111*** (0.0756)	0.2780*** (0.0669)	0.0367 (0.0234)	0.4626*** (0.1538)	0.3821*** (0.1384)	0.1023** (0.0461)
Size (t-1) * EXT_WTC	-0.0166*** (0.0049)	-0.0149*** (0.0044)	-0.0017 (0.0015)	-0.0239*** (0.0086)	-0.0197** (0.0077)	-0.0053** (0.0026)
Size (t-1)	-0.1680*** (0.0084)	-0.1471*** (0.0073)	-0.0282*** (0.0028)	-0.1655*** (0.0119)	-0.1371*** (0.0101)	-0.0360*** (0.0052)
Sales growth (t-1)	0.0007 (0.0017)	0.0003 (0.0014)	0.0004 (0.0006)	0.0038*** (0.0014)	0.0029*** (0.0011)	0.0011* (0.0006)
Cash flow (t-1)	0.3128*** (0.0288)	0.2552*** (0.0254)	0.0752*** (0.0094)	0.2355*** (0.0526)	0.1864*** (0.0414)	0.0609*** (0.0197)
Observations	35,982	35,982	35,982	11,696	11,696	11,696
R-squared	0.0817	0.0775	0.0313	0.1057	0.0991	0.0525
Number of firms	4,793	4,793	4,793	1,302	1,302	1,302
Country-sector-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Clustered standard errors	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors' calculations based on the EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: EXT_WTC is a dummy variable equal to 1 if the ratio of short-term debt + long-term debt to total liabilities is equal to or greater than 50% in a given year. Sales-growth is defined as the annual percentage change in sales revenues. Size is the logarithm of total assets. Trade credit is accounts payable over total assets, and cash flow is the ratio of earnings before interest, taxes, depreciation and amortisation (EBITDA) to total assets. SMEs are firms with fewer than 250 employees and large companies are firms with more than 250 employees. Standard errors are clustered at the firm level. *** $p < 0.01$. ** $p < 0.05$, * $p < 0.1$.

The crisis and the sluggish recovery

During the period of recovery from the 2008 global financial crisis, trade credit financing became important for tangible investment for both SMEs and large firms. Access to finance became difficult immediately after the crisis, but the extraordinary monetary policy efforts to lower the cost of external finance should have eased conditions for financing investment. It should be expected, on the one hand, that external finance would have become more important for investment relative to internal finance in the years after the financial crisis. But, on the other hand, for those firms that lacked external finance and were planning to invest, trade credit might have become the alternative source of financing. To check this hypothesis, the main empirical strategy is replicated by splitting the sample in the period before and after the financial crisis. Table 8 reports the estimated coefficients for the period before and after the financial crisis for the specification with trade credit and the split of the sample by firm size. The period before 2008 was a boom period when investment was still growing and firms were generating increasing cash flows. Hence during this period firms that used more external finance increased their investment. The results are similar to those in the previous table, where SMEs that relied on trade credit as an alternative source of financing invested relatively more in intangible assets, and SMEs whose share of external finance was high (where this finance came from financial institutions) increased their tangible investment more. Large firms that obtained most of their financing from financial institutions increased both tangible and intangible investment.

During the period of recovery from the 2008 crisis, companies that were able to obtain trade credit are those that were recovering faster with their investment activity, irrespective of their size. Results in the last four columns of Table 8 that focus on the post-crisis period are drastically different from those in the pre-crisis period. Trade credit became a significant source of finance for tangible investment for large firms, and SMEs seemed to have made use of trade credit for both tangible and intangible investment. These results are most likely due to the stark changes in the availability of external finance from financial institutions. Similarly, Carbo-Valverde et al. (2016) find that the capital expenditure of credit-constrained Spanish SMEs was increasingly funded with trade credit during the Great Recession.

During the recovery, by “defreezing” the liquidity squeeze and re-establishing trust among business partners, trade credit regained its role before the increase in the availability of bank lending. Consequently, the buffering role of trade credit took on particular importance for all companies at times when firms found it difficult to obtain loans from credit institutions.

Table 8 Investment and external finance: Recovery from the financial crisis

Variables	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		
	2000-2007								2008-2015								
	SMEs				Large				SMEs				Large				
	Tangible	Intangible	Tangible	Intangible	Tangible	Intangible	Tangible	Intangible	Tangible	Intangible	Tangible	Intangible	Tangible	Intangible	Tangible	Intangible	
Trade credit (t-1)	0.0438 (0.0431)	0.0532*** (0.0171)	-0.0201 (0.0621)	0.0254 (0.0295)	0.1448*** (0.0329)	0.0229** (0.0116)	0.1763** (0.0698)	-0.0126 (0.0261)	0.3078** (0.1420)	0.0690 (0.0525)	0.6546** (0.2579)	0.1743** (0.0804)	0.2632*** (0.0700)	0.0139 (0.0233)	0.2830 (0.2074)	0.0140 (0.0626)	
Size (t-1) * EXT_WTC	-0.0158* (0.0094)	-0.0034 (0.0034)	-0.0346** (0.0146)	-0.0089* (0.0046)	-0.0149*** (0.0046)	-0.0004 (0.0015)	-0.0131 (0.0113)	-0.0007 (0.0034)	Size (t-1)	-0.2349*** (0.0151)	-0.0476*** (0.0058)	-0.2062*** (0.0220)	-0.0607*** (0.0086)	-0.1849*** (0.0107)	-0.0376*** (0.0047)	-0.1762*** (0.0219)	-0.0243*** (0.0061)
Sales growth (t-1)	-0.0025 (0.0026)	-0.0008 (0.0008)	0.0031** (0.0015)	0.0006 (0.0006)	0.0006 (0.0018)	0.0006 (0.0009)	0.0024** (0.0011)	0.0015 (0.0011)	Cash flow (t-1)	0.2778*** (0.0516)	0.0986*** (0.0181)	0.2051*** (0.0737)	0.0939*** (0.0339)	0.2400*** (0.0320)	0.0590*** (0.0115)	0.1795*** (0.0514)	0.0561*** (0.0208)
Observations	14,275	14,275	5,023	5,023	21,707	21,707	6,673	6,673	R-squared	0.0808	0.0253	0.1215	0.0705	0.0491	0.0174	0.0598	0.0189
Number of firms	3,094	3,094	1,026	1,026	4,393	4,393	1,213	1,213	Country-sector-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustered standard errors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Clustered standard errors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors' calculations based on the EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: EXT_WTC is a dummy variable equal to 1 if the ratio of short-term debt + long-term debt to total liabilities is equal to or greater than 50% in a given year. Sales growth is defined as the annual percentage change in sales revenues. Size is the logarithm of total assets. Trade credit is accounts payable over total assets and cash flow is the ratio of earnings before interest, taxes, depreciation and amortisation (EBITDA) to total assets. SMEs are firms with fewer than 250 employees and large companies are firms with more than 250 employees. Standard errors are clustered at the firm level. *** $p < 0.01$. ** $p < 0.05$, * $p < 0.1$.

It is important to remember that the use of trade credit by a firm is twofold. A firm is not only a customer whose accounts payable are its borrowing from suppliers (on the liability side, as explored in this chapter). A firm can also be seen as a supplier, and therefore its accounts receivable (on the asset side) are a proxy for how much it lends to customers. Usually, firms that receive trade credit from their own suppliers are more likely to extend trade credit to their customers (Ferrando and Mulier, 2013). Box 2 explores the interlinkages of accounts payable and receivable and their impact on tangible investment.

Box 1 Net trade credit as a coordination device for investment for distressed companies

The chapter highlights the positive impact of trade credit on the financing of tangible investment since 2008. This box expands the analysis by going beyond firm's access of credit to examine their extension of trade credit to their customers. It uses a large sample of non-financial corporations in the European Union.

Most trade credit theories relate the use of trade credit to the presence of information asymmetries and the monitoring advantage that suppliers have over banks. This mainly considers the liabilities side, that is, accounts payable, as is done in this chapter. However, a growing strand of the literature also focuses on the importance of trade credit as a liquidity management tool, that is, mainly in the form of accounts receivable – the assets side (see Ferrando and Mulier, 2013, for a review of the literature). This box focuses on net trade credit, or the relative trade credit exposure between firms' customers and suppliers – that is, the difference between accounts receivable and accounts payable – and its link with investment.

Despite the wide body of literature on net trade credit, the evidence of the impact of net trade credit on investment is inconclusive. Coricelli and Frigerio (2016) argue that net trade credit is liquidity-absorbing and therefore has a negative impact on investment. They suggest that an increase in net trade credit drains liquid resources that firms could otherwise invest or use to support current production, even when controlling for a variety of firm- and country-specific characteristics. Furthermore, such a liquidity squeeze is particularly acute for small and medium-sized enterprises (SMEs).

On the other hand, Dass, Kale and Nanda (2015) show that the provision of trade credit to business partners can serve as a commitment device for making relationship-specific investments. Trade credit naturally emerges as a quality guarantee mechanism when the downstream company is uncertain about the quality of acquired goods and is affected by investment dynamics. The reverse effects – that is, the impact of trade credit on investment – are left unaddressed.

The analysis for this box finds that, whereas net trade credit has an overall negative impact on capital formation due to liquidity effects, the effect is less pronounced for firms that are in financial difficulties (distressed companies) than for non-distressed companies. The idea behind this is that through capital expenditure, distressed companies try to maintain vital business relations with their customers in order to participate in the final profits through trade credit repayments.

For the exercise we use a large panel of non-financial corporations in 23 EU countries derived from the Bureau van Dijk ORBIS database.⁶ The sample is comprised of around 9 million firm-year observations for the period 2004–2014.

To identify distressed firms the analysis is based on three distinct definitions, as outlined below.

EIBIS financial distress index

First, we consider a novel financial distress index that is calculated using the information derived from the 2016 wave of the European Investment Bank Investment Survey (EIBIS). This is the credit-constrained index presented in Chapter 6. As a reminder, the survey considers financially constrained companies to be those that are dissatisfied with the amount of finance obtained (received less), sought external finance but did not receive it (rejected), and/or did not seek external finance because they thought borrowing costs would be too high (too expensive) or they would be turned down

⁶ The following countries are excluded due to poor financial data coverage: Cyprus, Greece, Lithuania, Malta and Poland.

(discouraged). The probability of being constrained among firms surveyed in the EIBIS is regressed on a set of indicators of their financial situation (profitability, growth opportunities, financial leverage and cash holding) as well as on sector and country dummies. The estimated coefficients are then fitted to our sample of European firms.⁷ The resulting score is used to rank the firms according to their probability of being credit-constrained. For each year, financially constrained firms are identified as those with a score greater than a country threshold, which is directly derived from the survey.⁸

Distressed firms (OECD definition)

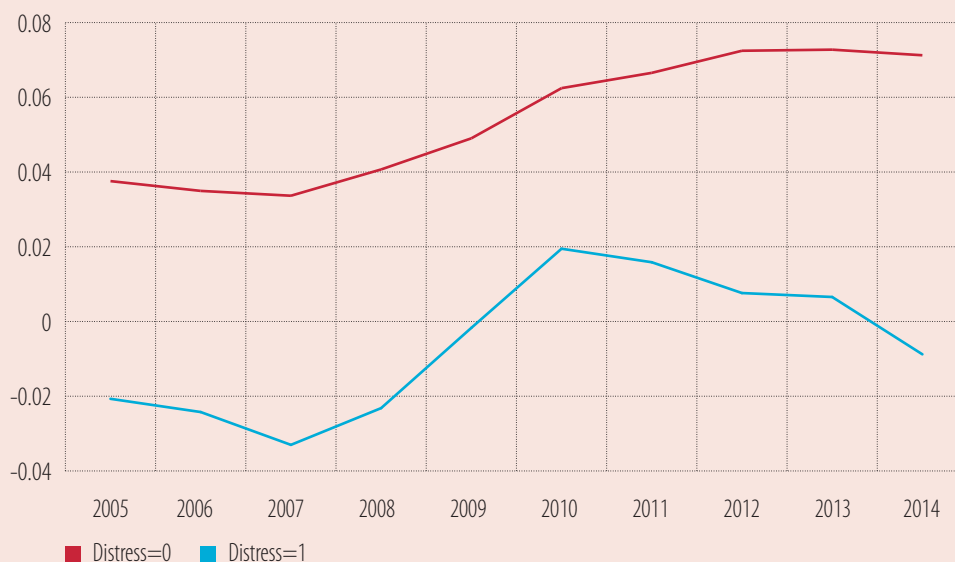
The second classification of distressed companies is derived from the definition proposed by the Organisation for Economic Co-operation and Development (OECD) (McGowan, Andrews and Millot, 2017). Distressed companies are firms more than 10 years old with negative profit or interest coverage ratio less than 1 for more than three consecutive years.

Distressed firms (Bank of England definition)

Lastly, a very broad definition proposed by the Bank of England (2013) selects companies with negative profits for three consecutive years.

Figures 1–3 display the trend of net trade credit (defined as net trade credit over gross sales) between distressed and non-distressed firms for the three indicators. For two classifications (the EIBIS and Bank of England), the net-trade-credit ratio is always positive and higher for non-distressed companies. In the case of the OECD classification, distressed companies increased their use of net trade credit more after the financial crisis.

Figure 1 EIB index:
net trade credit among financially constrained and not-constrained firms

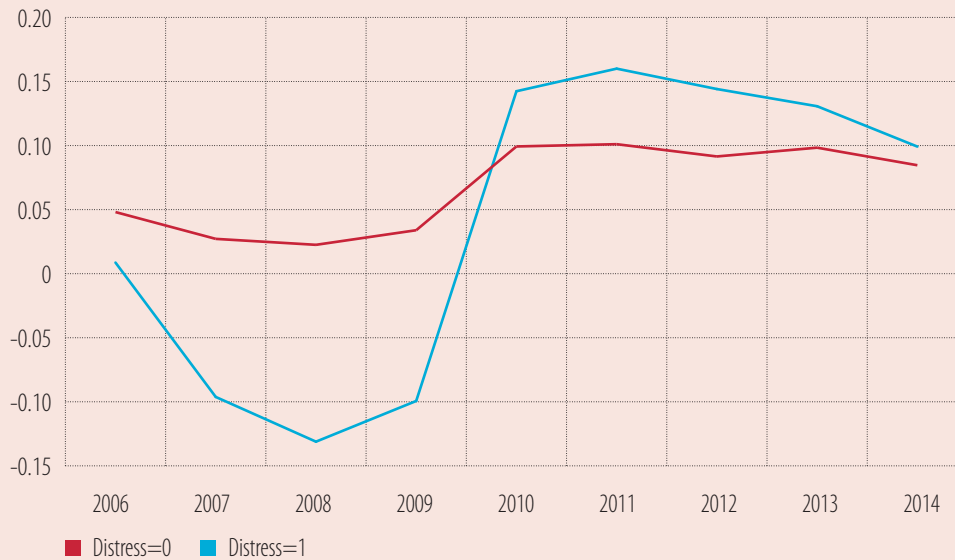


Source: Authors' calculations based on EIBIS2016 and the Bureau van Dijk ORBIS database.

⁷ The methodology is similar to the one used in Ferrando, et al. (2015) based on the Survey on the Access to Finance of Enterprises (SAFE) conducted by the European Central Bank and the European Commission.

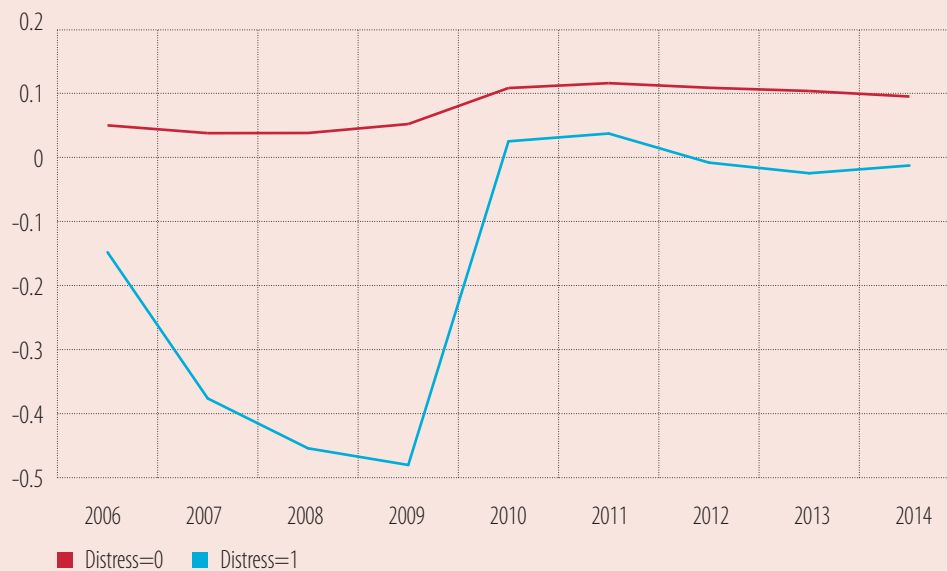
⁸ The threshold is defined as the top $x\%$ of the distribution of calculated scores by country, where x is the percentage of firms that reported being financially constrained in the first wave of the EIBIS.

Figure 2 OECD definition:
net trade credit among distressed and non-distressed companies



Source: Authors' calculations based on the Bureau van Dijk ORBIS database.

Figure 3 Bank of England definition:
net trade credit among distressed and non-distressed companies



Source: Authors' calculations based on the Bureau van Dijk ORBIS database.

To detect the relationship between investment and net trade credit, our main identification strategy is as follows:

$$\frac{I_{icst}}{K_{icst-1}} = \beta_1 NTCS_{icst} \times D_{icst} + \beta_2 NTCS_{icst} + \beta_3 D_{icst} + \beta_4 X_{icst-1} + \beta_5 v_i + \beta_6 \mu_{icst} + \varepsilon_{icstr}$$

where I corresponds to the actual investment levels, taken as the year-on-year change in tangible capital stock, K is the tangible capital level, $NTCS$ is the ratio of net trade credit to gross sales level, D denotes the distress dummy, and X is a vector of control variables, including the year-on-year growth in sales, the ratio of cash to total assets, the ratio of tangible assets to total assets, profitability as the ratio of profit/loss before tax to total assets, and the logarithm of total assets. Financial leverage is taken as the ratio of short- and long-term debt to total assets. The model is saturated by the company-specific fixed effects v_i and a vector of country-sector-year fixed effects μ_{icst} with sectors characterised at the four-digit level of the NACE Rev. 2 classification. Error terms are represented by ε_{icst} where subscripts i , c , s and t correspond to the firm, country, sector and time dimensions, respectively.

To address possible endogeneity issues, the lagged distress indexes are considered in an alternative specification. Due to the short-term nature of net trade credit, the variable can enter the model specification at time t . A further investigation, including instrumental variable estimates, suggests that the main model results still hold when controlling for aggregate demand dynamics. The main results are presented in Table 1.

Table 9 Impact of net trade credit on investment among distressed companies

	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Distress definition	EIBIS	EIBIS	OECD	OECD	Bank of England	Bank of England
NTCS x DISTRESS	0.010*** (0.003)		0.010*** (0.002)		0.008*** (0.002)	
NTCS x DISTRESS (lag)		0.013*** (0.004)		0.008*** (0.002)		0.007*** (0.002)
DISTRESS	-0.038*** (0.009)		-0.027*** (0.002)		-0.106*** (0.004)	
DISTRESS (lag)		-0.014*** (0.004)		-0.073*** (0.004)		-0.088*** (0.005)
NTCS	-0.024*** (0.002)	-0.022*** (0.002)	-0.014*** (0.002)	-0.011*** (0.002)	-0.014*** (0.001)	-0.012*** (0.001)
Company fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Additional firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Country sector-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	7,827,925	5,818,617	6,436,679	4,915,309	9,449,680	7,129,311
R2	0.271	0.278	0.294	0.305	0.285	0.293
Adjusted R2	0.087	0.082	0.091	0.089	0.090	0.084

Source: Authors' calculations based on the Bureau van Dijk ORBIS database.

Note: The dependent variable is net investment defined as investment at time t divided by the value of tangible capital at time $t-1$. Distressed companies are classified in line with the EIBIS (columns 1a and 1b), OECD (columns 2a and 2b), and Bank of England (columns 3a and 3b) methodologies. Additional firm-level controls include lagged sales growth, the lagged cash-to-assets ratio, lagged tangibility ratio, lagged profitability ratio, lagged log of total assets, and lagged financial leverage. $NTCS$ is the ratio of net trade credit to gross sales level. Standard errors are clustered at the firm level and are reported in parentheses, where * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

It can be readily observed that the results hold for financially constrained firms as well as for distressed companies in terms of statistical significance and, to a large extent, in terms of magnitudes. First, we confirm the negative impact of net trade credit on investment in non-distressed companies, confirming the liquidity-drain channel presented by Coricelli and Frigerio (2016). Similarly, distressed companies invest less, on average, than non-distressed companies. However, we find that when a company is under distress, the negative effect of net trade credit is less severe.⁹

It appears that the mechanisms behind net trade credit are more nuanced for distressed firms. Troubled companies operate in a difficult market environment, often under a stigma, with mistrust and in isolation. Established corporate relations, often supported by trade credit, appear to be a vital source of revenues. Capital expenditures sustain, if not improve, the quality of produced goods, allowing the company to keep its business relations and participate in the final profits through the trade credit repayment. Consequently, trade credit is important for the investment decisions of distressed firms, supporting their role throughout the supply chain. Because of such a mechanism, the existence of some distressed companies might be prolonged, locking in capital and labour resources and, consequently, decreasing aggregate allocative efficiency.

⁹ It is worth noting that when accounts receivable and payable are considered separately in the specification, the results in the main text are confirmed insofar as accounts payable have a positive impact on investment while accounts receivable have a negative one.

The analysis developed up to now shows the relevance of different external financing sources with respect to different types of investment. While trade credit became particularly important for SMEs in the recovery period, the results indicate the crucial role of external finance from financial institutions for tangible investments. A natural next step is to see what effect these particular external finance sources could have on different types of investment. Thus, this chapter continues with a static analysis using the EIBIS data, where it is possible to take a closer look at the different types of investment and see whether the main results can be verified.

A pecking order theory of finance for investment: a static approach

As explained at the beginning of the chapter, EIBIS data include additional types of intangible investment that are usually not capitalised as investment expenditures in firms' accounts. Such expenditures include training of employees and organisation and business process improvements (like restructuring and streamlining activities).

As explored in Chapter 3, these types of investment represent an important share of firms' total investment outlays (17% on average) (Figure 8). Especially for SMEs, these investment types play a significantly bigger role in their total investment than such investments by large enterprises (18% versus 12%). Therefore, it is important to also consider these investment types in the financing-investment analysis.

Figure 10 Average share of investment types across firm size, sector and age (%)

Source: EIBIS2017.

Note: IT: information technology; R&D: research and development; SMEs: small and medium-sized enterprises.

Furthermore, the survey provides information about firms' investment finance with a different breakdown. To recap, firms were asked what proportions of their finance for investment came from either internal finance or retained earnings (for example, cash or profits), intra-group lending from parent companies, or external finance. Furthermore, firms also reported the proportions of external finance used for their investment activities. Rather than distinguishing by maturity of external finance, as is the case for balance sheet data, the EIBIS instead asked for the specific type of financing instrument.

For the econometric analysis, we combined the information on the different types of finance and grouped them into six different categories according to their inherent characteristics (Ferrando and Preuss, 2017). Internal finance is directly taken from the survey. Insider finance includes intra-group lending and loans from family, friends and business partners, which is distinguished by the fact that the lender has at least some insider information on the borrowing company. Bank loans and other bank finance, such as overdrafts or other credit lines, are grouped under bank finance. Market-based finance is comprised of the proportions of newly issued bonds and equity. Grants – defined as support from public services – are taken from the survey.

Figure 9 shows that firms across all sizes, sectors and age groups tend to finance their investment predominantly through internal finance (70%, on average). Bank finance and factoring and leasing play a predominant role among the external financing sources, while market-based finance, insider finance and grants only make up a small share.

Figure 11 Average share of financial sources across firm size, sector and age (%)



Source: EIBIS2017.
Note: SMEs: small and medium-sized enterprises.

To assess the different financing behaviour for investment activities of SMEs versus large companies, we use a standard investment specification based on variables exclusively derived from the survey. Beside the variables on the different sources of finance, some control variables – similar to those introduced in the previous sections – are added to the specification. These are a profitability dummy, as a proxy of the financial health of the firms, and a dummy for the willingness to invest more, which proxies their growth opportunities.¹⁰

In order to account for the fact that both the investment and the financing variables are proportions of total investment and total financing, we apply a multinomial fractional response model to estimate the expected conditional mean:¹¹

$$E(y_{i,k} | x_i) = G(\beta_0 + \beta_j \text{Fin}_{ij} + \gamma_l \text{Con}_{i,l} + \delta_{i,m} + \varepsilon_i) \quad (3)$$

where y is a vector of the k proportions of types of investment for firm i . Fin denotes a vector of the different j proportions of the financial instruments (bank finance, market-based finance, insider finance, grants and other finance), Con is a vector of the control dummy variables (profitability and willingness to invest more), and δ a set of dummy variables to account for firms' heterogeneity in terms of $m \in \{\text{age, sector, country group}\}$.

¹⁰ The variable *profitable* takes the value 1 if the firm reported being profitable or breaking even and 0 otherwise. The variable *willingness to invest* is equal to 1 if the firm reported a willingness to invest more or about the same amount in the next financial year and 0 otherwise.

¹¹ See Preuss (2017) for details of the methodological approach.

The relevance of internal finance to allow for investment in intangibles is confirmed and, for SMEs, bank finance is available to support investment in tangibles more than for investment in intangibles. Table 9 reports the average partial effects of the regression results of the sample split between SMEs and large enterprises.¹² SMEs (panel a) exhibit different financing behaviour than large enterprises (panel b), as the financial sources show different significant impacts for certain investment types. For instance, for SMEs, the additional use of bank finance compared to internal finance exerts, on average, a positive impact on all tangible investment types and a negative impact on intangible investment, while for large enterprises, bank finance is only significantly positively associated with investment in land, buildings and infrastructure.

For SMEs' R&D investment, market finance and insider finance also play a relevant role. In line with earlier research,¹³ non-bank-related external financing instruments, such as market-based finance, insider finance and grants, play an important role in SMEs' R&D financing. Furthermore, the fact that most of the financial variable coefficients are negative for intangible investment by both SMEs and large enterprises confirms the importance of internal funding for these types of investment. The economic impact of external finance is sizeable. If a small-sized company increases bank finance relative to internal finance by 1 percentage point, investment in land, buildings and infrastructure is on average expected to increase by 0.074 of a percentage point.

Grant financing is used to a large extent by both large and small enterprises to finance land, buildings and infrastructure. The results show the relative importance of grants for infrastructure investment (accounting for around 0.13 to 0.17 of a percentage point more investment), which is possibly due to policy objectives to enhance energy efficiency. Leasing is crucial for machinery and equipment (more investment of about 0.4 of a percentage point for SMEs and 0.3 of a percentage point for large companies).

Grants positively influence SMEs' R&D, but not their investment in software and IT, possibly because policy objectives behind grants tend to focus on R&D only, disregarding the strong needs for software and IT upgrades in the current technological transformation phase.

To summarise, the results indicate that SMEs are more sensitive to external financing sources than large enterprises. As few coefficients point to statistical differences in the use of internal versus external finance for large enterprises, this is confirmation that large enterprises could be more indifferent to the choices of financial instruments used for their investment.

Overall, a pecking order theory of finance emerges from the analysis. Internal finance is key to supporting intangible investment, while bank finance seems to be more related to investment in tangibles. Trade finance, market-based finance and grants play an important role in supporting investment in R&D by SMEs.

¹² There are some important shortcomings to bear in mind when considering the estimation results. First, the endogeneity of the financing choices as investment and financing decisions might be simultaneously influenced by private information that is only observed by the firm. Second, there is possible reverse causality, as it is often unclear whether investment opportunities affect financing decisions or whether financing conditions affect investment decisions. Thus, although no causal interpretation should be inferred from the econometric exercise, the results are used to detect interesting linkages once other firms' characteristics are taken into account (Roberts and Whited, 2013).

¹³ See Hall and Lerner (2009) and Thum-Thysen et al. (2017).

Table 10 Investment and finance: static analysis (average partial effects)

PANEL a. SMEs						
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Land, buildings, infrastructure	Machinery, equipment	Research, development	Software, data, IT networks	Training	Organisation, process improvements
Bank finance	0.074*** (0.010)	0.077*** (0.015)	-0.012* (0.007)	-0.079*** (0.011)	-0.052*** (0.010)	-0.007 (0.007)
Market-based finance	0.178** (0.091)	-0.116 (0.160)	0.099*** (0.032)	-0.004 (0.117)	-0.160 (0.108)	0.003 (0.064)
Insider finance	0.048* (0.026)	-0.029 (0.037)	0.040*** (0.013)	-0.031 (0.023)	-0.038* (0.022)	0.010 (0.017)
Grants	0.125*** (0.034)	0.017 (0.056)	0.045** (0.018)	-0.164*** (0.040)	-0.023 (0.044)	-0.000 (0.025)
Other finance	-0.114*** (0.019)	0.408*** (0.022)	-0.050*** (0.012)	-0.135*** (0.017)	-0.094*** (0.016)	-0.016 (0.011)
Observations	6,980	6,980	6,980	6,980	6,980	6,980
Controls (profitability, willingness to invest more)	Yes	Yes	Yes	Yes	Yes	Yes
Age, sector, country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
PANEL b. Large enterprises						
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Land, buildings, infrastructure	Machinery, equipment	Research, development	Software, data, IT networks	Training	Organisation, process improvements
Bank finance	0.076*** (0.027)	0.023 (0.034)	0.008 (0.016)	-0.059*** (0.017)	-0.027* (0.015)	-0.020* (0.012)
Market-based finance	0.340*** (0.107)	-0.477*** (0.183)	0.204*** (0.065)	0.109* (0.061)	-0.098* (0.054)	-0.078 (0.048)
Insider finance	-0.075 (0.058)	0.033 (0.066)	0.035 (0.025)	-0.011 (0.026)	0.001 (0.019)	0.017 (0.017)
Grants	0.172*** (0.063)	0.001 (0.093)	-0.081* (0.047)	-0.039 (0.067)	0.011 (0.051)	-0.065 (0.042)
Other finance	-0.177*** (0.052)	0.268*** (0.057)	0.017 (0.030)	-0.044** (0.022)	-0.032* (0.020)	-0.032 (0.021)
Observations	1,112	1,112	1,112	1,112	1,112	1,112
Controls (profitability, willingness to invest more)	Yes	Yes	Yes	Yes	Yes	Yes
Age, sector, country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors' calculations based on EIBIS2017.

Note: Average partial effects of quasi-maximum likelihood estimations of a multinomial fractional response model with a logistic functional form. Robust standard errors are in parentheses. Dependent variables (columns 1 to 6) are bounded continuous variables [0,1] and sum up to 1 (unity). The same holds for the independent financial sources variables (Bank finance - Other finance). The reference group for independent financial sources variables is internal funds. The dummy variable "profitable" takes on the value 1 if the firm has reported being profitable or breaking even and 0 otherwise. The dummy variable "invest more" takes on the value 1 if the firm has reported a willingness to invest more or about the same amount in the next financial year and 0 otherwise. Significance levels indicated as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. FE: fixed effects; SMEs: small and medium-sized enterprises.

Conclusion and policy implications

Overall, the results show the importance of the availability of finance in determining investment. Since external finance, mainly from banks, was available to all sizes of firms to a certain degree before the crisis, it has played a key role in financing investment in tangible assets during the boom. During the bust, SMEs financed intangible investments with internal sources. They also relied on alternative external financing, like trade credit. This pattern is true in particular for firms at an early stage of development, which are typically SMEs (Berger and Udell, 1998). Surprisingly, the analysis found that large firms are also tapping trade credit to finance their tangible investments during the recovery period, probably crowding out small firms to a certain extent. If small firms shift the available trade credit to finance tangible investment instead of intangible investment – since they have not been able to access other forms of external finance during the post-crisis period – this might have serious consequences in terms of long-term growth. R&D investment is a big part of intangible investment, but it will not be undertaken given the lack of finance available for doing so.

Combining financing with different types of investment, the analysis puts forward a pecking order theory of finance: internal finance is key to supporting intangible investment, bank finance seems to be more related to tangible investments, and trade finance, market-based finance and grants provide a lifeline for SMEs to support investment in R&D.

From a policy point of view, there are issues in the financing of intangible assets that need to be addressed by creating incentives for banks, implementing targeted guarantee schemes, and incentivising their own resources and shareholders' equity for more firms.

Furthermore, the results highlight the importance of liquidity, especially for SMEs, during times of crisis. If debt to suppliers and contractors is the only external finance available to fund tangible and intangible investment besides internal finance, and if this holds for large firms as well, then SMEs will be crowded out of the market. Policies that make external finance available to both small and large firms during crises will be beneficial in this regard.

Annex A. Data characteristics

EIBIS sample characteristics

Table A1 displays the final sample distribution once the responses in the first wave of the European Investment Bank Investment Survey (EIBIS) are matched with the financial statements for those firms for which data on total investment can be derived from the balance sheet accounts (8,651 firms). The dataset contains around 90,000 observations, with 81% from SMEs. In terms of sectors, 32% of observations are from firms in manufacturing, 21% in construction, 23% in services and 25% in infrastructure.

