2023

INVESTMENT REPORT
2023/2024

Transforming for competitiveness

European Investment Bank

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Investment Report 2023/2024: Transforming for competitiveness.

About the report

The annual EIB report on investment and investment finance is a product of the EIB Economics Department. The report provides a comprehensive overview of the developments and drivers of investment and investment finance in the European Union. It combines an analysis and understanding of key market trends and developments, with a thematic focus explored in greater depth. This year, the focus is on Europe's transition to an innovative and green future. The report draws extensively on the results of the annual EIB Investment Survey (EIBIS) and the EIB Municipality Survey, combining internal EIB analysis with contributions from 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 to help define its positioning, strategy and policy. The director of Economics Department, Debora Revoltella, heads a team of 40 economists.

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The views expressed in this publication are those of the authors and do not necessarily reflect the position of the EIB.

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Preface

The digital and green transitions, combined with a growing roll-back of globalisation, are pushing the European economy to transform to be more sustainable, resilient, productive, and competitive. Now is the time to accelerate efforts to achieve those aims. After the severe economic shocks caused by the COVID-19 pandemic and the energy crisis, growth has slowed, and the economy risks falling into recession. However, unlike previous crisis periods, investment has remained surprisingly strong. This has been thanks to a combination of factors, including the high level of policy support with a strong focus on public investment, and the health of businesses, which enabled them to withstand the shocks comparatively well. Moreover, this period has seen some advances in the transformation of the European economy, despite the strains. Public investment remained resilient, and businesses have been investing in digitalisation, energy efficiency and reinforcing their supply chains.

Conditions for investment are rapidly deteriorating, however. Higher interest rates are coinciding with a reduction in fiscal space and a winding down of fiscal support for the overall economy. The financial buffers that have helped companies to keep investing, despite weakening growth and rising rates, are gradually being depleted. In this context, there are risks ahead for both public and private investment.

At the same time, effectively transforming the European economy will require huge levels of investment. Europe faces the challenges of digitalisation, ageing, the emerging trend of deglobalisation and cutting its reliance on fossil fuels. Competitiveness is the leitmotif that brings these elements together. Staying competitive will depend on the ability of firms to progressively increase productivity and successfully sell their goods and services in the global marketplace, ultimately improving living standards in a sustainable way. Competitiveness also depends on firms' ability to drive change and adapt to it through innovation, which must be supported by the availability of skilled employees, infrastructure, adequate finance and a conducive regulatory environment. In Europe, a well-oiled single market is also vital for enabling innovation. Fully removing internal barriers, increasing competition and taking advantage of economies of scale could smooth the reallocation of resources required for transformation and further improve efficiency, productivity and, ultimately, competitiveness.

To meet its climate goals and remain competitive, Europe needs to invest heavily in research and development (R&D), skills, infrastructure and the adoption of green, digital and more productive technologies. And despite the resilience of investment in recent years, funding to support these aims remains insufficient. In terms of productive investment (a measure that excludes housing), Europe lost pace after the global financial crisis, falling behind the United States. The gap between the European Union and the United States is still some 1.5 percentage points of gross domestic product (GDP), largely driven by lower investment in machinery, equipment and innovation. Europe's position in other important areas, such as R&D spending and the issuance of patents, is threatened, especially by China. And Europe faces the added challenge of ending its dependence on imported fossil fuels, with electricity prices projected to remain elevated for more than a decade before renewable energies start to push them down.

The investment to address these needs must be made by the private sector, for the most part. But that will not happen at sufficient speed and scale unless the public sector acts to create enabling conditions and to support investment in a catalytic way. As global competition accelerates, Europe must focus on the essentials: enhancing innovation and ensuring that innovative and highly productive firms have the resources and conditions they need to grow. These firms require a competitive environment that is open to change and disruptive innovation, as well as access to the sizeable and level playing field offered by the EU single market, which will allow them to reap economies of scale. They also need more suitable financial resources, such as equity or quasi-equity instruments, to be able to scale up their operations.

In the context of growing geopolitical risks and deglobalisation, there is also a need for more investment in the diversification and resilience of supply chains. The EU economy benefits from its openness to trade, while the EU single market offers strategic opportunities to diversify supplies among EU members.

However, Europe needs targeted strategies to further enhance its resilience against supply disruptions, particularly for raw materials that are critical to the green transition. Europe's aim to reduce emissions by 55% by 2030 represents a still greater challenge for the economy, but it also brings many opportunities. From innovating green technologies to deploying them, Europe's climate ambitions are reflected in increasingly clear incentives and the emergence of market-leading players.

Improving the availability of skills – by investing in education and training and by facilitating workers' ability to move – is also critical for the economy to transform and improve its competitiveness. The single market is a huge asset, but Europe has not yet fully realised its potential to facilitate the efficient allocation of capital and other resources and to help European firms grow into global champions.

This edition of the European Investment Bank's annual Investment Report focuses on the European economy's effort to transform and become more competitive, and to remain at the global technological frontier. The analysis it presents is supported the annual EIB Investment Survey of 12 000 European firms, the latest edition of which also included a special module on manufacturing firms covered by the EU Emissions Trading System. This report is divided into two parts. The first provides an assessment of the macroeconomic and financial environment in the European Union. It discusses trends and developments in investment, focusing on government and corporate investment. The second part looks at the structural challenges of promoting innovation and digitalisation, and addressing climate change.

Debora Revoltella
Director, Economics Department
European Investment Bank

Key findings

The European economy stagnated in the second half of 2023, after performing strongly in the aftermath of the pandemic. Going forward, it will remain under pressure from slower growth and challenges to European competitiveness, while also navigating the green transition. After the pandemic, coordinated fiscal support from national governments and EU institutions proved critical, underpinning Europe's economic resilience and spurring the public and private investment needed to transform and modernise the economy. Some progress has been made in digitalisation, energy efficiency, decarbonisation and building up the resilience of supply chains.

The pace of change needs to accelerate, even as investment becomes harder to sustain. To remain competitive in a sustainable way, the European Union and its members should focus on improving productivity, encouraging innovation, addressing skill gaps, scaling up new technologies and supporting young, dynamic firms. To stay ahead, Europe needs to invest in bolstering supply chains, given the emerging challenges of deglobalisation, such as protectionist policies and insecure trade routes. It needs to transform its economy, making it more digital and less dependent on fossil fuels. Amid tight monetary policy, and as governments embark on fiscal consolidation, public financing will need to be much more targeted. It should focus on instruments that are catalytic, in that they align private-sector incentives with the goals of Europe's economic transformation. Europe-wide policy instruments will be particularly important, as they preserve the level playing field within the single market. The goal should be to create an environment that enables the digital and green transformation, reduces uncertainty, improves the availability of skills and ensures reliable and affordable energy, all the while leveraging the power of the single market.

As growth slows and downside risks increase, the challenge of competitiveness returns to the fore

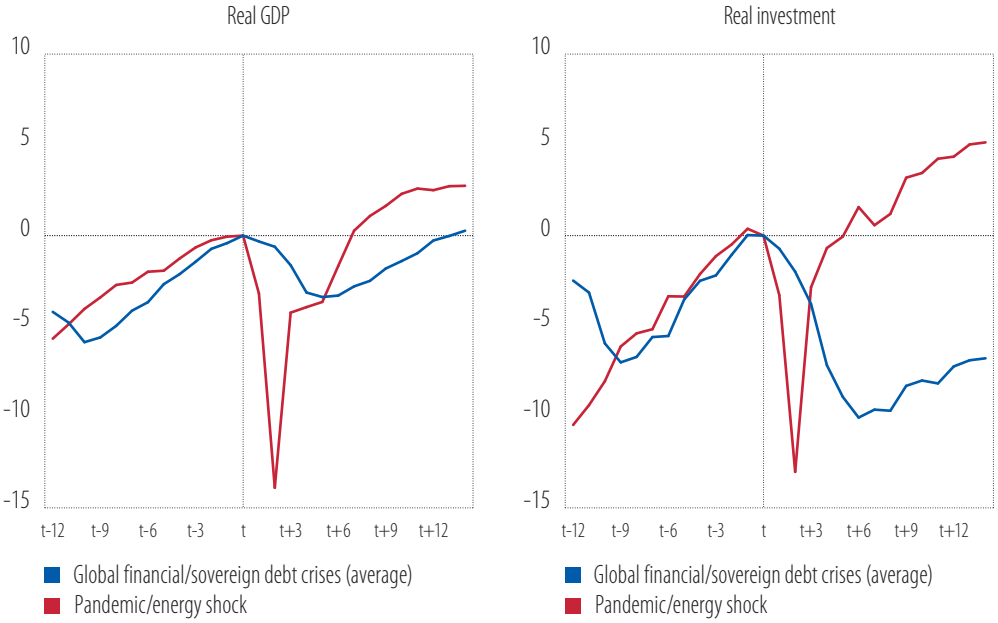
The combined shock of the pandemic and the energy crisis hit the European economy hard, but investment has proved significantly more resilient than in past crises. The economy rebounded quickly after the pandemic, buoyed by substantial policy support. Moreover, while the private sector entered the global financial crisis with excess debt, it faced the pandemic with financial reserves that acted as a buffer. The energy shock of 2022 once again buffeted the economy, and dealing with the crisis required additional fiscal support. At the same time, rising inflationary pressures triggered a tightening of monetary policies. As a result, growth abated and continued to decline in 2023, with intensifying downside risks. In this context, the resilience of investment has been a positive surprise. Investment rebounded rapidly in 2021 and expanded steadily, bringing real investment back to pre-pandemic levels after only six quarters, a pattern that contrasts with previous crises (Figure 1).

Investment growth is increasingly driven by machinery, equipment, intangible assets and non-residential construction. The strong recovery of investment following the pandemic was underpinned by expanding residential investment, but this weakened in the second half of 2022 in the face of monetary tightening and the dampening effect it had on housing markets. Since then, investment in machinery, equipment and intellectual property have taken up the slack, even though firms have been exposed to the same financial tightening (Figure 2). Strong firm profits helped support investment, as did ongoing public policy support.

Figure 1

GDP and investment trends

Pandemic/energy shock vs. the global financial/sovereign debt crises (deviation from the business cycle peak, in percentage points)

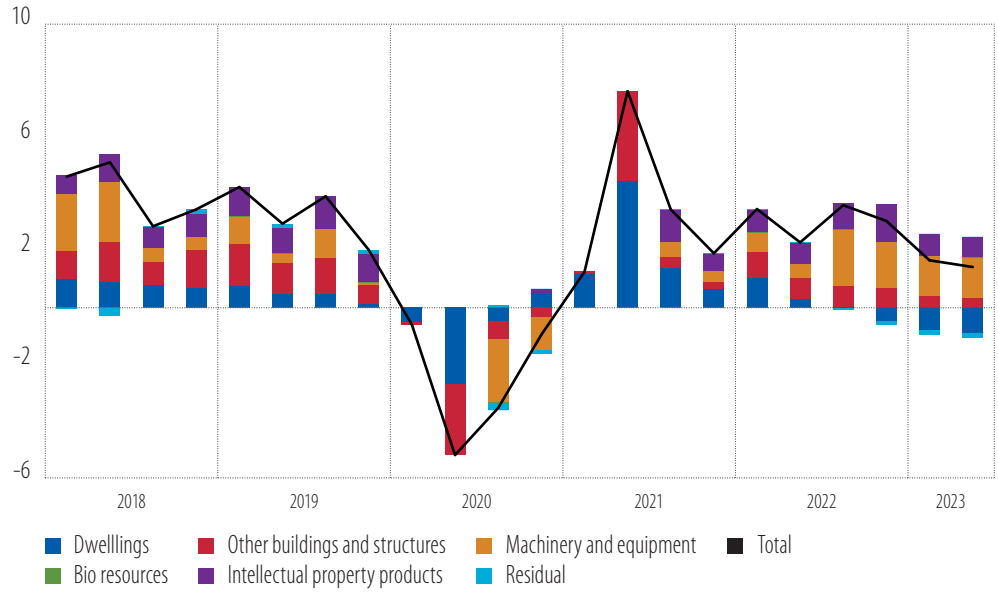


Source: *Eurostat national accounts database.*

Note: *The X-axis is time in quarters before and after the business cycle peak (t), which for the most recent period is the fourth quarter of 2019. The global financial crisis took place from the first quarter of 2008 to the second quarter of 2009 and the sovereign debt crisis from the third quarter of 2011 to the first quarter of 2013. GDP refers to gross domestic product.*

Figure 2

Contributions to EU investment growth (gross fixed capital formation, % change from the same period a year earlier)**, by asset class**

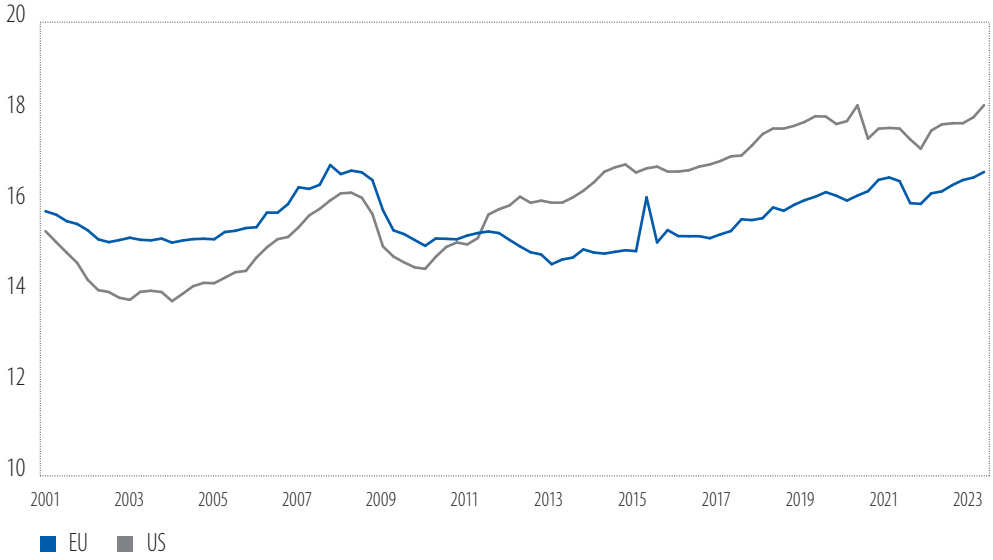


Source: *Eurostat. Data exclude Ireland.*

The resilience of investment is good news, but the gap in productive investment between Europe and the United States remains a challenge for European competitiveness. The resilience of investment means that productive investment (which excludes investment in housing) has continued to rise as a share of gross domestic product (GDP). This has been enough to keep pace with the rate of growth in productive investment in the United States. Europe shows no sign of falling (further) behind, as it did during the sovereign debt crisis. However, the gap remains at around 1.5 percentage points (Figure 3). Different levels of investment in machinery, equipment and intellectual property are behind this gap. The lack of investment represented by the gap is a significant cause for concern. Deglobalisation and the digital and green transitions require structural shifts in the European economy, which must also include a strong focus on developing skills.