Table A1 Distribution of the matched EIBIS and ORBIS data: number of observations by country, size and sectors, 2000–2015

Country	Total	Size		Sector			
		SMEs	Large enterprises	Manufacturing	Construction	Services	Infrastructure
Austria	1,976	1,425	551	513	449	470	544
Belgium	5,208	4,109	1,099	1,759	892	1,101	1,456
Bulgaria	2,440	1,729	711	732	621	591	496
Croatia	4,503	3,859	644	1,330	961	1,093	1,119
Cyprus	251	242	9	111	3	129	8
Czech Republic	2,963	2,255	708	1,382	507	504	570
Denmark	4,747	4,027	720	1,574	1,024	1,074	1,075
Estonia	2,930	2,833	97	876	646	659	749
Finland	4,221	3,473	748	1,284	905	960	1,072
France	5,099	3,998	1,101	1,866	887	934	1,412
Germany	2,603	1,940	663	694	573	553	783
Greece	2,583	2,204	379	810	463	839	471
Hungary	4,110	3,199	911	1,121	912	1,031	1,046
Ireland	3,934	3,796	138	1,106	857	1,087	884
Italy	4,962	3,553	1,409	1,539	992	1,112	1,319
Latvia	2,311	2,161	150	654	393	713	551
Lithuania	1,626	1,280	346	616	463	263	284
Luxembourg	983	808	175	226	270	230	257
Malta	1,232	1,196	36	260	122	705	145
Netherlands	3,650	3,133	517	1,246	653	686	1,065
Poland	2,977	2,041	936	849	590	450	1,088
Portugal	3,629	2,933	696	860	956	894	919
Romania	3,327	2,734	593	1,086	839	631	771
Slovakia	2,586	2,280	306	1,216	279	700	391
Slovenia	3,407	3,002	405	1,024	625	966	792
Spain	4,574	3,308	1,266	1,449	881	1,095	1,149
Sweden	4,552	3,602	950	1,351	1,114	879	1,208
United Kingdom	3,052	2,195	857	1,064	733	348	907
Total	90,436	73,315	17,121	28,598	18,610	20,697	22,531

Source: Authors' calculations based on EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: SMEs: small and medium-sized enterprises.

Correlation matrix

Table A2 provides some initial insights into the relationship between investment decisions of firms and types of finance used to fund them. Overall, investment is positively correlated with the firms' financial performance in terms of either growth opportunities or the ability to generate internal funds. However, overall investment shows a negative correlation with size, where the effect is mainly driven by machinery and equipment and software databases. Investment in land and buildings increases with firm size, while no statistically significant link is detected for R&D expenditures. This is in line with what was shown in Figure 2 in the main text: large enterprises reported in the survey having invested a relatively higher share in land and machinery and R&D than smaller enterprises.

External and internal finance is positively correlated with the four types of investment, whereas external finance has a higher correlation with tangible asset investments and internal finance seems to play a relatively more important role in intangible asset investments. This effect is confirmed when looking at the correlation between external-finance-intense firms (*EXT* variable) and tangible and intangible asset investments, where the effect is stronger for investment in tangibles than in intangibles. Moreover, R&D shows a negative, if any, correlation with external finance in general.

Table A2 Correlation matrix of regression variables

	Total	Land and buildings	Machinery and equipment	R&D	Software and databases	Internal (<i>t</i> -1)	External (<i>t</i> -1)	EXT	EXTWTC	Sales growth (<i>t</i> -1)	Size (<i>t</i> -1)	Cash Flow (<i>t</i> -1)	Trade credit (<i>t</i> -1)
Total	1												
Land and buildings	0.4494*	1											
Machinery and equipment	0.8808*	0.1928*	1										
R&D	0.2915*	0.0766*	0.1312*	1									
Software and databases	0.5459*	0.1476*	0.2902*	0.2072*	1								
Internal (<i>t</i> -1)	0.0102*	0,0016	0.0103*	0.0141*	0.0090*	1							
External (<i>t</i> -1)	0.0247*	0.0214*	0.0205*	-0,0022	0.0127*	-0.4029*	1						
EXT	0.0189*	0.0147*	0.0163*	-0,0015	0.0112*	-0.5604*	0.7216*	1					
EXTWTC	0.0102*	0.0157*	0.0093*	-0,0011	-0,0016	-0.4016*	0.4736*	0.4856*	1				
Sales growth (<i>t</i> -1)	0.0639*	0.0280*	0.0575*	0.0188*	0.0315*	-0.0283*	0.0139*	0.0153*	0.0110*	1			
Size (<i>t</i> -1)	-0.0953*	0.0110*	-0.0974*	0,0014	-0.0254*	0.0613*	0.0288*	0.0599*	0.0670*	-0.0458*	1		
Cash flow (<i>t</i> -1)	0.1176*	0.0356*	0.1104*	0.0387*	0.0598*	0.3415*	-0.1954*	-0.2233*	-0.1515*	0.0776*	-0.1488*	1	
Trade credit (<i>t</i> -1)	0.0324*	0.0137*	0.0261*	-0,001	0.0166*	-0.2286*	0.4925*	0.3656*	-0.1420*	0.0214*	-0.0559*	-0.1228*	1

Source: Authors' calculations based on EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: Internal finance is defined as the amount of retained earnings to total assets. External finance includes short-term loans, long-term debt and trade credit over total assets. *EXT* is equal to 1 for firms whose external finance is more than 50% of their total financing (internal plus external funds) and 0 otherwise. *EXTWTC* is equal to 1 for firms whose external finance is more than 50% of their total financing (internal plus external funds excluding trade credit) and 0 otherwise. Sales growth is defined as the annual percentage change in sales revenues. Size is the logarithm of total assets, cash flow is the ratio of earnings before interest, taxes, depreciation and amortisation (EBITDA) to total assets, and trade credit is accounts payable to total assets. Standard errors are clustered at the firm level. * $p < 0.05$.

Table A3 Differences between firms with high and low extensive margins of external finance

Country	Large				SMEs			
	EXT=0	EXT=1	Diff	t test	EXT=0	EXT=1	Diff	t test
Sales growth	0.19	0.29	0.09	***	0.21	0.28	0.07	***
Cash flow	0.12	0.07	-0.06	***	0.15	0.08	-0.07	***
Profitability	0.09	0.03	-0.06	***	0.11	0.03	-0.08	***
Cash holding	0.23	0.17	-0.06	***	0.30	0.16	-0.14	***
Collateral	0.47	0.44	-0.03	***	0.36	0.38	0.02	***

Source: Authors' calculations based on EIBIS2016 and the Bureau van Dijk ORBIS database.

Note: t-test on averages. EXT is equal to 1 for firms whose external finance is more than 50% of their total financing (internal plus external funds) and 0 otherwise. Sales growth is defined as the annual percentage change in sales revenues. Cash flow is the ratio of earnings before interest, taxes, depreciation and amortisation (EBITDA) to total assets, and profitability is profit/loss before taxes to total assets. SMEs: small and medium-sized enterprises. *** $p < 0.01$.

References

- Andrews, D. and Criscuolo, C. (2013). "Knowledge-Based Capital, Innovation and Resource Allocation." OECD Economics Department Working Paper No. 1046. OECD Publishing, Paris.
- Arrighetti, A., Landini, F. and Lasagni, A. (2014). "Intangible Assets and Firms' Heterogeneity: Evidence from Italy." *Research Policy*, 43(1), 202–213.
- Bank of England. (2013). "Inflation Report." Bank of England, London.
- Beck, T., Demirgüç-Kunt, A. and Maksimovic, V. (2008). "Financing Patterns Around the World: Are Small Firms Different?" *Journal of Financial Economics*, 89(3), 467–487.
- Begenau, J. and Salomao, J. (2016), "Firm Financing over the Business Cycle." Working Paper 3566. Stanford Business Graduate School.
- Berger, A. and Udell, G. (1998). "The Economics of Small Business Finance: The Roles of Private Equity and Debt Markets in the Financial Growth Cycle." *Journal of Banking & Finance*, 22(6–8), 613–673.
- Berger, A. and Udell, G. (2006). "A More Complete Conceptual Framework for SME Finance." *Journal of Banking Finance*, 30(11), 2945–2966.
- Boissay, F. and Gropp, R. (2007). "Trade Credit Defaults and Liquidity Provision by Firms." ECB Working Paper No. 753. European Central Bank, Frankfurt.
- Bougheas, S., Mateut, S. and Mizen, P. (2009). "Corporate Trade Credit and Inventories: New Evidence of a Trade-off from Accounts Payable and Receivable." *Journal of Banking & Finance*, 33(2), 300–307.
- Carbo-Valverde, S., Rodriguez-Fernandez, F. and Udell, G.F. (2016). "Trade Credit, the Financial Crisis, and SME Access to Finance." *Journal of Money, Credit and Banking*, 48(1), 113–143.
- Coricelli, F. and Frigerio, M. (2016). "Inter-Enterprise Credit and Adjustment During Financial Crises: The Role of Firm Size." CEPR Discussion Paper 11680. Centre for Economic Policy Research, London.
- Corrado, C., Hulten, C. and Sichel, D. (2005). "Measuring Capital and Technology: An Expanded Framework." *In Measuring Capital in the New Economy*, edited by Corrado, C., Haltiwanger J. and Sichel, D. Cambridge, MA: National Bureau of Economic Research MA.

- Covas, F. and Den Haan, W.J. (2012). "The Role of Debt and Equity Finance over the Business Cycle." *The Economic Journal*, 122(565), 1262–1286.
- Cressy, R. and Olofsson, C. (1997). "European SME Financing: An Overview." *Small Business Economics*, 9(2), 87–96.
- Cuñat, V. (2007). "Trade Credit: Suppliers as Debt Collectors and Insurance Providers." *Review of Financial Studies*, 20, 491–527.
- Dass, N., Kale, J.R. and Nanda, V. (2015). "Trade Credit, Relationship-specific Investment, and Product Market Power." *Review of Finance*, 19(5), 1867–1923.
- Dierickx, I. and Cool, K. (1989). "Asset Stock Accumulation and Sustainability of Competitive Advantage." *Management Science*, 35(12), 1504–1511.
- EIB (2016). "Investment and Investment Finance in Europe – Financing Productivity Growth. Annual Report." Economics Department, European Investment Bank.
- EIB (2017). "Surveying Corporate Investment Activities, Needs and Financing in the EU." Economics Department, European Investment Bank.
- Ferrando, A. and Mulier, K. (2013). "Do Firms Use the Trade Credit Channel to Manage Growth?" *Journal of Banking & Finance* 37, 3035–3046.
- Ferrando, A., Ludice, M., Altomonte, C., Blank, S., Felt, M.H., Meinen, P., Neugebauer, K. and Siedschlag, I. (2015). "Assessing the Financial and Financing Conditions of Firms in Europe: The Financial Module in CompNet." ECB Working Paper No. 1836. European Central Bank, Frankfurt.
- Ferrando, A. and Preuss, C. (2017). "What Finance for What Investment? Survey-Based Evidence for European companies" EIB Working Paper (*forthcoming*), European Investment Bank, Luxembourg.
- Ghosal, V. and Loungani, P. (2000). "The Differential Impact of Uncertainty on Investment in Small and Large Businesses." *Review of Economics and Statistics*, 82, 338–343.
- Grundy, B. and Verwijmeren, P. (2017). "The External Financing of Investment." Unpublished.
- Hall, B.H. and Lerner, J. (2009). "The Financing of R&D and Innovation." NBER Working Papers No. 15325. National Bureau of Economic Research, Cambridge, MA.
- Hunter L.C., Webster, E. and Wyatt, A. (2005). "Measuring Intangible Investment." Melbourne Institute Working Paper No. 15/05.
- Ipsos Public Affairs. (2017). "EIB Group Survey of Investment and Investment Finance. Technical Report." Ipsos.
- Jensen, M.C. (1986). "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers." *American Economic Review*, 76(2), 323–329.
- Jensen, M.C. and Meckling, W.H. (1976). "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure." *Journal of Financial Economics*, 3(4), 305–360.
- Kalemli-Ozcan, S. (2016). "Financial Frictions and Sources of Finance for European Firms." In *Investment and Investment Finance in Europe*. Luxembourg: European Investment Bank.
- Kalemli-Ozcan, S., Sorensen, B., Villegas-Sanchez, C., Volosovych, V. and Yesiltas, S. (2015). "How to Construct Nationally Representative Firm-level Data from the ORBIS Global Database." NBER Working Paper No. 21558. National Bureau of Economic Research, Cambridge, MA.
- Long, M.S. and Malitz, I.B. (1983). "Investment Patterns and Financial Leverage." NBER Working Paper No. 1145. National Bureau of Economic Research, Cambridge, MA.

McGowan A., Andrews M. and V. Millot (2017). "The Walking Dead? Zombie Firms and Productivity Performance in OECD Countries." OECD Economics Department Working Papers, No. 1372. OECD Publishing, Paris.

Modigliani, F. and Miller, M.H. (1958). "The Cost of Capital, Corporate Finance and the Theory of Investment." *The American Economic Review*, 48(3), 261–297.

Myers, S.C. (1977). "Determinants of Corporate Borrowing." *Journal of Financial Economics*, 5(2), 147–175.

Myers, S.C. and Majluf, N.S. (1984). "Corporate Financing and Investment Decisions When Firms Have Information that Investors Do Not Have." *Journal of Financial Economics*, 13(2), 187–221.

Petersen, M.A. and Rajan, R.G. (1997). "Trade Credit: Theories and Evidence." *Review of Financial Studies*, 10(3), 661–691.

Preuss, C. (2017). "The Nexus Between Corporate Finance and Investment Decisions: A Survey-Based Approach." Master's Thesis. University of Potsdam.

Roberts, M.R. and Whited, T.M. (2013). "Endogeneity in Empirical Corporate Finance." In *Handbook of the Economics of Finance*. Volume 2, edited by Constantinides, G.M., Harris, M. and Stulz, R.M. Elsevier.

Thum-Thysen, A., Voigt, P. Maier C., Bilbao-Osorio B. and Ognyanova D. (2017). "Unlocking Investment in Intangible Assets in Europe." Presentation at the European Commission's GPEARI Workshop, Lisbon. June 7.

Uncertainty is an obstacle to investment for

71% of firms

Innovative firms and young SMEs are

50%

more likely than other firms to be **credit constrained**

Large firms

2x

more likely **to be innovators** than SMEs

Leading innovators

3x

more likely to receive a **grant** than average firm

For **62%**

of firms **labour market regulation** is a barrier to investment

For **56%**

of firms **energy costs** are a barrier to investment

PART III

Business investment:
uncertainty, innovation
and resource allocation

Chapter 8

Recognising uncertainty: empirical evidence and policy options

Chapter at a glance

- *The empirical evidence presented in this chapter, along with information based on the matched EIBIS-Orbis 2016 dataset, shows that firms face considerable uncertainty regarding the future path of demand, technology, output market and input market conditions.*
- *Credit-constrained firms are substantially more likely to cite uncertainty as impeding their investment activity, implying that uncertain access to finance impedes investment.*
- *Resource flexibility is seen to be intricately tied to uncertainty and its effect on investment. Policies that make reallocation of labour and capital less costly will improve the resilience of firms to shocks and thereby reduce the wait-and-see attitude that uncertainty can have on investment.*
- *Firms that have adapted to globalisation, such as exporters, are much less likely to perceive uncertainty as impeding their investment activity. Exporters are much larger and more productive than non-exporters, and they also have much higher levels of intangible investments. This allows them to scale up production and sales without increasing capital stocks proportionately, since intangibles are non-rival in production.*
- *Policy that supports investment in intangibles, R&D and worker training not only boosts activity to improve future productive inputs, but can also indirectly reduce the sensitivity of investment to future uncertainty.*
- *The analysis in this chapter shows that regional differences in uncertainty are quite large. Macroeconomic circumstances still vary widely in the different EU regions. This has a significant effect on uncertainty and investment intensity.*

Recognising uncertainty using the EIBIS

“Uncertainty is seen to retard investment independently of considerations of risk or expected return. Introduction of uncertainty can be associated with slack investment, resolution of uncertainty with an investment boom.”

Ben Bernanke, in his 1975 doctoral dissertation for the Massachusetts Institute of Technology¹

Recent data have shown that corporate sector investment in the European Union (EU) is picking up, and that the number of firms reporting barriers is declining. The European Investment Bank Investment Survey (EIBIS) queries firms about the role of uncertainty in their investment decisions. About 70% of firms in the EU considered uncertainty to be an impediment to investment in 2016, including 40% that considered it a “major” impediment and 30% that cited it as an impediment, without specifying its extent. Preliminary findings from the EIBIS for 2017 suggest the situation has improved slightly, with the number of firms reporting that uncertainty is not a barrier increasing to 35%. However, in both years, uncertainty was, on average, perceived to be a more serious obstacle than other obstacles asked about in the survey, such as availability of finance, labour market regulations, energy costs and the demand for goods and services. Only availability of workers with relevant skills is considered to be as large an impediment as uncertainty.

¹ As cited in the Wall Street Journal, 22 July 2010.

While policy may not fully address uncertainty, low- or no-cost options exist that limit the increase of uncertainty and reduce its impact on investment activity. Exact quantification of the drivers of private investment and the prioritisation of policy to reduce uncertainty and foster investment are difficult. Yet, some policy directions appear helpful and feasible in the current environment.

Clearly, a stable and robust financial system with well-functioning credit markets is required. A reduction in policy uncertainty surrounding EU banking regulation and reform that will unfold in the current round of negotiations would help in this regard. And while advances and shifts in technology are important drivers of growth, they can also increase the uncertainty faced by firms as they navigate their path towards the future. A coherent and stable set of policy instruments regarding innovation, as well as an EU-wide policy on adoption of technology and enforcement of competition, would provide a level playing field that firms could count on when taking up risky innovative activities.

Associated with innovation and technology, there has been much uncertainty brought about by globalisation in recent decades, especially at the onset of the global financial crisis and in its aftermath. Where before the crisis all developments were pointing in one direction – namely, increases in global trade and financial flows – some now point to “peak trade” already being behind us. Furthermore, the outcome of the Brexit vote in the United Kingdom and the ensuing negotiations surrounding the separation of the UK from the European Union, as well as questions regarding multilateral trade agreements, could further cloud the ability of the business sector to see a clear path to the future. EU policymakers would do well to maintain clarity on the future strengthening of the internal market, as well as maintaining a firm stand in their view on global integration.

As technology and global competition interact, economic activity needs to shift across sectors and labour needs to switch between tasks. The upcoming platform technologies and the growing importance of data collection are changing the relationship between capital and labour. The changes will require forward-looking policy action on labour relations, both to reduce the uncertainty of firms wanting to invest in these technologies, but also to ensure an income distribution compatible with sustainable consumer demand. Reducing the costs of adjustment and limiting the irreversibility of decisions – for example by improving the flexibility of labour markets – would lower the social costs of external shocks and reduce the negative effect of uncertainty on investment.

Finally, as events will inevitably occur at some point that initiate a new economic downturn, policies need to be in place to prevent the shock from turning into fear of high unemployment and bankruptcy. The most important lesson might be to put a credible floor under the decline in economic activity. One possibility is to do this through public investments that are committed to kick in once certain levels of unemployment or GDP loss have occurred. Other proposals exist as well, underlining the importance of deliberate policy to address the issue.

Academic uncertainty

The study of uncertainty as a source of fluctuations in the business cycle in general, or in investment in particular, has ebbed and flowed over time in academic literature. There were booms in research activity subsequent to the seminal contributions by Knight (1921), Bernanke (1979) and, more recently, Bloom (2007). The Great Recession and its aftermath with persistently low investment have sparked renewed interest in understanding the mechanisms through which varying types of uncertainty affect investment decisions.

Besides theoretical considerations about the path through which uncertainty can affect investment, much applied work has considered how to measure various types of uncertainty. Theory and measurement interact, in the sense that measurements are only meaningful within a theoretical framework, and theory becomes sterile without empirical applicability.

Academic interest in uncertainty remains academic if it does not contribute to information that can be acted upon. While the current state of research does not provide quantitative predictions on how policy actions change uncertainty and thereby economic outcomes, enough evidence has built up about different types of uncertainty, the policy actions that may affect uncertainty, and the direction of the response of economic activity to uncertainty. In this sense, the remainder of Ben Bernanke's quotation that opened this chapter is instructive: "We don't need to measure the effect to take the lesson that whatever we can do to reduce uncertainty would be constructive." Bernanke's observation, together with existing knowledge of the different types of uncertainty, can provide sufficient guidance going forward.

The basic logic behind uncertainty as an impediment to investment is simple. There is value in waiting for new information to arrive before committing resources to irreversible investment, and this value increases when uncertainty is higher. Behind this statement, many details complicate the issue. To start with, uncertainty only matters for investment when the investment is to some extent irreversible. Installation costs, such as those required to sink cables or subway rails, are irreversible. But it is not just this type of sunk costs that matters. More generally, once productive resources are converted into capital goods, they cannot be converted back into labour and materials, even if the capital good itself can be sold. Irreversibility also pertains to a situation in which the sale price of an asset is lower than its purchase price, as is the case with "lemons".² Some forms of installed capital are very difficult or impossible to sell regardless of market circumstances, as in the case of human capital, for example. Especially difficult to assess empirically is the irreversibility of intangible capital.

Next, the value of waiting emerges because the arrival of new information (partially) resolves the uncertainty. To determine when this is the case and to what extent the uncertainty becomes resolved with new information requires a position on the nature of uncertainty. A long and drawn-out philosophical debate concerning uncertainty and risk has ensued since the work of Frank Knight (1921). Roughly, *uncertainty* is the state in which the distribution of future outcomes is not known or even knowable, whereas *risk* implies that market participants can compute moments of the distribution of future outcomes. In practice, this distinction is less clear and less useful. Of necessity, market participants trade in unknowable future outcomes and thus implicitly provide market-based moments of future outcome distributions. This happens both across market participants in any given point in time (for example, when venture capital firms place and spread their bets) and in aggregate time series (for example, when trading on sovereign bond defaults for even the safest benchmark countries). Sometimes, events happen frequently enough in relatively stable environments so that history can provide tight numerical estimates of the outcome distribution. But at any time, random and unexpected "Black Swan" events can occur that markets are known to under-price.

Relatedly, the value of having a wait-and-see attitude towards investment depends on the exact nature of the stochastic process. With random walks, the uncertainty at a future date may not be resolved with new information, but good news tomorrow sets up a different trajectory of outcomes further in the future than bad news tomorrow. In mathematically more complex but likely more realistic situations, the resolution of uncertainty in one dimension comes at the same time as new uncertainty crops up elsewhere.

Empirical evidence from the EIBIS-Orbis dataset

This chapter uses the EIB Investment Survey (EIBIS), linked to the Orbis database of Bureau van Dijk (a major publisher of business information) in an anonymised way so that researchers cannot trace a firm's identity. This matched EIBIS-Orbis database provides information about balance sheets and income statements of interviewed firms going back to 2000. The data annex to this report provides more information about the EIBIS and the matched database.

² Akerlof (1970) examines how the quality of goods traded in a market can degrade in the presence of information asymmetry between buyers and sellers, leaving only "lemons" behind. In American slang, a lemon is a car that is found to be defective only after it has been bought.

Answers to six questions from the EIBIS are exploited in this chapter.³ The analysis revolves around the answers to the question about uncertainty: *“Thinking about your investment activities in your country of operation, to what extent is uncertainty about the future an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all?”*⁴ The analysis also makes use of the answers to two similar questions, one regarding *“availability of staff with the right skills”* and the other pertaining to *“availability of finance”* instead of uncertainty about the future.

The fourth question that is used in this chapter is: *“Looking back at your investment over the last three years, was it too much, too little, or about the right amount to ensure the success of your business going forward?”* Possible answers here are: *“Too much,” “About the right amount,” “Too little,” “Company didn’t exist three years ago,” “Don’t know,”* and *“Refused.”*

The analysis further makes use of a question that asks about the share of cutting-edge equipment employed by firms: *“What proportion, if any, of your machinery and equipment, including ICT, would you say is state-of-the-art? By state-of-the-art I mean cutting edge or developed from the most recent ideas or methods.”* Finally, we look at the question on the impact of Brexit on investment activity.

In addition to the linked EIBIS-Orbis panel, we make use of records from the full firm-level Orbis database. This database has been constructed to give a representative view of firm dynamics in the countries covered. Information on the panel database can be found in Kalemli-Ozcan et al. (2015). The Orbis database provides financial and structural firm-level data for more than 170 million firms around the world. Financial data include information on balance sheets and income statements, while information on firms’ structure includes ownership data, industry of operation, legal status, date of incorporation. The analysis in this chapter is focused on the subset of EU Member States of the Orbis vintage from the second quarter of 2016. This vintage is linked to all historical Orbis files available from Bureau van Dijk.⁵ In merging historical files, Bureau van Dijk keeps only the most recently received data for each firm. Firms that stop reporting or cease to exist are kept in the database, reducing the likelihood of a survivorship bias of the database.

What are firms telling us?

Surveys are important instruments in the toolbox of social scientists. Answers to survey questions represent measures taken from a population on some construct. In the case of this chapter, we are interested in analysing whether firms consider uncertainty to be an obstacle to investment and in developing policy options to mitigate such obstacles. Reliability and validity of the survey instrument is not much of an issue given the careful design and sampling of the EIBIS. More of an issue is the target of the question on uncertainty: do the survey respondents all consider the same phenomenon when answering these questions? Further, does the concept of uncertainty that the respondent is considering when answering the survey question coincide with the concept considered in economic theory? Moreover, does the answer to the survey question convey information useful for policy?

Before turning to these considerations, this chapter first takes a look at the survey results. The first three columns of Table 1 show the percentage of firms that consider uncertainty to be a major, minor or no impediment to investment.⁶ Subsequent tables refer to this variable as *XIU*. The next three columns look at the fraction of total investment in firms giving these answers.

3 The complete EIBIS questionnaire is available at <http://www.eib.org/eibis>.

4 Respondent may also answer “Don’t know” or refuse to answer.

5 In particular, the vintages used are 10/2005, 07/2006, 10/2007, 08/2008, 10/2009, 10/2010, 10/2011, 10/2012, 04/2013, 07/2013, 10/2013, 12/2013, 03/2014, 07/2014, 10/2014, 12/2014 and 03/2015.

6 We exclude “Don’t know” or “Did not respond,” and renormalise to sum to 100.

Among firms, 40% see uncertainty as a major impediment and only one quarter do not see it as an impediment. As can be inferred from the results for the full sample, those firms that consider uncertainty to be a major concern invest less than average, so that only 28% of investment takes place in firms that consider uncertainty to be a major impediment, while 35% takes place in firms where uncertainty is not important.

The table then shows that the response systematically varies across major sectors as well as across geographical areas in the EU. In the periphery countries, the percentage of firms that see uncertainty as a major impediment is about 21 percentage points higher – about 61%. Remarkably, these firms account for slightly less than 30% of total investment. In the remaining groups of countries such differences are much smaller.

Table 1 Uncertainty as an impediment to investment

Category	Average			Investment-weighted average		
	Major	Minor	No	Major	Minor	No
Firms overall	40.08	35.21	24.71	28.39	36.14	35.47
Manufacturing	35.79	39.30	24.91	35.78	25.83	38.39
Electricity and gas	46.43	32.14	21.43	61.00	35.72	3.28
Water supply	35.71	40.91	23.38	1.59	51.82	46.59
Construction	44.50	33.62	21.88	81.41	12.27	6.32
Trade	40.34	34.11	25.55	17.04	63.33	19.63
Transportation	42.73	28.73	28.55	42.43	25.57	32.00
Accommodation	43.75	34.38	21.88	53.59	29.01	17.41
Information and communication	31.73	41.35	26.92	1.74	42.20	56.05
Cohesion	46.10	32.92	20.99	57.75	27.13	15.13
Other EU	27.99	40.58	31.43	20.68	28.62	50.70
Periphery	61.32	23.34	15.33	29.24	67.83	2.93

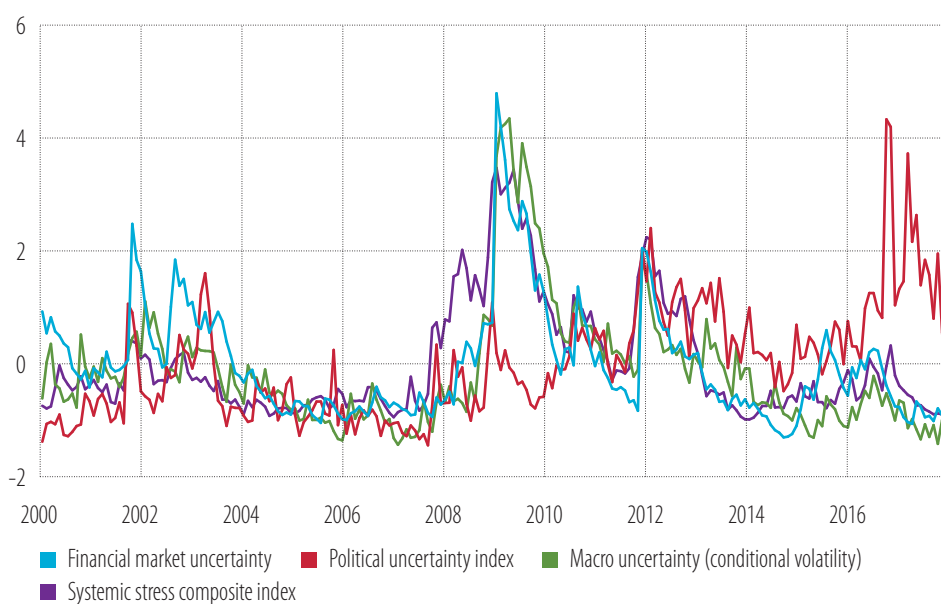
Source: EIBIS2016 and authors' calculations.

As discussed, the uncertainty that a firm faces may be related to its technology, to actions of its competitors, to circumstances in the markets for its capital, labour and material inputs, to circumstances in its output markets, and to (macro)economic, institutional/regulatory and political circumstances in its local, national or regional environment. Turning to the concept of uncertainty and its interpretation by the respondents, we look at correlations between the survey and various other measures of uncertainty inferred from observable data. We look at time-series dispersion or cross-sectional volatility of indicators at the appropriate level to proxy for the various sources of uncertainty.

Technological uncertainty is captured by considering a firm's past volatility of productivity, measured as the standard deviation of labour productivity growth over the past five years. We label this π_i^Y , for each firm i in the period 2010-15. These measures are constructed for the linked EIBIS firms that have been in operation continuously for the previous five years. Next, we consider the cross-sectional dispersion of productivity growth across firms in the same (two-digit) industry as the respondent, labelled π_i^X , sourced from the full Orbis dataset. To look at the competitive environment, we use the full Orbis panel to compute market-share churning for each two-digit industry (labelled $churn_i$), computed as the sum of the absolute value of market share changes, averaged over the prior three years. For volatility in input markets, we compute gross job reallocation of firms in each two-digit industry averaged over the prior three years (labelled gjr_i), also using the full Orbis panel. For uncertainty in output markets, we compute firm-specific volatility of firm-level output growth over the prior five years (labelled q_i^Y).

Macro-level uncertainty measures can be constructed in various ways, as discussed in recent papers (such as Baker et al., 2016). Most of these measures rely on high-frequency data available from stock markets, other financial markets or textual analysis of news items. Figure 1 shows four macro time series on uncertainty. As seen in the figure, financial market uncertainty, macroeconomic uncertainty and the systemic stress composite index were all not particularly elevated in 2015 and 2016. The only substantial increase is seen in the economic policy uncertainty following the referendum on the EU in the UK. The EIBIS measure is a snapshot in time for firms that differ by industries, location or other characteristics, and is thus difficult to compare with time-varying macro indicators of uncertainty.

Figure 1 Measures of macroeconomic and financial market uncertainty



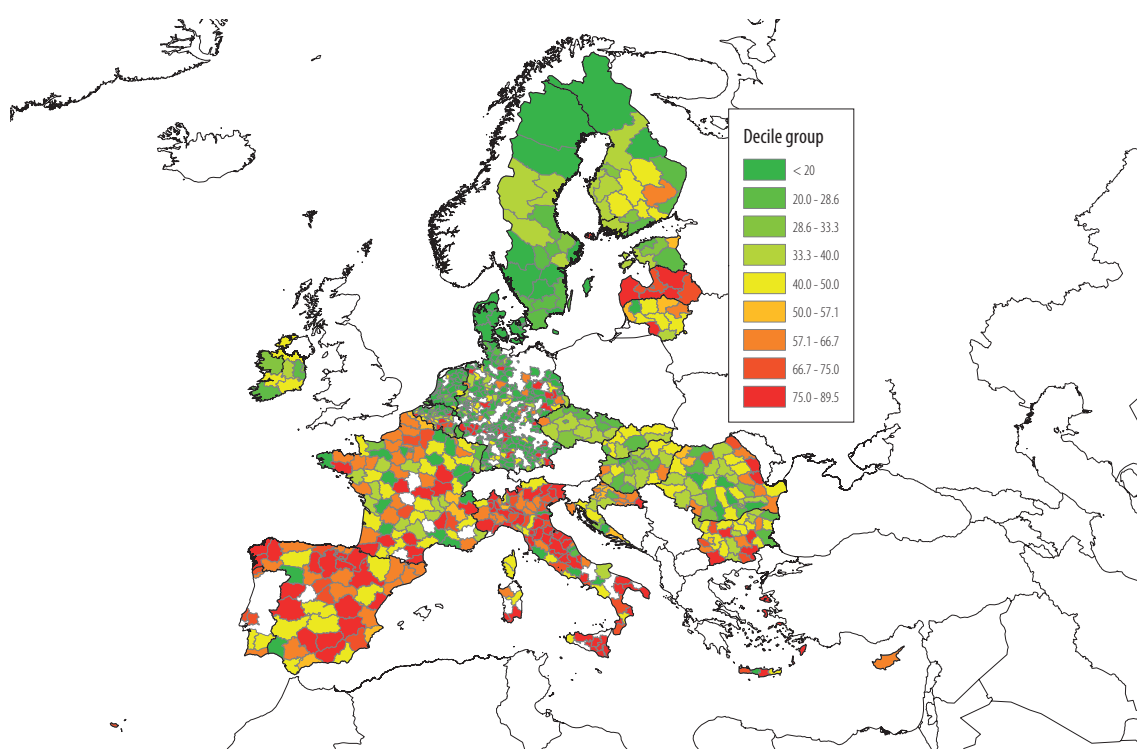
Source: European Central Bank, Thompson Reuters, Eurostat; Baker, Bloom and Davis (2016), EIB staff calculations.

Note: Macroeconomic and financial market measures of uncertainty are described in ECB Economic Bulletin Issue 8, 2016.

The regional dimension provides variation to compare measures of firm-level uncertainty with macro measures. Perceptions of uncertainty from the survey vary significantly across EU regions (Figure 2). Using the matched EIBIS-Orbis dataset, we are able to compute a dispersion indicator at the NUTS-3 regional level,⁷ looking at the most recent one-year job reallocation rates averaged across local firms in the region, gjr^r . The correlation between this measure and the share of firms in the region stating that uncertainty is a major impediment is shown in Table 2.

⁷ The third level of the Nomenclature of Territorial Units for Statistics (NUTS), consisting of small regions for specific diagnosis. See <http://ec.europa.eu/eurostat/web/nuts>.

Figure 2 Uncertainty as a major impediment to investment activity by NUTS-3 region, 2015 (share of total answers)



Source: EIBIS2016, authors' calculations

Note: The numbers on the map are the shares of answers "A major impediment" in the total number of answers. Groups are divided by deciles. Regions with shares of 0 or above 90 are counted as missing. Some of the EIBIS respondents are not matched with a NUTS-3 region.

An increase in all firm-specific volatility measures is associated with an increase in the likelihood of firms citing uncertainty as an impediment to their investment activity (Table 2). The first column of Table 2 reports the extent to which the likelihood that a firm considers uncertainty to be an impediment to investment changes when there is a unit increase in one of the objective uncertainty measures in the table. Thus a unit increase in firm-level volatility of productivity growth increases the likelihood of that firm replying that uncertainty is a major impediment to investment (relative to the likelihood that it is not an impediment) by 1.6 percentage points, and the result is highly statistically significant. Among the uncertainty proxies, correlations are fairly high between the measures of firm-level productivity and sales growth volatility (π^V and q^V) and for the churning rate of market shares (*churn*) and the average gross job reallocation across firms (*gjr*). The remaining subsections of this chapter assess the sensitivity of investment to uncertainty, where the uncertainty measure is from either the EIBIS or one that appears relevant to the type of uncertainty being discussed. For example, the rate of employment churn at the regional level should be relevant for macro uncertainty and the dispersion of industry productivity may be relevant to uncertainty from innovation.

Overall, the EIBIS question on uncertainty correlates well with various proxies for uncertainty that can be computed from observable economic measures. The advantage of the EIBIS question is that it can be repeated over time-tracked (policy-induced) changes at the firm level. Table 2 further points to a fact that will be discussed more fully below, namely that different firms face different types of uncertainty. A single policy measure will not serve to reduce uncertainty impediments to investment. Instead, careful analysis should uncover the types of uncertainty that firms are facing and develop policies to tackle the specific type of uncertainty at its source.

Table 2 Correlation between uncertainty measures

	Marginal effect	π^v	π^x	churn	gjr	q^v
<i>XIU</i>						
π^v	1.60***	1.00	0.15	0.17	0.13	0.79
π^x	7.63***		1.00	0.50	0.41	0.17
<i>churn</i>	3.48***			1.00	0.72	0.20
<i>gjr</i>	8.67***				1.00	0.15
q^v	1.68***					1.00

Source: EIBIS2016, ORBIS and authors' calculations.

Note: The first column, marginal effect, displays the marginal effect from a multinomial probit of the three answers to the question on uncertainty on the different objective measures. The remaining columns display Spearman correlation coefficients. *XIU* is the percentage of firms that consider uncertainty to be a major, minor or no impediment to investment; π^v is the standard deviation of firm-specific total factor productivity growth (volatility) in the period 2010-15; π^x is the cross-section standard deviation of firm-level productivity growth (dispersion) in 2015 for each two-digit industry; *churn* is the sum of the absolute value of market share changes, averaged over the prior three years within two-digit industry; *gjr* is the gross job reallocation of firms in each two-digit industry averaged over the prior three years; and q^v measures the standard deviation of firm-level output growth over 2010-15.

Uncertainty and financial stability

Despite receding uncertainty about the basic stability of the European financial sector in 2015 and 2016, much uncertainty remains about the way forward for the financial sector and what that might mean for firms attempting to obtain credit. A new European regulatory regime is under construction at the same time as some legacy issues remain in banks in certain areas of the euro zone. This reduces the ability of regulators to take quick action towards the endpoint regulatory regime, and causes uncertain transitional paths, for example in increasing capital ratios. Other areas of transition involve quality of capital, funding profiles, risk management procedures and bail-in of debt, to name but a few. During the transition phase, increased uncertainty about financial system resilience may result in tighter credit conditions. Furthermore, uncertainty may worsen as a consequence of changing timelines for reform or further revisions to planned regulations that can hit firms idiosyncratically based on their location and balance sheet.

If one thing is certain, it is that more changes will be coming. The European Central Bank (ECB) is cognizant of the necessity to be transparent about future regulatory changes and the practical application of new regulations.⁸ Nonetheless, the political process through which changes are put in place in the EU and G20 arenas means that the end-result of proposed changes cannot be considered certain even if the main regulators and financial sector firms have come to agreement.

To assess whether the uncertainty question of the EIBIS might be measuring some form of uncertainty of the financial system, Table 3 looks jointly at uncertainty and indicators of credit market tightness. The table shows the results both for the unweighted firm shares across responses to the uncertainty question and for the investment-weighted responses.

⁸ Keynote speech by Benoît Cœuré, member of the ECB Executive Board at SZ (Süddeutsche Zeitung) Finance Day 2016, Frankfurt am Main, 2 March 2016.

Table 3 Uncertainty and financial constraints

Category	Average			Investment-weighted average		
	Major	Minor	No	Major	Minor	No
Firms overall	40.08	35.21	24.71	28.39	36.14	35.47
High credit constraints	66.79	22.86	10.34	39.48	59.59	0.93
Low credit constraints	43.48	45.09	11.43	57.34	35.55	7.12
No credit constraints	26.34	35.91	37.75	18.11	25.30	56.59
High cash-to-total-assets ratio	38.04	34.82	27.14	16.94	20.67	62.39
Low cash-to-total-assets ratio	38.52	36.99	24.49	34.84	24.08	41.08
High debt-to-total-assets ratio	39.21	36.87	23.93	23.64	28.96	47.40
Low debt-to-total-assets ratio	36.92	35.60	27.48	38.44	20.21	41.35

Source: EIBIS2016, ORBIS and authors' calculations.

Note: Credit constraints inferred from the answers to the following question: "Thinking about your investment activities in your country of operation, to what extent is availability of finance an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all?" High and low groups for cash-to-total assets and debt-to-total assets ratios are above and below the median, respectively.

Credit-constrained firms see uncertainty as an impediment to investment significantly more than the average firm. While 40% of firms overall state that uncertainty is an impediment, two thirds of firms facing high credit constraints regard uncertainty as an impediment, and only one quarter of firms not facing credit constraints state that it is an impediment. Of total investment by firms not facing credit constraints, only 18% is conducted by firms that see uncertainty as a major impediment. The pattern of uncertainty does not vary meaningfully across firms by their ratio of cash to assets.

Of course, cash, credit constraints, uncertainty and investment co-vary in complex ways. For example, firms faced with credit constraints may retain earnings to be used for future investment, resulting in a positive correlation between investment and cash. By contrast, firms facing uncertainty may invest less, but also retain cash as a means of buffering future fluctuations, thus resulting in a negative relationship between cash and investment. To further explore the relationship, Table 4 looks at how the average investment-to-sales ratio varies for groups of firms with high or low cash-to-asset ratios, or with high or low credit constraints.

Table 4 Investment-to-sales ratios, uncertainty and financial constraints, 2015

Category	Overall	Uncertainty			Past investment		Credit-constrained				
		Major	Minor	Not	Too little	Too much	High level	Low level	None	High cash	Low cash
Firms overall	0.13	0.11	0.17	0.13	0.08	0.17	0.11	0.13	0.14	0.07	0.17
Manufacturing	0.13	0.07	0.21	0.07	0.07	0.12	0.10	0.11	0.16	0.08	0.17
Electricity and gas	0.44	0.36	0.54	0.58	0.42	0.00	0.22	0.25	0.64	0.46	0.41
Water supply	0.36	0.35	0.32	0.40	0.19	0.66	0.35	0.42	0.32	0.07	0.52
Construction	0.09	0.09	0.12	0.04	0.06	0.13	0.06	0.07	0.12	0.05	0.13
Trade	0.07	0.04	0.05	0.13	0.03	0.08	0.05	0.04	0.04	0.03	0.08
Transportation	0.16	0.16	0.16	0.19	0.13	0.17	0.16	0.21	0.15	0.07	0.20
Accommodation	0.14	0.16	0.11	0.11	0.08	0.46	0.19	0.18	0.07	0.04	0.17
Information and communication	0.18	0.07	0.34	0.07	0.05	0.20	0.04	0.35	0.09	0.02	0.09
Cohesion	0.11	0.11	0.11	0.09	0.08	0.19	0.10	0.13	0.10	0.06	0.14
Other EU	0.20	0.11	0.27	0.19	0.09	0.09	0.12	0.14	0.22	0.10	0.25
Periphery	0.09	0.08	0.13	0.06	0.04	0.28	0.12	0.07	0.07	0.04	0.10

Source: EIBIS2016, ORBIS, and authors' calculations.

Note: Credit constraints inferred from the answers to the following question: "Thinking about your investment activities in your country of operation, to what extent is availability of finance an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all?" High and low groups for cash-to-total assets and debt-to-total assets ratios are above and below the median, respectively. In past investment, firms are split according to their answers to the question: "Looking back at your investment over the last three years, was it too much, too little, or about the right amount to ensure the success of your business going forward?" The possible answers were: "Too much," "About the right amount," "Too little," "Company didn't exist three years ago," "Don't know," and "Refused."

Table 4 displays the overall intensity as the average ratio of firm-level investment to sales for all firms in the EIBIS-Orbis 2015 dataset. The first column shows the ratio for all firms and for all firms split by industry or by EU region. The next three columns show the investment-to-sales ratio for firms stating that uncertainty was a major or minor impediment to investment, or not an impediment. The middle series of columns (labelled "Past investment") shows the bivariate split across firms that state that they have in the past invested as much as they needed, and across those that invested less than desired. The right-hand series of columns (labelled "Credit-constrained") show the investment-to-sales ratio for firms that are credit-constrained or have a low cash-to-assets ratio.

The investment intensity of firms that view uncertainty as an impediment is lower than the average.

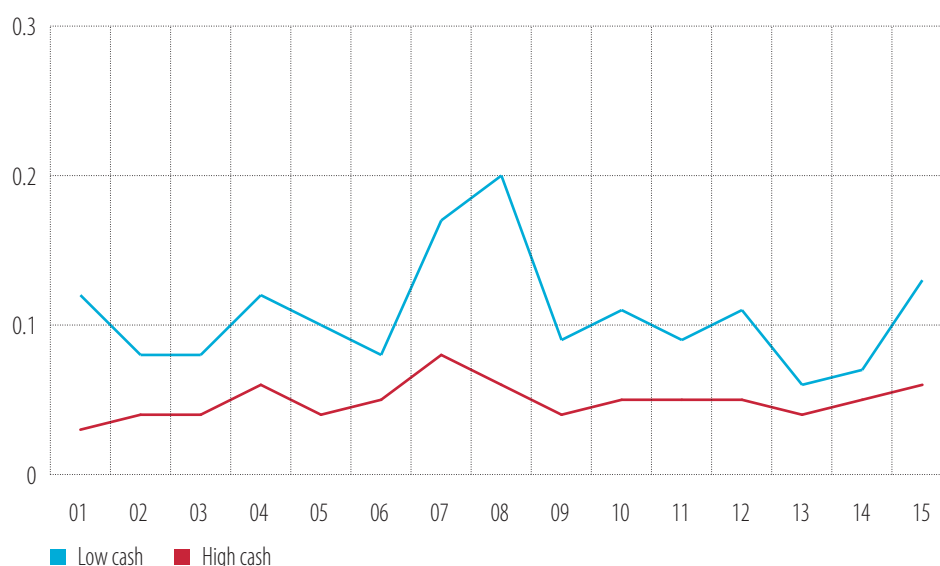
For all firms, the average investment-to-sales ratio is 13%, with the intensity varying across sectors from 7% in construction to 13% in manufacturing and 30% or above in utilities and information and communications. Investment intensity is lower in the periphery countries than in the cohesion countries and the other EU countries. The next three columns show the investment-to-sales ratios of firms, split across their response to the uncertainty impediment question. Overall, and for most sectors and regions, investment intensity for firms that state that uncertainty is a major impediment is lower than for all firms. While overall investment intensity varies greatly across the EU regions, the investment-to-sales ratio is equally low (11%) in all regions for firms that view uncertainty as a major impediment.

The series of columns in the middle of Table 4 show investment intensity split by firms according to their view on investment in the previous year. In sectors other than utilities and communications, firms stating they had invested too much in the past have higher investment ratios than for their sector as a whole. Remarkably, these firms have much higher investment-to-sales ratios than the average in most sectors and regions. This suggests that such firms may have anticipated the recovery too much.

Except for the electric utilities and communication sectors, all sectors and regions show that firms with high cash-to-assets ratios are less investment-intensive than firms with low cash buffers. This could point towards a wait-and-see attitude. While expecting future conditions to improve, firms maintain a good financial position to support future investment. Overall, the investment-to-sales ratio does not vary much when firms are split according to their perception of credit constraints. There is a geographical variation, however. In cohesion countries, investment intensity does not vary substantially across credit-constraint tightness. In the group of other EU countries, credit-constrained firms have significantly lower investment-to-sales ratios than the average. Only in periphery countries are credit-constrained firms more investment-intensive than the average for this country group.

Firms with relatively low cash levels invest more in relation to sales, but also are more volatile. Figure 3 plots the ratio of aggregate investment to aggregate sales for firms with high cash-to-assets ratios versus low cash-to-assets ratios. Firms with high cash-to-assets ratios have a lower investment-to-sales ratio that also appears less cyclical. In the most recent year (2015) the investment-to-sales ratio is near the pre-crisis level.

Figure 3 Aggregate investment-to-sales ratios by cash-to-assets ratios



Source: ORBIS, Bureau van Dijk and authors' calculations.

Finally, using the full Orbis dataset, we run a panel regression of firms' investment-to-asset ratio on lagged investment intensity, two financial variables (namely, the cash-to-asset ratio and the cash flow-to-assets), an uncertainty measure, and uncertainty interacted with the two financial variables. Table 5 shows the results.⁹

A high cash flow-to-assets ratio is associated with higher investment-intensity. Moreover, it mitigates the effect of uncertainty on investment. Of the various uncertainty proxies, a firm's historical volatility reduces investment, as does its sales volatility. Further, uncertainty strengthens the negative effect of cash holdings. Industry-level productivity dispersion is also negatively correlated with investment, while it increases the positive effect of cash flow, somewhat at odds with the earlier evidence that the effect of dispersion as an uncertainty proxy seems unimportant.

⁹ The dynamic panel literature argues that one should use instrumental variables or generalised method of moments in dynamic panels because the ordinary least squares (OLS) estimate of the coefficient of the lagged dependent variable is biased. The same may be true for other regressors only to the extent that they are correlated with the lagged dependent variable. The expected bias on the lagged dependent variable in this regression is about -0.08 , so the coefficient could be 0.22 instead of 0.30 . Since we are not interested in the persistence of investment per se and today's uncertainty is arguably uncorrelated with past investment, we apply the OLS estimate.

Table 5 Investment intensity, dynamic panel regression

Dependent variable	Investment rate				
	(1)	(2)	(3)	(4)	(5)
Investment rate (t-1)	0.300*** (0.005)	0.300*** (0.005)	0.300*** (0.005)	0.300*** (0.005)	0.301*** (0.005)
Cash-to-total assets ratio (t-1)	-0.070*** (0.009)	-0.089*** (0.032)	-0.058*** (0.010)	-0.053*** (0.018)	-0.068*** (0.010)
Cash flow-to-total assets ratio (t-1)	0.099*** (0.014)	0.257*** (0.043)	0.136*** (0.016)	0.181*** (0.025)	0.106*** (0.014)
Cash-to-total assets ratio (t-1)*Uncertainty	-0.011** (0.005)	-0.030 (0.025)	-0.007 (0.010)	-0.001 (0.012)	-0.009* (0.005)
Cash flow-to-total assets ratio (t-1)*Uncertainty	0.009 (0.007)	0.139*** (0.034)	0.054*** (0.014)	0.071*** (0.017)	0.013* (0.007)
$\log(\pi^V)$	-0.060*** (0.020)				
$\log(\pi^X)$		-0.373* (0.195)			
$\log(churn)$			0.038 (0.066)		
$\log(gjr)$				-0.012 (0.071)	
$\log(q^V)$					-0.054*** (0.020)
Fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	33,957	33,957	33,957	33,957	33,957
R ²	0.233	0.233	0.233	0.233	0.233
Adjusted R ²	0.221	0.221	0.221	0.221	0.221
Residual standard error	1.376	1.376	1.376	1.376	1.376

Note: π^V is the standard deviation of firm-specific total factor productivity in the period 2010-15; π^X is the cross-section standard deviation in 2015 for each firm's two-digit industry; *churn* is the sum of the absolute value of market share changes, averaged over the prior three years within a two-digit industry; *gjr* is the gross job reallocation of firms in each two-digit industry averaged over the prior three years; q^V measures the standard deviation of firm-level output growth over 2010-15. The interaction uncertainty changes for each regression together with the regressor measuring uncertainty: $\log(\pi^V)$, $\log(\pi^X)$, $\log(churn)$, $\log(gjr)$, $\log(q^V)$. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

High cash holdings are associated with lower investment rates, and uncertainty reinforces this effect. Volatile firm-level productivity and output growth reinforce the negative correlation between high cash holdings and the investment rate. This observation is in line with a wait-and-see attitude response to uncertainty.

Uncertainty and innovation

In the theories linking uncertainty and investment, one route presents a positive relationship: undertaking innovative activity is inherently uncertain, but if successful a firm will have lower marginal costs and collect quasi-rents on its intellectual property.¹⁰ If the spread of outcomes of the innovative activity increases without changing the mean outcome, investment in innovation will rise

¹⁰ Quasi-rent differs from pure economic rent in that it is a temporary phenomenon. In this case, it arises from patents or other legal protections for intellectual property.

owing to the ability to leverage success through increasing scale and reduce losses from failure through shrinking. Bartelsman, Gautier and De Wind (2016) present such a mechanism in their model. Firms can choose to invest in a safe, known production technology or in a technology with risky returns. Having invested in the risky technology, firms can leverage the return by shutting down if the innovation is unsuccessful in the market, or scaling up in the event of success. In an economy where the riskiness of technology is increasing over time, the average returns go up as well, as long as the scaling options remain available. However, economic institutions that harm the downsizing or firm exit processes, for example through firing costs or costly bankruptcy proceedings, will reduce aggregate returns through two channels. First, fewer firms will choose the risky investment. Second, successful firms will not scale up as much and unproductive firms will remain larger or stay in the market longer.

The EIBIS data provide some opportunity to analyse this effect. The survey has questions on research and development (R&D) and investment by asset type, and the linked EIBIS-Orbis dataset provides, for a selection of firms, information on their intangible capital or on the high-tech nature of their technology.

The analysis starts by looking at whether the uncertainty question of the EIBIS might be measuring some form of uncertainty related to technology or innovation. The first three columns of Table 6 show the average response of firms, split across firms by characteristics related to innovation. The next three columns show the weighted average firm response, using investment weights (that is, showing the share of investment for each across columns for each row). The characteristics considered are time-series volatility of historical productivity growth of the firm, high dispersion of productivity growth across firms in the relevant industry, the intensity of intangible capital, and whether the firm has state-of-the-art technology.

Table 6 Uncertainty and innovation

Category	Average			Investment-weighted average		
	Major	Minor	No	Major	Minor	No
Overall	40.08	35.21	24.71	28.39	36.14	35.47
High π^v	47.17	35.27	17.56	73.92	17.07	9.01
Low π^v	38.12	37.26	24.62	21.83	26.18	51.98
High π^x	39.60	38.45	21.95	44.99	30.69	24.32
Low π^x	41.84	35.66	22.50	19.25	19.24	61.51
High intangibles	38.15	32.94	28.91	11.05	54.00	34.95
Low intangibles	41.09	35.94	22.97	40.91	18.79	40.31
High state-of-the-art technology	38.45	34.61	26.94	39.03	33.62	27.35
Low state-of-the-art technology	39.63	37.83	22.55	21.65	46.54	31.81

Source: EIBIS2016 and authors' calculations.

Note: High and low intangibles are split by the median of the share of intangible assets in total fixed assets. High and low state-of-the-art are derived from firms' answers to the question: "What proportion, if any, of your machinery and equipment, including ICT, would you say is state-of-the-art? By state-of-the-art I mean cutting-edge or developed from the most recent ideas or methods." π^v is the standard deviation of firm-specific total factor productivity in the period 2010-15; π^x is the cross-section standard deviation in 2015 for each firm's two-digit industry; *churn* is the sum of the absolute value of market share changes, averaged over the prior three years within a two-digit industry; *gjr* is gross job reallocation of firms in each two-digit industry averaged over the prior three years; q^v measures the standard deviation of firm-level output growth over 2010-15.

By contrast, the two rows above (high π^v and low π^v) show that firms that have high historical volatility in their own productivity growth (π^v) respond in a much higher proportion that uncertainty is a major impediment. When looking at the share of investment, nearly 75% of investment in high-volatility firms takes place in firms that state that uncertainty is a major impediment, whereas less than 10% takes place in firms that state that uncertainty is not an impediment. While it is possible that a country-specific uncertain macro environment has resulted in higher volatility for some of those firms that make large investments, the more likely explanation is that an uncertain technological and market environment specific to those firms is driving their response to the survey question.

Intangible capital appears related to fewer impediments from uncertainty. Less than 20% of the investment of firms with high stocks of intangible capital takes place among those that are impeded by uncertainty. This could point towards the possibility that technology associated with intangibles improves the ability of firms to scale under fluctuating demand conditions. However, the EIBIS question regarding what proportion of equipment is state-of-the-art is not correlated with fewer impediments from uncertainty.

Table 7 shows investment-to-sales ratios in 2015 from the EIBIS-Orbis matched dataset. It first shows the ratio for all firms, and for all firms split by industry or by EU region. The next series of columns shows the investment-to-sales ratio for firms stating that lack of availability of skilled workers was a major impediment to investment, a minor impediment or no impediment. The table also shows the bivariate splits across firms by high- or low-productivity volatility, across firms in industries with high- or low-productivity dispersion, or for firms with high or low intangible capital intensity or high or low shares of state-of-the-art equipment.

Problems with access to skilled workers do not seem to result in major differences in investment intensity across most sectors. In the other EU countries category, however, investment intensity is considerably higher in firms that see a lack of skilled workers. If these firms are being held back by a bottleneck, it could affect overall investment significantly.

Productivity volatility is associated with slightly higher investment intensity overall, and especially so in the group of other EU countries. Productivity dispersion has very little correlation with investment intensity across sectors and regions. Of interest in Table 7 is that investment intensity is lower than average for firms that have high intangible capital stocks. One possibility is that the official investment categories do not yet cover all spending on items that could be considered intangible assets, such as business organisation. Another possibility to be explored in future research is that intangible assets are a substitute for physical capital. For example, by having enterprise information systems, less office space can be used in a more flexible manner, reducing the need for structures investment.

Table 7 Investment-to-sales ratios, uncertainty and innovation, 2015

Category	Overall	Skill impediment			Innovativeness							
		Major	Minor	No	High π^v	Low π^v	High π^x	Low π^x	High intangibles	Low intangibles	High SOA	Low SOA
Firms overall	0.13	0.13	0.14	0.12	0.12	0.10	0.10	0.11	0.09	0.17	0.19	0.09
Manufacturing	0.13	0.19	0.10	0.07	0.09	0.07	0.08	0.07	0.07	0.18	0.22	0.07
Electricity and gas	0.44	0.39	0.45	0.48	0.48	0.28	0.38	0.15	0.73	0.44	0.52	0.41
Water supply	0.36	0.52	0.32	0.30	0.23	0.48	0.26	0.55	0.49	0.39	0.38	0.31
Construction	0.09	0.07	0.14	0.08	0.13	0.05	0.07	0.11	0.04	0.15	0.15	0.05
Trade	0.07	0.05	0.12	0.03	0.05	0.04	0.04	0.05	0.05	0.05	0.10	0.04
Transportation	0.16	0.14	0.20	0.16	0.14	0.14	0.13	0.15	0.03	0.23	0.20	0.13
Accommodation	0.14	0.15	0.16	0.08	0.18	0.13	0.08	0.14	0.09	0.18	0.12	0.15
Information and communication	0.18	0.05	0.09	0.45	0.08	0.08	0.08	0.03	0.11	0.50	0.23	0.08
Cohesion	0.11	0.10	0.11	0.13	0.09	0.12	0.09	0.11	0.07	0.13	0.13	0.09
Other EU	0.20	0.27	0.21	0.12	0.27	0.08	0.13	0.10	0.10	0.32	0.35	0.09
Periphery	0.09	0.07	0.12	0.08	0.10	0.07	0.07	0.08	0.08	0.10	0.09	0.08

Source: EIBIS2016 and authors' calculations.

Note: Skill impediment is derived from the answers to the question: "Thinking about your investment activities in your country of operation, to what extent is availability of staff with the right skills an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all?" High and low state-of-the-art (SOA) is derived from answers to the question: "What proportion, if any, of your machinery and equipment, including information and communications technology, would you say is state-of-the-art? By state-of-the-art I mean cutting-edge or developed from the most recent ideas or methods." π^v is the standard deviation of firm-specific total factor productivity in the period 2010-15; π^x is the cross-section standard deviation in 2015 for each firm's two-digit industry; churn is the sum of the absolute value of market share changes, averaged over the prior three years within a two-digit industry; gjr is the gross job reallocation of firms in each two-digit industry averaged over the prior three years; q^v measures the standard deviation of firm-level output growth over 2010-15. High and low intangibles are split by the median of the share of intangible assets in total fixed assets. SOA: state-of-the-art.

Uncertainty and globalisation

Following decades of uninterrupted increases in global import intensity, the crisis – with its precipitous drop in trade – brought with it the notion of "peak trade." The analysis in Timmer et al. (2016), using the World Input Output Database (WIOD), argues that the emergence of global value chains, with their fragmentation of international production, looks to have reached its peak, with global demand shifting to less trade-intensive goods and services and with technology making reshoring of production economically feasible.

On top of the possible break in trend, Brexit and the election of Donald Trump in the United States have brought change, at least in prospects, to pro-trade policy. To further heighten the uncertainty, some analysts contend that the claim of a slow-down in trade as a share of GDP may be premature, and that enough signals point to further intensification (Tomb and Trivedi, 2017). There are sufficient reasons to suspect that firms, especially those that are globally active, may take a wait-and-see attitude towards large investments.

The EIBIS-Orbis data can shed some light on the issue. The EIBIS has a question on whether the firm is an exporter as well as a question on how the firm expects its investment to be impacted (positively or negatively) by Brexit. In addition, the EIBIS-Orbis matched dataset contains information on revenue from exporting and whether the firm is part of a multinational group.

Table 8 looks at whether the uncertainty question of the EIBIS might be measuring some form of uncertainty related to globalisation. The first three columns of Table 8 show the average response of firms, split across firms by characteristics related to trade. The next three columns show the weighted-average firm response, using investment weights. The globalisation characteristics considered are export status, export intensity and the perceived impact of Brexit on investment.

Internationally oriented firms are less concerned with the impact of uncertainty on their investment.

The percentage of exporting firms that report that uncertainty is a major impediment is lower than for firms overall. Conditional on exporting, firms with high or low export intensity show a similar pattern to that of exporting versus non-exporting firms, with a lower percentage of high-export firms regarding uncertainty as a major impediment. Nevertheless, among firms with high export intensity uncertainty is seen as a major impediment by firms that invest a lot (Table 8, column 5).

The effects of Brexit on uncertainty are a bit more subtle: firms that see a positive effect of Brexit as well as those that see a negative effect from it perceive a major impediment from uncertainty.¹¹

From the investment-weighted response, among the firms that think that Brexit will have a negative impact on their activity, 80% of total investment is made by firms that consider uncertainty to be a major impediment.

Table 8 Uncertainty and innovation

Category	Average			Investment-weighted average		
	Major	Minor	No	Major	Minor	No
Firms overall	42.98	34.83	22.19	30.32	33.91	35.77
Exporter	37.85	38.52	23.63	43.38	31.12	25.50
Non-exporter	47.60	31.44	20.96	19.01	36.32	44.68
High-intensity	41.21	31.66	27.14	67.40	21.72	10.88
Low-intensity	51.62	28.29	20.09	27.04	62.44	10.52
Brexit negative	49.58	33.80	16.62	79.45	10.90	9.65
Brexit positive	45.98	31.03	22.99	34.04	41.73	24.23

Source: EIBIS2016 and authors' calculations.

Note: High and low intensity refer to the export intensity of exporters, where high and low are above and below the median of the export-to-sales ratio, conditional on exporting. Brexit negative and positive are derived from the answers to a question about the impact of Brexit on firms' investment activity.

Table 9 shows the investment-to-sales ratio in 2015 from the EIBIS panel. It first shows the ratio for all firms, and for all firms split by industry or by EU region. The next columns show the investment-to-sales ratio for exporters and non-exporters and for high export-intensity versus low export-intensity firms. The table also shows the bivariate split across firms that state that Brexit would positively or negatively affect investment.

Exporters have lower investment-to-sales ratios than non-exporting firms (11% versus 17%). Further, among exporters, the investment-to-sales ratio is lower among firms with higher export intensity. This

¹¹ We omit the category of firms stating that Brexit would have no impact on their investment.

may seem surprising, but it is not inconsistent with recent findings about differences between the two types of firms. Exporters are much larger and more productive than non-exporters, but also have much higher levels of intangible investment. Intangibles allow for the scaling-up of production and sales without increasing capital stocks proportionately, because intangibles are non-rival in production.

Overall, the investment-to-sales ratio does not differ between those who consider Brexit a positive event for investment and those who consider it a negative event. However, for both groups, the investment-to-sales ratio is lower than for those firms that consider Brexit to be unimportant. Related to the point above, it is likely that the firms with a strong opinion on the effects of Brexit are involved in exports, and thus have lower investment-to-sales ratios. Furthermore, in agreement with the results in Table 8, it is possible that the investment-to-sales ratio is also held back owing to the increased upside or downside risks following Brexit.

Table 9 Investment-to-sales ratio and globalisation, 2015

Category	Overall	Exporter		Export intensity		Brexit impact	
		No	Yes	High	Low	Negative	Positive
Firms overall	0.13	0.16	0.11	0.09	0.14	0.11	0.11
Manufacturing	0.13	0.35	0.08	0.08	0.12	0.07	0.12
Electricity and gas	0.44	0.43	0.61	n.a.	0.13	0.57	0.01
Water supply	0.36	0.41	0.15	0.08	0.46	0.16	0.53
Construction	0.09	0.07	0.16	0.03	0.06	0.08	0.05
Trade	0.07	0.04	0.09	0.06	0.04	0.05	0.02
Transportation	0.16	0.16	0.16	0.12	0.14	0.20	0.12
Accommodation	0.14	0.12	0.23	0.28	0.17	0.21	0.08
Information and communication	0.18	0.30	0.07	0.02	0.91	0.06	0.02
Cohesion	0.11	0.14	0.08	0.09	0.15	0.10	0.14
Other EU	0.20	0.23	0.17	0.06	0.06	0.12	0.07
Periphery	0.09	0.11	0.07	0.18	0.16	0.10	0.01

Source: EIBIS2016, ORBIS, and authors' calculations.

Note: High and low intensity refer to the export intensity of exporters, where high and low are above and below the median of the export-to-sales ratio, conditional on exporting. Brexit negative and positive are derived from the answers to a question about the impact of Brexit on firms' investment activity.

Uncertainty and resource flexibility

As firms alter their level of inputs, they incur adjustment costs. Uncertainty about these adjustment costs can affect investment. Considerable adjustment costs occur both for changing the size and composition of the capital stock (Cooper and Haltiwanger, 2006) and for changing the number and type of employees (Hamermesh and Pfann, 1996).¹² The underlying sources of the adjustment costs are varied, ranging from the policy environment (affecting the degree of financial constraints or employment protection) to costs inherently associated with the nature of production, such as the costs of purchasing, configuring and installing capital or costs of matching workers with vacancies. Measures taken to reduce such adjustment costs will increase the sensitivity of input demand to fluctuations in business conditions, whether they arise from the supply or demand side. In other words, reducing adjustment frictions will not only increase average investment rates, but also reduce the inaction of firms that occurs when they are faced with uncertainty.

¹² Adjustment costs in labour can affect investment demand indirectly through interrelated factor demand.

The EIBIS question explicitly asks whether firms see uncertainty as an impediment to investment. Firms that answer in the negative are either facing little uncertainty or are in a position to undertake investment despite the uncertainty because their adjustment costs are low or the irreversibility of their investment is low. To explore this issue, proxies are needed for uncertainty as well as for resource flexibility in order to see if a negative answer to the EIBIS question happens more often with firms with high flexibility and low uncertainty than it does with firms with low flexibility and high uncertainty. Proxies for uncertainty are the aforementioned volatility of dispersion of productivity growth (π^y and π^x) or industry-level volatility in downstream demand (q^x). The measures of volatility of own-sales growth or employment reallocation cannot be used as a proxy for uncertainty, as they depend both on fluctuations in business conditions and on resource flexibility. Proxies for resource flexibility at the firm level could be related to the ratio of materials to sales. At the industry-country level, we can estimate the elasticity of input growth to downstream conditions as a measure of flexibility. Finally, we can look at country-time specific regulatory indicators, such as the OECD employment protection indicator, as a measure of resource flexibility.