Figure 3

Productive investment (real gross fixed capital formation excluding residential investment, % of real GDP)



Source: *Eurostat and Organisation for Economic Co-operation and Development (OECD) national accounts.*
Note: *European Union excluding Ireland. Productive investment includes all investment outside of residential investment.*

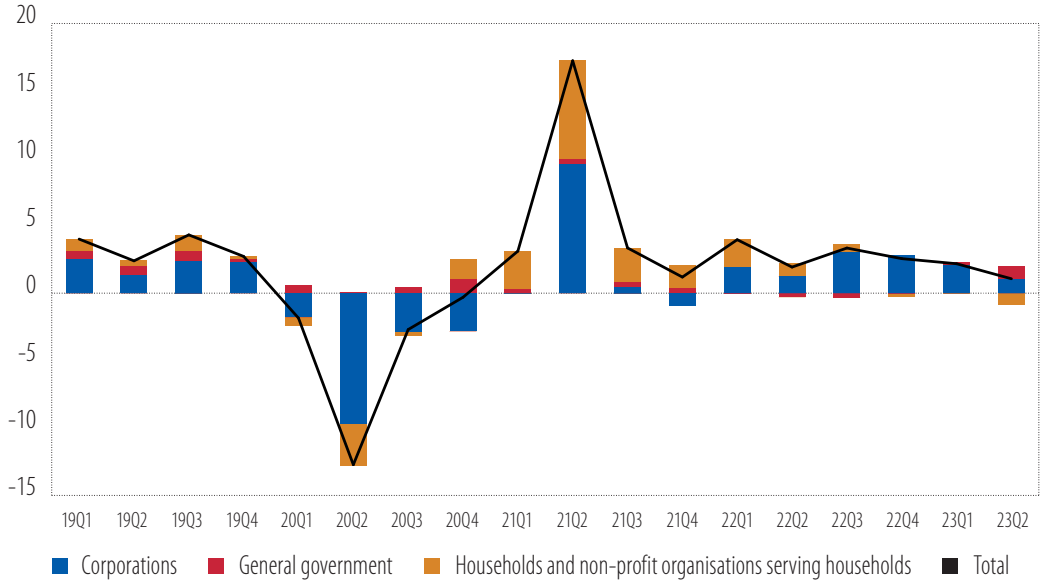
Looking back, policy intervention proved critical, underpinning public and private investment and allowing firms to step up their transformation

Public intervention at the national and EU level has played an essential role in cushioning the effects of shocks, allowing investment to recover strongly, driven first by households and more recently by companies. Accommodative fiscal policies meant that public investment remained resilient throughout the pandemic. Moreover, several types of fiscal spending supported firms and households, paving the way for a strong, demand-driven recovery. Households were the main driver of the recovery in investment from the fourth quarter of 2020. But Russia's invasion of Ukraine, the energy shock, inflation and rising interest rates then brought household investment to a standstill in mid-2022. Thereafter, the corporate sector, having benefited from public support and strong demand, took over as almost the sole driver of investment growth (Figure 4).

The performance of public investment since the start of the pandemic stands in remarkable contrast to the historical record of economic crises, thanks in part to the suspension of EU fiscal rules. The share of public investment in GDP increased sharply in 2020, as GDP fell. Since then, it has remained stable, even as GDP recovered. This performance contrasts with the average pattern of historical crises from 26 countries in the Organisation for Economic Co-operation and Development (OECD). Public investment in those countries fell for at least three years after the peak of a crisis (Figure 5). The suspension of EU fiscal

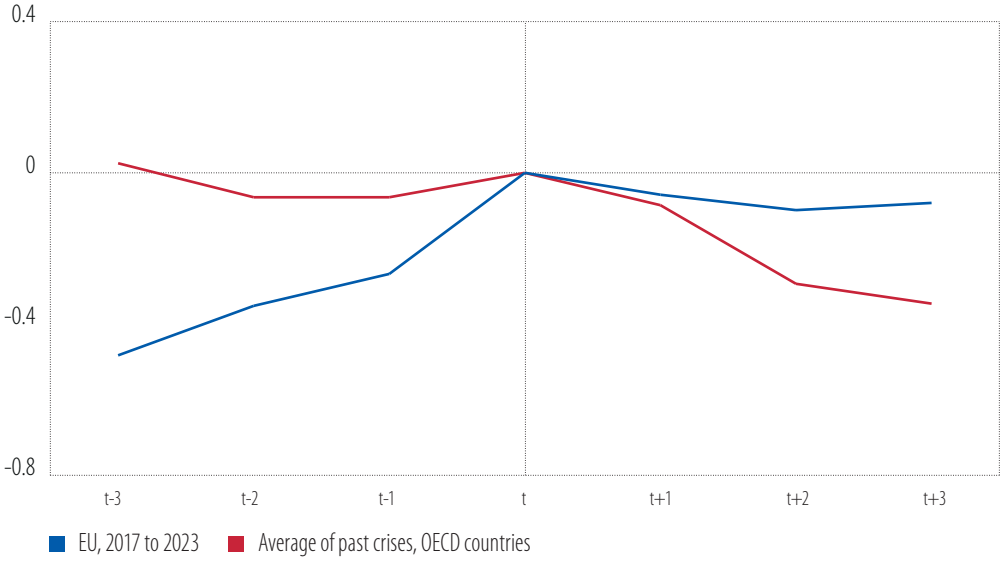
rules played an important part in the resilience of public investment. The energy shock resulted in a shift in government support to the direct benefit of businesses, and the start of the deployment of the Recovery and Resilience Facility helped to shield public investment.

Figure 4
Contributions to EU investment growth (gross fixed capital formation, % change from the same period a year earlier)**, by institutional sector**



Source: *Eurostat.*
Note: *Data exclude Ireland.*

Figure 5
Government investment remained resilient in the wake of the pandemic, outperforming government investment after past crises (deviation from the crisis peak, in percentage points of GDP)

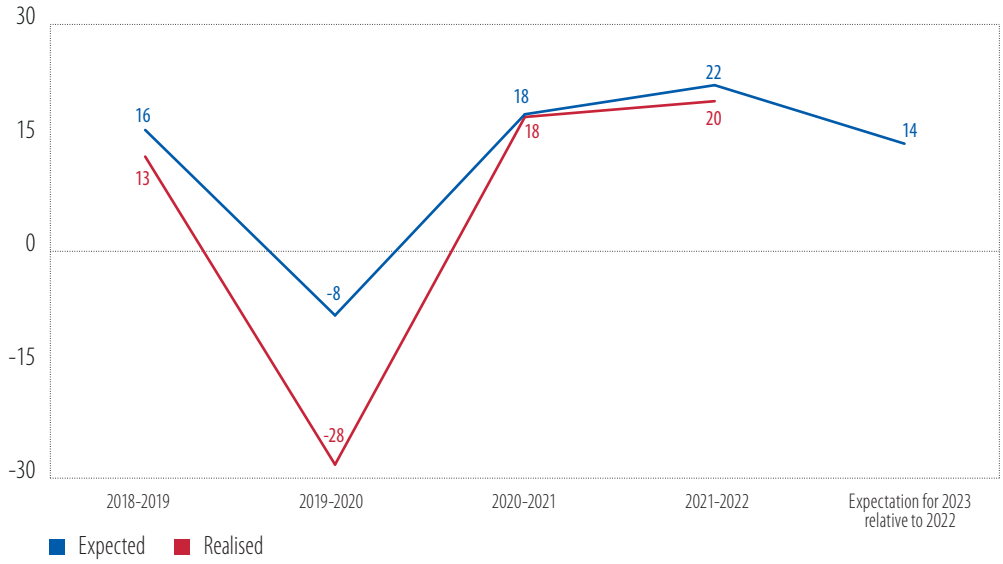


Source: *EIB staff calculations based on Eurostat and OECD national accounts.*
Note: *The crisis peak is represented by year t. The average of past crises is based on the methodology of Larch et al. (2022). See Chapter 2 for more information.*

Corporate investment has also proved resilient thanks to public support and companies' financial buffers, but firms' expectations for the current year were less optimistic. Exceptional public support during the pandemic, and the ensuing rapid recovery in demand, allowed firms to build up financial reserves, which helped them withstand the series of shocks. 80% of EU firms were profitable in 2023, 2 percentage points above the historical average. Firms with profits of at least 10% of turnover were 8 percentage points more likely to accelerate investment than firms that only broke even. Policy support and financial buffers have helped to shield and sustain corporate investment, with firms meeting their expectations for investment even in 2022, after the start of the energy crisis. However, this overall performance belies significant variation between countries and particularly between sectors. There are also signs of weakening, with fewer firms in 2023 expecting to increase investment (Figure 6).

Figure 6

Already in mid-2023, firms expected investment to slow in the year ahead (net balance of firms increasing investment vs. those decreasing it, % of firms)

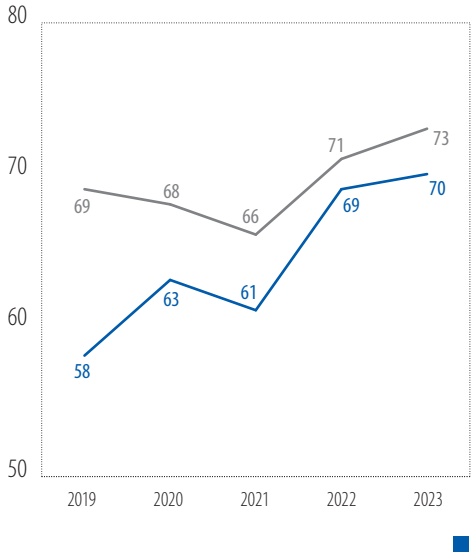


Source: *EIB Investment Survey (EIBIS) 2018-2023.*

Because they were able to keep investing, European firms could respond to shocks – notably through greater investment in digitalisation, energy efficiency and diversifying their supply chains – thus embarking on needed transformation. The use of advanced digital technologies by European firms picked up since the pandemic, effectively closing what had been a 11 percentage point gap with the United States (Figure 7). Firms have likewise been able to respond to high energy prices by accelerating investments in energy efficiency (Figure 8). In response to supply disruptions, 20% of firms say they have invested in digital inventory tracking systems and 24% of importers have sought to diversify supply chains. Indeed, firms have used repeated crises as an opportunity to transform. Firms also held on to their employees throughout the energy crisis. EU unemployment declined to 6% in October 2023 from 6.3% in January 2022. The number of bankruptcies remained surprisingly low.

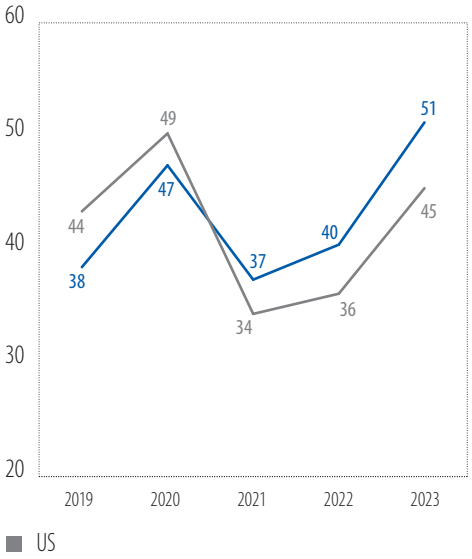
Strong corporate investment at the EU level belies substantial differences among EU members that are influenced by unique national conditions. While the sectoral breakdown of aggregate investment is not yet available for all EU members, even for early 2023, it is clear that there are different trends among countries and even within macro-regions. In some countries, real corporate investment exceeded its pre-pandemic level by 5% or more by early 2023, whereas in others it stagnated or remained well below levels before the pandemic (Figure 9).

Figure 7
Share of firms using at least one advanced digital technology (in %)



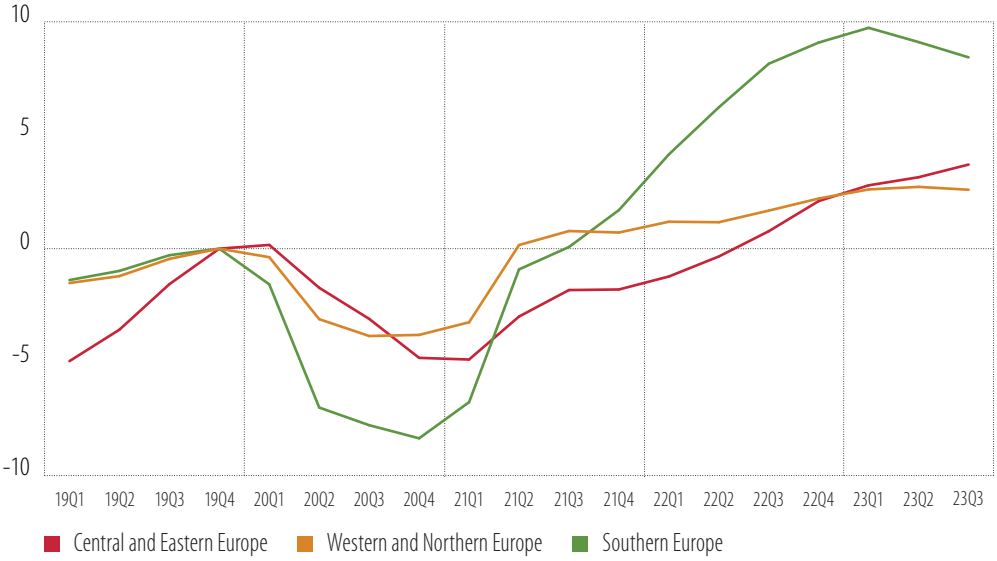
Source: *EIBIS 2019-2023.*

Figure 8
Share of firms investing in energy efficiency (in %)



Source: *EIBIS 2019-2023.*
Note: *Data refer to the year preceding the survey.*

Figure 9
Real private sector investment in the European Union (deviation from the fourth quarter of 2019, in %)



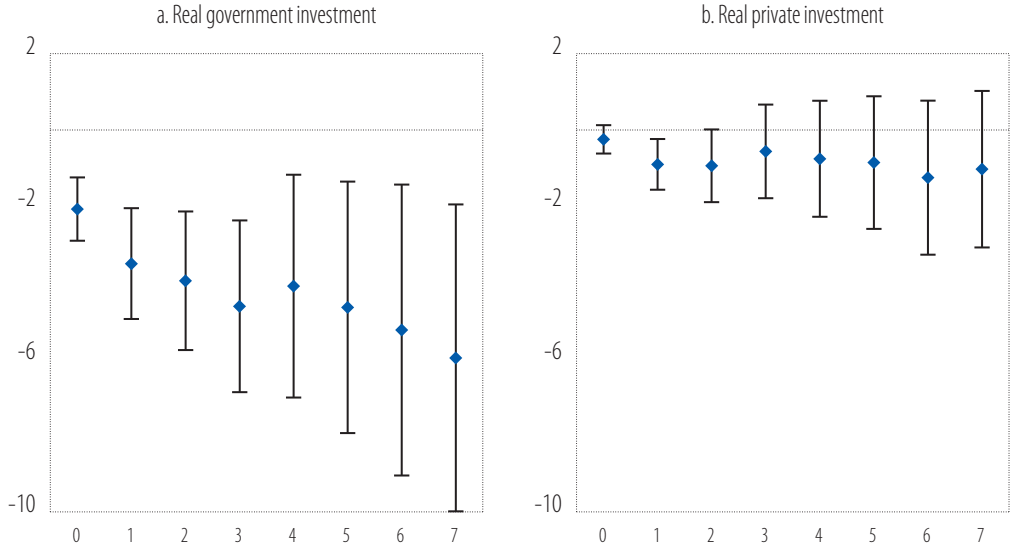
Source: *Eurostat.*

Looking forward, the pace of investment and transformation may be harder to sustain

Although governments are better prepared than in the past, the reinstatement of fiscal rules is likely to result in fiscal consolidation, which tends to affect public investment disproportionately. European governments made progress in fiscal consolidation after the sovereign debt crisis, and have already done so since the pandemic. This partly explains why interest rate spreads between euro area countries have continued to evolve within ranges reflecting economic fundamentals. Sovereign bond yields rose around 3% from January 2022 to October 2023, but risk spreads hardly widened. This environment has supported public investment, but the deactivation of the general escape clause of the Stability and Growth Pact in 2024 is likely to lead to further fiscal consolidation. Historical data for 16 OECD countries show that such fiscal retrenchment usually has a disproportionate and long-lasting effect on public investment (Figure 10a).

Private investment is also negatively affected by fiscal consolidation, with implications for growth and competitiveness. The analysis of past episodes of government belt-tightening shows that a fiscal consolidation of 1% of GDP can be expected to lead to a 1% fall in private investment (Figure 10b). This is largely caused by spillover effects from public to private investment, as well as the direct impact of eliminated tax incentives and subsidies. Investment in equipment and non-residential structures is usually most affected.

Figure 10
The effect of fiscal consolidation equivalent to 1% of GDP on real public and private investment (% change, by years after the announcement)**, based on data from 16 OECD countries**



Source: *Kolev and Schanz (2024).*
Note: *The black lines represent 95% confidence intervals.*

The Recovery and Resilience Facility may effectively shield public investment for the first three years after the reinstatement of EU fiscal rules, but its implementation is key. Grants provided by the facility are similar in size to the spending cuts that would be required by a reinstatement of the pre-crisis fiscal rules, particularly for countries in Southern and Central and Eastern Europe. The Recovery and Resilience Facility could therefore provide a temporary shield for public investment, but its implementation is already facing hurdles, with the gap between planned and completed disbursements widening to EUR 127 billion by the third quarter of 2023. Measures related to infrastructure investment are the most likely to be delayed. Obstacles include cost increases due to inflation, supply chain disruptions, lack of planning and implementation capacity for complex projects, particularly at the regional or local government level, and

governance issues. The debate in Germany around internal debt brake rules illustrates how the public investment needed for long-term competitiveness and sustainability can face considerable governance hurdles at the national level.

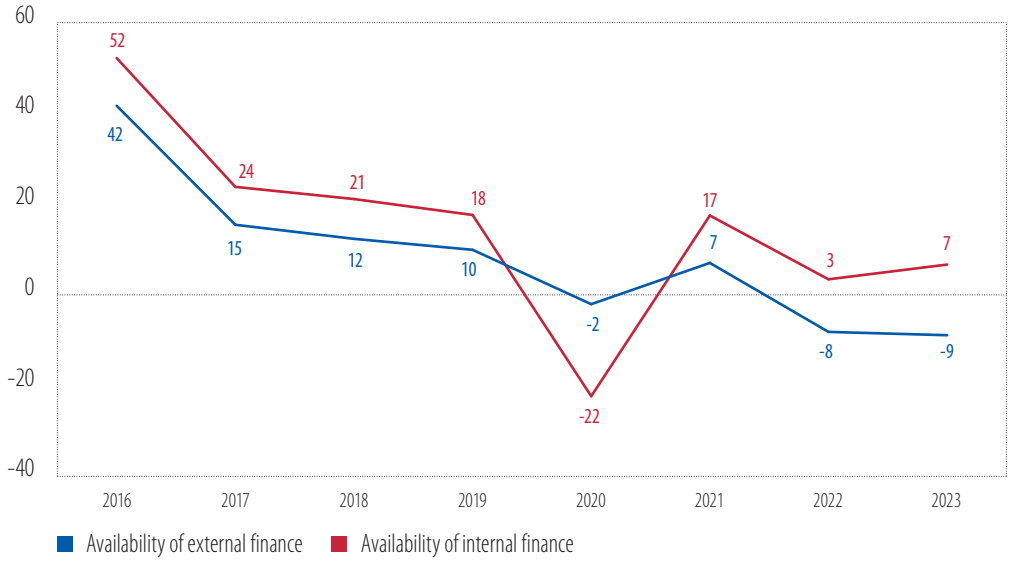
Pulling back on public investment would be bad news for competitiveness, given the positive effect public investment has on private investment, including in digital technology and climate action. For example, regional investment in digital infrastructure (and thus higher internet speeds) and firms' adoption of advanced digital technologies are associated with higher levels of labour productivity. However, there is also a positive interaction between the two. Public investment can, in fact, increase returns from firms' investment in digital technology. We also show that an increase of 1 percentage point of GDP in public investment in a region is associated with a 1.1 percentage point increase in firms' investment as a share of assets. In another example, we show that the disbursement of EU financing for climate-related projects in a region is associated with greater investment in climate mitigation and adaptation measures not only by firms in that region, but also by firms in neighbouring regions.

The outlook for corporate investment is dimming, however, as policy support is wound down, internal financial buffers dwindle and external financing conditions tighten. Looking at the next 12 months, firms overall are pessimistic about the evolution of external financing, reflecting the combined effects of monetary tightening and the winding down of policy support linked to the pandemic and the energy shock (Figure 11). Corporate holdings of liquid assets have played a major role in supporting investment since the pandemic, shielding firms from the need to tap external financing, but these holdings are now back to their pre-crisis trend. In 2023, firms were only weakly positive about their ability to tap internal finance in the coming year, and aggregate data show that corporate bank deposits are trending lower.

Figure 11

Firms' view of the availability of external and internal finance in the coming year

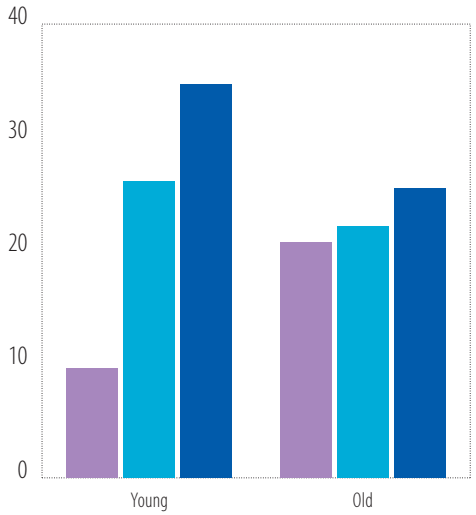
(net balance of positive vs. negative views, % of firms)



Source: EIBIS 2016-2023.

Worsening external finance conditions will particularly affect young and innovative companies. Firms introducing innovations that are new to the market are more likely to expect that their ability to access external finance will worsen. This is even more so the case for young, innovative firms, reflecting their greater dependence on external finance and exposure to any increase in risk aversion (Figure 12). Innovative firms are also more likely to finance investment using grants (Figure 13). Like all firms, they have enjoyed increased public support since 2020, but in 2023 most innovative firms were already seeing a marked drop in the availability of public grants, with worrying implications for innovation going forward.

Figure 12
Firms expecting the availability of external finance to worsen in the next 12 months (in %)**, by age and innovation status**



Source: *EIBIS 2023.*

Figure 13
Firms using grants to finance investment (% of firms using external finance)**, by innovation status**

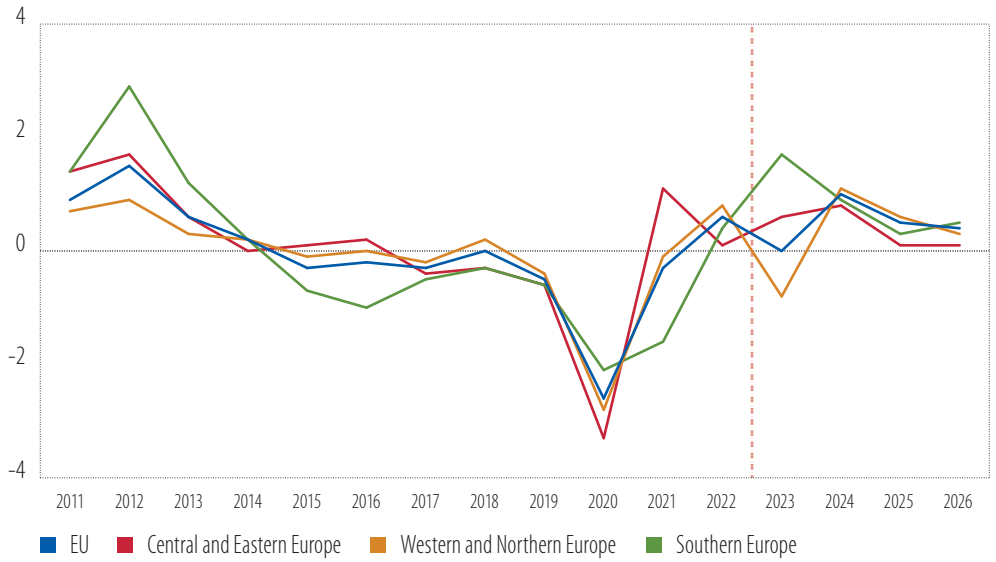
Source: *EIBIS 2016-2023.*

After years of sizeable and widespread policy support, firms will have to make do with much more targeted interventions. According the stability and convergence plans submitted by EU members, the fiscal stance of governments was still mixed in 2023, with countries in Northern and Western Europe adopting an expansionary stance (Figure 14). From 2024 onward, however, the overall stance across Europe is projected to be one of consolidation, standing in contrast to dramatic expansion during the pandemic. For firms, this is likely to result in weaker domestic demand and the withdrawal of many broad-based support measures that have helped to sustain corporate investment.

The longer-term outlook for corporate investment is also clouded by a number of structural barriers, of which energy costs, a lack of skilled staff and uncertainty about the future are the most prominent. Energy costs remained a major concern for EU firms, and were most often cited as a reason companies may pull back on future investment (Figure 15). This is unsurprising as 70% of EU firms saw energy prices rise by more than one-quarter, compared with only 30% of US firms. Even if the energy shock is now less severe, it will take more than a decade before energy prices drop to stable low levels, and European firms will have to find ways to remain competitive until that happens. A lack of people with the right skills remains a serious constraint for firms all over Europe (whether for specific skills, or an overall staff shortage). Uncertainty is also a key concern, limiting investment and transformation.