In countries with high employment protection or high bankruptcy costs, the share of firms perceiving uncertainty to be a major impediment is noticeably higher, while the share of firms that do not consider uncertainty to be an impediment is much lower. Table 10 presents the distribution of firms or investment across responses to the uncertainty question from the EIBIS, split across the rows according to proxies for resource flexibility. When considering the distribution of investment across firms based on the answer to the uncertainty question, employment protection does not seem to matter, but there is much more investment in firms perceiving a major impediment in countries with high bankruptcy costs. The material-to-sales ratio, which was considered a proxy for the ability of a firm to shift demand fluctuations down the supply chain, does not seem to affect the perception of uncertainty.

Table 10 Uncertainty and resource flexibility

Category	Average			Investment-weighted average		
	Major	Minor	No	Major	Minor	No
Overall	42.98	34.83	22.19	30.32	33.91	35.77
High EPL	48.87	30.51	20.61	26.24	46.54	27.22
Low EPL	32.67	42.23	25.10	28.85	26.49	44.66
High bankruptcy costs	48.66	32.47	18.87	59.27	23.47	17.26
Low bankruptcy costs	32.74	39.07	28.19	20.66	37.40	41.94
High materials-to-sales ratio	37.62	37.72	24.66	23.27	43.01	33.72
Low materials-to-sales ratio	39.09	38.24	22.66	27.80	13.29	58.91

Source: EIBIS2016, OECD, World Bank and authors' calculations.

It would be useful to shed more light on the interaction between investment, uncertainty and adjustment costs. To the extent that the perceived uncertainty as measured by the EIBIS is correlated with the proxy measures, one would expect the correlation to be lower when resource flexibility increases. However, the flexibility measures may themselves be indicative of an uncertain environment. Further research and modelling will be needed to disentangle the various mechanisms.

Conclusion and policy implications

Many studies, including this one, find that uncertainty is associated with lower investment. Uncertainty may originate from a wide range of sources, many of which are outside the control of policymakers. This limits the scope for policy to boost investment through this channel. Nonetheless, certain policies can be used to target specific types of uncertainty to encourage investment.

The empirical evidence presented in this chapter from the EIBIS and other micro and sector-level data show that firms face considerable uncertainty regarding the future path of demand, technology, and output and input market conditions. While the link between indicators that proxy for these sources of uncertainty and subjectively perceived uncertainty at the firm level are not strong, they generally are positively correlated. Further, investment at the firm level is seen to respond not only to market fundamentals but also to these sources of uncertainty.

Turning to policy, we start with uncertainty in input markets: credit-constrained firms are substantially more likely to cite uncertainty as impeding their investment activity. This implies that uncertain access to finance is an impediment to investment. While improving access to finance is usually a policy priority around the world, it is particularly important to address problems with access to finance in times of heightened uncertainty. Further, policy should strengthen the ability of the financial system to allocate credit based on the fundamentals of the firm's return on investment.

Resource flexibility is seen to be intricately tied to uncertainty and its effect on investment. Structural reform policies that make reallocation of labour and capital less costly will increase the resilience of firms to shocks and thereby reduce the wait-and-see attitude that uncertainty can have on investment. For example, reforming entry regulations, streamlining bankruptcy proceedings and lowering firing costs all reduce the irreversibility of firm-level decisions. In this regard, any policies that can reduce the option value to firms of waiting will reduce the link between uncertainty and investment. For example, clearly laying out time paths for policy changes and committing to these reforms will reduce the value to firms of waiting until updated information on policy becomes available.

Globalisation potentially has large positive economic effects by increasing access to markets for outputs, but it has also generated difficulties and uncertainties for different groups of firms and individuals. Those who have adapted to globalisation, like exporters, are much less likely to perceive uncertainty as impeding their investment activity. Exporters are typically larger and more productive than purely domestic firms, so while exporters perceive uncertainty to be an impediment less often than other firms, more investment is at stake on aggregate. Since the Brexit vote, uncertainty has increased, both for firms that expect positive outcomes from Brexit and for firms that expect negative outcomes. Again, for these firms the aggregate volume of investment at stake is much larger than for firms that do not have strong perceptions about the effect of Brexit on investment. As yet there are no clear policy options to improve the situation outside the current and future EU, but further strengthening of internal markets and implementing clear and forward-looking policy regarding global trade could improve the outlook for large, productive EU firms.

Policy that supports investment in intangibles, R&D and worker training not only boost activity aimed at improving future productive inputs in general, but can also indirectly reduce the sensitivity of investment to future uncertainty. Innovation and uncertainty go hand in hand. Yet innovation is at the heart of increases in economic well-being. The analysis indicates that firms with higher stocks of intangible capital are less likely to perceive uncertainty as impeding their investment activities. For firms undertaking innovative investments, coping with technological uncertainty is exactly their area of expertise. Coping with the uncertainty of future demand, especially in areas with strong social aspects such as health care for the ageing or clean energy, often falls outside the expertise of the firm. It is in this area that targeted innovation policy – for example, in the form of innovation prizes or large “moonshots” – could both lower investment costs and reduce future market uncertainty.

A system of pro-cyclical fund-raising and counter-cyclical investment spending from a pre-prioritised and authorised ledger of projects could have a stimulating effect on investment without negative consequences for expectations of sustainability. Macroeconomic uncertainty remains a very difficult area for policy to resolve. The analysis in this chapter has shown that regional differences in uncertainty are quite large. Macroeconomic circumstances still differ considerably across EU regions and this affects uncertainty and investment intensity to a great extent. Traditional macroeconomic stimulus, such as deficit spending, can actually exacerbate uncertainty. Thus a permanent mechanism that is automatically activated in the event of negative economic shocks should be an improvement.

References

- Akerlof, G. (1970). "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism." *The Quarterly Journal of Economics*, 84(3), 488–500.
- Baker, S., Bloom, N. and Davis, J. (2016). "Measuring Economic Policy Uncertainty." *The Quarterly Journal of Economics*, 131(4), 1593–1636.
- Bartelsman, E., Gautier, P. and De Wind, P. (2016). "Employment Protection, Technology Choice, and Worker Allocation." *International Economic Review*, 57(3), 787–826.
- Bernanke, B. (1979). "Long-Term Commitments, Dynamic Optimization, and the Business Cycle." Doctoral dissertation, Massachusetts Institute of Technology.
- Bloom, N. (2007). "Uncertainty and Investment Dynamics." *The Review of Economic Studies* 74 (2): 391–415.
- Cooper, R. and Haltiwanger, J. (2006). "On the Nature of Capital Adjustment Costs." *The Review of Economic Studies*, 73(3), 611–633.
- Hamermesh, D. and Pfann, G. (1996). "Adjustment Costs in Factor Demand." *Journal of Economic Literature*, 34(3), 1264–1292.
- Kalemli-Ozcan, S., Sorensen, B., Villegas-Sanchez, C., Volosovych, V. and Yesiltas, S. (2015). "How to Construct Nationally Representative Firm-Level Data from the ORBIS Global Database." NBER Working Paper No. 21558, National Bureau of Economic Research, Cambridge, MA.
- Knight, F. (1921). "Risk, Uncertainty and Profit." Boston: Hart, Schaffner & Marx; Houghton Mifflin Co.
- Timmer, M., Los, B., Stehrer, R. and de Vries, J. (2016). "An Anatomy of the Global Trade Slowdown Based on the WIOD 2016 Release." GGDC Research Memorandum 162, University of Groningen. <http://www.ggdc.net/publications/memorandum/gd162.pdf>.
- Tomb, I., and Trivedi, K. (2017). "'Peak Trade' Is Premature." VoxEU.org. September 14. <http://voxeu.org/article/peak-trade-premature>.

Chapter 9

How to get young SMEs to drive innovation in Europe

Chapter at a glance

This chapter identifies five different innovation profiles for EU firms based on their R&D investment and innovation activities: basic, adopters, developers, incremental innovators, and leading innovators.

- *Basic firms – that is, firms that do not engage in any type of innovation – are more common among young small and medium-sized enterprises (SMEs), while innovators are more often old and large firms.*

To further explore why young SMEs are not more active in innovation, this chapter analyses the impact of structural impediments, highlighting the fact that business regulations, availability of skills, and access to finance play a role in SME innovativeness.

- *Innovative firms tend to be more severely affected by structural obstacles to investment.*
- *SMEs use less external finance than large firms.*
- *Innovative firms are more likely to rely on external finance. Among them, leading innovators receive more grants, confirming the importance of this instrument for innovation policy in the EU.*

When looking at access to external finance, this chapter finds that SMEs, and in particular young SMEs, are more credit-constrained than large or old firms. In addition, innovators, especially leading innovators, are more credit-constrained than basic firms.

Overall, the analysis confirms the missing role of young SMEs as leading innovators. This may explain the gap in business R&D investment between the EU and the US.

The role of SMEs in economic performance and innovation

There is an ongoing debate in policy and academic circles about which firms matter most for job creation and growth, with answers ranging from a few large stars or unicorns to the glitter of many young small firms with high growth potential (see Haltiwanger et al., 2010, and Calvino et al., 2016, for an overview of the different positions). The interest in small firms is no surprise. Small and medium-sized enterprises (SMEs) are not only a large part of the economy but also, almost by definition, at the heart of the Schumpeterian process of creative destruction, since most new firms are small, as are most of the exiting firms (Bravo-Biosca, 2017).

Young SMEs need to be able to grow. However, high shares of SMEs in entry into and exit from the marketplace should not unto itself be equated with the conditions for a successfully functioning Schumpeterian growth process. The core of the growth potential of a Schumpeterian business process lies in the presumption that those small entrants bring to the market better-performing business practices, processes or products, and can grow to become large successful entities that challenge the value-creation abilities of incumbent firms, small and large alike, and induce them to adopt similar or even better innovations to improve their operations.

What is needed is the right type of churning – one where the successful entrants can grow out of SME status and the failing firms can restructure or exit. It is also important that the successful entrants have access to adequate finance. If it is true that entrants are most often SMEs, there is no reason to expect or wish that they remain so. There are concerns that this churning process may be hampered in the EU. Bravo-Biosca (2017) shows that EU countries have a larger share of static firms compared to the US – that is, firms that do not grow or shrink – and that this correlates with lower aggregate productivity growth for EU economies.

Innovative young SMEs also need to be able to grow. When looking at innovation as a source of successful churning and growth, young, small firms are even more promising actors in the Schumpeterian dynamics. Young small firms may have a key role in creating new ideas, developing them into successful innovations, and becoming world-leading frontier firms. In his early works, Joseph Schumpeter emphasised the role of new entrepreneurs entering niches of markets. By introducing new ideas and by innovating, these entrepreneurs challenged existing firms through a process of “creative destruction,” which was regarded as the engine behind economic progress (Schumpeter, 1939). This was later labelled as Schumpeter’s Mark I model (Malerba and Orsenigo, 1995). In later works, Schumpeter (1942) mainly paid attention to the key role of large firms as engines of economic growth in terms of accumulating non-transferable knowledge in specific technological areas and markets, which became known as Schumpeter’s Mark II model.

The advantage of small new firms holds particularly for more radical innovations that disrupt existing positions. Incumbent firms are more reluctant to be engaged in such innovations because they want to avoid the cannibalisation of their existing profits and are often trapped in incumbent expertise (Henderson, 1993). Thus, a lack of small new innovators may reduce the introduction of more radical breakthrough innovations that lay the foundations for completely new markets. It may also reduce the innovativeness of incumbent firms because they miss out on the challenge to adopt the latest innovations to escape competition, and they miss the opportunity to acquire and further improve on small firms’ ideas.

The lack of fast-growing SMEs in leading innovation sectors in the EU may explain the gap in business R&D investment with respect to the US. There are concerns that the Mark I “creative destruction” model is less at play in the EU innovation landscape, where a larger share of innovation activities are concentrated in older firms and sectors. The lack of concentration of innovators in new sectors and new firms, particularly in digital technologies, goes a long way to explaining the persistent business R&D deficit gap of the EU compared to the US (Cincera and Veugelers, 2014). There are also

concerns that adoption of the latest innovations may be hampered in Europe. Recent work by the Organisation for Economic Co-operation and Development (OECD) shows an increasing divide in productivity performance between leading and following firms, consistent with a lack of incentives and/or capabilities to adopt the latest innovations by non-leading firms (Andrews et al., 2016).

This chapter uses evidence from the EIB Investment Survey (EIBIS) to characterise the involvement of the whole spectrum of businesses in investing in innovations in Europe. The analysis will look not only at SMEs versus large firms, but also single out younger versus older firms within each group. For their innovation profile, it will characterise both how active firms are in adopting the latest innovations, as well as how active they are in creating new innovations, which can be represented either by incremental improvements to their existing offerings or more drastic innovations that are new to the market. This analysis will make it possible to better characterise whether the Schumpeterian creative destruction process in Europe pertains more to the Mark I model, the Mark II model or both. It will also improve the diagnosis of any possible European innovation and adoption deficits. Which types of firms have innovation deficits? Old or young SMEs? Large or young incumbents?

The chapter then looks at the barriers to investment that different types of firms may face. The discussion focuses on access to external finance, as this has been identified in the literature as a major barrier in particular for small, young firms, and particularly those undertaking more drastic innovations. The chapter concludes with some policy suggestions.

Characterising the innovative strategies of young and/or small firms

EIBIS covers firms of all sizes and ages in all sectors and all EU Member States. This chapter makes use of the EIBIS 2016 results. The sample used for the analysis includes 8,900 firms, of which 7,450 (or 84%) are SMEs and 16% are less than 10 years old.¹ Among SMEs, 18% are less than 10 years old, while only 7% of large firms are less than 10 years old. This is consistent with young vintages being more likely to be (still) small-scale, and with entrants typically being SMEs. It also reflects the difficult road for young firms to rapidly grow out of SME status, resulting in only a few larger firms (with more than 250 employees) younger than 10 years old.

Countries with high shares of SMEs include the Baltics, Ireland, Slovakia and Slovenia. Countries with below-average shares of young firms among their SMEs include Spain, Ireland, Austria, Belgium and Germany. The sectoral distribution of firms in the sample is spread across manufacturing (29%), construction (22%), infrastructure (26%), and services (23%). The sample contains firms from both innovation-leading as well as innovation-lagging countries: 46% of firms are from innovation-leading countries and 54% from innovation-lagging countries.² Overall, the sample is sufficiently broad in its sectoral and geographic coverage to also cover firms with non-leading innovation profiles.

This analysis identifies five firm profiles based on their R&D investment and innovation activities: basic, adopting, developers, incremental innovators, and leading innovators. When identifying innovation profiles, it should be recognised that many firms do not engage in any type of innovation – that is, they neither develop innovations themselves nor adopt innovations already developed elsewhere. These companies are listed as “basic”.

¹ There are very few firms in the sample that are start-ups: less than 1% are younger than two years old and 4.5% are between two and five years old. The low number of very young firms in EIBIS is partly due to the sampling design of the survey, which is based on firms that provided information on their balance sheet and profit and loss account in the year before the interview.

² Innovation-leading and innovation-lagging countries are defined based on the European Commission's European Innovation Scoreboard. Innovation-leading countries include “innovation leaders” and “strong innovators” (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, Netherlands, Slovenia, Sweden and the United Kingdom), while innovation-lagging countries include “moderate innovators” and “modest innovators” (Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia and Spain).

Even within the group of firms involved in innovating, there are differences in innovation profiles. Most of the firms have a low innovation profile – that is, they are not engaged in costly and risky investments in research and development (R&D) themselves, but they do nevertheless regularly implement existing innovations that are new to their firm. These companies are listed as “adopters.” Examples of important process innovations that firms can adopt revolve around digital technology innovations.

Another part of the business ecosystem is more innovative, ranging from being involved in their own R&D activities to, if successful, generating innovations that improve on existing technologies and products. Those that are not (yet) successful are listed as “developers.” Those that are successful are “innovators,” but that designation is broken down into two categories. Most of these improvements will be incremental improvements, although R&D investments may occasionally also generate more drastic innovations that lay the foundations for completely new applications. Thus there are two groups of “innovators”, depending on which type of innovations they introduce: “incremental innovators” and “leading innovators.”

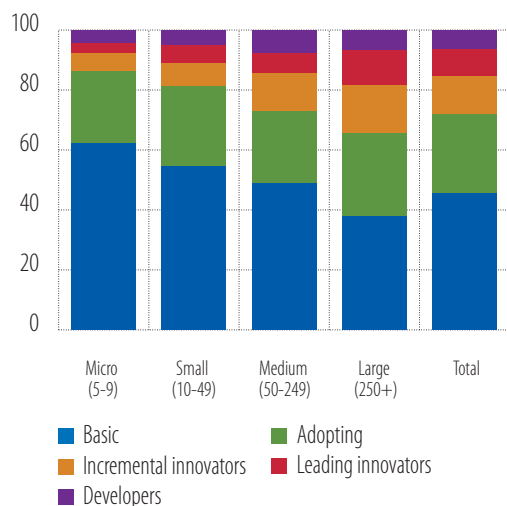
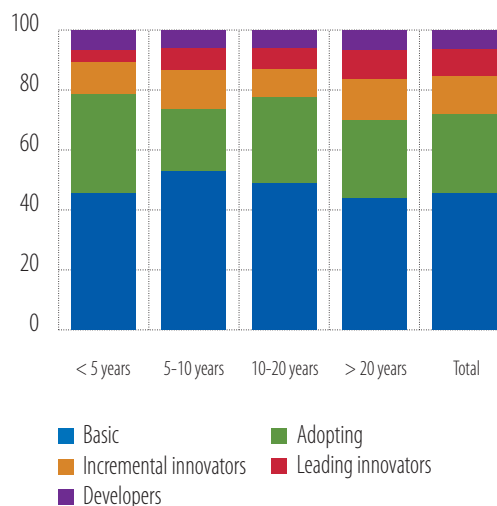
Figure 1 summarises the classification of firm profiles. Although there may be only a handful of leading innovators engaged in introducing drastic innovations, these are pivotal actors in the innovation growth story, as they lay the foundations for new markets and technologies that others can adopt and further improve. Results using EIBIS confirm the highly skewed innovation profile of the EU business ecosystem: 78.5% of firms report no (substantial) R&D, 58% did not introduce any innovation, and of those that introduced innovations, only 30% introduced innovations that were new to the market. Thus, 52% of the firms in the sample were basic, 26% were adopters, 5% were developers, 9.5% were incremental innovators, and 6.5% were leading innovators.

Figure 1 Innovation profiles

R&D expenditures	Active	5.3% Developers	9.5% Incremental innovators	6.5% Leading innovators
	Inactive	52.2% Basic	26.2% Adopting	
		No	New to the company	New to the market or globally new
Developing new products				

Source: EIBIS16, for fiscal year 2015.

Note: The development of new products is based on questions 18 and 19 of EIBIS, namely “Q18. What proportion of the total investment was for developing or introducing new products, processes or services?” and “Q19. Were the new products, process or services (A) new to the company, (B) new to the country, (C) new to the global market?” R&D activity is defined as firms reporting substantial R&D (amounting to at least 0.1% of firm turnover).

Figure 2 Innovation profiles and firm size (weighted percentages)**Figure 3** Innovation profiles and firm age (weighted percentages)

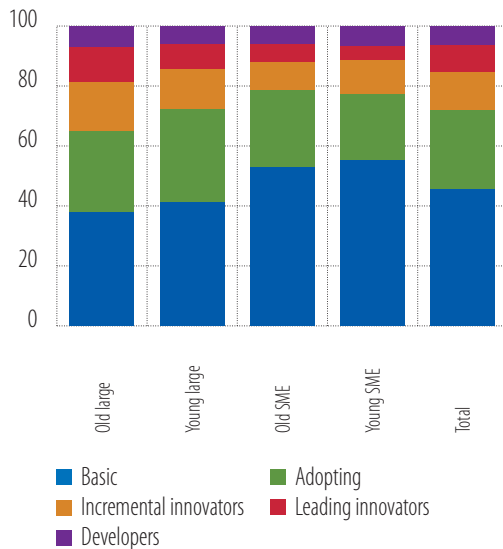
Source: EIBIS16 for fiscal year 2015.

Note: The innovation profiles are defined as in Figure 1.

Basic firms are more common among young SMEs, while innovators are more often old, large firms; this might be evidence of the weak contribution of young SMEs in the EU to the process of creative destruction. Figure 2 shows that the share of basic firms is much higher among SMEs, particularly the small and micro firms, which also have a low share of leading innovators. Leading innovators are overrepresented in the group of large firms. This is a first piece of evidence in favour of Mark II rather than Mark I of Schumpeterian dynamics. When looking at the age profile of companies, there are only small differences in innovation (Figure 3). Young firms are not significantly more likely to be introducing innovations that are new to the market or incremental improvements, compared to older cohorts. They are also not more likely to be adopting existing innovations. This is further evidence against Mark I in the EU.

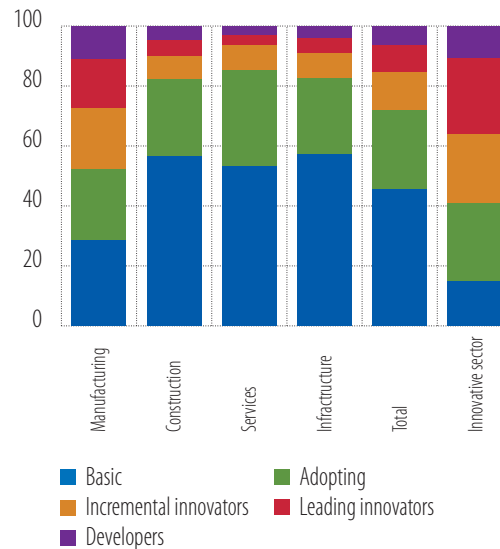
Figure 4, combining firm age and firm size, further illustrates the weakness of the Mark I regime in the EU. Young SMEs are more likely to be basic and less likely to be leading innovators, compared to the average, but even compared to old SMEs. They are only marginally more likely to be actively pursuing R&D compared to old SMEs. Although young large firms are less likely to be basic and more likely to be leading innovators compared to the average, they are less likely to be leading innovators compared to older large firms.

Box 1 reports results from the 2012–14 wave of Eurostat’s Community Innovation Survey (CIS) and provides further evidence of large firms being more engaged in innovation than SMEs. The CIS asks about four types of innovation: organisation innovation, product innovation, marketing innovation and process innovation. Large enterprises are twice as likely as SMEs to introduce each of the four types of innovation. Unfortunately, the CIS survey does not make it possible to differentiate old and young firms.

Figure 4 Innovation profiles and size-age groups (weighted percentages)

Source: EIBIS16 for fiscal year 2015.

Note: Young (old) firms are less (more) than 10 years old. SMEs (large firms) have fewer (more) than 250 employees. The four size-age categories are formed by combining the age and size categories. The innovation profiles are defined as in Figure 1.

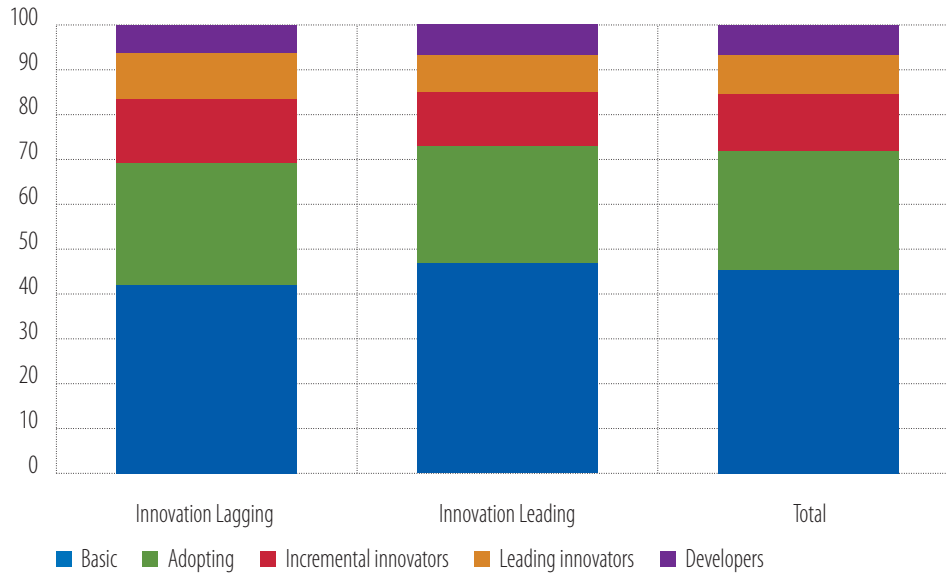
Figure 5 Innovation profiles and sectors (weighted percentages)

Source: EIBIS16 for fiscal year 2015.

Note: The innovative sectors are identified based on the OECD definition of innovative sectors. The classification is based on NACE Rev. 2 at the four-digit level. The innovation profiles are defined as in Figure 1.

Firms in the manufacturing sector are on average more engaged in innovation. Whether or not and how firms will be innovative is sensitive to the opportunities and challenges of the sectoral and national innovation system in which they operate. Figure 5 shows that firms in manufacturing are more likely to be R&D active. This holds particularly in the high-tech segments of manufacturing. Firms in infrastructure, construction and services are more likely to be basic. Firms in services are more likely to be adopters rather than being R&D active. Figure 6 shows no marked differences between innovation-leading and innovation-lagging countries in the innovation profiles of their firms. But this is because there is substantial heterogeneity across countries within each group, as shown in Figure 7, panels a and b.

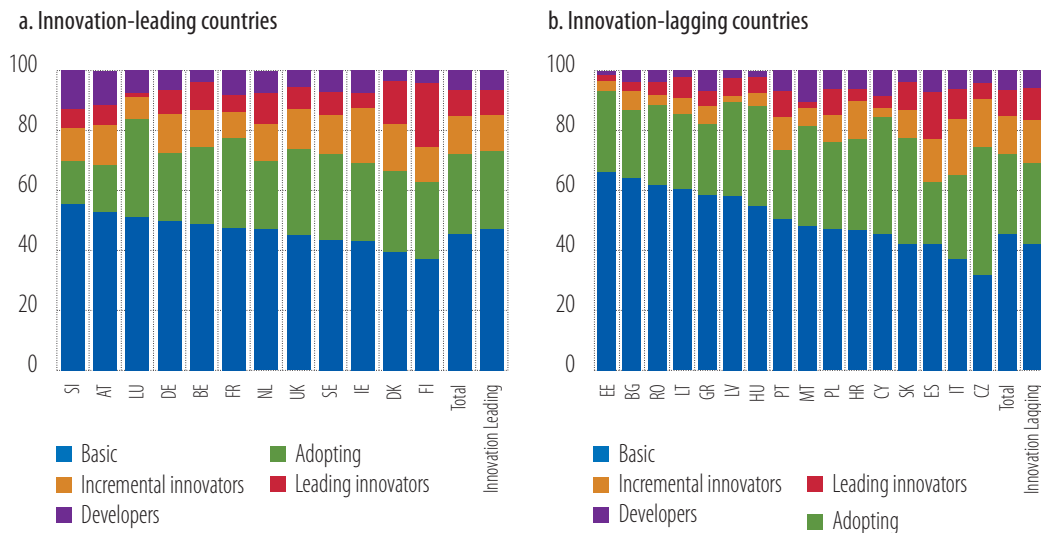
Figure 6 Innovation profiles in innovation leading and lagging countries



Source: EIBIS16 for fiscal year 2015.

Note: Innovation-leading and innovation-lagging countries are defined based on the European Innovation Scoreboard. The innovation profiles are defined as in Figure 1.

Figure 7 Innovation profiles in innovation-leading and innovation-lagging countries (weighted percentages)



Source: EIBIS16 for fiscal year 2015.

Note: Innovation-leading and innovation-lagging countries are defined based on the European Innovation Scoreboard. The innovation profiles are defined as in Figure 1.

Large firms are more likely to innovate than SMEs, suggesting a missing role for young firms in innovation in the EU. A multivariate analysis makes it possible to control for sectoral and country-specific effects that might be driving the innovation profile of firms. Table 1 presents the results of a multinomial analysis assessing the likelihood that the different age-size groups of firms pertain to any of the innovation profiles (adopting, incremental innovator, leading innovator, developer) relative to a basic innovation profile, controlling for sector and country of the firms. The multivariate results confirm that both young and old SMEs are less likely to be involved in innovation compared to old, large firms, for any innovation profile.

The results also confirm that young SMEs are not significantly different from old SMEs in terms of innovation profiles. Overall, Table 1 confirms the descriptive results that firm age does not seem to matter significantly for characterising the innovation profile of firms. This implies that young firms – most of which are small firms, but even if they are larger – are not more likely to be adopting the latest innovations, nor are they creating and/or introducing their own innovations, particularly more radical innovations that are new to markets. Old, large firms are the most likely innovators, especially leading innovators, confirming that the EU innovation system is more characterised as a Schumpeter “accumulative” Mark II rather than a “creative destruction” Mark I, on average. The analysis confirms the missing role of young firms with more drastic innovations for new markets in the EU innovation landscape.

Table 1 Innovation profiles and size-age group (multinomial logit)

	Adopting	Incremental innovators	Leading innovators	Developers
Young large	0.04 (0.05)	-0.03 (0.03)	-0.04 (0.02)	35.47 (0.02)
Old SME	-0.03* (0.01)	-0.04*** (0.01)	-0.04*** (0.01)	-0.01 (0.01)
Young SME	-0.03 (0.02)	-0.03** (0.01)	-0.04*** (0.01)	-0.01 (0.01)
Number	8,900	8,900	8,900	8,900

Source: EIBIS16 for fiscal year 2015.

Note: The table reports marginal effects from a multinomial logistic regression. Standard errors are reported in parentheses. The innovation profiles are defined as in Figure 1. The base outcome is basic. Young (old) firms are less (more) than ten years old. SMEs (large firms) have fewer (more) than 250 employees. The four size-age categories are formed by combining the age and size categories. The reference category for size-age groups is old and large. Country and sector fixed effects are included. The regression is based on non-weighted firm-level data. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Impeded access to finance, burdensome business regulations and other obstacles faced by innovative young and/or small firms

The various obstacles that firms of different innovation profiles may face are further explored. EIBIS asks firms nine questions about long-term obstacles to investment. Table 2 shows that the three profiles of firms that develop new products – adopting, incremental and leading innovators – are more likely to report that all nine obstacles are more severe barriers to investment compared to basic firms. In line with the findings of Schneider and Veugelers (2010), availability of staff with the right skills is more likely to be an impediment for firms with the three innovative profiles. Similarly, the probability of experiencing regulatory burdens – both labour market and business regulations – is higher for adopting, incremental and leading innovators.

The problem of access to finance is greater for innovators, especially leading innovators. For a given innovation strategy, firm size and age also matter in relation to obstacles. Business regulations are more significant barriers for SMEs. Young SMEs, in particular, are significantly more likely to perceive access to finance as a barrier. Overall, young SMEs with a leading innovation profile have the highest probability of rating access to finance as a barrier.

Table 2 Obstacles to investment and innovation profiles

	Demand for product or service	Availability of staff with the right skills	Energy costs	Access to digital infrastructure	Labour market regulations	Business regulations and taxation	Adequate transport infrastructure	Availability of finance	Uncertainty about the future
Young large	-0.03 (0.05)	0.02 (0.04)	-0.01 (0.05)	-0.03 (0.05)	0.07 (0.05)	0.09* (0.05)	0.04 (0.05)	0.09* (0.05)	-0.03 (0.05)
Old SME	-0.02 (0.01)	-0.01 (0.01)	0.02 (0.01)	0.01 (0.01)	0.04*** (0.01)	0.05*** (0.01)	-0.01 (0.01)	0.07*** (0.01)	-0.02 (0.01)
Young SME	-0.08*** (0.02)	0.00 (0.02)	-0.02 (0.02)	-0.02 (0.02)	0.02 (0.02)	0.04** (0.02)	-0.02 (0.02)	0.10*** (0.02)	-0.08*** (0.02)
Adopting	0.04*** (0.01)	0.06*** (0.01)	0.05*** (0.01)	0.05*** (0.01)	0.06*** (0.01)	0.04*** (0.01)	0.07*** (0.01)	0.04*** (0.01)	0.02** (0.01)
Incremental innovators	0.08*** (0.02)	0.08*** (0.02)	0.08*** (0.02)	0.07*** (0.02)	0.09*** (0.02)	0.08*** (0.02)	0.07*** (0.02)	0.03* (0.02)	0.05*** (0.02)
Leading innovators	0.05** (0.02)	0.09*** (0.02)	0.02 (0.02)	0.06*** (0.02)	0.08*** (0.02)	0.09*** (0.02)	0.04* (0.02)	0.08*** (0.02)	0.03* (0.02)
Developers	-0.02 (0.02)	0.04 (0.02)	0.01 (0.02)	-0.01 (0.02)	0.02 (0.02)	0.04* (0.02)	-0.01 (0.02)	0.00 (0.02)	-0.02 (0.02)
Observations	8,755	8,846	8,839	8,744	8,775	8,812	8,788	8,801	8,752
(Pseudo) R2	0.05	0.05	0.08	0.06	0.05	0.07	0.06	0.06	0.08

Source: *EBIS16 for fiscal year 2015.*

Note: The table reports marginal effects from logistic regressions. Standard errors are reported in parentheses. The dependent variables are indicator variables equal to 1 if a firm considers a category to be a minor/major obstacle to investment ("Q38: Thinking about your investment activities, to what extent is each of the following an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all?"), and zero otherwise. Young (old) firms are less (more) than 10 years old. SMEs (large firms) have fewer (more) than 250 employees. The four size-age categories are formed by combining the age and size categories. The reference category for size-age groups is old and large. The innovation profiles are defined as in Figure 1. The reference category for innovation profiles is basic. Country and sector fixed effects are included. The regression is based on non-weighted firm-level data. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Young SMEs, especially those that are introducing more radical innovation, are more financially constrained. Although innovating firms face myriad obstacles, as shown in Table 2, the most frequently discussed explanation for the differences in dynamic structure between Europe and the US is a greater willingness on the part of US financial markets to fund the growth of new companies with more radical projects in new sectors (O'Sullivan, 2005). With innovation investments typically generating large and uncertain sunk costs, availability of internal and external finance is a critical issue for innovating firms (Czarnitzki, 2006). And with imperfect capital markets, firm size (or market power) may matter. Capital market imperfections are due to asymmetric information problems, which are exacerbated the more risky the investment is. Collateral and firm reputation help mitigate this problem.