Figure 14

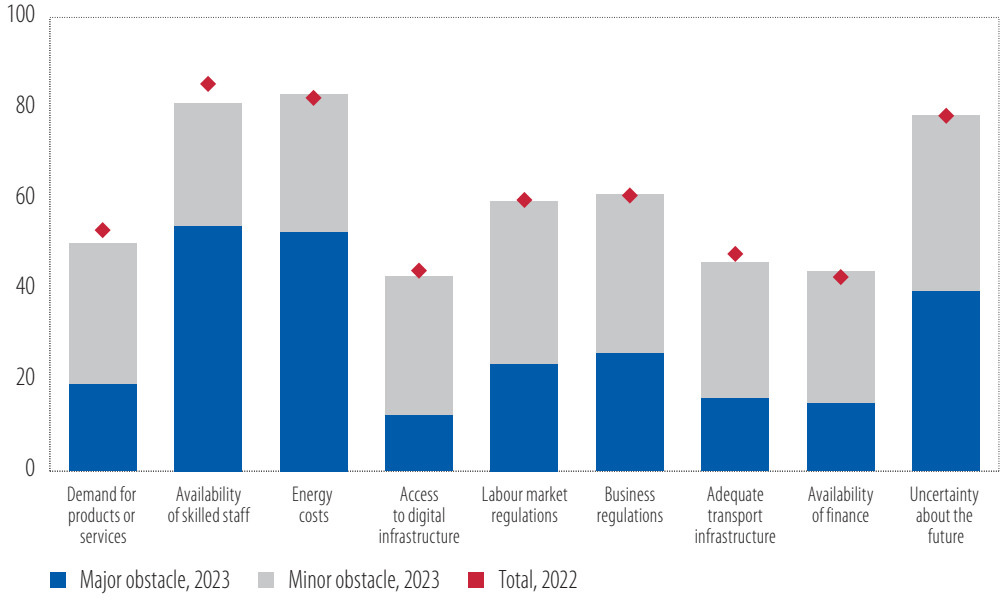
Historical changes to the structural primary balance and future projections based on EU members' stability and convergence programmes (% GDP)



Source: *Annual macro-economic database of the European Commission's Directorate-General for Economic and Financial Affairs (AMECO) and national stability and convergence programmes. Figures from 2023 onwards are forecasts.*

Figure 15

Long-term barriers to investment (% of firms)



Source: *EIBIS 2022-2023.*

Firms have made competitiveness-enhancing progress on innovation, digitalisation and the resilience of supply chains, but more must be done

In global innovation, Europe maintains a leading role in green technologies, but it lags behind on digital innovation and is at risk of being overtaken by China in the overall issuance of patents. This pattern is visible in the latest data on total research and development (R&D) expenditure, as well on the performance of top R&D investing companies. European firms account for 18% of the top 2 500 R&D companies globally, but only 10% of the new entrants to this group, vs. 45% for the United States and 32% for China. Europe's smaller role is also visible in data on patenting, which show that growing Chinese investment in R&D is bearing fruit (Figure 16). The European Union still leads in the number of patents for green technologies, but China has been catching up, while China and the United States already issue twice as many patents for digital technologies (Figure 17).

Figure 16
Number of patents issued (weighted by GDP), **by region**

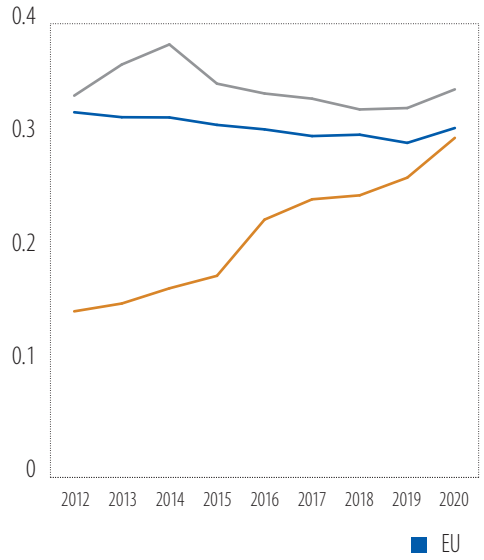
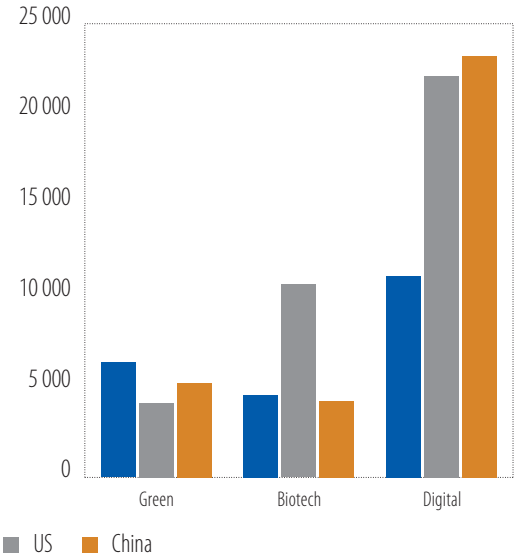


Figure 17
Number of patents issued in 2020, by technology domain



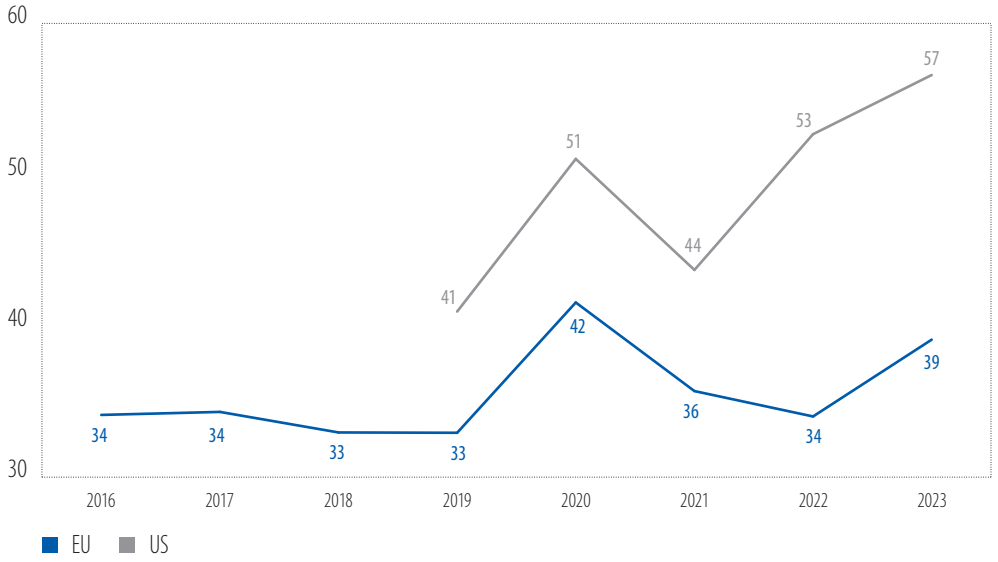
Source: *EIB staff calculations based on Patent Cooperation Treaty (PCT) patents (PATSTAT) in collaboration with the Research and Development Monitoring Research Centre at KU Leuven.*
Note: *For specifications see Chapter 5.*

European firms are also lagging in the adoption of new technologies. Specifically, data from the EIB Investment Survey (EIBIS) indicate that the European Union has a lower share of firms that invest to develop or introduce new products, processes or services than the United States (39% vs. 57%), with the gap remaining stable in the last two years at around 18 percentage points (Figure 18). This difference is overwhelmingly driven by the number of firms that say they invest to adopt products, processes or services that are used in their industry, but are new to the company.

Europe is focusing strongly on public support for innovation, from seed-stage to growth-stage financing, with finance for growth and scale-up companies being the most pressing concern. Venture capital finance in the European Union is underdeveloped relative to the United States and has been hurt by tighter financial conditions (Figure 19). This particularly affects funding for companies trying to scale up their operations. Despite strong public support, the fragmentation of Europe's capital markets limits investors' exit opportunities and leads to a strong reliance on mergers and acquisitions as an exit strategy, as well as an over-dependence on investors from outside the European Union. There is notably a dearth

of financing for more mature scale-up activities, with six to eight times as much financing available in the United States (in dollar terms). Venture debt is a nascent market in Europe, while other forms of growth finance are still in their infancy. The tightening of financial market conditions appears to have disproportionately affected scale-up activities.

Figure 18
Development or introduction of new products, processes, or services (% of firms)



Source: *EIBIS 2016-2023.*

Figure 19
Venture capital investment in the European Union (cumulative, USD billion)**, by month**

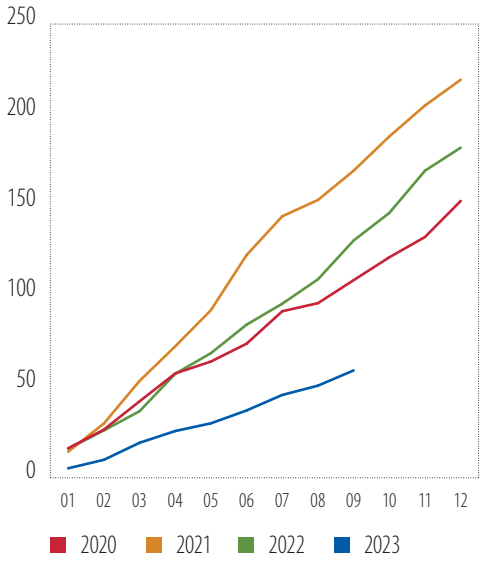
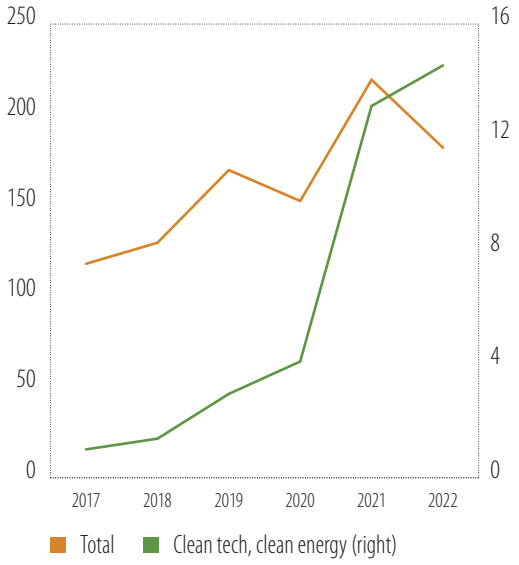
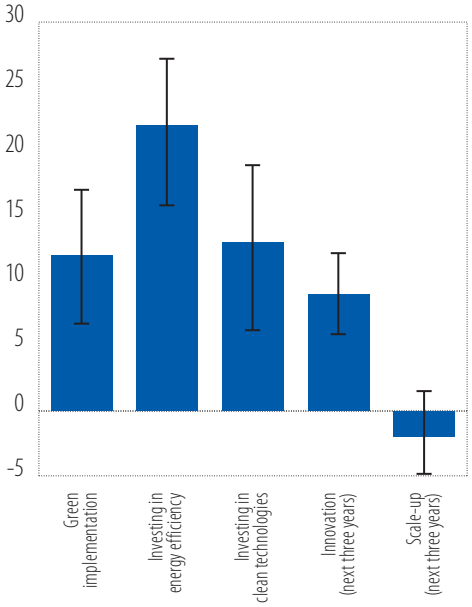


Figure 20
Venture capital investment (USD billion)**, 2017-2022**



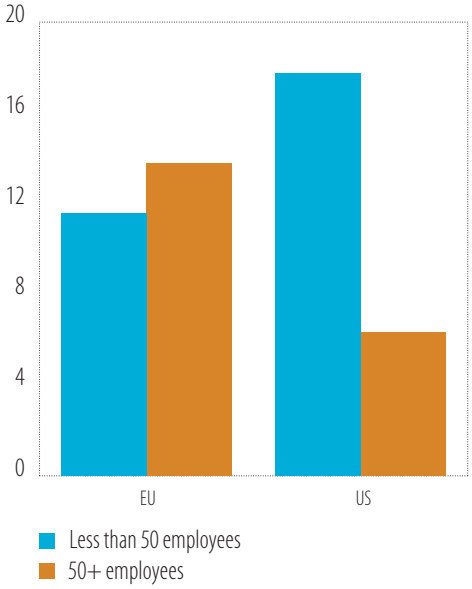
Source: *EIB staff calculations based on PitchBook data, Inc.*

Figure 21
Estimated effect of grants and subsidies on the probability of investing in climate, innovation and scaling up production (in %)



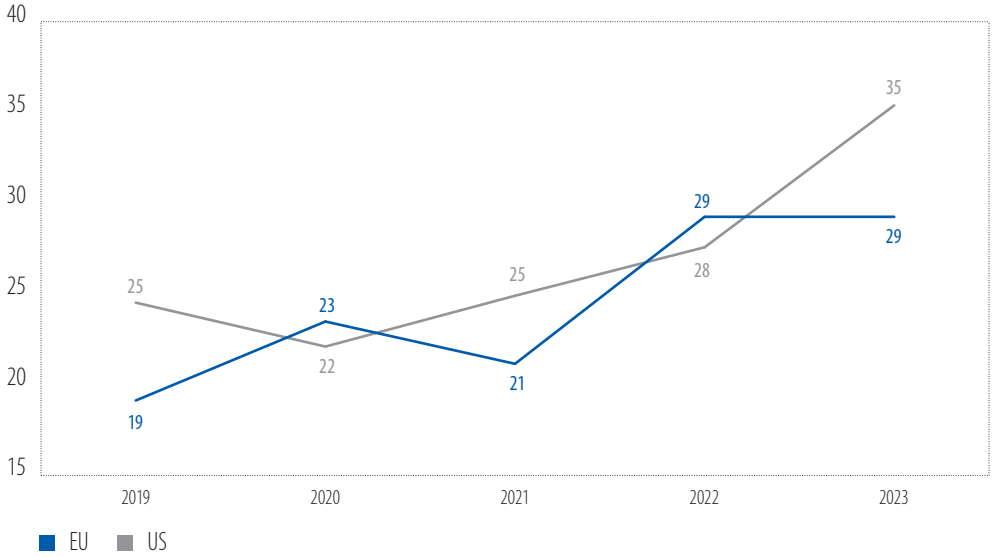
Source: *EIBIS 2016-2023.*
Note: *The black lines represent confidence intervals at the 95th percentile. See Chapter 3 for details.*

Figure 22
Estimated effect of grants and subsidies on the probability of making green investments (in %)



Source: *EIBIS 2016-2023.*
Note: *See Chapter 3 for details.*

Figure 23
Use of big data analytics and artificial intelligence (% of firms)



Source: *EIBIS 2019-2023.*

In Europe, grants and subsidies are more likely to go to larger firms, while firms that receive grants and subsidies invest more in innovation, including R&D, and in green investment (Figure 21). In Europe, large firms are more likely to receive grants and subsidies, which fund innovation and transformation (Figure 22). However, this may partly disincentivise radical transformation, as large incumbent firms may be more reluctant to carry through a radical change to their business model.

The gap in the adoption of advanced digital technologies between the United States and the European Union has been narrowing since the pandemic, but EU firms may be falling behind on artificial intelligence. Strengthening the competitiveness of the European economy through the green and digital transformation is not only about innovation at the technological frontier, but also about adopting and deploying these technologies. While the share of firms using at least one advanced digital technology is now similar on both sides of the Atlantic, US firms appear to be surging ahead on the use of big data analytics and artificial intelligence, with EIBIS data showing a 6 percentage point gap between the United States and Europe (Figure 23).

Competitiveness will also require further progress on decarbonisation, building on the recent acceleration in energy efficiency investment

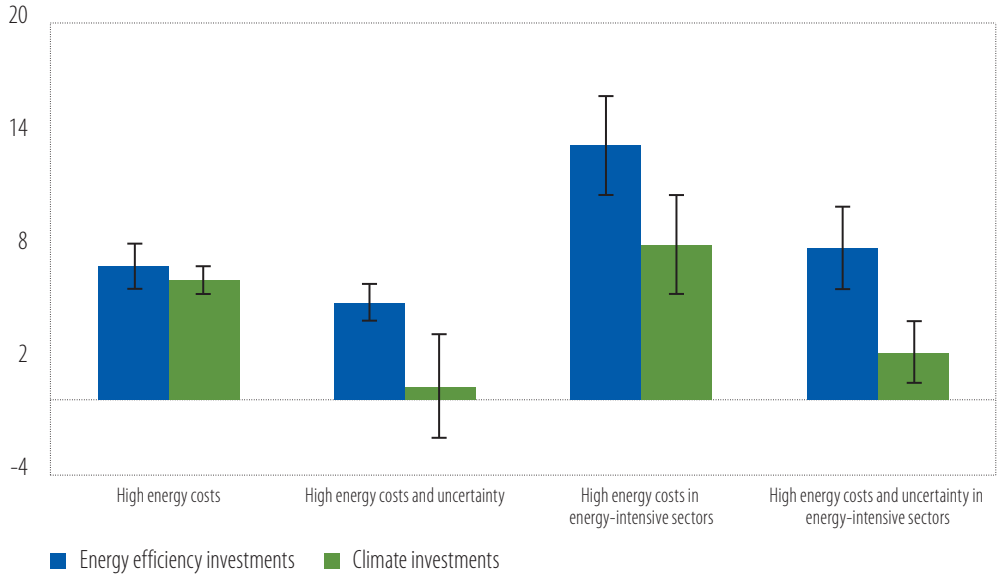
While firms have responded quickly to the energy shock by increasing energy efficiency, the more thorough structural transformation of energy-intensive industries is taking time, and it might affect the competitiveness of some EU industries going forward. EU members responded quickly to fast-rising energy prices and the threat to energy supplies, but mostly through relatively short-term fixes, such as subidies, to ameliorate energy market strains. EU firms invested in energy efficiency and also passed costs through to final consumers. They were less likely than US firms to stop the production of energy-intensive goods and services. It may take ten or 15 years, however, for electricity prices to be predominantly determined by the production costs of clean energy sources, and therefore structurally lower. In the meantime, energy costs may pose a challenge to the competitiveness of many industries.

Under pressure from high energy costs and uncertainty, firms are prioritising investments in energy efficiency, with uncertainty taking a heavier toll on more general investment in climate action; firms in energy-intensive sectors are investing more in both categories. Firms that see high energy costs as an obstacle are significantly more likely to invest in energy efficiency (Figure 24). Uncertainty about the future (including future energy policies and prices) reduces this effect, however. When both energy costs and uncertainty are seen as obstacles, the overall effect remains positive for energy efficiency investment, but not for general climate investment, which covers mitigation and adaptation. For climate investment, the positive effect of concerns about energy costs is outweighed by greater sensitivity to uncertainty, leading to no significant effect overall. Encouragingly, however, the overall impact on energy efficiency and climate investment always remains positive for firms in energy-intensive industries.

Firms are more likely to invest in new green products and services when they see the green transition as an opportunity rather than a risk. Industries can be categorised by whether they face a high, medium or low risk from the transition. Even when controlling for country, sector and size effects, firms in higher risk categories are more likely to invest in new green products and services (Figure 25). Unsurprisingly, this effect is much stronger for firms that see the transition as an opportunity, suggesting that transformative action is also being influenced by how companies perceive market opportunities.

Figure 24

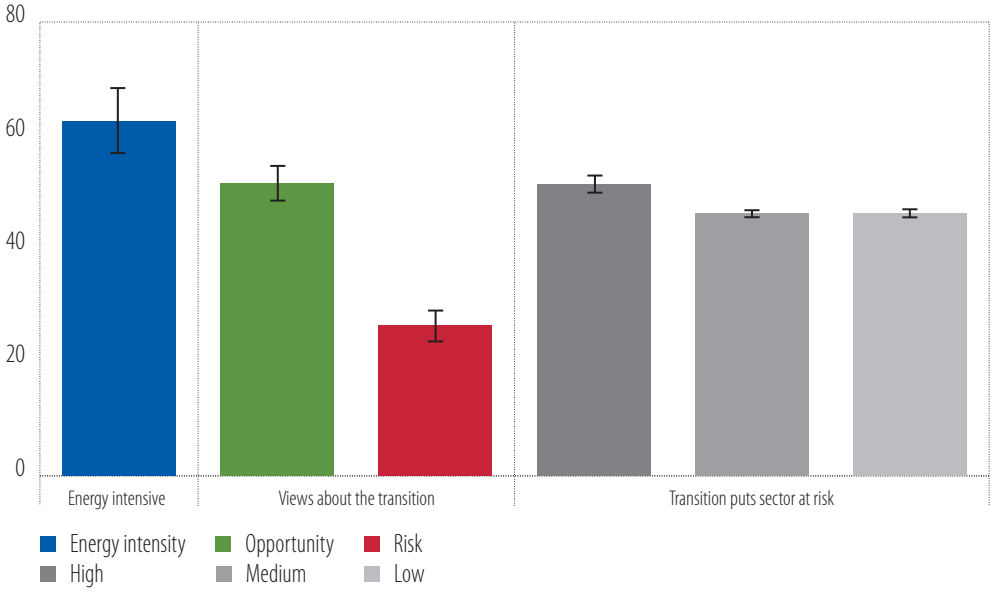
Marginal effects of higher energy costs and uncertainty on investment in climate action and energy efficiency (in percentage points)**, by energy intensity of industry**



Source: *EIB staff calculations.*
Note: *The black lines represent 95% confidence intervals. For details see Chapter 5.*

Figure 25

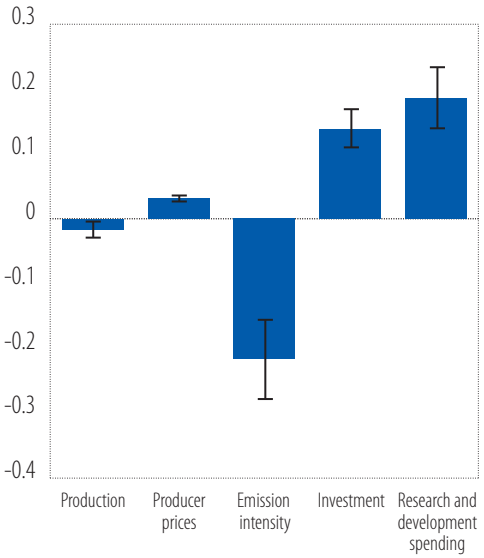
Probability of investing in new green products and services (in %)**, by transition risk category and firms' perception of the climate transition**



Source: *EIB staff calculations.*
Note: *The black lines represent 95% confidence intervals. For details see Chapter 5.*

The European Emissions Trading System is proving effective as a stimulus for investment and innovation, leading to a decline in the emissions intensity of industries it covers. Data for firms covered by the Emissions Trading System (ETS) were examined using panel regression for 2012 to 2022, after controlling for factors such as labour, energy costs and value added. It showed that a 1% increase in the price of carbon is associated with a significant 0.2% reduction in emissions intensity, but with only a very marginal effect on production volumes and prices (Figure 26). At the same time, a 1% rise in carbon prices is associated with increases of 0.1% in investment and 0.2% in R&D spending, suggesting that investment and innovation have been critical to reducing emissions. The decision to withdraw free carbon allowances for some industrial sectors under the latest phase of the trading system, Phase IV, also led to a 20% greater reduction in emissions intensity for those sectors than for sectors still granted free allowances (Figure 27).

Figure 26
Estimated effect of a 1% increase in the ETS carbon price (in %)



Source: *EIB staff calculations.*
Note: *The black lines represent 95% confidence intervals. For details see Chapter 5.*

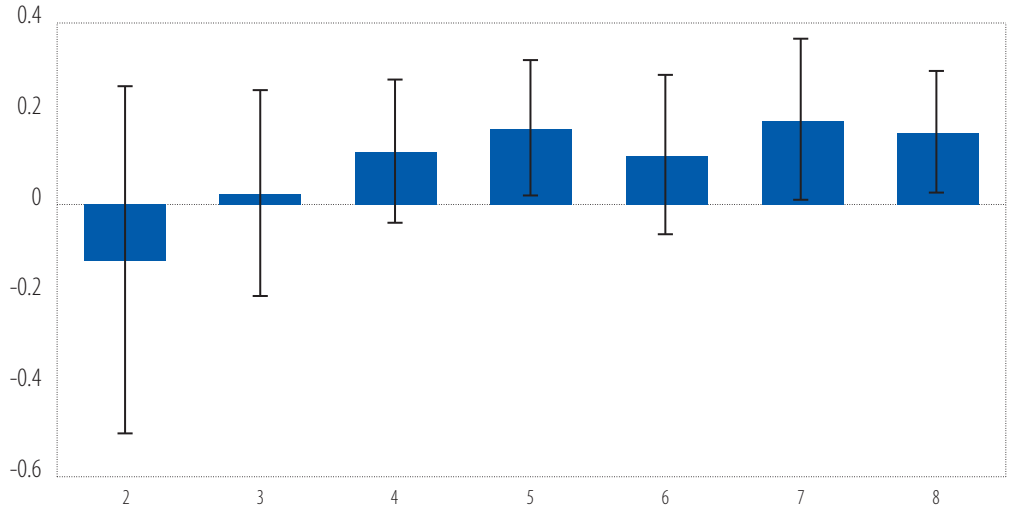
Figure 27
Effect of losing free allowances on firms' carbon emissions intensity (an index, 2015=100)

Source: *EIB staff calculations, EU Transaction Log and Eurostat.*
Note: *For details see Chapter 5. The red line represents when industries lost their free allowances.*

More carbon-intensive manufacturing firms rely on long-term debt to pay for investment in decarbonisation, but access to such finance will become scarcer as financial institutions increasingly price in climate risks. Access to external finance enables decarbonisation among manufacturing firms covered by the Emissions Trading System. For example, a 1 percentage point increase in firms' long-term debt-to-asset ratio is associated with 0.2% lower carbon intensity (Figure 28). Moreover, more carbon-intensive firms are more dependent on long-term debt, with those firms' leverage correlated with progress on reducing their carbon intensity. This emphasises the importance of long-term debt in financing decarbonisation. The risk for carbon-intensive firms is that such finance will become scarcer as financial conditions tighten and as the financial sector begins to price in the cost of climate risks.

Figure 28

Effect of leverage on the decarbonisation progress of firms in various deciles of carbon intensity (coefficient of correlation)



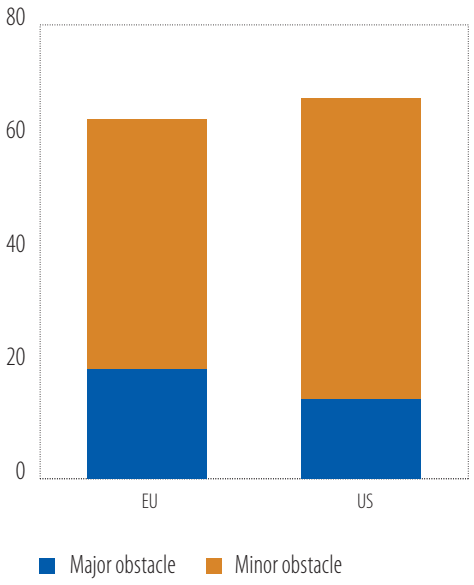
Source: *EIB staff calculations.*
Note: *Average statistics calculated on a sample of EU ETS manufacturing firms from 2013 to 2020. Leverage is loans and long-term debt scaled by total assets. For more details see Chapter 5.*

The ETS manufacturing firms that are reducing their carbon intensity the fastest are also much more likely to transform by investing in innovative new products. A 2023 EIB survey of 373 manufacturing firms in the trading system separates firms that see themselves as ahead of competitors in decarbonisation from those that lag behind. Among firms that invested in technologies to reduce greenhouse gas emissions in the last five years, almost 60% of self-reported leaders focused on product innovation, compared with only 25% of laggards. The data also confirm that the leaders reduced the carbon intensity of their production faster.