Young SMEs with less collateral and less of a track record will face more financial barriers. Although larger firms may be financially constrained as well, they are less so than smaller firms. A large literature confirms the lack of access to finance as the major hampering factor for innovation, for all types of firms, but more for small than for large firms (Hall, 2002; Beck and Demirgüç-Kunt, 2006). In the context of access to finance, perhaps more important than firm size is the radicalness of the innovative project (of the leading innovators) and the effect of firm age, if they are combined in young leading innovators. Previous analysis of German Community Innovation Survey (CIS) data, which include information on firm age, confirms that small firms and R&D-intensive firms are more constrained by lack of internal and external funding, but that on top of this, young and highly R&D-intensive firms, which are the ones introducing more radical innovations, are even more financially constrained (Schneider and Veugelers, 2010; Gaspar et al., 2009; Revest and Sapio, 2012).

SMEs are less likely to use external finance than large firms. Firms with innovative projects are more likely to rely on external financing. The EIB survey allows an assessment of what type of financing firms are using for their investments (for investments in general, not for their investments in R&D specifically). Table 3 reports the results from a multivariate analysis on firm characteristics associated with the likelihood of financing investments with external sources. On average, firms finance 31% of their investment activities using external sources. The results in Table 3 confirm that SMEs are less likely than large firms to use external sources to finance their investments: that is, they rely more on internal sources. This holds as much for young SMEs as for old ones. With young firms having a shorter period of time to build internal sources, one would have expected a greater inclination for young firms to rely on external sources. For a given firm size and age, the results show at the same time that firms with innovative projects are more likely to rely on external financing, although that share of financing that is external is not necessarily higher. In particular, leading innovators with more radical innovative projects are more likely to use external sources of finance.

Leading innovators are more likely to receive grants. Among the different types of external finance, the category of grants represents an innovation policy instrument in EU countries for alleviating the access-to-finance obstacle for innovators. Figures 8 and 9 show the share of firms that receive grants for different size-age groups and innovation profiles. While the size and age profile of firms does not make a big difference for receiving grants, Figure 9 shows that leading innovators receive grants much more often than the other firms. The regression results support this finding. The last column of Table 3 shows that, in contrast to other forms of external funding, there is no bias for small or young firms in getting grants for their investment projects. Therefore, while grants do not seem to aggravate the external financing bias for these firms, neither are they significantly redressing it, for which a significant and stronger positive coefficients would be needed. The regression results also confirm that firms with innovative projects are more likely to get grants. This holds particularly for leading innovators.

The evidence so far shows the importance of external sources for financing, especially for leading innovating projects, with SMEs more likely to rely on internal funding. Thus, barriers to accessing finance may go a long way towards explaining why SMEs, and particularly young SMEs, are less likely to have leading innovating projects. Whether SMEs, and particularly young entrants, are more credit-constrained, particularly when they have more radical innovative projects, is further examined.

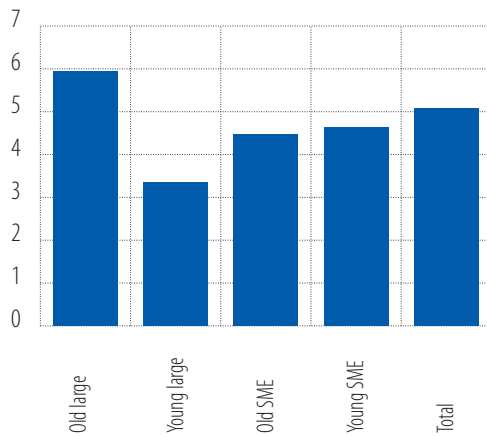
Table 3 External finance, grants and innovation profiles

	External finance	External finance % share	Grants
Young large	0.03 (0.06)	1.68 (4.39)	0.01 (0.03)
Old SME	-0.08*** (0.02)	-3.04** (1.26)	-0.01 (0.01)
Young SME	-0.07*** (0.02)	-3.06* (1.58)	-0.01 (0.01)
Adopting	0.07*** (0.01)	0.97 (0.99)	0.03*** (0.01)
Leading innovators	0.10*** (0.02)	-1.06 (1.75)	0.07*** (0.01)
Incremental innovators	0.07*** (0.02)	-1.58 (1.49)	0.04*** (0.01)
Developers	0.08*** (0.03)	3.07 (1.91)	0.04*** (0.01)
Observations	7,602	7,602	7,502
(Pseudo) R ²	0.04	0.07	0.10

Source: EIBIS16 for fiscal year 2015.

Note: The table reports marginal effects from logistic regressions (estimated coefficients from an ordinary least squares regression in column 2). Standard errors are reported in parentheses. The dependent variable is an indicator variable equal to 1 if a firm uses external finance, and zero otherwise (column 1); the share of investment financed by external sources (column 2); and an indicator variable equal to 1 if a firm uses grants, and zero otherwise (column 3). Young (old) firms are less (more) than 10 years old. SMEs (large firms) have fewer (more) than 250 employees. The four size-age categories are formed by combining the age and size categories. The reference category for size-age groups is old and large. The innovation profiles are defined as in Figure 1. The reference category for innovation profiles is basic. Country and sector fixed effects are included. The regression is based on non-weighted firm-level data. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

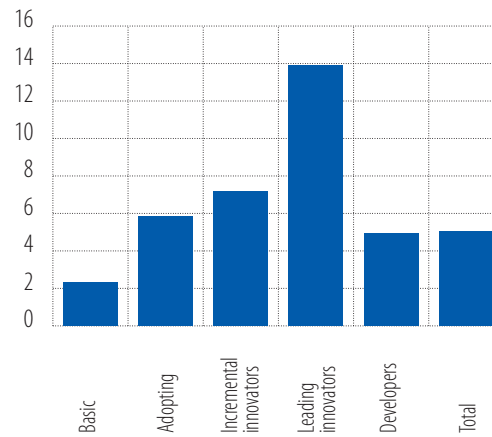
Figure 8 Grant use and size-age groups (weighted percentages)



Source: EIBIS16 for fiscal year 2015.

Note: The figure shows the weighted percentage of firms that use grants as a source of external finance. The size-age groups are defined as in Figure 4.

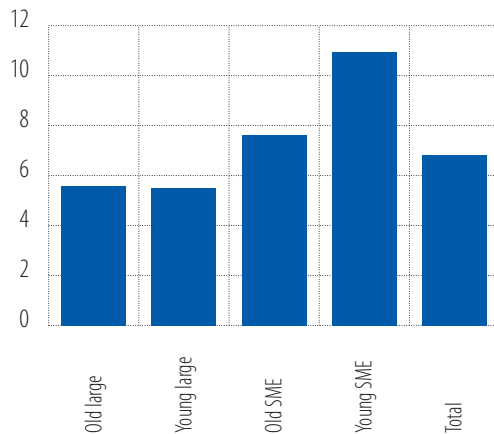
Figure 9 Grant use and innovation profiles (weighted percentages)



Source: EIBIS16 for fiscal year 2015.

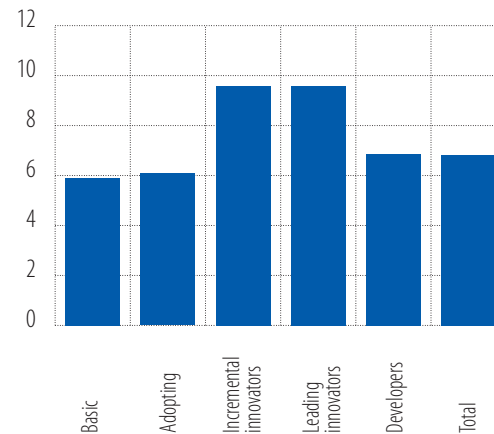
Note: The figure shows the weighted percentage of firms that use grants as a source of external finance. The innovation profiles are defined as in Figure 1.

SMEs are more credit-constrained than large firms. Among SMEs, the young ones are additionally constrained. Innovators, and especially leading innovators, are also more credit-constrained than basic firms. EIBIS contains rich and unique information for identifying the extent to which firms are credit-constrained. Firms that are credit-constrained either (1) obtained external finance but not all the amount expected (quantity-constrained); (2) did not apply because they thought external finance would be too expensive (price-constrained); (3) thought they would be rejected and were discouraged from applying (discouraged); or (4) were rejected when they sought external finance (rejected). A credit-constrained variable that takes the value of 1 if a firm falls into any of these categories is constructed. Among the total sample, 7% of the firms are credit-constrained. Figure 10 shows that 6% of both young and old large firms report being credit-constrained, while that percentage is higher for SMEs, especially young ones: 8% for old SMEs and 11% for young SMEs. Looking at the innovation profiles, basic firms, adopters and developers are not that different from the overall sample (6%) (Figure 11). Firms that are active in innovation have a higher probability of being credit-constrained (10%), which confirms that their innovative activities are more difficult to externally finance.

Figure 10 Credit constraints and size-age groups (weighted percentages)

Source: EIBIS16, for fiscal year 2015.

Note: The figure shows the weighted percentage of credit-constrained firms. Young (old) firms are less (more) than 10 years old. SMEs (large) firms have fewer (more) than 250 employees. The four size-age categories are formed by combining the age and size categories.

Figure 11 Credit constraints and innovation profiles (weighted percentages)

Source: EIBIS16, for fiscal year 2015.

Note: The figure shows the weighted percentage of credit-constrained firms. The innovation profiles are defined as in Figure 1.

Young SMEs with radical innovative projects are the most credit-constrained category of firms. The results of the econometric analysis shown in Table 4 confirm that leading innovators are more likely to be credit-constrained. This also holds for incremental innovators, but to a lesser extent. Firms that are only adopting innovations are not significantly more credit-constrained, and, somewhat unexpectedly, developers are also not significantly more credit-constrained, all else being equal. Irrespective of their innovation profile, SMEs are significantly more likely to be credit-constrained. This holds particularly for young SMEs, confirming the lack of collateral and reputation that hurts young firms on the financial market. But young age only hurts small-sized firms. The few young firms that have made it into large-firm status are not more likely to be credit-constrained than older large firms. Young, small firms with radical innovation projects are doubly constrained: first from being young and small, and second from having a radical project. They thus end up being the most credit-constrained category of firms. Their disadvantage does not go beyond this double constraint, as there is no significant interaction effect (column 2). The right part of Table 4 confirms this analysis for the most objective and binding component of credit constraint: that is, being rejected.

Table 4 Credit-constraints and innovation profiles

	(1)	(2)	(3)	(4)
	Credit-constrained		Rejected	
Young large	0.01 (0.03)	0.01 (0.03)	-0.01 (0.02)	-0.01 (0.02)
Old SME	0.03*** (0.01)	0.03*** (0.01)	0.02*** (0.01)	0.02*** (0.01)
Young SME	0.08*** (0.01)	0.08*** (0.01)	0.05*** (0.01)	0.05*** (0.01)
Adopting	-0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)
Leading innovators	0.06*** (0.01)	0.07*** (0.01)	0.03*** (0.01)	0.03*** (0.01)
Incremental innovators	0.03*** (0.01)	0.03*** (0.01)	0.01 (0.01)	0.01 (0.01)
Developers	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)
Leading innovators* Young SME		-0.04 (0.03)		-0.02 (0.03)
Observations	8,900	8,900	8,900	8,900
Pseudo R ²	0.05	0.05	0.05	0.05

Source: EIBIS16 for fiscal year 2015.

Note: The table reports marginal effects from logistic regressions. Standard errors are reported in parentheses. The dependent variable is an indicator variable equal to 1 if a firm is credit-constrained and zero otherwise (columns 1 and 2); and an indicator variable equal to 1 if a firm was rejected when seeking external finance (columns 3 and 4). Young (old) firms are less (more) than 10 years old. SMEs (large firms) have fewer (more) than 250 employees. The four size-age categories are formed by combining the age and size categories. The reference category for size-age groups is old and large. The innovation profiles are defined as in Figure 4.1. The reference category for innovation profiles is basic. Country and sector fixed effects are included. The regression is based on non-weighted firm-level data. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Conclusion and policy implications

This chapter introduces a novel classification of innovation profiles for EU firms based on their R&D investment and innovation activities. The classification groups firms in five distinct categories: basic, adopters, developers, incremental innovators and leading innovators. The analysis finds that basic firms – that is, firms that do not engage in any type of innovation – are more common among young SMEs, while innovators are more often old, large firms, especially leading innovators. To further understand why young SMEs are less likely to be leading innovators in the EU, the chapter further explored the obstacles faced by these firms, particularly access to finance.

The analysis shows that SMEs and young SMEs are more credit-constrained than large or old firms. In addition, innovators, especially leading innovators, are more credit-constrained than basic firms. Combined, young, small firms with more radical innovation projects are the most credit-constrained. Controlling for size and age of firms, leading innovators are more likely to receive grants, confirming the importance of this instrument for innovation policy in the EU.

Access to finance cannot be tackled in isolation, but should be embedded in an innovation environment that also addresses the other barriers to innovation. Although the evidence clearly supports the importance of access to finance for highly innovative growth projects, it also shows that the importance of other impediments to innovation cannot be ignored. These other barriers relate to problems with the demand for innovations, the regulatory burdens, and access to skills. Taken together, these barriers reduce the expected rates of return on R&D investments. All this is a strong reminder that the innovation deficit in Europe is systemic. As these other barriers reduce the expected rates of return on highly innovative projects, they affect the appetite of financiers to provide funds for these projects.

Any innovation financing policy should fit into a systemic innovation policy, creating the framework conditions for a favourable environment for innovation investments. Even though the empirical evidence in this chapter confirms the access-to-finance problem for SMEs, this in itself does not make a case for government intervention in support of SMEs. Even if there is a case to be made for intervention in terms of financial market failure, it is not clear whether governments could redress this failure without introducing government failure. Any SME innovation investment policy intervention needs a failure test to assess whether the policy instrument is the most appropriate to best alleviate market failures.

Development of private capital markets – especially the high-risk, early-stage segments – might address the market failures faced by young SMEs. Firms face different barriers involving financial market failure, depending on their age and size and the ambitions of their innovative projects. In particular, young, small firms with more radical innovation projects experience difficulties raising tranches of external finance. Any innovation investment policy intervention therefore needs differentiation that addresses different segments of the business population. Supporting the development of private capital markets – especially the high-risk, early-stage segments – and/or public funding can be warranted to solve the market failures faced by young, small firms with radical innovative projects.

Evaluating the effectiveness of policies is essential in order to learn from best practices. Due to tight government budgets, the efficiency and effectiveness of policies are of increasing importance for policymaking in general and for innovation policymaking in particular. This also holds for innovation policy, and it calls for an explicit build-in of evaluation as early as the design phase of the policy process. What is needed is infrastructure to (1) collect and organise the data needed for policymaking in a comprehensive and coherent way; (2) set procedures for the ongoing evaluation of the effectiveness of policies; and (3) evaluate, research and discuss long-term policies. Cross-national coordination can help build critical scale into evaluation expertise, learning from best practices and benchmarking.

Box 1 Results from Eurostat's 2014 Community Innovation Survey

In the context of the Europe 2020 strategy, the European Union (EU) aims to build an innovation-friendly environment to create sustainable growth, competitiveness and jobs. Since 1993, the Community Innovation Survey (CIS) has measured the innovativeness of enterprises in the EU. The innovation statistics are used by both policy makers and the research community. They provide a decision-making tool and help to assess initiatives taken in the innovation field. The European Innovation Scoreboard is one example of the regular outputs based on the collected results.

The CIS is conducted in all EU Member States and some European Free Trade Association (EFTA) and Candidate Countries. It covers enterprises with 10 or more employees in the industry and service sectors.³ The survey provides information on four different types of innovation – namely, product, process, organisational and marketing innovation – and on various aspects of the innovation project, such as development of the innovation, cooperation arrangements, sources of information, and public financial support received by the enterprises.

An innovation is defined as the introduction by an enterprise of a new or significantly improved product, process, organisational method, or marketing method. An innovation must have characteristics or intended uses that are new or that make a significant improvement to what was previously used or sold by the enterprise. However, an innovation can fail or take time to prove itself. An innovation only needs to be new or significantly improved for the enterprise – it is not necessarily new to the market. It could have originally been developed or used by other enterprises or organisations.

Innovation activities include the acquisition of machinery, equipment, buildings, software and licences, as well as engineering and development work, feasibility studies, design, training, R&D and marketing when they are specifically undertaken to develop and/or implement a product or process innovation. Innovative enterprises are those that undertook innovation activities during the period 2012–14, including enterprises with ongoing and abandoned activities.

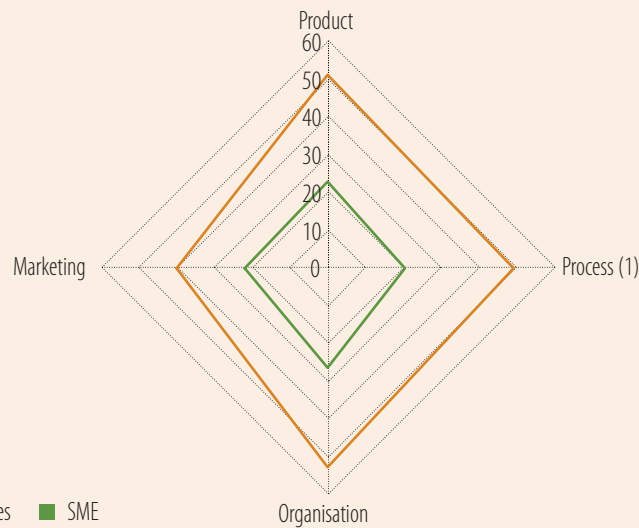
During the three-year reference period from 2012 to 2014, almost half of enterprises (49.1%) reported innovation across the EU countries, a proportion that remained relatively stable compared to the previous survey covering the period 2010–12. However, the share of innovative enterprises can vary significantly according to the size of the enterprises, the type of innovation, the sector and the country.

In the EU, 96.3% of the firms covered by the survey are small or medium-sized enterprises (SMEs). Accordingly, the results reported in the total mainly relate to enterprises with fewer than 250 employees. Nevertheless, in terms of number of employees, SMEs represent less than the half of total employment (49.6%) among EU countries. During 2012–14, nearly 8 out of 10 large enterprises in the EU reported innovation activities (78.1%). In comparison, innovation took place in less than five out of 10 SMEs (48%) during the same period.

During 2012–14, organisational innovation was the most common type of innovation undertaken by enterprises (27.3% of all enterprises), followed by product innovation (23.9%), marketing innovation (22.8%) and process innovation (21.6%). It is important to note that individual firms may have introduced more than one of these types of innovation. Compared to SMEs, large enterprises are twice as likely to introduce these four types of innovation (Figure 1).

³ CIS data and metadata are available on the Eurostat website at <http://ec.europa.eu/eurostat/web/science-technology-innovation/data/database>.

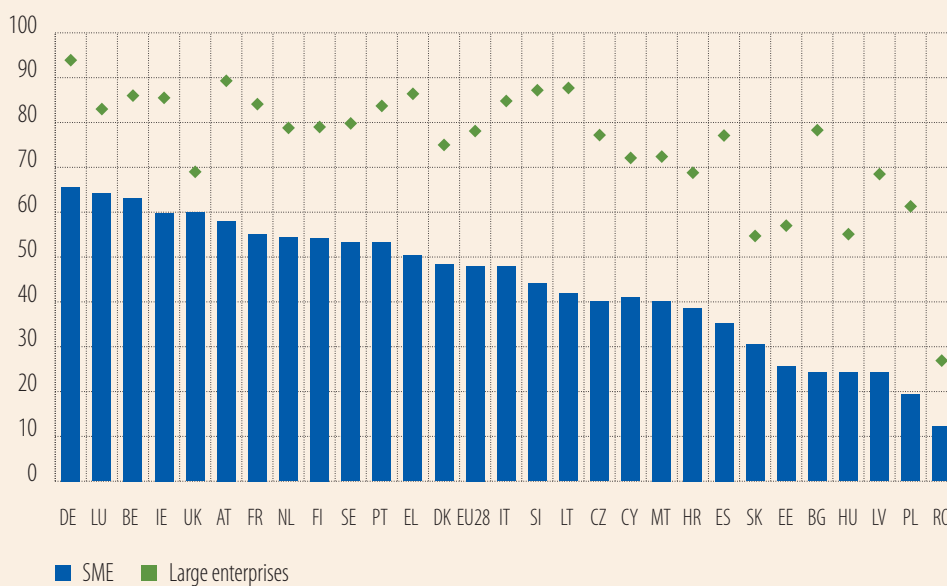
Figure 1 Proportion of innovative enterprises by type and size class, EU28, CIS 2014 (% of total enterprises)



Source: Eurostat, 2014 Community Innovation Survey.
 Note: (1) Excluding Slovenia.

As shown in Figure 2, the highest proportions of innovative enterprises during the period 2012–14 were observed in Germany (67% of all enterprises), Luxembourg (65.1%) and Belgium (64.2%). The lowest levels of innovation activity were observed in Poland (21%) and Romania (12.8%). The ranking is different when it focuses on large enterprises: more than 87% of large enterprises report innovation activities in Germany, Austria, Lithuania and Slovenia.

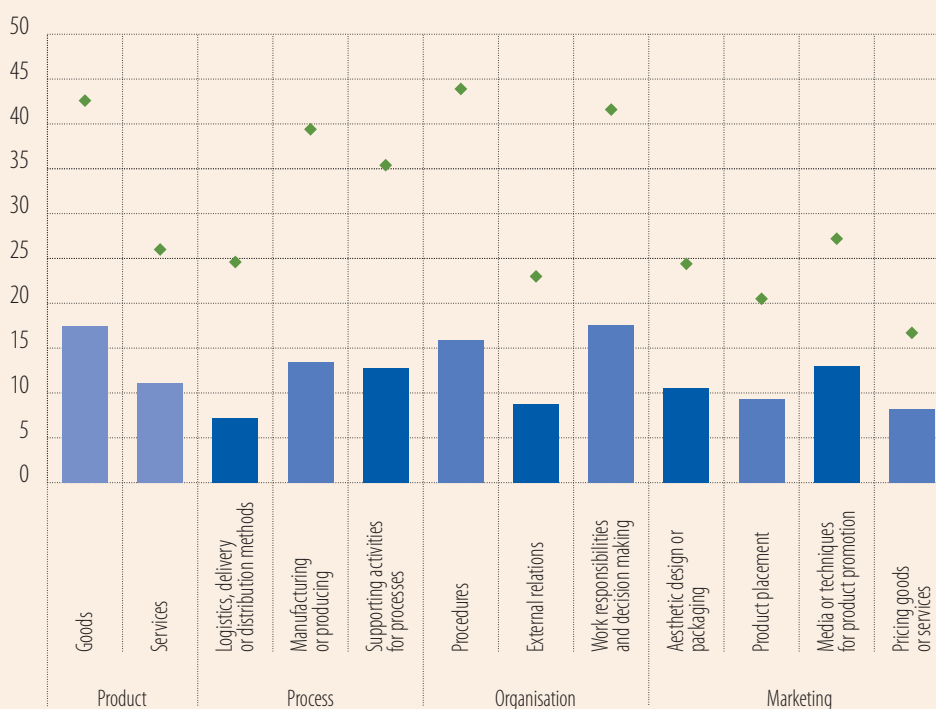
Figure 2 Share of innovative enterprises, by EU country and size class, CIS 2014 (% of total enterprises)



Source: Eurostat, 2014 Community Innovation Survey.

Figure 3 presents the specific types of innovation implemented, by size of the enterprise. The biggest differences between large enterprises and SMEs have been recorded for process and organisational innovation. In particular, with reference to process innovation, new or significantly improved logistics, delivery, or distribution methods have been implemented more in large enterprises than in SMEs (24.6% versus 7.2%). The same pattern is observed for new methods in manufacturing or producing (39.4% versus 13.4%) and with regard to the supporting activities for processes such as maintenance systems or operations for purchasing, accounting, or computing (35.4% versus 12.8%).

Figure 3 Proportion of innovative enterprises by specific type of innovation and firm size, EU-28 (1), CIS 2014 – % of total enterprises



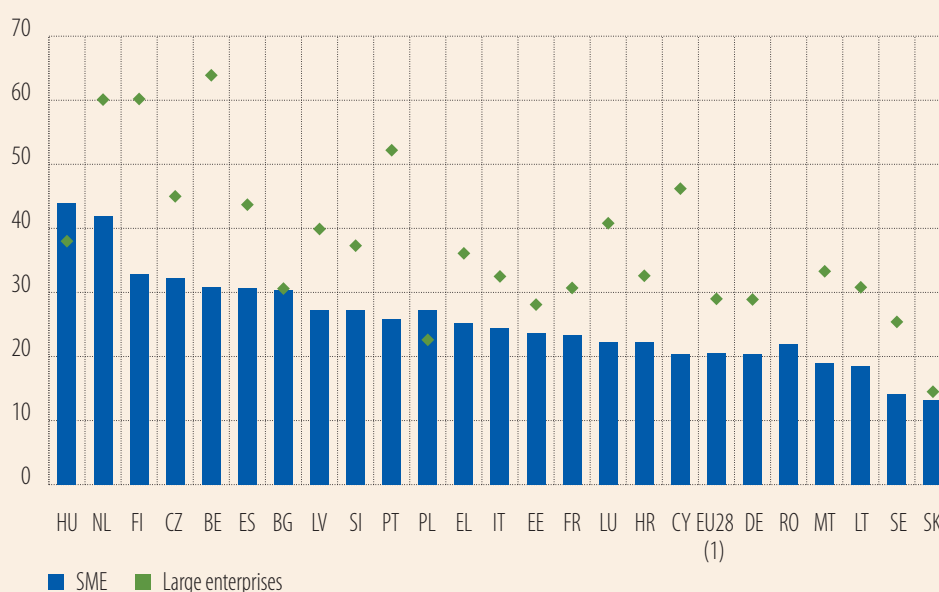
Source: Eurostat, 2014 Community Innovation Survey.

Note: The EU-28 excludes the United Kingdom.

Large enterprises receive more public financial support for innovation activities than SMEs. During 2012–14, one in five enterprises (21.1%) engaging in a product and/or process innovation received public financial support for their innovation activities. This support included financial support via tax credits or deductions, grants, subsidised loans and loan guarantees, but excluded R&D and other innovation activities conducted entirely for the public sector under contract. Regardless of the size of the enterprises and the provenance of the funds, the shares of product and/or process innovative enterprises that received financial public support were highest in Hungary, the Netherlands, Finland and the Czech Republic, with more than one-third of the enterprises receiving such support (Figure 4). The lowest shares were observed in Slovakia, Sweden and Lithuania, where less than 20% of the product and/or process innovative enterprises reported financial support from the public administration.

In most countries, large innovative enterprises are more likely to obtain financial support than SMEs. More than one in two enterprises with 250 employees or more that introduced product and/or process innovation received funds from the various levels of government in Belgium, Finland, the Netherlands and Portugal, while less than one in four did in Romania, Slovakia and Poland. However, SMEs seem to be more likely than large firms to receive public funding support in Hungary, the Netherlands, Finland and the Czech Republic.

Figure 4 Share of product and/or process innovative enterprises that received public funding for innovation activities, by EU country (% of total of product and/or process innovative enterprises)



Source: Eurostat, 2014 Community Innovation Survey.

Note: (1) Excluding Denmark, Ireland, Austria and the United Kingdom.

A focus on the provenance of the public funding reveals that some EU countries receive more financial support from the European Union or from the central government than others. An EU average, based on partial results,⁴ shows that 6% of the surveyed enterprises engaging in product and/or process innovations received funding at the EU level. The highest proportions have been reported by firms in Hungary, Latvia, Bulgaria and Poland, where more than one in five such enterprises have been supported in their innovation activities at the European level. The lowest shares were observed in Luxembourg, Italy, the Netherlands, Croatia and Germany.

CIS 2014 also gathered information concerning the reasons why some enterprises do not innovate. The enterprises that did not engage in any innovation activities were asked if they did not feel the need to innovate or whether they were prevented due to barriers to innovation. The vast majority (83%) of the non-innovators stated that they simply did not have any compelling reason to innovate. The remaining non-innovative enterprises (16.7%) reported that they had considered innovating, but that barriers to innovation were too large.⁵ These results are based on information provided by 19 of the EU Member States.⁶

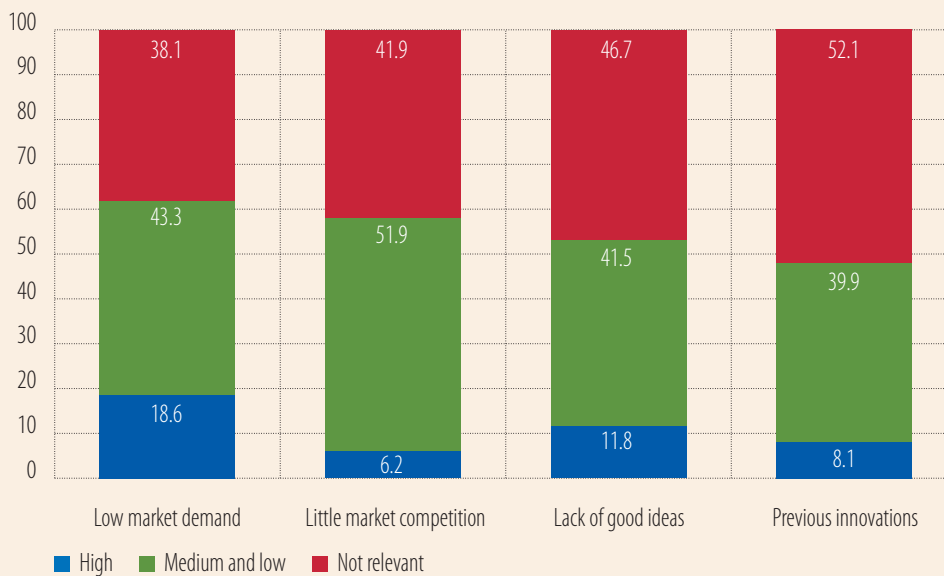
⁴ EU-28 excluding Denmark, Ireland, Austria and the United Kingdom.

⁵ The difference of 0.3% could be potentially due to a lack of imputation for non-response from non-innovators.

⁶ Excluding Belgium, Denmark, Germany, Ireland, Spain, Slovenia, Finland, Sweden and the United Kingdom

A more in-depth look at the data presented in Figure 5 shows that enterprises consider low market demand to be the most important reason not to innovate (reported by 18.6% of non-innovators), followed by that fact that previous innovations were already introduced (11.8%). Less than one in 10 enterprises report the lack of good ideas as highly important (8.1%), while 6.2% of the non-innovative enterprises cited low market competition.

Figure 5 Reasons not to innovate by degree of importance, EU-28, partial results (% of non-innovators with no compelling reason to innovate)



Source: Eurostat, 2014 Community Innovation Survey.

Note: The EU-28 excludes Belgium, Denmark, Germany, Ireland, Spain, Slovenia, Finland and the United Kingdom.

References

- Andrews, D., Criscuolo, C., and Gal, P. (2016). "The Global Productivity Slowdown, Technology Divergence and Public Policy: A Firm-level Perspective." Brookings Institution Hutchins Center Working Paper No. 24.
- Beck, T., and Demirgüç-Kunt, A. (2006). "Small and Medium-size Enterprises: Access to Finance as a Growth Constraint." *Journal of Banking and Finance*, 30(11), 2931–2943.
- Bravo-Biosca, A. (2017). "Firm Growth Dynamics and Productivity in Europe." In *Remaking Europe: The New Manufacturing as an Engine for Growth*, edited by Veugelers, R. Brussels: Bruegel Blueprint.
- Calvino, F., Criscuolo, C. and Menon, C. (2016). "No Country for Young Firms? Start-up Dynamics and National Policies." OECD Science, Technology and Industry Policy Paper No. 29. OECD, Paris.
- Cincera, M., and Veugelers, R. (2014). "Differences in the Rates of Return to R&D for European and US Young Leading R&D Firms." *Research Policy*, 43, 1413–1421.
- Czarnitzki, D. (2006). "Research and Development in Small and Medium-sized Enterprises: The Role of Financial Constraints and Public Funding." *Scottish Journal of Political Economy*, 53(3), 335–357.
- Gaspar, V., Bovha-Padilla, S. and Veugelers, R. (2009). "Finance for Innovation and Growth." In *Financing SMEs in Europe*, edited by Balling, M. and Gnan, E. Vienna: SUERF.
- Hall, B.H. (2002). "The Financing of Research and Development." *Oxford Review of Economic Policy*, 18(1), 35–51.
- Haltiwanger, J. C., Jarmin, R.S. and Miranda, J. (2010). "Who Creates Jobs? Small vs. Large vs. Young." NBER Working Paper No. 16300. National Bureau of Economic Research, Cambridge, MA.
- Henderson, R. (1993). "Underinvestment and Incompetence as Responses to Radical Innovation: Evidence from the Photolithographic Alignment Equipment Industry." *RAND Journal of Economics*, 24(2), 248–270.
- Malerba, F., and Orsenigo, L. (1995). "Schumpeterian Patterns of Innovation." *Cambridge Journal of Economics*, 19(1), 47–65.
- O'Sullivan, M. (2005). "Finance and Innovation." In *The Oxford Handbook of Innovation*, edited by Fagerberg, J., Mowery, D. and Nelson, R. Oxford: Oxford University Press.
- Revest, V., and Sapio, A. (2012). "Financing Technology-based Small Firms in Europe: What Do We Know?" *Small Business Economics*, 39(1), 179–205.
- Schneider, C. and Veugelers, R. (2010). "On Young Highly Innovative Companies: Why They Matter and How (Not) to Policy Support Them." *Industrial and Corporate Change*, 19(4), 969–1007.
- Schumpeter, J. (1939). "Business Cycles." Volume 1. New York: McGraw-Hill.
- Schumpeter, J. (1942). "Capitalism, Socialism and Democracy." New York: Harper.

Chapter 10

Resource (mis)allocation in European firms: the role of firm characteristics, managerial decisions and business environment constraints

Chapter at a glance

Large differences in productivity across firms within an economy may indicate poor allocation of resources. When marginal revenue products of inputs are not equal across firms that compete in the same market, aggregate economic performance could be improved by reallocating inputs from low-marginal-product uses to high-marginal-product uses.

In this chapter, the dispersion of the marginal revenue product of capital (MRPK) and the marginal revenue product of labour (MRPL) are used as proxies for the possible misallocation of resources. The analysis reports a number of findings, including the following:

- *The dispersion of the MRPK has increased steadily over the past 15 years, pointing to rising misallocation of capital across firms. At the same time, the dispersion of the MRPL has also increased since the global financial crisis, but at a milder pace.*
- *The MRPK and MRPL vary with key characteristics of firms in the EU, and exporters and subsidiaries, as well as innovative firms, tend to have higher marginal revenue products of factors.*
- *The business environment in which firms operate affects marginal revenue products. The analysis suggests that if labour market regulations, energy costs or access to finance were eased, firms could adjust their marginal revenue products in a way that would benefit them and the economy as a whole. Reforms to labour market regulations could enable the mobility of capital and labour across firms, industries and countries within the EU by making it easier for more efficient firms to access more resources. This would then better enable them to enter a market and grow. It would also allow less productive firms to downsize and, if necessary, exit a market.*
- *Similarly, inefficiencies in the European energy market, reflected in higher prices, may create the wrong incentives for firms in their choice of input mix. Credit constraints may also limit the optimal capital structure of firms.*
- *Policy measures that improve the business environment by addressing inefficiencies and distortions due to the fragmentation of EU labour, energy and financial markets are expected to support the reallocation of resources towards more productive firms and contribute to economic efficiency. As the EU is a single market with free movement of labour and capital, the message concerning the inefficient allocation of resources and the possibility for reallocation should be considered not only at the level of individual EU Member States but also at the European level.*

From resource (mis)allocation to aggregate productivity

Although the staggering cross-country dispersion of per capita income has been a subject of much research, accounting for the sources of this dispersion has proven to be difficult. The most important factor appears to be productivity. However, “productivity” is an elusive, catch-all concept, difficult to define and measure. Economist Moses Abramovitz called it “a measure of our ignorance.” The economic literature finds that even within a narrowly defined industry, some firms produce much more output or create more value added with the same amount of inputs (Hsieh and Klenow, 2009). Some firms compete in a market for the same customers but perform better. This has been variously attributed to differences in access to technology, managerial skills, skills of workers, quality of capital, or the way the firm is organised (Bloom and Van Reenen, 2010; Syverson, 2011).

Reallocating labour and capital to more productive firms helps increase aggregate productivity. The slowdown in economic growth in the US, EU Member States and other developed economies has generated a sense of urgency among policymakers to identify impediments to productivity growth and find ways to spur growth. Although a number of explanations have been put forth, rising misallocation of resources across European countries could be one of the culprits (Gopinath et al., 2017). Indeed, the heterogeneity in firm productivity may indicate poor allocation of resources and may have a negative impact on the aggregate performance of an economy (Bartelsman, Haltiwanger and Scarpetta, 2013).

In the years before the global financial crisis in several European countries, capital and labour accumulated rapidly in sectors and firms that were not the most productive. Gopinath et al. (2017) argue that the misallocation of resources can explain low productivity growth in Southern Europe since the early 2000s. For example, they find that in Spain, Italy and Portugal, the misallocation of capital increased rapidly during the decade and even accelerated after 2008, which is consistent with decreased productivity at the aggregate level.

Public policy can support economic recovery by reducing frictions in the reallocation of resources and by giving incentives to invest in more productive and innovative firms. Capital and labour move across firms and sectors when firms grow or shrink and when firms enter or exit a market. The firms that grow and enter the market need to be more productive than firms that shrink and may have to exit. Workers and capital should move to firms that exploit these factors of production more efficiently. How do low-productivity firms survive? With limited incentives for market exit, firms can stay in a market with low profits and little production. Inefficient bankruptcy laws may not support the closure of firms that perform poorly or the reallocation of their capital and labour to other firms. Labour market regulations may prevent firms from rapidly adjusting working hours if the demand for the firm's products or services falls. Business regulations can limit market entry for new market participants. For instance, the low rates of firm entry and firm exit after the crisis in some European countries and the survival of zombie firms may have locked resources in unproductive usages.

If cost-minimising firms were to face identical input prices in a perfectly functioning spot market economy, marginal revenue products would be equalised across firms. This chapter draws on an analytical paper by Gorodnichenko et al. (2017) and documents the substantial heterogeneity in the way firms in Europe use capital and labour to produce output and create value added. The marginal revenue product of capital (proxied by turnover/fixed assets \times capital share) and the marginal revenue product of labour (proxied by turnover/number of employees \times labour share) are computed for firms in Europe. The chapter discusses how the marginal revenue products vary with the key characteristics of firms as well as across countries and sectors.¹ The analysis shows that resource allocation in firms varies across Europe, and that it is affected by the environment in which the firms operate. These factors prevent firms from fully optimising their use of labour and capital.

¹ See Gorodnichenko et al. (2017) for a detailed discussion of how this analysis has been carried out.

A relatively low marginal revenue product of capital (MRPK) indicates that the firm uses too much capital, while a high MRPK means that the firm has too little capital and may be constrained in its attempt to invest and increase its assets. Similarly, a firm with a relatively high marginal revenue product of labour (MRPL) has too few employees from the economy-wide point of view, while a firm with a low MRPL has on the margin employees who contribute too little compared to what their productivity would be elsewhere in the economy. Hence the economy would benefit if firms with very low and high levels of MRPK or MRPL were to reallocate resources. If the dispersion of marginal revenue products across firms that compete in the same market is substantial, an economy may achieve considerable gains by reallocating inputs from low-marginal-product uses to high-marginal-product uses. In this sense, misallocation of resources has a negative impact on the economy.

Little is known in the economic literature about why firms have different marginal revenue products. If the dispersion of marginal revenue products across firms reflects barriers and distortions, dispersion is economically undesirable. If it reflects optimising behaviour of firms (for example, compensating for differentials), then it is economically rational from the standpoint of the firms and may be optimal from a social welfare standpoint. A key question therefore is which of these phenomena are consistent with the data.

A new database, the EIB Investment Survey (EIBIS), makes it possible to investigate the possible causes of frictions that prevent optimal reallocation of resources. To a large extent, the lack of research on this question has been caused by data limitations. In particular, research in this area typically uses census-type data to calculate the MRPK or MRPL for firms in a given economy and measure misallocation as dispersion of the MRPK or MRPL across firms. But census-type data usually contain only basic information about capital (balance sheet) and employment. As a result, researchers cannot determine why a given dispersion of marginal revenue products exists.

The first wave of EIBIS, which was collected in 2016 and refers to the fiscal year 2015, is used to address this challenge. EIBIS contains information on the behaviour and constraints of firms such as how firms obtain capital and whether the quantity is sufficient. It also reports on the quality of firms' capital stock (whether it is state-of-the-art), capacity utilisation, rates of innovation, structural impediments to investment, investment plans, and employment growth, among other areas. This information is typically difficult to observe at the firm level in administrative data and when examining data comparable across 28 countries. Importantly, the design and implementation of EIBIS is consistent across countries, which is critical for understanding cross-country variation in the dispersion of marginal revenue products. With this information, it is possible to estimate the extent to which these factors affect cross-sectional dispersion of marginal revenue products. For instance, consistent with Asker, Collard-Wexler, and De Loecker (2014), the analysis suggests that dynamic adjustment of inputs is an important force in accounting for cross-sectional variation in marginal revenue products.

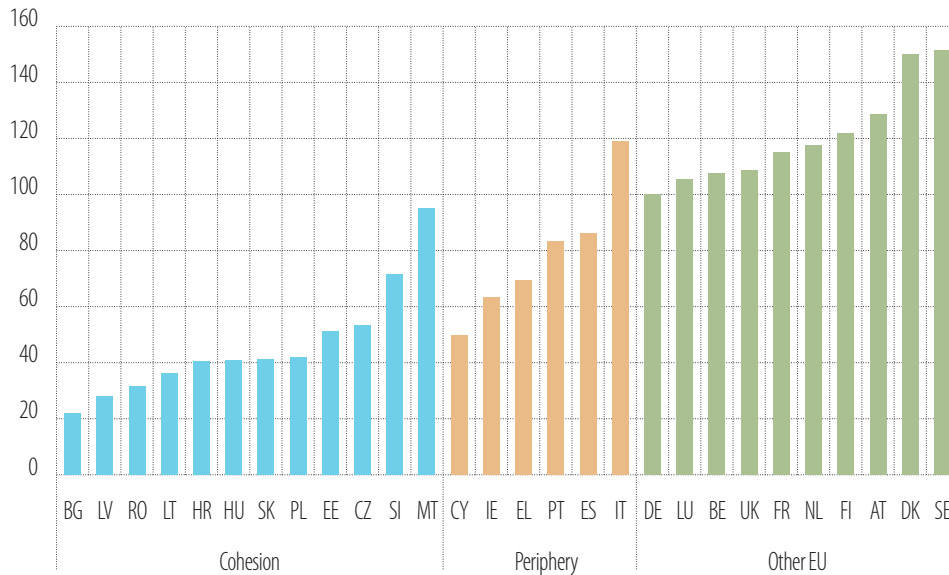
Stylised facts on firm-level aggregate productivity and resource (mis)allocation using EIBIS

Using firm-level data from EIBIS, Figure 1 shows differences in total factor productivity across EU countries. The estimates are intuitive, showing, for example, that firms are more productive on average in France than Hungary.² Figure 2, in turn, indicates that, with the exception of Ireland and Luxembourg, this measure of aggregate firm-level productivity is highly correlated with GDP per capita. The outlying nature of Ireland and Luxembourg may be driven by the composition of those economies and the coverage of EIBIS, which does not include firms in the financial sector. Differences in aggregate productivity across countries may be due to different technology available in each country. But if

² Because aggregate productivity could be driven by differences in the prices of inputs or output and exchange rates across countries, this analysis also estimates a similar model using only the 19 countries that are in the euro zone. It finds that the ranking of countries according to their average firm-level productivity is similar.

technology and knowledge can move freely across borders within the EU, aggregate productivity also varies with the efficiency with which labour and capital are used and whether they are allocated to the most productive firms.

Figure 1 Average firm-level productivity index, 28 EU Member States, 2015

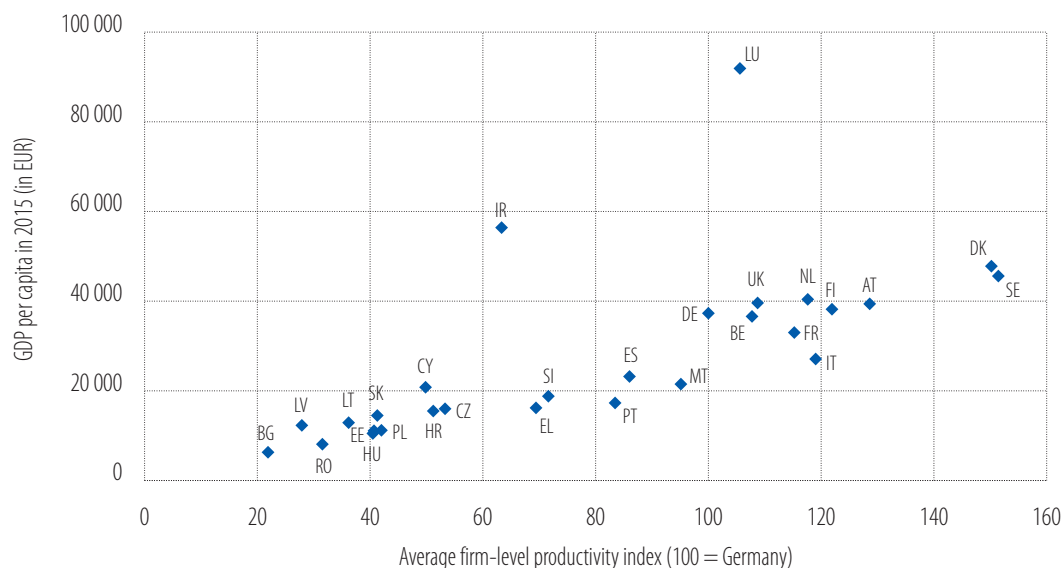


Source: EIBIS 2016 for fiscal year 2015, Bureau van Dijk's Orbis database, OECD and Eurostat.

Note: The figure is based on an ordinary least squares regression where value added is the dependent variable and the explanatory variables are labour and capital. The regression includes fixed effects for each industry (manufacturing is the omitted category) and country (Croatia is the omitted category). The figure shows the estimated coefficients on each country dummy using an index for which the level of Germany is 100. Firms are weighted using employment weights to make them representative of the economy. The weights are based on data on the number of employees within each country and industry from Eurostat's Structural Business Statistics (SBS) and on data on the number of employees from EIBIS.

Business investment: uncertainty, innovation and resource allocation

Figure 2 Average firm-level productivity index and GDP per capita, 28 EU Member States, 2015



Source: EIBIS 2016 for fiscal year 2015, Bureau van Dijk's Orbis database, OECD and Eurostat.

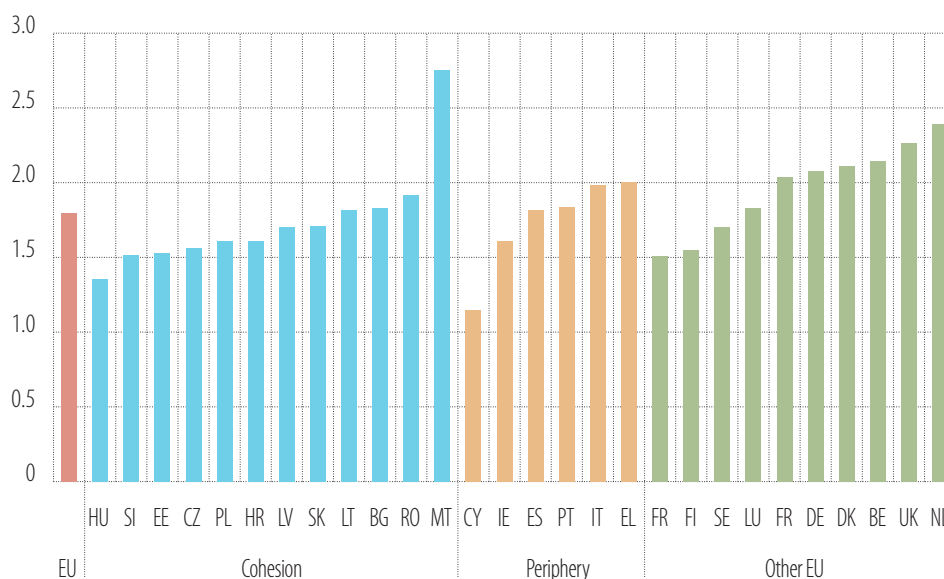
Note: The figure is based on ordinary least squares regression where value added is the dependent variable and the explanatory variables are labour and capital. The regression includes fixed effects for each industry (manufacturing is the omitted category) and country (Croatia is the omitted category). On the x axis, the figure shows the estimated coefficients on each country dummy using an index for which the level of Germany is 100. The y-axis shows GDP per capita in 2015 (in EUR). Firms are weighted using employment weights to make them representative of the economy. The weights are based on data on the number of employees within each country and industry from Eurostat's Structural Business Statistics (SBS) and on data on the number of employees from EIBIS. GDP per capita is from Eurostat.

High dispersion in marginal revenue products across firms within the same country and industry points to allocative inefficiency within the economy, which affects aggregate economic performance. In addition to examining productivity levels across countries, the extent of allocative inefficiency across firms within the same country is estimated by analysing the dispersion in the MPRK and MRPL. Indeed, the variation in the MRPL and MPRK may reflect not only differences in factor prices, but also differences in constraints, taxes and regulation. Moreover, management quality may vary across firms and may capture different abilities or willingness to optimise – for example, management may maximise the size of their firms for the prestige that comes with leading an important company, instead of adjusting the factors used in production to minimise costs or maximise profits. Figures 3 and 4 show that the dispersion of the MPRK and MRPL within countries is substantial. Substantial heterogeneity in marginal revenues products may be a sign that there is potential to improve efficiency in an economy. Countries where the dispersion is high would benefit from a more substantial reallocation of resources from low to high MPRK and MRPL firms.

Keeping in mind that Europe is characterised by a single market, with free mobility of labour and capital, two quantities are compared to better understand whether the aggregate economic performance across the EU would increase by reallocating resources within countries or across countries. The first quantity is the level of the MPRK (in logarithm) in each country. It corresponds to the standard deviation of this level across the 28 EU Member States, which is relatively low, at 0.46. The second quantity is the average of the within-country dispersion of the MPRK (as shown for each country in Figure 3). It is substantially higher, at 1.82. Similarly, the standard deviation of the logarithm of the MRPL across countries is 0.81, while the average of the within-country dispersion of the MRPL (as shown in Figure 4) is 1.03. The fact that the cross-country variation of the MPRK is lower than the average within-country dispersion of the MPRK suggests that the gains of reallocating capital within countries are likely to be more helpful to increase aggregate productivity than improving cross-country flows of capital.

At the same time, the difference between the dispersion of the MRPL across countries and within countries is smaller, indicating that there is significant room to improve the reallocation of labour not only within each individual EU Member State but also across the EU.

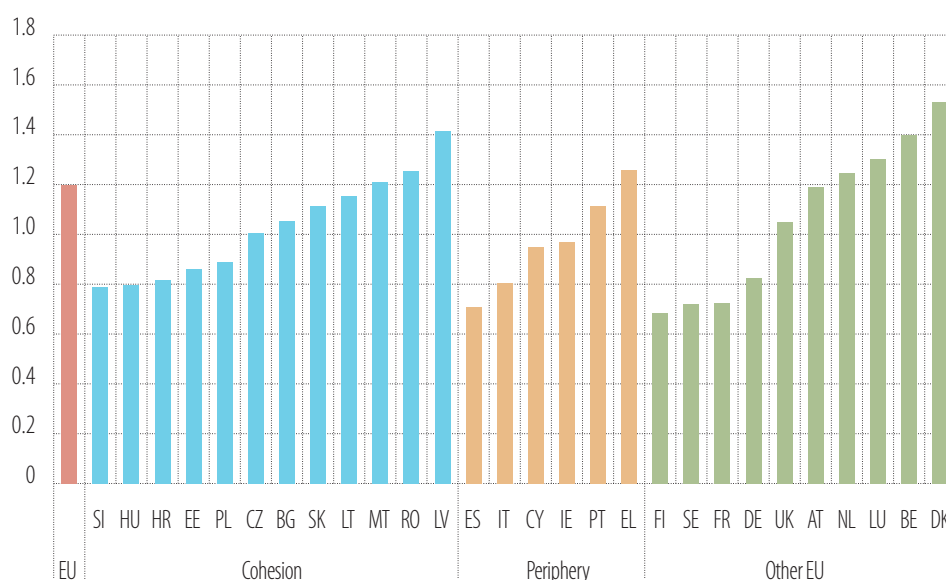
Figure 3 Dispersion of the marginal revenue product of capital (MRPK), 28 EU Member States, 2015



Source: EIBIS 2016 for fiscal year 2015, Bureau van Dijk's Orbis database, OECD and Eurostat.

Note: The figure is based on an ordinary least squares regression where the MRPK (turnover/fixed assets \times capital share, in logarithm) is the dependent variable and the explanatory variables are fixed effects for each industry (manufacturing is the omitted category) and country (Croatia is the omitted category). The figure shows the standard deviation of the logarithm of the MRPK (net of industry fixed effects) for each country. The value for the EU is based on a regression that does not control for country fixed effects. Firms in the EIBIS are weighted using employment weights to make them representative of the economy. The weights are based on data on the number of employees within each country and industry from Eurostat's Structural Business Statistics (SBS) and on data on the number of employees from EIBIS.

Figure 4 Dispersion of the marginal revenue product of labour (MRPL), 28 EU Member States, 2015

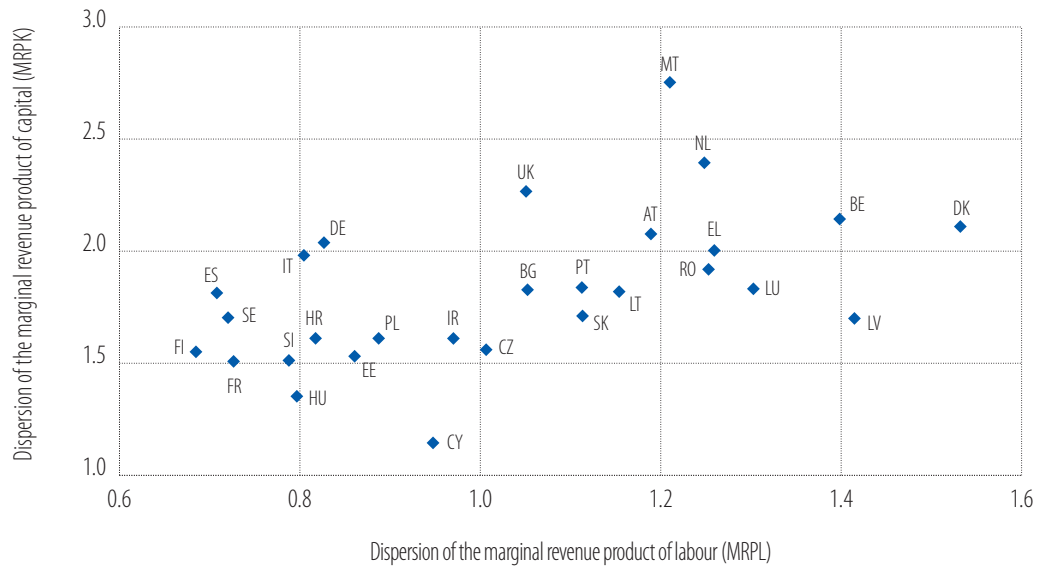


Source: EIBIS 2016 for fiscal year 2015, Bureau van Dijk's Orbis database, OECD and Eurostat.

Note: The figure is based on an ordinary least squares regression where the MRPL (turnover/number of employees \times labour share, in logarithm) is the dependent variable and the explanatory variables are fixed effects for each industry (manufacturing is the omitted category) and country (Croatia is the omitted category). The figure shows the standard deviation of the logarithm of the MRPL (net of industry fixed effects) for each country. The value for the EU is based on a regression that does not control for country fixed effects. Firms in the EIBIS are weighted using employment weights to make them representative of the economy. The weights are based on data on the number of employees within each country and industry from Eurostat's Structural Business Statistics and on data on the number of employees from EIBIS.

The dispersions of the MRPK and MRPL are positively correlated across EU countries, indicating that several countries would benefit from reallocating both capital and labour across firms. Figure 5 shows a relatively high positive correlation (0.53) between the dispersion of the MRPK and MRPL across countries. In other words, countries where labour should be reallocated across firms within the country (because of a high dispersion of the MRPL) would also benefit if capital were reallocated from firms with a low MRPK to firms with a high MRPK.

Figure 5 Dispersion of the marginal revenue product of capital (MRPK) and the marginal revenue product of labour (MRPL), 28 EU Member States, 2015



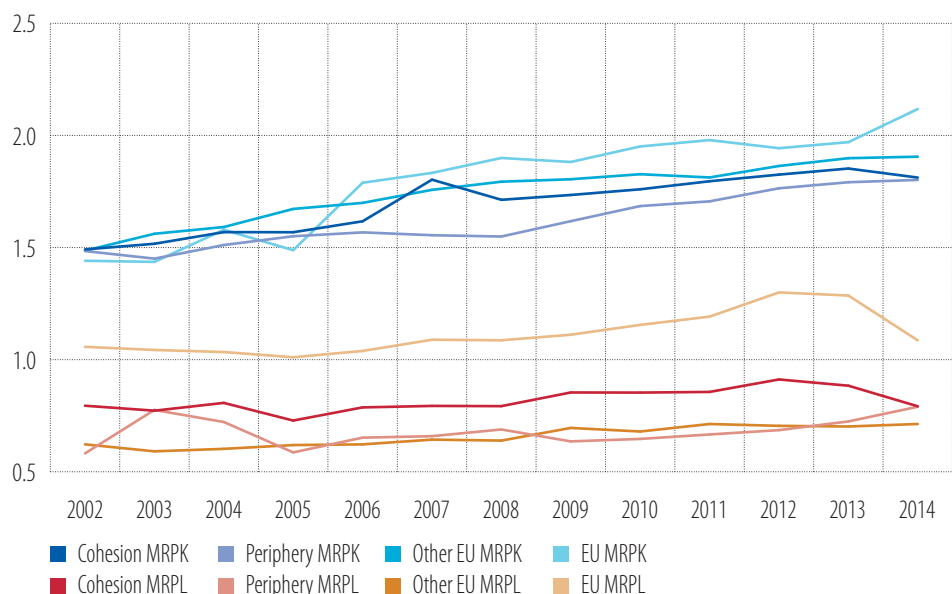
Source: EIBIS 2016 for fiscal year 2015, Bureau van Dijk's Orbis database, OECD and Eurostat.

Note: On the y-axis, dispersion of the MRPK as in Figure 3; on the x-axis, dispersion of the MRPL as in Figure 4.

The misallocation of resources in the EU has been increasing during the last decade, but at a faster pace more for capital than for labour. The Bureau van Dijk's Orbis database is used to explore the evolution of misallocation of resources and productive inefficiency over time, whereas the cross-section of EIBIS refers only to fiscal year 2015. The Orbis database has many more observations than EIBIS but does not contain the rich information on the questions asked in EIBIS.³ In Figure 6, EU countries are classified in three different groups: cohesion, periphery and other EU countries. Figure 6 shows that the dispersion of the MRPK has been increasing over time in all groups. In particular, and in line with Gopinath et al. (2017), this dispersion in the periphery countries has been increasing at a faster pace since 2008. Unlike the dispersion of the MRPK, the dispersion of the MRPL has remained more stable over time. These results are much in line with the literature (Gamberoni, Giordano and Lopez-Garcia, 2016). But it is important to point out that there is no group of countries where the dispersion of either the MRPK or MRPL has been decreasing over the last decade. In addition, the overall dispersion in the EU (that is, without controlling for country effects) suggests that the dispersion of the MRPK and MRPL has been increasing more rapidly than in the different country groups over time.

³ Gorodnichenko et al. (2017) show that the effects of some basic characteristics (such as size, age, employment growth and the investment rate) on the MRPK and MRPL using data from the Orbis are similar to the estimates reported in this chapter, which focuses on data from EIBIS.

Figure 6 Evolution of the dispersion in the marginal revenue product of capital (MRPK) and the marginal revenue product of labour (MRPL) for three groups of EU countries over 2002–14

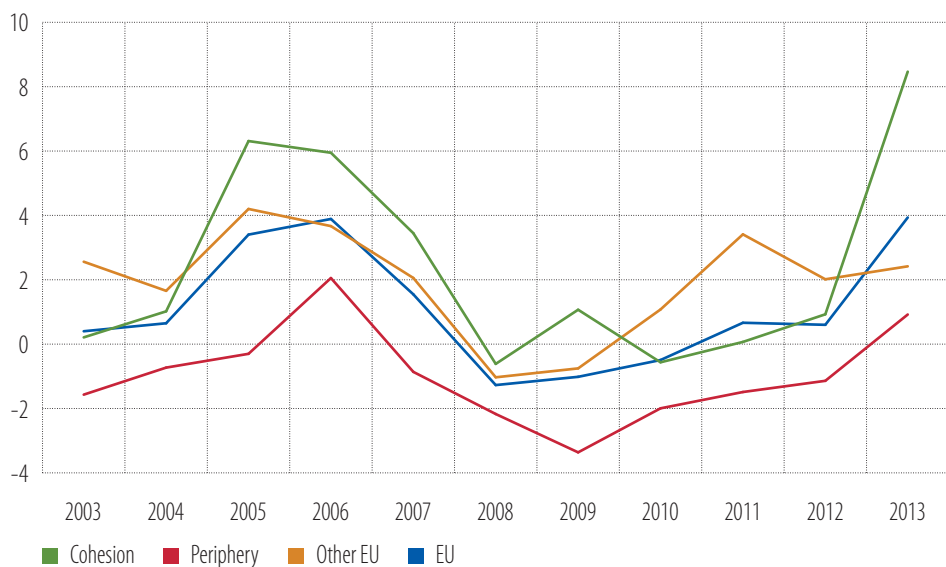


Source: Bureau van Dijk's Orbis database, OECD and Eurostat.

Note: The figure shows the evolution of the dispersion in the MRPK or MRPL over time. The dispersion is computed as the standard deviation of the logarithm of the MRPK (or MRPL) in each country and year. The figure shows the coefficient of variation, that is, the standard deviation of the logarithm of the MRPK (net of the interactions of year and industry fixed effects) for each country group. The estimates of the MRPK and MRPL are net of the interactions of country, year and industry (at the four-digit level). In other words, the regression has the logarithm of the MRPK (or MRPL) as the dependent variable and the interactions of country, year and industry as the explanatory variables. The figure shows the standard deviation of the residuals from this regression. Countries are grouped into three country groups: cohesion (12 countries): BG, CZ, EE, HR, HU, LT, LV, MT, PL, RO, SI, SK; periphery (6 countries): CY, EL, ES, IE, IT, PT; and other EU countries (10 countries): AT, BE, DE, DK, FI, FR, LU, NL, SE, UK. The dispersion in each group is an average of the dispersion across countries in that year, i.e. each country receives the same weight when computing the average. The value for the EU is based on a regression that does not control for country fixed effects, i.e. it only includes the interactions of year and industry. Firms in the Orbis database are weighted using employment weights to make them representative of the economy. The weights are based on data on the number of employees within each country and industry from Eurostat's Structural Business Statistics (SBS) and on data on the number of employees from the ORBIS database.

In line with the increased misallocation of resources in Europe, aggregate productivity growth has been falling since the global financial crisis. The increases in the dispersion of the marginal revenue products have consequences for aggregate productivity growth, which has been falling rapidly since 2007 in all three country groups (Figure 7). In the periphery, productivity growth was even negative between 2007 and 2012, with negative implications for economic growth. And this period was precisely the period when the dispersion of the MRPK started to increase at a faster pace in periphery countries.

Figure 7 Moving average of firm-level productivity growth for three groups of EU countries over 2003–13 (%)



Source: Bureau van Dijk's Orbis database, OECD and Eurostat.

Note: The figure is based on a pooled ordinary least squares regression where value added (in logarithm) is the dependent variable and the explanatory variables are labour and capital (also in logarithms). The regression adds fixed effects for each country group ("other" in the year 1995 is the omitted category), fixed effects for industries (at the NACE Rev. 2, two-digit level) and the interactions of industries with labour and capital. The country groups are cohesion (10 countries): BG, CZ, EE, HR, HU, LV, PL, RO, SI, SK; periphery (4 countries): ES, IE, IT, PT; and other EU countries (10 countries): AT, BE, DE, DK, FI, FR, LU, NL, SE, UK. No data are available (or only for a very limited number of firms) on value added for CY, EL, LT, MT. The figure shows the growth rate of the estimated coefficients on each country group over time. The growth rate is a moving average over three years, that is, the growth rate shown for 2005 is the average of the growth rates in 2004, 2005 and 2006. The growth rate for the EU is an average of the three country groups. Firms in the Orbis database are weighted using employment weights to make them representative of the economy. The weights are based on data on the number of employees within each country and industry from Eurostat's Structural Business Statistics (SBS) and on data on the number of employees from the Orbis database.

Estimating marginal revenue products of capital and labour

Gorodnichenko et al. (2017) introduce a model for the optimisation of behaviour for firms that derives the expressions for the MRPK and MRPL from the production function and the demand function. Following this theoretical model, the MRPK consists of two terms: (1) the capital share, which is estimated using data from the financial statements of the firms from the Orbis database; and (2) turnover divided by fixed assets, with both variables reported by firms in EIBIS. Similarly, MRPL consists of two terms: (1) the labour share, which is also estimated using data from the financial statements of the firms from the Orbis database; and (2) turnover divided by the number of employees, with both variables reported by firms in EIBIS.⁴

⁴ Some firms have very low or very high ratios of turnover to fixed assets or turnover to number of employees. To address this issue, the distributions of the two ratios are winsorised at the 1st and 99th percentiles of the distributions in each country. This means that firms that have a very low (high) ratio in each country are attributed the value of the firm at the 1st (99th) percentile of the distribution in their country.

To estimate the capital and labour shares used in the MRPK and MRPL, the analysis relies on the fact that firms in the EIBIS can be linked with the Orbis database, which contains data on the financial history of firms from 2000 to 2014, including the wage bill, material costs and total costs of goods sold. The labour share S_{it}^L is estimated for each firm in EIBIS using data from Orbis on the wage bill and costs of goods sold as

$$S_{it}^L = \frac{\text{costs of employees}_{it}}{\text{costs of goods sold}_{it}}.$$

The capital share S_{it}^K is estimated using data on the employment share and material costs as

$$S_{it}^K = 1 - \frac{\text{costs of employees}_{it}}{\text{costs of goods sold}_{it}} - \frac{\text{material costs}_{it}}{\text{costs of goods sold}_{it}},$$

where i and t index firms and time.⁵ The cost shares for capital and labour vary over time because they are based on the financial statements of the firm over the period 2000 to 2014. But in this chapter they are used to analyse a cross-section of firms in EIBIS, which means that an average of the cost shares over all years that are available at the firm level is used. For example, if the firm started operating in 2012, the cost shares will refer to the averages over 2012, 2013 and 2014. But if the firms started operating before 2000, the cost shares will be an average over all years from 2000 to 2014.