Most EU firms say that climate change is already affecting their business, but fewer firms are implementing climate adaptation measures, with insurance notably underutilised. According to EIBIS 2023 data, 63% of the firms in the European Union and 67% in the United States say they are at risk from climate change, up by at least 6 percentage points from the previous survey (Figure 29). However, only 36% of EU firms have taken steps to adapt to climate change, and only 13% of firms in Europe have bought insurance against climate risks (Figure 30). Among firms that have already experienced the fallout of climate change, the share of those insured is only 17%. One obstacle may be the moral hazard of assuming that governments will bail out businesses in the event weather-related losses. The availability of finance poses another barrier, with finance-constrained firms less likely to invest in climate adaptation.

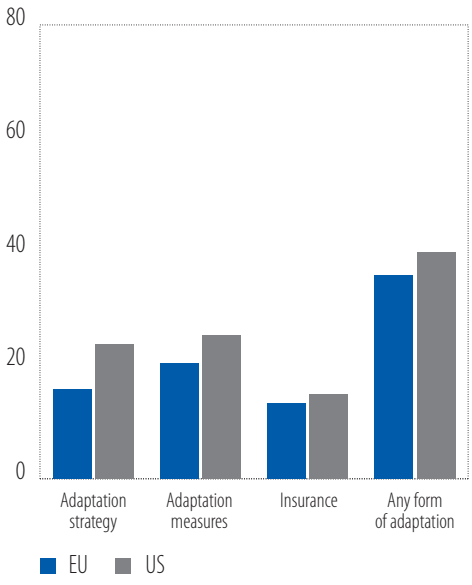
Public funds play a vital role in catalysing business investment in adaptation, especially in the most vulnerable regions and sectors. Analysis of EIBIS data confirms that European firms are more likely to invest in adaptation when a higher share of EU funds within the country is devoted to climate adaptation. These funds help companies to adapt by providing direct financial incentives, by creating a framework for adaptation through standards and guidelines or by supporting skills development, knowledge-sharing and research.

Figure 29
Share of firms that say climate change already affects their business (in %)



Source: *EIBIS 2023.*

Figure 30
Share of firms undertaking climate adaptation measures (in %)



Source: *EIBIS 2023.*

Amid fiscal consolidation, future competitiveness will require targeted regulatory and financial interventions that address market failures

In the face of climate change, the accelerating pace of digitalisation, deglobalisation and ageing, the challenges to Europe's competitiveness are becoming even more pressing. Europe needs to do whatever it can to raise productivity, ensure the resilience and diversification of its supply chains and make its economy sustainable. This cannot be done without maintaining and promoting productive investment, including a focus on supportive conditions, to address the massive investment required for the green and digital transformation.

Public investment should be protected from fiscal consolidation, while public support for firms should target the needs of the transformation. Recognising that fiscal space will be reduced, and investment conditions will likely worsen, the broad support measures employed during the pandemic and energy crises must be replaced by more targeted incentives that encourage structural transformation, to avoid an investment slowdown that would endanger Europe's competitiveness and the pace of the climate transition.

Innovation needs continued support, as do young, innovative firms; this support should also address the gap in financing for scale-up companies. Europe needs to protect its lead in green innovation and catch up in other areas. It also must address the greater financial constraints faced by younger and more innovative firms. With equity financing for startups and scale-ups particularly affected by tighter financial conditions, there is a heightened need for European public finance, which is a cornerstone investor in Europe's underdeveloped venture capital market.

EU policy instruments have an important role to play in promoting the scale-up of innovative firms and strategic industries while preserving a level EU playing field. Fragmented European markets weigh on the competitiveness of European firms, preventing them from leveraging the full potential of the single market. The single market should be an advantage, and it should help companies to reach

economies of scale quicker than major trading partners. A better integrated common market would enable the rapid development of infant industries and encourage the relocation of promising foreign firms to Europe to exploit competitive advantages. The European Union needs to make more progress on the capital markets union, which will widen markets and improve exit opportunities for the venture capital market, as well as bring in more private long-term investors.

The diversification and resilience of supply chains has also become an important policy goal. As much as one-third of firms in major manufacturing sectors report access to raw materials, microchips and other intermediate goods as major obstacles to production. In response, many firms are diversifying suppliers and employing digital supply-chain management tools. Achieving strategic autonomy in certain commodities and technologies is also vital for the green transition.

Firms need clear and consistent signals on policies and regulations, which will drive green investment. Analyses of the Emissions Trading System and the impact of high energy prices show just how effective price signals are at driving investment for decarbonisation. But they also show that uncertainty about future prices and policies strongly undermines investment. In addition, Europe needs to address the possible moral hazard of companies' betting that governments will come to their aid in the event of weather-related losses, which may be undermining business investment in adaptation, and therefore the resilience of the European economy to climate change.

Skills shortages are hampering transformation, with measures needed to support and encourage investment in training and facilitate the movement of labour. The number of firms reporting a lack of skilled workers as a major obstacle is increasing, but this has not resulted in more firms investing in training. The shortage of skilled employees is holding back the most transformative firms: those that are more innovative and advanced in adopting green technologies. It is important to encourage the efficient reallocation of resources to enable innovative, highly productive and high-growth firms to access skilled labour – something that is facilitated by the timely exit of less dynamic firms.

Actions to improve the business environment and lower barriers could provide a significant boost to investment. Some obstacles such as weak demand, adverse financing conditions and uncertainty clearly affect investment. Other obstacles like skills are more often an issue for more productive firms that invest more, and that need more skilled staff to expand. Analysis of the investment rates of firms that do and do not report obstacles suggests that addressing even one such barrier, so that it is no longer seen as a "major obstacle," could substantially stimulate corporate investment.

PART I

Sustaining investment in challenging times

This time is different: **Three and a half years after the start of the COVID-19 pandemic, real investment is 5% above pre-crisis levels**

It was down 11% at the same point **after the global financial crisis.**

But investing has become more expensive:
Firms' borrowing costs rose from 1.4% to 5.3% per year from January 2022 to October 2023.

European initiatives could soften the blow:
The Recovery and Resilience Facility could offset spending cuts, by providing funds equal to 1/3 to 1/2 of planned fiscal tightening expected in the European Union from 2024 to 2026.

And fiscal tightening puts investment at risk:

A fiscal consolidation of 1% of GDP could result in a 4-6% decline in real public investment and a 1% drop in real private investment.

Bringing down investment barriers is key:

Removing major obstacles could boost corporate investment by 1 percentage point of total assets.

Chapter 1

The macroeconomic environment

Macroeconomic conditions for investment deteriorated in 2022 and 2023. Largely sparked by Russia's invasion of Ukraine, the food and energy price shocks of 2022 transferred wealth away from EU households and governments and triggered widespread inflation. When central banks raised interest rates rapidly, corporate funding costs rose. After putting in place measures to offset the impact of higher energy prices on households and businesses, governments gradually started to consolidate their finances. Demand from countries outside the European Union slowed, in part because the Chinese economy softened.

Nevertheless, public and corporate investment remained robust, at least until the first half of 2023. Total investment grew by 1.6% during the first half of 2023, relative to a year earlier. In the second quarter of 2023, 14% of EU firms surveyed in the EIB Investment Survey (EIBIS) said they intended to increase investment in 2023 compared with 2022 – a figure only slightly smaller than a year earlier.

During 2023, the factors that initially supported investment began to fade. Domestic demand at first remained quite strong because households were willing to dip into their savings to maintain consumption, unemployment remained low, and fiscal policy offset some of the shock of inflation on their income. While demand was still strong, firms passed on much of the increase in costs to clients. But none of these factors are likely to persist. Tighter financial conditions are feeding through into corporate and household funding costs, job vacancies are shrinking and fiscal policy is set to consolidate. The outlook for foreign demand is the only bright spot.

Higher geopolitical tensions and energy prices are likely to have structural consequences for the EU economy. Although energy prices have come down substantially from their peak, they remain higher than before the energy crisis, which is unsurprising because fossil fuel imports from Russia had to be replaced with more expensive substitutes. Energy-intensive industries appear to have been affected already, recording substantial declines in production. Higher and more volatile costs are likely to remain a drag for the competitiveness of EU firms. This is particularly true in Eastern Europe, where inflation was exceptionally high and in most countries not offset by currency depreciation. Meanwhile, EU and national policies continue to drive the green transition, which is needed to combat climate change and reduce Europe's dependence on fossil fuels. Europe's strategic autonomy became a key concern as global supply chains for materials, services and goods linked to the energy and green transition were increasingly exposed to geopolitical tensions.

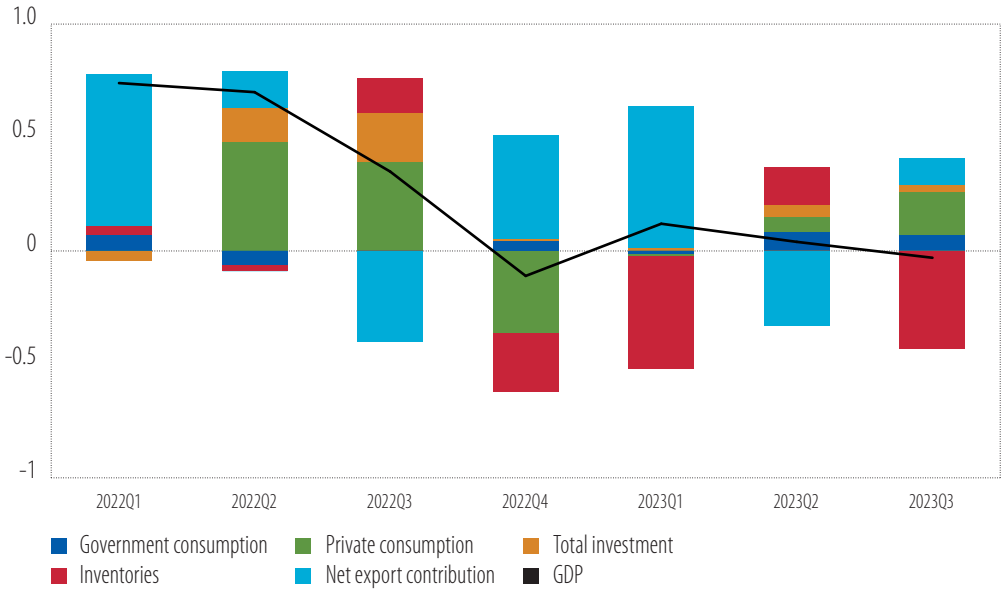
Introduction

This chapter discusses the macroeconomic backdrop to investment. After briefly overviewing the macroeconomic situation, it covers the inflationary and disinflationary periods of 2022 and 2023, the impact of tighter monetary policy, the resilience of domestic demand, fiscal policy and the consequences of fiscal consolidation, and the temporary weakness of external demand. The main message is that the factors that initially supported investment are starting to fade, weakening the outlook. Two boxes discuss why inflation rose much more in some EU members than in others, and recent trends in trade patterns with key countries.

A bird's eye view of the economy

Growth sputtered towards the end of 2022, but the economy continued to expand despite numerous headwinds. After brisk progress in the first three quarters of 2022, gross domestic product (GDP) growth slowed, becoming virtually stagnant from the fourth quarter on, but recording an overall result of 3.4% for the year (for the European Union and the euro area). Meanwhile, accelerating inflation prompted central banks to raise interest rates. Domestic demand was initially resilient, but weakened once households had drawn down savings accumulated during the pandemic and job prospects dimmed. Net exports remained strong until the first quarter of 2023 despite the slowdown in global trade and demand, and government spending's contribution to growth vanished in the second quarter of 2022. By the third quarter of 2023, EU GDP was stable compared to the previous quarter, with inventories weighing on output.

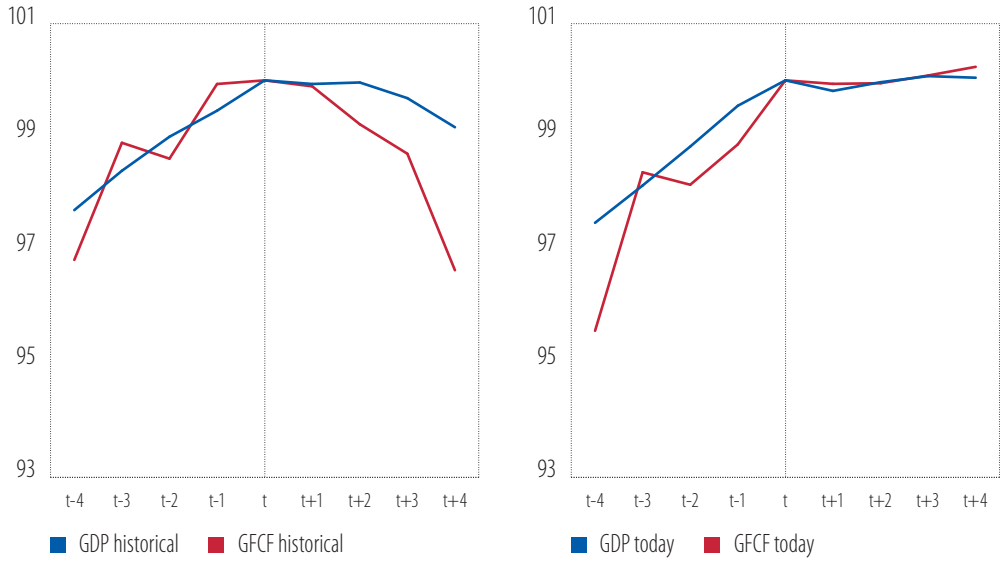
Figure 1
EU GDP and the components of demand (% GDP)**, adjusted for season and calendar day**



Source: *Eurostat, EIB staff calculations.*

Investment has not slowed as much as other components of aggregate demand. As interest rates skyrocketed and global demand faltered, investment showed surprising resilience, with gross fixed capital formation being the only component to contribute to EU growth in the first half of 2023. Investment has been stronger than it usually is in comparable phases of the business cycle (Figure 2), confirming the evidence from EIBIS 2023. Investment is also examined in other parts of this report (Chapter 3).

Figure 2
Investment and GDP during recent business cycles (an index)



Source: *Eurostat, EIB staff calculations.*
Note: *On both graphs t indicates the quarter corresponding to the slowest growth or the peak of the expansion and is fixed at 100, t-n indicates the previous quarters and t+n the following ones. The left panel is calculated by averaging the quarter before and after the latest period of slowdown or recession in the European Union (2001-Q2, 2008-Q1, 2011-Q3, 2016-Q4, with the quarters in 2008 and 2011 corresponding to actual recessions), while the right panel represents the current cycle with t fixed at 2022-Q3. GFCF refers to gross fixed capital formation, a measure of investment.*

Investment in machinery and equipment, intellectual property and commercial buildings fared better (+2.9%) than residential investment (-3.8%) over the year leading into the second quarter of 2023. Productive investments – those excluding residential investment – were particularly strong in Central and Eastern European countries (Slovakia, Romania, Lithuania, Estonia and Bulgaria, but not Hungary). Those investments were also stronger in the Netherlands, France and Italy than in Germany and Spain. Residential investment grew at almost 50% annually in Greece, returning to the level reached in 2013 for the first time, while it declined by around 10% in Sweden, Denmark, Italy and Luxembourg.

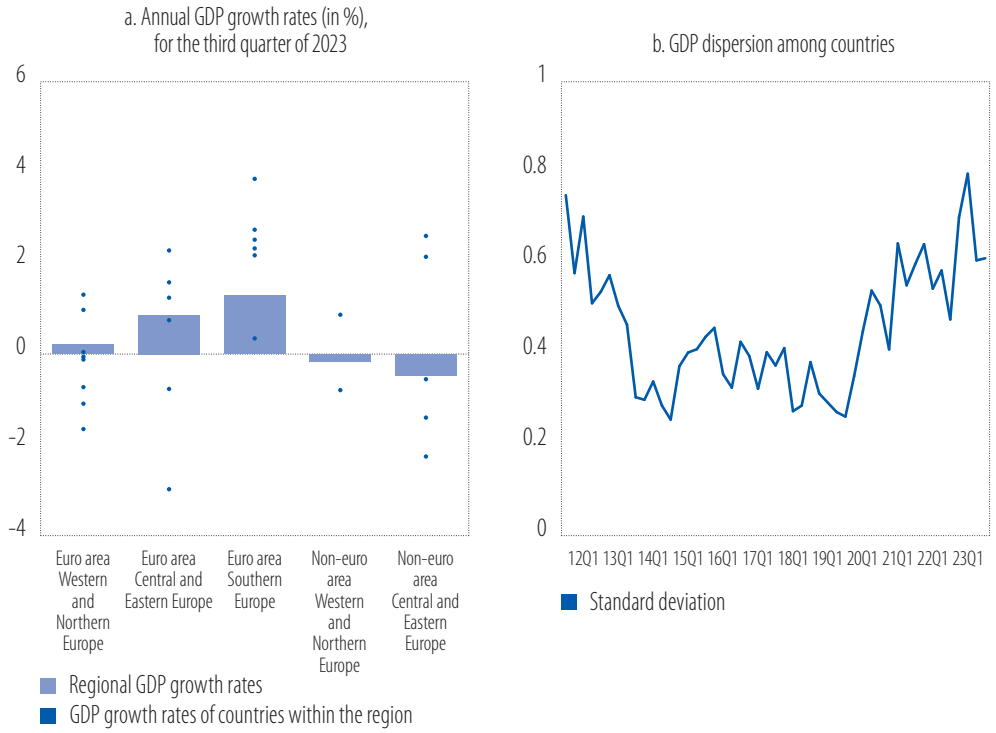
Firms planned to continue increasing investment despite tighter monetary policy. Based on information collected by the EIBIS during the second quarter of 2023, firms planned to increase their investment spending in 2023 compared to the previous year. Manufacturing firms in Western and Northern Europe were the most likely to say they planned to invest. Investment intentions were weakest in the construction sector in Central and Eastern Europe, where a rise in interest rates brought an abrupt halt to a long real estate market boom.

Industry led the slowdown in production, while services were more resilient. Surveys support this evidence, with the manufacturing purchasing manager's index (PMI) for the euro area declining to below 50 (the threshold between contraction and expansion) in mid-2022 and then dipping to a low point of 42.7 in July 2023, despite an uptick at the beginning of the year. In November, it was still at a weak 44.2. The services PMI fell below 50 in August 2023 (and was still at 48.7 in November). Data on industrial production confirm this picture, as EU figures for the third quarter of 2023 suggest a 1.1% drop compared to the preceding quarter and a 4.2% fall with respect to the previous year. By September, industrial production had declined 5.7% from the peak reached in the same month a year before.

The situation in EU countries varies, depending on firms' specialisation and position in production chains, along with their sensitivity to rising interest rates. The energy shock has abated but not vanished, with oil prices volatile and rising towards USD 100 per barrel when the conflict between Israel

and Hamas broke out in October 2023. At the same time, the sudden rapid increase in interest rates is feeding through into the EU economy. These shocks are having varying effects on the 27 EU members, as is made clear in the widening gap in GDP growth rates – even within groups of countries that otherwise tend to move in tandem (Figure 3). The standard deviation of growth rates is almost as high as during the beginning of the European sovereign debt crisis in 2009-2010. Private consumption shows a similar dynamic, contracting in 14 of 27 EU members in mid-2023.

Figure 3
Growth and dispersion in growth



Source: *Eurostat.*
Note: *Regional averages are weighted by GDP.*

Source: *Eurostat.*
Note: *Growth rates have been standardised at the country level to avoid having growth rates influence the level of dispersion.*

Firms initially remained profitable despite rising energy and wage costs and tighter funding conditions

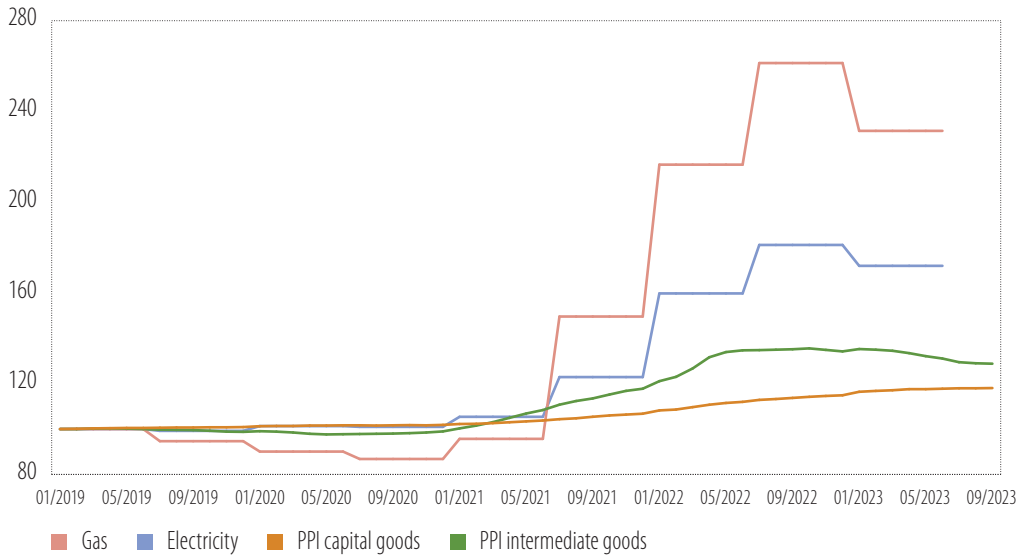
Despite the major increase in production costs and monetary tightening, firms have on average remained profitable (encouraging them to invest), while energy prices have fallen somewhat from their peak in mid-2022. This section argues that firms in energy-intensive sectors may nevertheless struggle to recover from the shock, and that countries in which inflation was particularly high (such as those in Central and Eastern Europe) may not find it easy to regain their competitiveness within the European Union. Box A discusses why inflation was so much higher in Central and Eastern Europe.

Firms preserved their profitability in the face of rising energy and wage costs

Energy prices have receded since their peak in late 2022, but cost pressures persist. High energy prices pushed up firms' input costs and eventually the prices of intermediate and capital goods (Figure 4). Gas prices peaked in the second half of 2022, hitting levels about 2.5 times higher than at the start of 2021.

They have fallen back since then, but only partially, and are reflected in a slight reduction in the costs of intermediate goods. In contrast, the prices of capital goods have not yet started to decline.

Figure 4
EU electricity and gas prices and selected producer prices (January 2019=100)



Source: *Eurostat.*
Note: *Gas and electricity prices are simple averages over all consumption bands for non-household consumers at six-month intervals. The latest data available are for September 2023. PPI stands for the producer price index.*

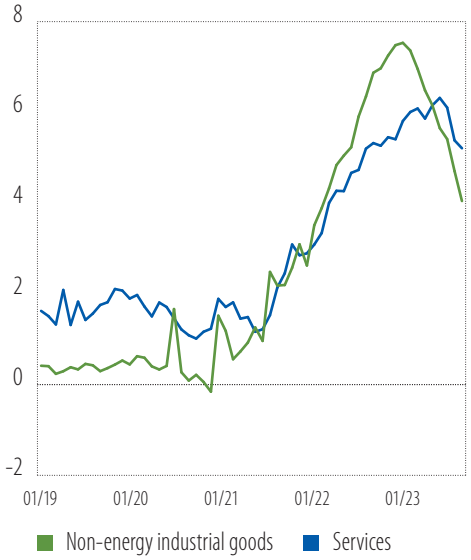
The pressures affecting costs were different for industrial and service-sector firms. The extent of competition, the importance of wages in production costs and a post-pandemic catch-up in demand for services help explain why prices moved at different paces in services and industry (Figure 5). Energy prices rose a lot more in the European Union than in non-EU countries, making it harder for manufacturers of goods traded globally to raise prices. In addition, wages count for a larger share of production costs in services than in industry, meaning that service prices followed the gradual increase in wages more closely. Finally, once businesses reopened following the pandemic, demand for services increased sharply while supply had in many cases been cut (in hospitality and transport, for example). Supply has taken time to ramp back up, leading to a more sustained increase in labour costs and prices in the services sectors (Figure 6).

Despite the increase in costs, firms generally remained profitable. Firms responded to the rising energy prices by trying to save energy, renegotiating energy contracts, changing their sources of energy, and, in the case of energy-intensive firms, lowering production (see the survey evidence discussed in Chapters 3 and 5). But over half of EU firms also passed on energy costs to their customers, eventually leading to the gradual spread of higher energy prices through the economy. This strategy allowed most firms to stay profitable. The share of national income coming from their gross profits remained almost unchanged despite the increase in costs, at just above 40%.

The widespread nature of the energy crisis and the economic context made it easier for firms to pass on higher costs. Rises in energy and food prices affected firms and their competitors similarly, making it easier justify price increases. After losing money during the pandemic, firms may also have been particularly eager to preserve profitability (Bank for International Settlements (BIS), 2023). Consumer demand remained fairly strong because fiscal policy had offset much of the pandemic's shock to incomes while health concerns constrained spending on services. In aggregate terms, consumers had built up savings, which they were ready to spend once economies reopened (see below). At that point, firms did not have enough qualified staff to raise output quickly, and firms outside Southern Europe struggled to

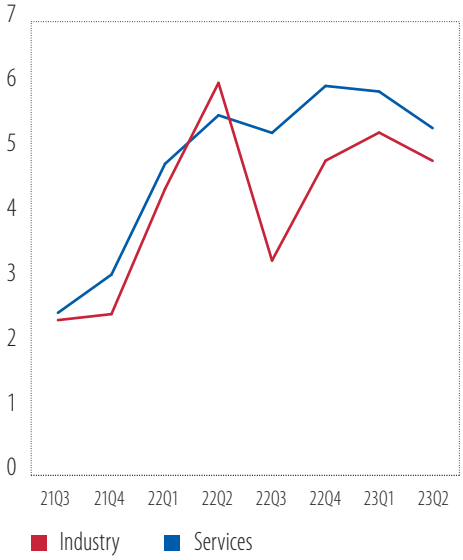
fill vacancies. In addition, sectors such as the car industry were unable to secure the supplies they needed, mostly because of transport bottlenecks for imports from Asia, but also because Russia's invasion of Ukraine had hindered production there. Firms could then sell lower production volumes at a higher price.