The role of firm characteristics, managerial decisions and business environment constraints in explaining the marginal revenue products for European firms

To explore the role of firm characteristics, managerial decisions and business environment constraints in explaining the differences in marginal revenue products, Gorodnichenko et al. (2017) estimate a Huber robust regression relating the MRPK and MRPL, respectively, to country and industry fixed effects and a set of explanatory variables that capture firm characteristics and the environment in which the firms operate. With this information, it is possible to estimate the extent to which these factors affect the dispersion of marginal products across European firms. The estimates recover partial correlations and the interpretation does not make causal statements on the impact of the explanatory variables on the marginal revenue products. There is no unambiguously exogenous variation in the explanatory variables and the interpretation of the estimated relationship is tentative. However, the predictive power of the estimates can shed light on what factors are likely to be quantitatively important and where future work should concentrate efforts to estimate causal effects.

EIBIS contains rich information on a number of variables that may explain the differences in the level of the marginal revenue products across firms. Table A1 in the Annex reports descriptive statistics on the variables used in the regression analysis. The working samples have 7,554 and 8,473 observations. The number of observations is different when the MRPK or MRPL is the dependent variable because of the availability of data on fixed assets or number of employees. The estimated effects are reported using bar graphs. For example, Figure 8 plots estimated coefficients on basic firm demographics. Subsequent figures will show the estimated coefficients on the other explanatory variables. In Figure 8, almost all coefficients, or 11 out of 12, are statistically significant at a 10% confidence level.

⁵ The cost shares for labour and capital need to be between 0 and 1. When data on costs of employees in the Orbis database are missing, data on value added – ebitda are used. Similarly, when data on the cost of goods sold in Orbis are missing, data on turnover or sales are used instead. When data on material costs are missing, data on turnover – value added are used instead. When data on the labour share or material costs are not available at the firm level, the cost shares for labour and materials are estimated using data from the Industrial Analysis section of the OECD's Structural Analysis Database (STAN) or from Eurostat national accounts that are available at the level of the country, year and industry (two-digit NACE classification).

Firm age, size, organisation structure and exporter status

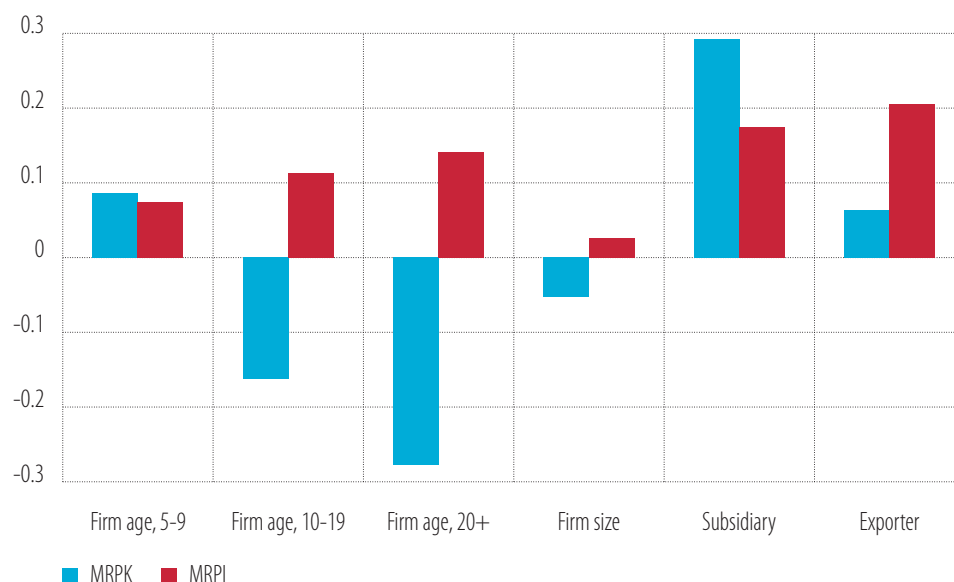
The basic demographics of the firms consist of information on the age, employment size, organisational structure (for example, whether it is a subsidiary) and export status. In EIBIS, firm age is a categorical variable with four categories: less than 5 years old, 5 to 9 years old, 10 to 19 years old, and 20+ years old. The vast majority of the firms in the analysis are old. Only 5% of the firms are fewer than 5 years old, 11% are between 5 and 9 years old, 26% are between 10 and 19 years old and 58% have been operating for more than 20 years. The fact that EIBIS does not cover very small firms (fewer than five employees) could partly explain the low number of very young firms.⁶ The average number of employees per firm is 221 or 162, depending on whether the MRPK or MRPL, respectively, is the dependent variable for the analysis. In firm-level surveys, larger firms are typically over-sampled because their answers are likely to be less affected by measurement error and are of better quality. But in the regression analysis, firms are weighted based on their number of employees to make them representative of the economy. The weights compare the number of employees covered by the firms in EIBIS to the number of employees in the same country and industry according to Eurostat.

Young and small firms appear to be more constrained in their use of capital than large firms. The estimated coefficients shown in Figure 8 show that older firms tend on average to have a lower MRPK, but also have a higher MRPL. The effect of firm size has the same sign as firm age. Younger and smaller firms have a higher MRPK because they have too little capital and are constrained in accumulating fixed assets. For example, this could be driven by the fact that they may not have a long credit history with their banks or have limited assets to provide as collateral, which will limit their capacity to access more bank finance. Larger and older firms have a higher MRPL, on average. Firms with a large number of employees and that have been operating for many years may have local monopsony power in the labour market and hence a higher MRPL than would be observed in a competitive setting. The higher MRPL in older firms could also be related to a greater accumulation of firm-specific human capital over time.

Exporters and subsidiaries of international groups tend to produce more turnover with the same amount of resources. EIBIS also asks whether the firm is a subsidiary of another company (27% of the firms in the sample) or an exporter (46% of the firms). A firm is considered an exporter if it directly exports goods and services to another country. Figure 8 shows that subsidiaries tend to have a higher MRPK. A subsidiary of another company could be expected to have access to cheap intra-group capital, which would result in a lower MRPK and perhaps a higher MRPL. But at the same time, a subsidiary may be rationed and monitored for efficient use of capital by the parent company, resulting in a higher MRPK. Subsidiaries also have a higher MRPL, on average, which is consistent with subsidiaries of foreign firms paying higher wages and employing relatively fewer employees than local firms when producing the same level of turnover. Similar to subsidiary status, exporter status is associated with a higher MRPK and MRPL. This finding is consistent with these firms being more exposed to competition in international markets and hence relatively more careful to not use excessive amounts of inputs. Because of the stronger competition, exporting firms are likely to employ high-quality inputs (Verhoogen, 2008).

⁶ The low number of very young firms in EIBIS is also due to the sampling design of the survey, which is based on firms that are in the Orbis database and that provided information on their balance sheet and profit and loss account in the year before the interview.

Figure 8 Association of basic firm characteristics with the marginal revenue product of capital (MRPK) or the marginal revenue product of labour (MRPL)



Source: EIBIS 2016 for fiscal year 2015, Bureau van Dijk's Orbis database, OECD and Eurostat.

Note: The figure shows estimated coefficients from robust regressions where the MRPK or MRPL are the dependent variables. Firms are weighted to make them representative of the economy based on the number of employees. Of the estimated coefficients, 11 out of 12 are statistically significant at a 10% confidence level. Estimated coefficients that are not statistically significant are shown in grey. For firm age, the omitted category is "less than 5 years."

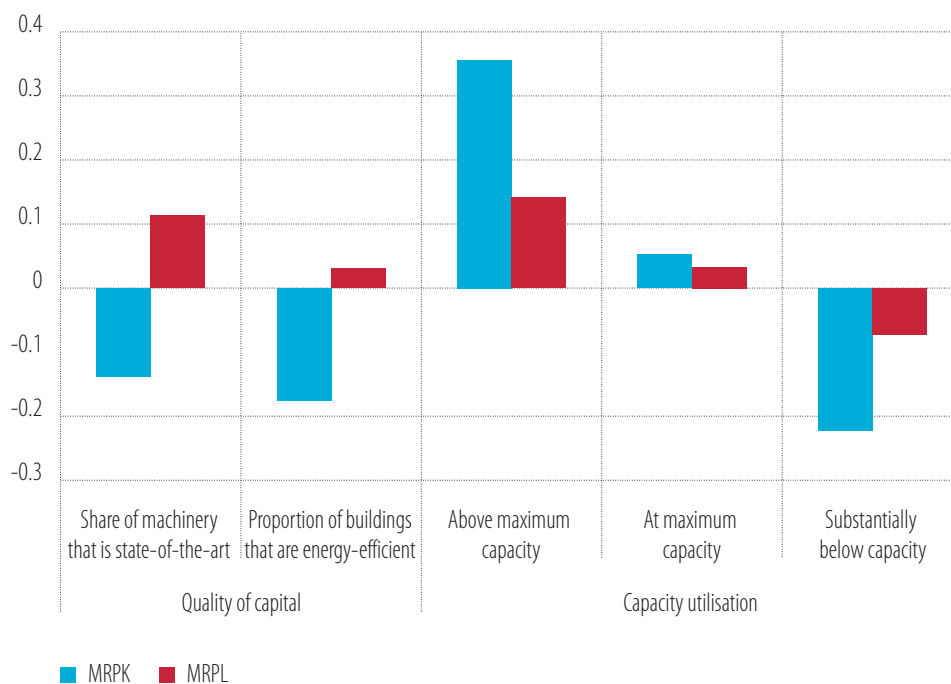
Capital quality and capacity utilisation

There are two questions on the quality of capital in EIBIS. The first question asks about the proportion of machinery and equipment (including ICT) that is state-of-the-art, "cutting edge or developed from the most recent ideas or methods." The average proportion in the sample is 40%, suggesting that most capital stock in the EU is not state-of-the-art. The second question asks about the proportion of the commercial building stock that satisfies high energy-efficiency standards (only 34% on average in the sample). These are direct measures of capital quality, although they are clearly subjective measures. While information on basic demographics is typically available in firm-level surveys or large administrative databases such as Orbis, information on the quality of capital is much more difficult to obtain at the firm level.

The marginal revenue products can vary across firms because they use the factors of production with different intensity. In addition to capital quality, information on capacity utilisation is used. The company is asked if it operated at its maximum capacity attainable under normal conditions – with normal conditions defined as the "company's general practices regarding the utilisation of machines and equipment, overtime, work shifts, holidays, etc." The categories are above maximum capacity (4% of firms in the sample); at maximum capacity (45% of firms); somewhat below full capacity (39% of firms); and substantially below full capacity (11% of firms). Ideally, one would like to have information on capital utilisation, but capacity utilisation is likely to be a good proxy for capital utilisation.

Figure 9 shows the estimated coefficients on quality of capital and capacity utilisation. All estimated coefficients are statistically significant at a 10% confidence level. Perhaps surprisingly, firms with better capital quality have a lower MRPK. They may have recently invested in updating their machinery and equipment (including ICT) and the new capital has not yet been put to full use. But this negative coefficient on capital quality should be interpreted with caution, as it is not robust to alternative specifications of the model.⁷ At the same time, capital quality is positively associated with a MRPL. This indicates that in firms with better machines and buildings, each employee produces more turnover. This could be due to the fact that capital and labour appear to be substitutes for production.

Figure 9 Association of quality of capital and capacity utilisation with the marginal revenue product of capital (MRPK) or the marginal revenue product of labour (MRPL)



Source: EIBIS 2016 for fiscal year 2015, Bureau van Dijk's Orbis database, OECD and Eurostat.

Note: The figure shows estimated coefficients from robust regressions where the MRPK or MRPL are the dependent variables. Firms are weighted to make them representative of the economy based on the number of employees. All estimated coefficients are statistically significant at a 10% confidence level. For capacity utilisation, the omitted category is "somewhat below capacity."

Firms that are below capacity utilisation may be wasting resources. Figure 9 also shows that firms that are at (and especially above) maximum capacity have a substantially higher MRPK and MRPL, consistent with the expectation that marginal products of inputs are high. This is because high product demand requires machinery, equipment and labour to be used to the fullest possible extent and beyond. The estimated coefficients also suggest that firms with low capacity utilisation have a low marginal revenue product of (idle) machinery, equipment and labour.

⁷ For instance, when capital quality is interacted with each country, the estimated coefficient on capital quality is positive but not statistically significant and none of the interaction terms are statistically significant. Alternatively, when a model with only the 19 countries of the euro zone is used, the estimated coefficient on the share of machinery and equipment that is state-of-the-art is not statistically significant.

Constraints to investment

In EIBIS, firms are asked nine different questions on structural impediments to investment and whether a given impediment is a major obstacle, a minor obstacle or not an obstacle at all. The list of obstacles includes demand for products or services (53% of the firms report it to be a major or minor obstacle); availability of staff with the right skills (69%); energy costs (52%); access to digital infrastructure (33%); labour market regulations (58%); business regulations (for example, licences, permits, bankruptcy) and taxation (62%); availability of adequate transport infrastructure (38%); availability of finance (51%); and uncertainty about the future (74%). The obstacles will be felt differently by firms and this may affect their marginal revenue products of capital and labour.

Energy costs and labour market regulation prevent firms from adjusting capital and labour. The estimates in Figure 10 suggest that firms reporting energy costs to be an impediment tend to have a lower MRPK and MRPL. This suggests that energy could be a complement to capital and labour (Hassler, Krusell and Olovsson, 2012). In addition, Gorodnichenko et al. (2017) argue that if energy is an input that has a low elasticity of substitution with value added, an energy price shock can lower the MRPK and MRPL.

Figure 10 Association of obstacles to investment with the marginal revenue product of capital (MRPK) or the marginal revenue product of labour (MRPL)



Source: EIBIS 2016 for fiscal year 2015, Bureau van Dijk's Orbis database, OECD and Eurostat.

Note: The figure shows estimated coefficients from robust regressions where the MRPK or MRPL are the dependent variables. Firms are weighted to make them representative of the economy based on the number of employees. Of the estimated coefficients, 10 out of 18 are statistically significant at a 10% confidence level. Estimated coefficients that are not statistically significant are shown in grey. For each obstacle, the omitted category is "not an obstacle."

Similarly, labour market regulations are associated with a lower MRPK and MRPL, suggesting that they could result in excess capital and employment in firms. In other words, because of more stringent labour market regulations, firms do not reduce their assets and number of employees when demand goes down. Frictions in the labour market might thus lead to an inefficient use of resources.

The analysis suggests that firms can cope with minor issues in business regulations, but not when business regulations present major issues. The estimated coefficient on business regulations is not statistically significant. However, when the intensity of the impediment (major or minor obstacle) is considered, firms reporting business regulations to be a major obstacle to investment end up having a lower MRPK.

Digital and transport infrastructure are complements to capital and labour. Firms that report access to digital infrastructure or transport infrastructure tend to have a higher MRPK and MRPL, suggesting that infrastructure is a complement to capital and labour. It is also important to point out that, on average, more productive firms (especially firms in the services sector as well as exporters) are more likely to report access to digital and transport infrastructure to be impediments to investment, as they may be better aware of their needs in this area.

As for the other obstacles, firms reporting demand for products or services to be obstacles tend to have a higher MRPL. While deficient demand as an obstacle to investment might be expected to result in a lower MRPK and MRPL if existing capital and labour are adequate or more than adequate to satisfy product demand, the positive coefficient on the MRPL may be brought about by the fact that capacity utilisation is controlled for and the effect may hence already have been taken into account. The positive relationship is also consistent with greater competition, which forces firms to have high marginal revenue products.

Firms that report the availability of finance as an obstacle tend to have a lower MRPL. This finding suggests that when firms do not have sufficient access to finance, they likely substitute capital with labour. In other words, if firms are not faced with finance constraints, they adjust their number of employees to become more efficient. Below, a different indicator of finance constraints is used, but it is also found to be negatively associated with the MRPK and MRPL.

In the EU context, impediments to investment may also reflect inefficiencies in the EU single market, which would suggest a need for better integration policies. More generally, the fact that firms do not (or cannot) optimise their marginal revenue products may indicate that inefficiencies in labour, energy, transport, financial and digital markets in the EU, and especially the fragmentation of these markets, play a role.

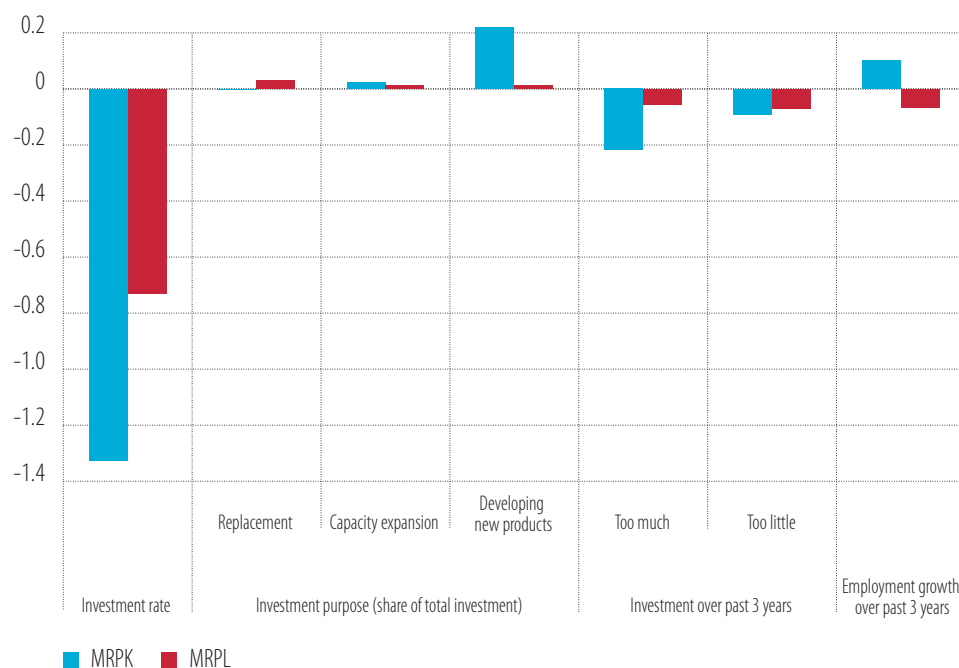
Investment decisions

Firms are exposed to a variety of shocks and to adjustment costs they may face in order to respond to optimal factor allocation. One way to measure these adjustment costs is to examine the dynamics of inflows or outflows of capital and labour. Materials are often assumed to adjust more rapidly. The analysis here uses data on the investment rate (investment divided by turnover), which is 13% on average in the sample, and the growth rate of employment over the past three years, which is 12% on average in the sample.

Two more questions on investment decisions are relevant. The first question collects information on the proportion of total investment spent on different investment purposes: replacing existing buildings, machinery, equipment and IT; expanding capacity for existing products/services; developing or introducing new products, processes or services; and a final “other” investment category. Most investment is spent on replacement, which on average accounts for 56% of total investment. Capacity expansion accounts for 23%, while only 15% of total investment is spent on developing or introducing new products, processes and services (and only 3% is spent for “other” purposes). The second question asks the firm to look back at investment over the last three years – “was it too much, too little, or about the right amount to ensure the success of the business going forward?” The vast majority of firms consider that they invested about the right amount (74%); 20% report that they spent too little; and only 4% report that they spent too much. A small number of firms (less than 1%) did not exist three years ago.

Firms that recently invested tend to have a lower marginal product of capital due to diminishing returns on additional fixed assets. Figure 11 shows that a high investment rate is negatively associated with the MRPK. Indeed, investment increases the amount of capital available to the firm and this will be associated with a lower MRPK due to diminishing returns on each additional unit of fixed assets. Similarly, the investment rate is negatively associated with the MRPL. Although this pattern may be consistent with measurement error in turnover, the MRPL could decrease due to the fact that the firm may need time to adjust its use of labour after an investment is made.

Figure 11 Association of adjustment factors with the marginal revenue product of capital (MRPK) or the marginal revenue product of labour (MRPL)



Source: EIBIS 2016 for fiscal year 2015, Bureau van Dijk's Orbis database, OECD and Eurostat.

Note: The figure shows estimated coefficients from robust regressions where the MRPK or MRPL are the dependent variables. Firms are weighted to make them representative of the economy based on the number of employees. Of the estimated coefficients, 10 out of 16 are statistically significant at a 10% confidence level. Estimated coefficients that are not statistically significant are shown in grey. For investment purposes, the omitted category is "investment in other." For investment over the past three years, the omitted category is "about the right amount." The estimated coefficient for the category "firm did not exist three years ago" is not statistically significant and is not shown.

Investments in innovation increase the MRPK. Firms that spend a higher share of their investment on developing or introducing new products, processes or services tend to have a higher MRPK, suggesting that innovative firms may be constrained in expanding their capital. In other words, as the firm expands into these new areas, it may need time to accumulate the optimal capital stock. It may also be more difficult to obtain financing for investment in innovation because of the uncertainty associated with the returns on the investment, compared to investing in replacement or capacity expansion, which are based on the firm's existing products or services that have already been tested by the market.

Firms that invested “the right amount” in the last three years tend to have a higher MRPK. Firms that invested too little or too much (as opposed to “about the right amount”) tend to have a lower MRPK and MRPL. For instance, those firms that have invested too much are endowed with too much capital, which explains the lower MRPK because of diminishing returns on capital. It is probably not a surprise that firms that did not plan their investments accurately are less efficient. This could happen if these firms were hit by unexpected shocks and were not able to adjust capital or labour rapidly over the past three years.

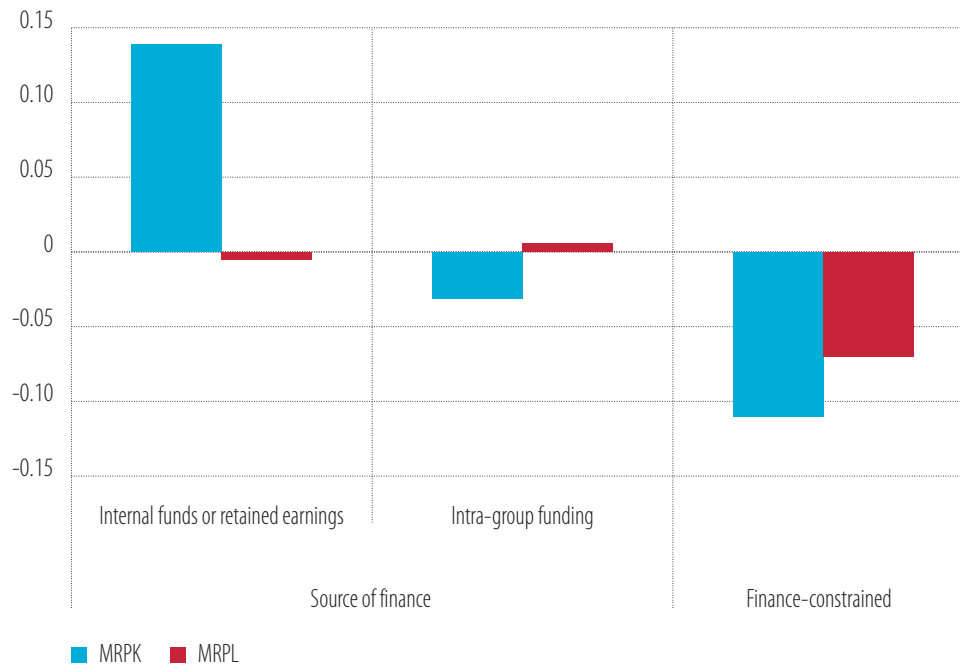
Firms that grew rapidly over the last three years tend to have a higher MRPK and lower MRPL. A higher MRPK could happen if there is substitutability of capital and labour and each additional unit of fixed assets becomes more productive as the firm’s number of employees increases. Employment growth also reduces the MRPL, which could be explained by diminishing returns on labour and the time needed for new staff to become fully productive, particularly in cases where a firm has difficulties in finding workers with the right skills.

Sources of finance

The standard model of a profit-maximising or cost-minimising firm yields the prediction that marginal revenue products should be equal across firms if all firms face the same price of capital and labour. But in practice, firms can have different costs of capital depending on factors such as their age, credit history, how connected they are to capital markets, the collateral they can provide, or different sources of finance. Specifically, numerous studies document that the cost of external funds is greater than the cost of internal funds or the funds obtained within a business group (Desai, Foley and Hines, 2004; Fama and French, 2002). EIBIS asks firms what proportion of their investment was financed by each of the following: internal funds or retained earnings (for example, cash, profits); external finance (for example, financing from banks, private or public equity); and intra-group funding for subsidiaries (for example, a loan from the parent company). Internal funds or retained earnings represent the largest source of finance for investment, at 69% on average, while 29% comes from external finance (and less than 2% from intra-group funding, which would be relevant for subsidiaries).

Firms that are finance-constrained have lower marginal revenue products. This indicates that they are also constrained in adjusting their use of capital and labour. Figure 12 shows that firms that use a higher share of internal funds or retained earnings (for example, cash, profits) to finance investment tend to have a higher MRPK. This finding is consistent with the view that firms using internal funds are more likely to be capital-constrained. A measure of finance constraints is also used: firms can be constrained if they either (1) obtained external finance but not all the quantity expected; (2) were rejected when they sought external finance; (3) did not apply because they thought external finance would be too expensive; or (4) thought they would be rejected and were discouraged from applying. Certain types of firms, such as small-scale start-ups and young and innovative firms, tend to face greater difficulties in obtaining external finance (Lerner and Hall, 2010). In EIBIS, 9% of firms reported that they are finance-constrained. Although one might have expected that such a status would lead to a higher MRPK, it should be noted that firms may be denied credit due to their poor fundamentals. If this latter effect dominates, the negative correlation for both the MRPK and MRPL should be observed.

Figure 12 Association of sources of finance with the marginal revenue product of capital (MRPK) or the marginal revenue product of labour (MRPL)



Source: *EIBIS 2016 for fiscal year 2015, Bureau van Dijk's Orbis database, OECD and Eurostat.*

Note: *The figure shows estimated coefficients from robust regressions where the MRPK or MRPL are the dependent variables. Firms are weighted to make them representative of the economy based on the number of employees. Of the estimated coefficients, 3 out of 6 are statistically significant at a 10% confidence level. Estimated coefficients that are not statistically significant are shown in grey. For the source of finance, the omitted category is "external finance" (for example, financing from banks, private or public equity).*

Conclusion and policy implications

This chapter relies on data from the EIB Investment Survey (EIBIS) to better understand the differences in the way firms across the EU use labour and capital. The analysis uses the dispersion of the marginal revenue product of capital (MRPK) and the marginal revenue product of labour (MRPL) among firms in the same country or within the overall EU single market as measures of possible misallocation of resources. The impact of firm characteristics, managerial decisions or the business environment on the capacity of a firm to adjust to optimal use of resources is assessed, using information on basic demographics of firms (including the firm's number of employees, age, industry and country), subsidiary and exporter status, capacity utilisation and quality of capital stock, obstacles to long-term investment, investment plans and employment growth, and sources of finance for investment. This information is typically difficult to observe at the firm level in administrative data and with data comparable across 28 countries.

The analysis shows that there is room for more efficient allocation of resources within the EU. Policymakers can take steps to support more efficient firms and contribute to a better reallocation of resources in EU countries. The results suggest that if labour market regulations, energy costs or access to finance were eased, some firms could more easily adjust their use of capital and labour and thus benefit the economy as a whole. Indeed, removing these frictions could significantly raise productivity. Reforms to labour market regulations could enable the mobility of capital and labour across firms, industries and countries within the EU by making it easier for more efficient firms to access more resources so that they could enter a market and grow. Reforms could also allow less productive firms to downsize and, if necessary, exit a market. While Europe is a single market, labour market regulations differ substantially by country.

Despite the progress made in recent years, the European energy market is still underperforming, for various reasons. The current market design does not provide the right incentives for sufficient investments to ensure security of supply. Market concentration and weak competition remain an issue. In particular, the European energy landscape is still too fragmented due to regulatory barriers and lack of sufficient interconnected infrastructure. As a response, in 2015 the European Commission published a Strategy for a European Energy Union, together with a communication on electricity network interconnections to improve the functioning of energy markets. This strategy aims to coordinate and integrate the energy policies of the EU and its Member States in various fields, including energy security, energy efficiency, decarbonisation, cross-border flows and research and innovation on energy. More consistent, balanced and coordinated policies at the EU level are expected to facilitate a cost-efficient transition to a secure, low-carbon energy supply, resulting in a better allocation of resources for firms in the EU. To reduce fragmentation of the EU financial market, a number of policies have also been developed in recent years, as documented in Chapter 6.

Annex. Descriptive statistics for the explanatory variables

Table A1 Descriptive statistics for the samples where the marginal revenue product of capital (MRPK) and the marginal revenue product of labour (MRPL) are the dependent variables

Firm age	MRPK		MRPL	
	Mean	Standard deviation	Mean	Standard deviation
Less than 5 years	0.047	0.212	0.048	0.213
5–9 years	0.115	0.318	0.115	0.319
10–19 years	0.260	0.438	0.262	0.439
20+ years	0.579	0.494	0.576	0.494
Employment size	221	2951	162	1001
Subsidiary	0.266	0.442	0.256	0.436
Exporter	0.459	0.498	0.451	0.498
Quality of capital				
Share of machinery that is state-of-the-art	0.401	0.323	0.402	0.325
Proportion of buildings that are energy-efficient	0.340	0.348	0.340	0.349
Capacity utilisation				
Above maximum capacity	0.044	0.205	0.044	0.206
At maximum capacity	0.451	0.498	0.453	0.498
Somewhat below capacity	0.387	0.487	0.383	0.486
Substantially below capacity	0.111	0.314	0.110	0.313
Obstacle to investment (major or minor)				
Demand for products or services	0.526	0.499	0.519	0.500
Availability of staff with the right skills	0.687	0.464	0.691	0.462
Energy costs	0.522	0.500	0.522	0.500
Access to digital infrastructure	0.326	0.469	0.327	0.469
Labour market regulations	0.582	0.493	0.587	0.492
Business regulation	0.616	0.486	0.617	0.486
Availability of adequate transport infrastructure	0.379	0.485	0.378	0.485
Availability of finance	0.509	0.500	0.508	0.500
Uncertainty about future	0.741	0.438	0.738	0.440
Investment rate	0.128	0.368	0.116	0.329

Firm age	MRPK		MRPL	
	Mean	Standard deviation	Mean	Standard deviation
Share of investment, by purpose				
Replacing existing buildings, machinery, equipment and IT	0.564	0.388	0.560	0.387
Expanding capacity for existing products/services	0.232	0.317	0.228	0.313
Developing or introducing new products, processes or services	0.152	0.266	0.151	0.266
Other	0.033	0.158	0.039	0.172
Investment over the past three years				
Too much	0.041	0.199	0.042	0.200
About the right amount	0.738	0.440	0.741	0.438
Too little	0.205	0.404	0.200	0.400
Company didn't exist three years ago	0.001	0.038	0.002	0.042
Employment growth over the past three years				
	0.122	0.500	0.119	0.491
Sources of finance				
Internal funds or retained earnings	0.693	0.363	0.695	0.362
External finance	0.286	0.353	0.285	0.353
Intra-group funding	0.017	0.110	0.016	0.108
Credit-constrained				
	0.093	0.291	0.093	0.291
Sample size				
	7,554	7,554	8,473	8,473

Source: EIBIS 2016 for fiscal year 2015.

References

- Asker, J., Collard-Wexler, A. and De Loecker, J. (2014). "Dynamic Inputs and Resource (Mis)allocation." *Journal of Political Economy*, 122(5), 1013–1063.
- Bartelsman, E., Haltiwanger, J. and Scarpetta, S. (2013). "Cross-country Differences in Productivity: The Role of Allocation and Selection." *American Economic Review*, 103(1), 305–334.
- Bloom, N. and Van Reenen, J. (2010). "Why Do Management Practices Differ Across Firms and Countries?" *Journal of Economic Perspectives*, 24(1), 203–224.
- Desai, M.A., Foley, C.F. and Hines, J.R. (2004). "A Multinational Perspective on Capital Structure Choice and Internal Capital Markets." *Journal of Finance*, 59(6), 2451–2487.
- Fama, E.F. and French, K.R. (2002). "Testing Trade-off and Pecking Order Predictions about Dividends and Debt." *Review of Financial Studies*, 15(1), 1–33.
- Gamberoni, E., Giordano, C. and Lopez-Garcia, P. (2016). "Capital and Labour (Mis)allocation in the Euro Area: Some Stylized Facts and Determinants." ECB Working Paper No. 1981. European Central Bank, Frankfurt.
- Gopinath, G., Kalemli-Ozcan, S., Karabarbounis, L. and Villegas-Sanchez, C. (2017). "Capital Allocation and Productivity in South Europe." *Quarterly Journal of Economics*, forthcoming.
- Gorodnichenko, Y., Revoltella, D., Svejnar, J. and Weiss, C.T. (2017). "Resource (Mis)allocation in European Firms: The Role of Constraints, Firm Characteristics and Managerial Decisions." EIB Working Paper. European Investment Bank, Luxembourg, forthcoming.
- Hassler, J., Krusell, P. and Olovsson, C. (2012). "Energy-saving Technical Change." NBER Working Paper No. 18456. National Bureau of Economic Research, Cambridge, MA.
- Hsieh, C.-T. and Klenow, P.J. (2009). "Misallocation and Manufacturing TFP in China and India." *Quarterly Journal of Economics*, 124(4), 1403–1448.
- Lerner, J. and Hall, B.H. (2010). "The Financing of R&D and Innovation." In *Handbook of the Economics of Innovation, Volume 1*, edited by Hall, B.H. and Rosenberg, N. Elsevier, Amsterdam.
- Syverson, C. (2011). "What Determines Productivity?" *Journal of Economic Literature*, 49(2), 326–365.
- Verhoogen, E.A. (2008). "Inequality in the Mexican Manufacturing Sector." *Quarterly Journal of Economics*, 123(2), 489–530.

The EIB: achieving impact through investment in Europe

The EIB – the EU bank – plays an important catalytic role in promoting sound investment projects in support of EU policy goals in Europe and beyond. In 2016, the EIB provided EUR 75bn in long-term finance to support private and public productive investment, with the EIF providing EUR 9.5bn. At a first estimate, together this helped realise investment projects worth roughly EUR 280bn.

The EIB is both a bank and a public institution. As a bank, it raises money on the international capital markets, using its AAA credit rating. As a public institution owned by the 28 Member States of the EU, it lends these funds to finance investment projects that address systemic market failures or financial frictions, targeting priority objectives such as European cohesion, competitiveness and climate action via support for innovation and skills, SMEs, the environment, and strategic infrastructure.

The EIB Group stepped up its lending substantially during the financial crisis in support of Europe's recovery. However, the Bank's natural raison d'être as a long-term investor remains to achieve structural impacts by addressing market failures and frictions, to enhance productivity and competitiveness in line with its four priorities. We play a leading role in Europe in developing financial instruments to crowd-in the private sector and multiply the impact of public funds, helping to support the much needed re-prioritisation of public support for investments in innovation and infrastructure. Within the EIB Group, the European Fund for Strategic Investments (EFSI) exemplifies this approach and is proving its efficacy. As of mid-October 2017, EUR 47bn of EFSI transactions were approved, covering all 28 EU countries, expected to mobilise EUR 241bn in total investments, or 76% of the full EUR 315bn envisaged. As the first pillar of the Investment Plan for Europe undertaken by the European Commission and the EIB, EFSI forms an integral part of the EIB Group's activities, further enhancing the Group's capacity to address market failures in risk-taking that hold back investment.

The EIB Group is responding to the need to boost innovation through support for investment in different kinds of intangibles, including skills. In 2016, the Group signed operations worth EUR 13.5bn to support education and skills development, digital infrastructure and the financing of innovative firms. These investments will contribute to improving educational facilities for some 890,000 students and are expected to help install or upgrade 11 million high speed digital connections. The Bank is a major financier of research and development in Europe, but we also recognise that innovation-related investments go beyond R&D to include a wide range of investment in both tangible and intangible assets. Such diverse investments require a range of financing types, and the Group – particularly through the EIF – is active in fostering the use of instruments such as guarantees, SME loan securitisation and venture capital. Indeed, the EIF is a cornerstone investor in funds that account for around 50% of the EU venture capital market, helping this market to develop and expand its geographical reach. The EIB Group is committed to addressing issues of access to finance for SMEs as long as market failures and frictions exist. The Group's support for SMEs, which accounts for some EUR 33.6bn of EIB Group operations, helps to address financing gaps to foster innovation and make European firms more competitive to sustain and create jobs.

The EIB is the world's largest multilateral lender for climate action, with EUR 19.5bn (26% of total financing) provided for climate action projects in 2016. We expect to lend USD 100bn for climate action over the five years to 2020. In addition to our commitment of 25% of lending for climate action inside the EU, we have set the ambitious target for climate finance to reach 35% of our lending in developing countries by 2020, while we are also working to mainstream climate action into all our operations. The EIB is also at the forefront of innovation in climate investment instruments to mobilise resources from private investors, such as the highly successful Global Energy Efficiency and Renewable Energy Fund (GEREEF) and the development of green bond markets.

The EIB: achieving impact through investment in Europe

The recovery of investment in all kinds infrastructure does not only require financing; it is just as important to address gaps in capacity for project planning, preparation and prioritisation between alternatives, at national, regional and municipality levels. The Bank's advisory activities and technical assistance can help projects to get off the ground and maximise the impact and value-for-money of investments. The European Investment Advisory Hub (EIAH), implemented as the second pillar of the Investment Plan for Europe, expands the Bank's ability to provide comprehensive technical assistance in the sourcing, preparation and development of investment projects. We also actively work with the European Commission to drive forward the third pillar of the Plan, which focuses on support for reforms to remove bottlenecks and regulatory barriers to ensure an investment-friendly environment, and to facilitate greater EU-level coordination to fully realise the benefits of the single market in areas such as transport and energy. In this context, the Bank's research work – including this report – and the lessons we are able to draw from our project assessment and advisory activities, constitute an important part of the Bank's contribution to EU policy efforts.

The investments supported by the EIB Group have a strong and lasting impact on the EU economy. The EIB's economists have worked closely with the European Commission Joint Research Centre in Seville, Spain, to try to gauge the overall macroeconomic impact of EIB-supported operations in terms of jobs and growth in the EU. To this end, the well-established RHOMOLO economic model has been used to assess the future impact of the investments supported by all EIB Group operations during 2015-16, including investments supported under the European Fund for Strategic Investments (EFSI). This modelling exercise suggests that EIB-supported investments provide both a short-term boost to the economy (the "investment effect"), which fades over time, and a longer-lasting structural impact on productivity and competitiveness. Hence, by 2020, the investments supported by the EIB Group in 2015 and 2016 are expected to have raised the level of EU GDP by 2.3% and to have added 2.25 million jobs. In the long term, this investment effect will wear out, with loans being repaid and capital goods starting to depreciate, but the structural impact of the investments on growth and jobs will remain. After 20 years, by 2036, the expected impact is still estimated at around 1.5% of EU GDP above the baseline scenario and some 1.27 million extra jobs.

Figure 1 Expected impact on EU GDP from EIB Group-supported investments approved in 2015 and 2016 (% of GDP)

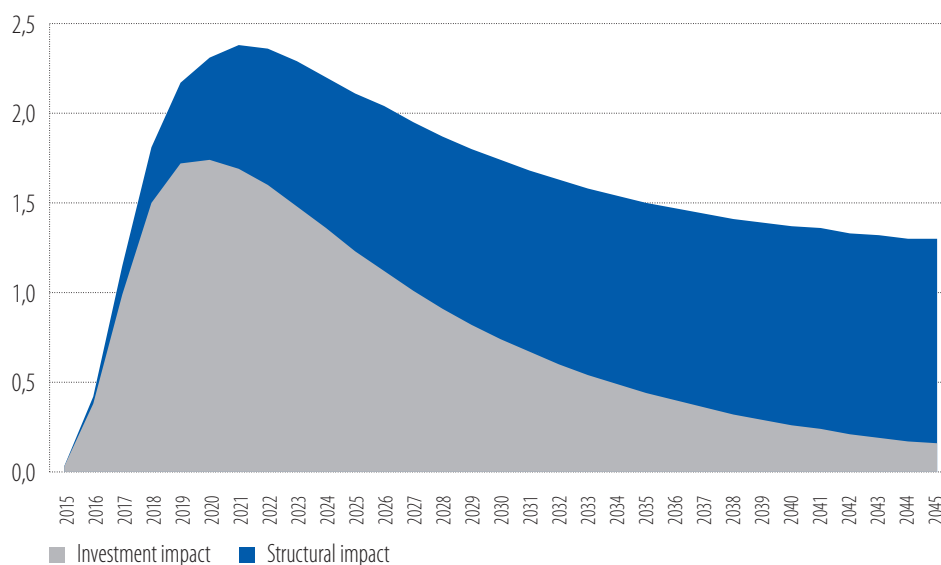
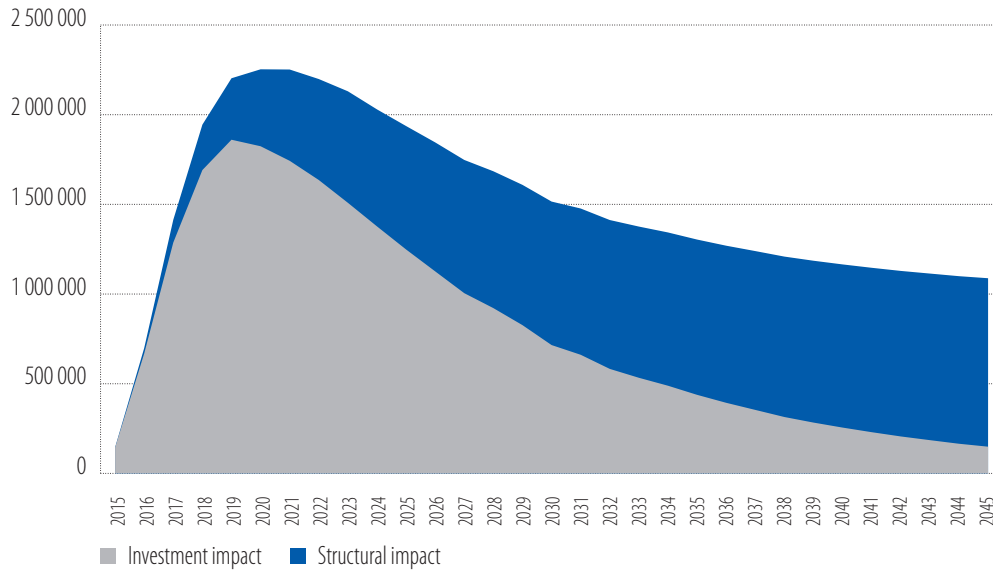


Figure 2 Expected impact on EU employment from EIB Group-supported investments approved in 2015 and 2016 (number of jobs)



The impact of EFSI operations approved from its inception in 2015 until the end of 2016 has also been estimated, in line with the macroeconomic assessment of EIB Group activities. These operations are expected to support investments in the EU economy in the coming years of some EUR 161bn. By 2020, these investments are expected to increase EU GDP by 0.67%, raising employment by some 690,000 jobs. In the longer term, in 2036, European GDP is still expected to be 0.4% higher, with 340,000 more jobs than would have been the case in a scenario without EFSI-supported investments.

Data annex

The availability and quality of the data on investment are critical to supporting effective policy making. In addition to national accounts, economists need to rely on other sources of macroeconomic data to analyse important aspects of investment, including infrastructure investment and intangible investment, and they increasingly make use of firm-level data.

The EIB has made important steps in bridging some of the data gaps by developing an internally consistent methodology to estimate infrastructure investment and PPP finance; by running a survey on corporate investment and investment finance; and by participating in the financing of the production of a database on investment in intangible assets and stocks of intangible capital. This annex outlines these datasets and provides references to detailed methodological notes.

Estimating infrastructure investment in the EU

Data on infrastructure investment, let alone its financing sources, are not available in any ready-to-use form. Over the years, the EIB has developed a new methodology to estimate infrastructure investment.

The basic idea is to use Eurostat's national accounts data on gross fixed capital formation (GFCF) in the sectors commonly considered to be "infrastructure sectors" (i.e. education, health, transport and utilities) to construct estimates of total and government infrastructure investment.¹ Private investment is then derived as the difference between the two.

In a next step, the private infrastructure aggregate is broken down with the help of Projectware data. This allows us to distinguish between corporate (non-project) infrastructure investment and investments made through Special Purpose Vehicles (SPVs, i.e. projects). The latter can further be divided into Public-Private Partnership projects and non-PPP projects, using data described in (Kappeler and Nemoz, 2010).² Finally, Revoltella et al. (2016) use newly available Eurostat data on GFCF for a more precise proxy for infrastructure investment, which is GFCF in other buildings and structures.

The new data has the advantage that it excludes many non-infrastructure investments, such as investments in trucks or in other machinery and equipment (that are included in total fixed assets), and therefore reduces the risk of overestimating infrastructure investments. The new Eurostat data also allow us to differentiate between GFCF in the transport sector and in the ICT sector (which were previously lumped together). This gives us a more granular view of individual investment trends across different sectors.

1 For details see Wagenvoort, R., de Nicola, C., and Kappeler, A. (2010). "Infrastructure Finance in Europe: Composition, Evolution, and Crisis Impact". EIB Papers. 15 (1), pp. 16-39. Luxembourg: EIB.

2 Kappeler, A., and Nemoz, M. (2010). "Public-Private Partnerships in Europe – before and during the recent financial crisis." Luxembourg: European Investment Bank.

Although the new data captures infrastructure investment better, a few caveats remain. The most important one being the fact that the new data do not allow us to distinguish between GFCF in total fixed assets and in other buildings and structures for the government sector – which means that we have to approximate government investment in other buildings and structures. To do so, we use the following formula:

$$GGFCF(obs) = GGFCF(tfa) * \left(\frac{\text{government net capital stock}(obs)}{\text{government net capital stock } t f a} \right) - \text{implied depreciation},$$

where GGFCF(obs) and GGFCF(tfa) are government GFCF in other buildings and structures and in total fixed assets respectively and

$$\text{implied depreciation} = \left(\frac{\text{total economy net capital stock } (obs)}{\text{total economy net capital stock } (t f a)} - \frac{GFCF(obs)}{GFCF(t f a)} \right).$$

That is, we use the share of other buildings and structures in the government capital stock as a proxy for the share of government gross fixed capital formation in other buildings and structures (adjusted for differences in depreciation rates). In other words, we assume that the share of government gross fixed capital formation in other buildings and structures is equal to its historical share.

It should be noted that applying this formula requires us to make two minor data adjustments. First, when data on the net capital stock of a country is missing, we replace the missing value with the average net capital stock of the region in which the country is located (i.e. Northern Europe, Southern Europe or Central and Eastern Europe). Second, to deal with outliers, we set negative implied depreciation differentials equal to zero.

EIB Investment Survey

The EIB Group Survey on Investment and Investment Finance (EIBIS) is an EU-wide survey that gathers qualitative and quantitative information on investment activities by both SMEs (with between five and 250 employees) and larger corporates (with 250+ employees), their financing requirements and the difficulties they face.

Using a stratified sampling methodology, EIBIS is representative across all 28 Member States of the EU and this applies to four firm size classes (micro, small, medium and large) and four sector groupings (manufacturing, services, construction and infrastructure) within countries. It is designed to build a panel of observations over time, and is set up in such a way that survey data can be linked to firms' reported balance sheet and profit and loss data.³ The first wave of the survey took place between July and November 2016; the second one between April and August 2017.

EIBIS is intended to complement already available information on investment activities in the EU. It adds a firm-level dimension to available macro-economic data and thus allows for more fine-grained analysis of firm investment patterns. EIBIS also adds to existing firm-level surveys at the national level by providing full comparability of results across countries. EIBIS complements the EC investment survey by asking a much wider set of both qualitative and quantitative questions on firm investment activities and the ECB/EC SAFE survey by focusing on the link between firm investment and investment finance decisions.

³ 40% of the companies interviewed in Wave 2 are panel companies.

All aggregated data in this report are weighted by value added to better reflect the contribution of different firms to economic output.

The aggregate survey data, the questionnaire and a detailed account of the survey methodology are available on www.eib.org/eibis.

EIBIS-Orbis matched dataset

This report includes analysis based on a dataset that combines firm-level information from Bureau van Dijk's Orbis with the first survey round of EIBIS – the EIBIS-Orbis matched dataset. The matching was carried out by the current survey provider IPSOS to preserve firms' anonymity. Orbis is a proprietary dataset that contains firm-level accounting information and ownership data, gathered and standardised to the so-called "global format" that makes accounting data comparable across jurisdictions. Items from the balance sheet and profit-and-loss accounts have been used to construct standard financial ratios for firms that reflect financing activity and financial health. All data were reviewed following standard cleaning procedures to eliminate outliers and inconsistencies. Negative values for fixed assets, total assets and other stock variables were removed and all ratios have been winsorised at 1% level.

The matched dataset complements the cross-sectional perspective of EIBIS with time series information starting in 2000. It allows us to construct custom panel datasets, for instance to analyse firms' investment dynamics as in Chapters 7, 8 and 10 of this report.

Investment in climate change mitigation

Investment in CCM comprises renewable energy, networks, energy efficiency, transport infrastructure, agriculture land use/land use change and forestry, and research and development. It includes investments that would be economically and financially viable without placing any special value on greenhouse gas abatement, as well as those that would be unattractive if not for the climate imperative.

Renewable energy

Data from the International Energy Agency (IEA) and Bloomberg New Energy Finance (BNEF) are the basis for the estimates of investment in renewable energy presented in this chapter.

IEA estimates are based on analysis of annual capacity additions and unit investment costs, derived in part from surveys with industry, IEA Technology Collaboration Programmes, the International Renewable Energy Agency (IRENA) and other organisations. Investment does not include operating and maintenance expenditures, financing costs, research and development spending, mergers and acquisitions or debt and equity market transactions. Investment outlays are counted in the year that an asset becomes operational. Thus, the investment for 2016 actually reflects spending carried out in previous years too.

BNEF estimates are based on disclosed deal values, or BNEF estimates based on comparable transactions. Investment outlays are counted on the date of financial close. The estimates include all biomass and waste-to-energy, wave and tidal; geothermal and wind generation > 1 MW, hydro 1–50 MW; biofuels > 1 million l/y; all solar projects (<1 MW counted as distributed capacity).

Networks

Investment in electricity networks includes transmission, distribution and grid-scale battery storage. The data reflect three drivers: investment in new infrastructure to accommodate new demand, investment to replace ageing infrastructure, and the investment required to integrate renewables into the power system. Network investment to accommodate new demand is calculated based on the commissioning of new transmission and distribution lines and on the analysis of data provided by the 2016 NRG Expert Transmission and Distribution Database. The applied unit investment costs are based on past capital expenditures and data from industry surveys. Investment in asset replacement assumes an average lifetime of 40 years for assets already in operation. Unit replacement costs are derived from costs of new infrastructure. Investment costs of transmission and distribution networks required for renewables integration are derived from renewable integration costs based on literature reviews. The analysis of investments in the digitalisation of the electricity grid is based on analysis of NRG, BNEF and MarketsandMarkets. Investment in grid-scale electricity storage is based on the capacity deployment reflected in the US Department of Energy Global Energy Storage Database. Investment in pumped-hydro storage, the largest component of global storage investment, is included in the hydropower data of WEI 2017.

Energy efficiency

There are no official data on investment in energy efficiency, and estimating it presents some unique challenges. Energy efficiency is typically a component of a larger investment. For example, when a piece of machinery is replaced, the new machinery might have a number of enhancements, including lower energy consumption. Energy efficiency investments are made by many agents – both public and private – across many sectors, including households and enterprises. Dedicated financing for energy efficiency is in its infancy. This means that for the majority of investments, the source of financing does not provide a clear-cut distinction between energy efficiency and other aspects of the investment.

Two broad approaches have been taken by the IEA to estimating energy efficiency investment. The bottom-up approach calculates for a given country the additional cost of the 25% most efficient appliances over and above the average cost of appliances in a given category. For example, in the area of residential lighting, energy efficiency investment would be estimated as the number of high efficiency light bulbs purchased times the cost difference between a high-efficiency bulb and a regular bulb.

The top-down approach estimates how much would have been spent on energy if aggregate energy intensity remained fixed from one year to the next. This is the monetary value of the energy efficiency savings. Combined with an assumption about the payback period of energy efficiency investments this yields an estimate of how much would have been invested to yield the observed reduction in energy use. In comparison with the bottom-up approach, the top-down approach has the advantage of requiring less data, but it has two disadvantages. First energy intensity is not energy efficiency, and to the extent that reductions in energy use resulted from structural shifts to lower-energy activities, the top-down approach would over-estimate efficiency investment. Second, there is inevitably some overlap between the top-down measure of energy efficiency and the other categories of CCM investment used in this report. For example, switching from fossil fuels to renewable energy has a large impact on the aggregate energy intensity. Also, improvement in vehicle efficiency is hard to distinguish in the aggregate data from reductions in energy consumption due to investment in transport infrastructure.

Bottom-up estimates of investment in energy efficiency are not available prior to 2015. To estimate the previous years, a top-down methodology was used. Imputed energy savings are calculated on the basis of changes in aggregate energy intensity. The savings are smoothed out using a three-year moving average. Investment is assumed to be proportional to the smoothed out energy savings, and the model is calibrated to agree with the 2015 bottom-up estimate.

Transport infrastructure

CCM investment in transport infrastructure is estimated on the basis of OECD International Transport Forum data on capital formation in rail and inland waterways. The data are available up to 2015, and 2016 is estimated holding the ratio to gross fixed capital formation constant at the 2015 level.

The statistics are based on a survey of total gross investment (defined as new construction, extensions, reconstruction, renewal and major repair). Member countries supply data in current prices. OECD reports that despite the relatively long time series, complexities with regard to data definition and coverage have rendered international comparisons difficult. The indicators such as the investment share of GDP depend on a number of varying factors, such as the quality and age of existing infrastructure, the maturity of the transport system, the geography of the country, and the transport intensity of its productive sector. OECD therefore advises caution when making comparisons of investment data between countries, and instead would encourage studying the evolution of individual countries or aggregates over time.

Forestry

Available data on gross fixed capital formation in forestry are taken from Eurostat, Statistics Explained: Forests, forestry and logging. The data go up to 2013. Subsequent years are estimated by assuming that the ratio of forestry to gross fixed capital formation remains constant.
Research and development

We use four sources of information on R&D

- OECD survey data for government R&D. These data are available up to 2013 for most countries and for some countries in 2014. CCM R&D is assumed to be composed of the following top-level categories in the database: energy efficiency, renewable energy, hydrogen and fuel cells, other power storage technologies, and other cross-cutting technologies. In addition, carbon capture and storage (which is under fossil fuel technologies in the database) is included in the analysis. These data refer to government expenditure at the national level and do not include EU programmes.
- IEA data on corporate R&D spending on clean energy up to 2016, with state-owned enterprises (partly overlapping with public R&D) up to 2015.
- BNEF estimates of public and corporate R&D.
- EIB financing of R&D in manufacturing sectors, including automotive, chemicals and other manufacturing.

INTAN-Invest database

Intangible investment is an important aspect of investment that is difficult to estimate with data from national accounts. But the changing nature of the global economy has placed more attention on intangible assets as a source of economic growth. In order to understand how intangible assets can be a driver of value creation for individual firms and the economy as a whole, it is important to measure them properly. Although the fixed asset boundary in national accounts has been continuously expanded to better account for the role of intangibles, official estimates treat only a limited range of intangible assets as investment. For instance, 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 adoption of the European System of National and Regional Accounts 2010 (ESA 2010, which replaces ESA 1995), R&D expenditure is

also 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.

The INTAN-Invest database has expanded the core concept of business investment in national accounts by treating as intangible investment much business spending on intangible assets – including design, brand equity, firm-specific training, and organisational efficiency. Intangible assets are defined there as investments that enable knowledge to be commercialised and are classified into three broad categories: computerised information, innovative property and economic competencies (see Table 1). Some of the intangible assets are already capitalised in national accounts (SNA 2008/ESA 2010), including R&D, mineral exploration, computer software and databases, and entertainment, literary and artistic originals. But expenditures for design, branding, new financial services, organisational capital and firm-provided training are instead currently treated as intermediate costs in national accounts.

Asset	Intangibles included in national accounts?	Capitalisation factor	Depreciation rate
Computerised Information			
Purchased software	Yes	1	0.315
Own-account software	Yes	1	0.315
Databases	See note	1	0.315
Innovative property			
R&D	Yes	1	0.15
Design	No	0.5	0.2
Mineral exploration	Yes	1	0.075
Financial innovation	No	1	0.2
Artistic originals	Yes	asset-specific	asset-specific
Economic competencies			
Advertising	No	0.6	0.55
Marketing research	No	0.6	0.55
Own-account organisational capital	No	1	0.4
Purchased organisational capital	No	0.8	0.4
Training	No	1	0.4

Source: *Investment and Investment Finance in Europe 2016*.

INTAN-Invest 2016 data cover total investment in industries from NACE sections A to M (excluding M72) and section S plus the market sector component of NACE M72, P, Q and R (while previous INTAN-Invest estimates did not include industries P and Q but incorporated industry R as a whole). The analysis excludes the real estate industry (NACE section L).

GLOSSARY OF TERMS AND ACRONYMS

ABS	Asset-Backed Security
Adaptation	Adaptation addresses the risks posed by climate change rather than the underlying causes. For example, investment in carbon capture and storage counts as mitigation whereas investment in improved sea defences counts as adaptation.
Adopting firms	Firms that have no substantial R&D (R&D-to-sales ratio lower than 0.1%) but have introduced new products, processes or services.
APP	Asset Purchase Programme
Baltics	Estonia, Latvia and Lithuania
Basic firms	Firms that have no substantial R&D (R&D-to-sales ratio lower than 0.1%) and have introduced no new products, processes or services.
Benelux	Belgium, the Netherlands and Luxembourg
BLS	Bank Lending Survey
BvD ORBIS	Bureau van Dijk ORBIS database: database of private and listed company information from around the world. It includes, among others, companies' financial accounts, ownership structures and details of mergers and acquisitions activity.
CCM	Climate Change Mitigation: mitigation addresses the underlying causes of climate change. It seeks to control the level of GHGs in the atmosphere by reducing emissions or increasing sequestration.
CDS	Credit Default Swaps
CET1 ratio	Common Equity Tier 1 ratio
CI	Carbon Intensity. Emissions of CO ₂ equivalent per unit of activity, e.g. CO ₂ /GDP.
CMU	Capital Markets Union
Cohesion countries	Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia
Construction	Based on the NACE classification of economic activities, firms in group F (construction).
Developers	Firms that have substantial R&D (R&D-to-sales ratio equal to or higher than 0.1%) but have introduced no new products, processes or services.
Dynamic shift	Interaction over time of the change of an industry investment rate and its share of value added in the total.
EBA	European Banking Association
Economic competencies	In INTAN-invest: a category of intangible assets in the INTAN-invest database that includes expenditures on brand, organisational capital and training.

Glossary of terms and acronyms

EE	Energy Efficiency
EI – Energy Intensity	Energy consumption divided by activity, e.g. energy/GDP.
EIB Infrastructure Database	The EIB Infrastructure Database is a unique combination of macro data and project level data for estimating infrastructure investment in Europe.
EIB Municipality Survey 2017 (EIBIS add-on module)	In 2017, the EIB conducted a survey of municipalities on the back of the EIB Investment Survey.
EIBIS	The annual EIB Group Survey on Investment and Investment Finance (EIBIS). Qualitative and quantitative information on the investment activities of 12,500 firms in the EU. See also www.eib.org/eibis .
ERDF	European Regional Development Fund
ESIF	European Structural and Investment Funds: a common name encompassing various EU Funds.
ETS	Emissions Trading Scheme
European Innovation Scoreboard	The European Innovation Scoreboard provides a comparative analysis of innovation performance in EU countries, other European countries, and regional neighbours. It classifies countries based on a number of indicators – including business and public R&D expenditure, scientific publications by universities, number of doctorate students, patent and trademark applications, broadband penetration, investment in other intangibles beyond R&D such as ICT training, as well as innovative activities by firms. The Scoreboard defines four categories of countries: innovation leaders, strong innovators, moderate innovators and modest innovators.
EV	Electric Vehicles
External finance-constrained	External finance-constrained describes municipalities that did not use external finance because (1) of a limit on the amount of debt; (2) they did not apply because they thought it would be too expensive; (3) they thought they would be turned down; or (4) they were legally not allowed to borrow.
FCI	Financial condition index
FDI	Foreign Direct Investment
FFE	Fossil Fuel Energy
Firms' perceived investment gap	Firms' perceived investment gap is computed based on their responses to the question: Looking back at your investment in the past three years, would you say that investment has been in line with needs, above needs or below needs to ensure the competitiveness of your company going forward?
FiT	Feed-in tariffs are subsidised prices for supply of renewable energy to the grid.

FSB	Financial Stability Board
GERD	Global expenditures on R&D
GFCF – Gross Fixed Capital Formation	Net resident producers' acquisitions of fixed assets plus certain additions to the value of non-produced assets realised by the productive activity of producer or institutional units. Fixed assets are produced assets used in production for more than one year.
GHG	Greenhouse gas
Grants	External finance involving, for example, support from public sources
GVA	Gross Value Added
ICT	Information and communication technology
IIP	International Investment Position
Incremental innovators	Firms that have substantial R&D (R&D-to-sales ratio equal to or higher than 0.1%) and have introduced new products, processes or services new to the company.
Industries	According to statistical classification of economic activities Rev. 2: A: Agriculture, forestry and fishing; B: Mining and quarrying; C: Manufacturing; D: Electricity, gas, steam and air conditioning supply; E: Water supply; sewerage, waste management and remediation activities; F: Construction; G: Wholesale and retail trade; repair of motor vehicles and motorcycles; H: Transportation and storage; I: Accommodation and food service activities; J: Information and communication; K: Finance and insurance; L: Real estate; M: Professional, scientific and technical activities; N: Administrative and support service activities; O: Public administration and defence; compulsory social security; P: Education; Q: Human health and social work activities; R: Arts, entertainment and recreation; S: Other service activities; T: Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use.
Infrastructure	Infrastructure as defined for the EIB Infrastructure Database includes the following sectors for the macro-analysis: transport, utilities, health, education and communication. Infrastructure in the Municipalities Survey captures urban transport, social housing, ICT, health, education and environment. The Data Annex describes the procedures for computing infrastructure investment in more detail.
Infrastructure sector	Based on the NACE classification of economic activities, firms in groups D and E (utilities), group H (transportation and storage) and group J (information and communication).

Innovation lagging countries	Innovation lagging countries are defined based on the European Innovation Scoreboard of the European Commission. They include 'Moderate Innovators' and 'Modest Innovators' (Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia and Spain).
Innovation leading countries	Innovation leading countries are defined based on the European Innovation Scoreboard of the European Commission. They include 'Innovation Leaders' and 'Strong Innovators' (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, the Netherlands, Slovenia, Sweden and the United Kingdom).
Innovative property	In INTAN-invest: a category of intangible assets in the INTAN-invest database that includes expenditures on: research and development; new product development costs in the financial industry; design; mineral explorations, entertainment, artistic and literary originals.
Innovative sector	Innovative sectors are identified based on the OECD definition of innovative sectors. The classification is based on NACE Rev. 2 at four-digit level.
Intangible assets	An asset that lacks physical substance, unlike physical assets such as machinery and buildings.
Intangible investment	In INTAN-Invest: Expenditures on: research and development; new product development costs in the financial industry; design; mineral explorations, entertainment, artistic and literary originals; brand; organisational capital; training.
Intangible investments (EIBIS)	Expenditures on: research and development (R&D) (including the acquisition of intellectual property); software, data, IT networks and website activities (software and databases); training of employees; and organisation and business process improvements (including restructuring and streamlining).
Investment cycle	Based on the expected investment in the current financial year compared to the last one, and the proportion of firms with a share of investment greater than EUR 500 per employee.
Investment rate or investment intensity	The ratio of GFCF to GDP or gross value added. In the case of firm data, total fixed assets is often used as denominator.
IPP	Intellectual property products: fixed assets that consist of the results of research and development, mineral exploration and evaluation, computer software and databases, entertainment, literary or artistic originals and other intellectual property products, intended to be used for more than one year.
Large companies	Firms with at least 250 employees.

Leading innovators	Firms that have substantial R&D (R&D-to-sales ratio equal to or higher than 0.1%) and have introduced new products, processes or services new to the market/ globally new.
Manufacturing	Based on the NACE classification of economic activities, firms in group C (manufacturing).
MDB	Multilateral Development Bank
MRPK	Marginal revenue product of capital
MRPL	Marginal revenue product of labour
NPLs	Non-performing loans
NUTS	Nomenclature of territorial units for statistics: a hierarchical system for dividing up the economic territory of the EU.
Other Central Europe	Czech Republic, Hungary, Slovakia and Slovenia
Other EU	Austria, Belgium, Denmark, Germany, Finland, France, Luxembourg, the Netherlands, Sweden and the UK
Other Northern Europe	Austria, Denmark, Finland, Ireland and Sweden
Other Southern Europe	Cyprus, Greece, Malta and Portugal
PE	Private Equity
Perceived infrastructure investment gap	Infrastructure investment gaps are defined as the difference between infrastructure investment needs and actual infrastructure investment. The perceived investment gap is computed based on municipalities' responses to the following question from the EIBIS 2017 add-on module: For each of the following, would you say that, overall, past investment in your municipality has ensured the right amount of infrastructure, or led to an under-provision or over-provision of infrastructure capacity?
Periphery countries	Cyprus, Greece, Ireland, Italy, Portugal and Spain
PPPs	Public Private Partnerships
PV	Photovoltaic
R&D	Research and experimental development
RDI	Research, Development and Innovation
RE	Renewable Energy
Reallocation	Change of the share of value added of an industry in the total holding the investment rate fixed to the benchmark period.
SAFE	Survey on the Access to Finance of Enterprises, published by the ECB and the EC.
Schumpeter's creative destruction	Notion suggesting that technological innovation commercialised by new market entrants will erode the market power, profits and value of established companies by making old technology obsolete and will lead to economic change.

Schumpeter's Mark I model	Notion suggesting that innovation and technological change come from entrepreneurs, or wild spirits.
Schumpeter's Mark II model	Notion suggesting that agents that drive innovation and the economy are large companies which have the capital to invest in research and development of new products and services and to deliver them to customers more cheaply.
Service sector	Based on the NACE classification of economic activities, firms in group G (wholesale and retail trade) and group I (accommodation and food services activities).
Smart grids	Digital grid infrastructure preparing for future growth of distributed technologies such as roof top solar, battery storage, demand flexibility, electric vehicles and the related data flows.
SMEs	Firms with between 5 and 249 employees.
SMEsec	SME securitisation
South East Europe	Bulgaria, Croatia and Romania
Static shift	Change of the investment rate of a given industry over time holding its share of total value added fixed to the benchmark period.
Tangible investments (in EIBIS)	Expenditures on: land, business buildings and infrastructure; and machinery and equipment.
Tobin's Q	The ratio between a physical asset's market value and its replacement value.
Unicorn	A company, usually a start-up, that does not have an established performance record, with a stock market valuation or estimated valuation of more than USD 1bn.
VC	Venture Capital
WEF Infrastructure Quality Score	Question from the World Economic Forum's Global Competitiveness Report: How would you assess general infrastructure (e.g., transport, telephony, and energy) in your country? 1 = extremely underdeveloped; 7 = extensive and efficient by international standards.
Young firms	Firms less than 10 years old

INVESTMENT REPORT 2017/2018



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