Figure 5
EU inflation for different goods (% change from the previous year)**, by sector**



Source: *Eurostat.*
Note: *Shown are components of the Harmonised Index of Consumer Prices (HICP).*

Figure 6
Labour costs (% change from the previous year)**, by sector**



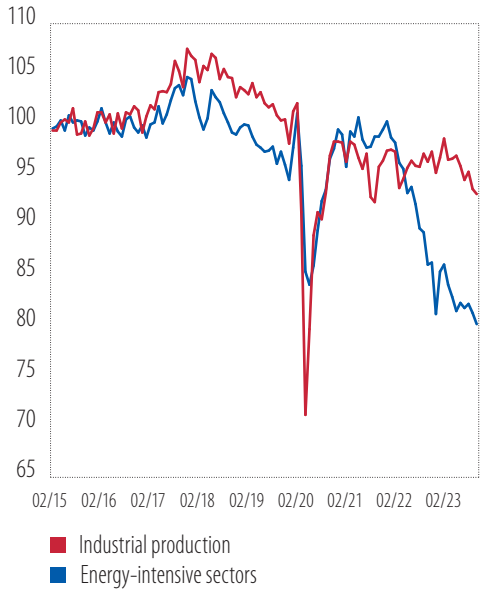
Source: *Eurostat.*
Note: *Industry excludes construction.*

The increase in energy and wage costs may have longer-term consequences

Energy-intensive firms in the European Union have largely opted to reduce production. Chapter 5 discusses their outlook in detail. In Germany alone, production in energy-intensive sectors declined by one-fifth with respect to their peak in December 2021 (Figure 7). That said, energy-intensive firms appear to be waiting to see how the business environment evolves and have not (yet) started to shed labour. Applications for short-term work benefits in the sector had not increased significantly by October 2023.

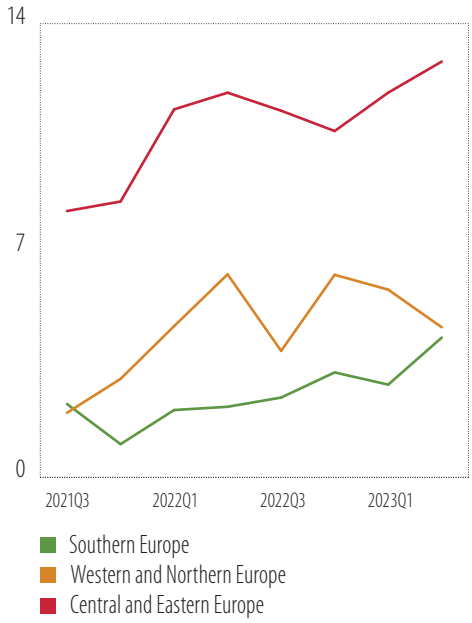
Unit labour costs rose far more in Eastern European countries, harming their competitiveness. Although high energy prices hit all EU countries, they stoked costs and inflation far more in Central and Eastern Europe (Figure 8). (Box A offers a few explanations.) As a result, the region's competitiveness could suffer. Figure 9 illustrates this with a measure of competitiveness that it based on each country's labour costs and the productivity of employees relative to those of its trading partners: the real effective exchange rate of unit labour costs. For each country, this measure of competitiveness takes the increase in labour costs relative to its trading partners as a starting point, subtracts any increase in labour productivity to arrive at the increase in labour costs per unit of output, and subtracts any depreciation of the country's nominal exchange rate vis-à-vis its trading partners. The larger the value, the greater the loss in the country's competitiveness relative to its trading partners. Most of the countries with large losses in competitiveness are located in Central and Eastern Europe. In the past, appreciations in the rate have been associated with lower exports (Figure 10). Central and Eastern European economies – particularly those inside the euro area – will have to rely on improving productivity or limiting wage growth to regain their previous level of competitiveness. Programmes that stimulate investment, such as the Cohesion Fund, the European Regional Development Fund and the Recovery and Resilience Facility, are designed to help.

Figure 7
Industrial output in Germany, overall economy and energy-intensive sectors (2015=100)



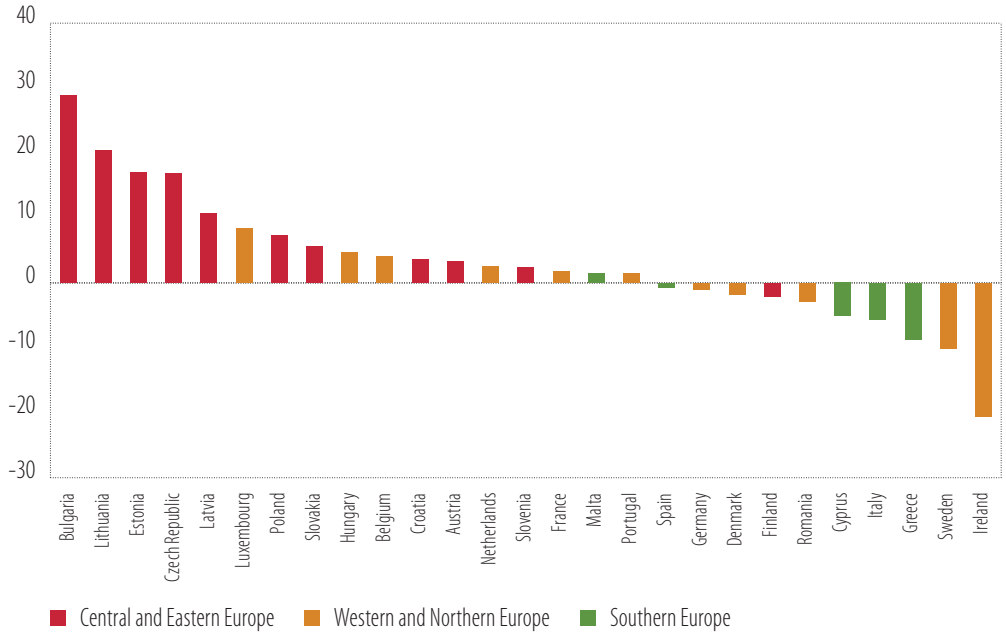
Source: *Federal Statistical Office of Germany.*
Note: *The index reflects production in the overall economy and in energy intensive sectors separately.*

Figure 8
Labour costs (% change from the previous year)**, by region**



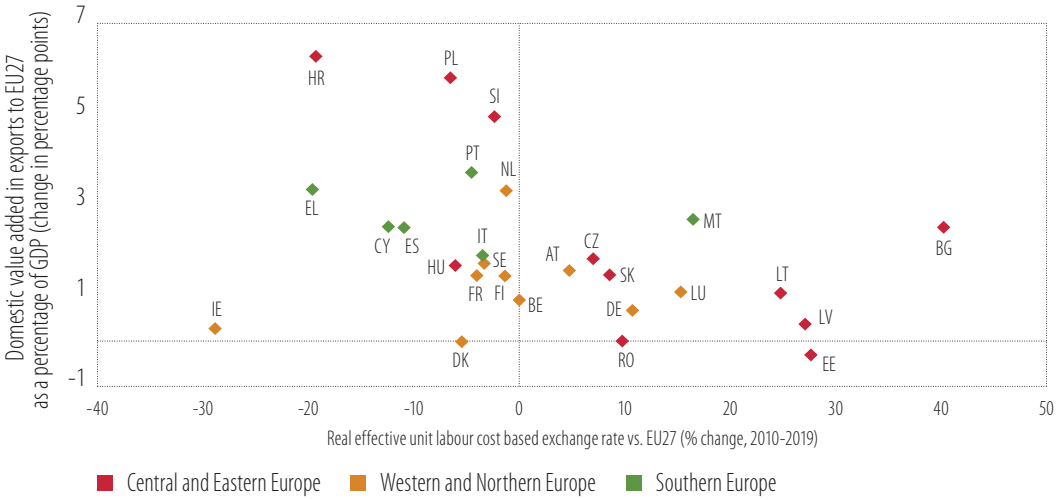
Source: *Eurostat.*
Note: *Indices of national labour costs have been aggregated using weights for 2022 GDP.*

Figure 9
Real effective unit labour costs vs. EU trading partners (in %)**, second quarter 2019 compared to second quarter 2023**



Source: *Eurostat.*

Figure 10
Appreciation in the real exchange rate vs. domestic value added in exports



Source: *Eurostat.*
Note: *The real effective unit labour cost based exchange rate measures a country's cost of producing manufactured goods relative to the countries exported to in the European Union. Domestic value added in exports measures the extent to which exported goods have been produced in the country under consideration, net of imports of intermediate goods that were used to produce the exported goods.*

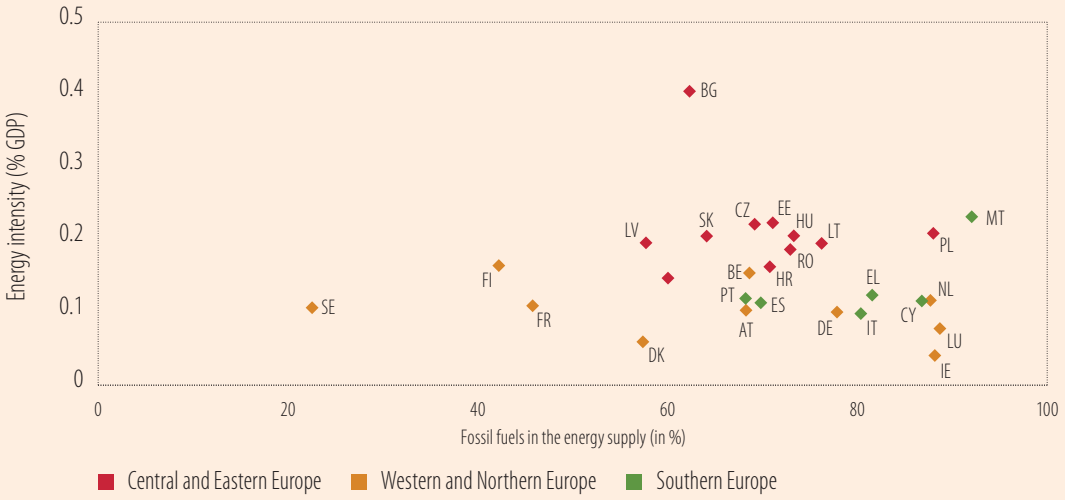
Box A
Why did inflation rise so much more in Eastern Europe?

The spike in global energy prices may have hit all EU countries, but it stoked inflation far more in Central and Eastern Europe. Different positions in the business cycle and structural vulnerabilities to energy shocks help explain this divergence. One structural reason is that households in these countries tend to be poorer and spend a greater share of their income on food, transport and energy than their Western European peers (see Müller, 2023). Another is that these countries rely more on fossil fuels to generate energy and their economies use more energy to produce goods and services (Figure A.1).

Central and Eastern European economies also appeared to be operating closer to capacity when the food and energy shocks hit, making it easier for firms to pass on price increases (see, for example, Bank of Lithuania, 2022). Most economies in the region had emerged faster from the pandemic than those in the rest of the European Union, with real GDP levels in many countries actually several percentage points higher in 2021 than in 2019. In contrast, most Southern European countries had not yet recovered. Business surveys support this explanation. The share of firms reporting labour shortages in the fourth quarter of 2021 tended to be higher in Central and Eastern European countries than in Southern European ones (Figure A.2). Unsurprisingly, economies running at a higher capacity and a more pronounced shortage of labour caused wages in some industries in Central and Eastern Europe to rise more than twice as fast as elsewhere in the European Union.

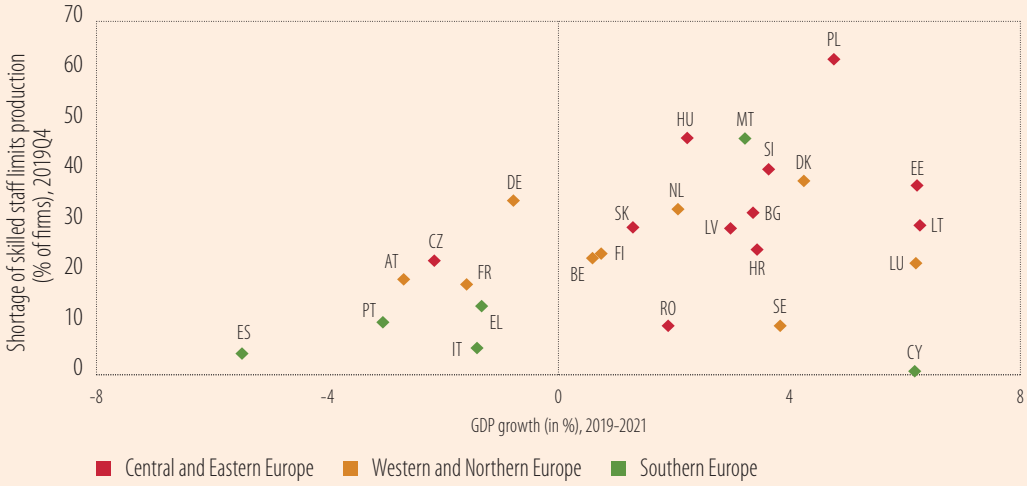
Finally, idiosyncratic factors explain some of the differences in inflation between countries. For example, energy prices in some countries had been so low that the shock resulted in a disproportionate increase (Estonia), while in others, retail energy prices were subsidised to keep consumer price inflation low (Hungary). In some economies, variable energy price contracts were more prevalent, meaning that the rise in wholesale energy prices were passed on to retail prices more quickly (the Baltic region), while elsewhere agreements to limit energy price rises smoothed out inflation but prolonged its duration (Slovakia).

Figure A.1
Energy intensity vs. share of fossil fuels in the energy supply



Source: *Eurostat.*

Figure A.2
GDP growth during the pandemic vs. shortages of skilled staff



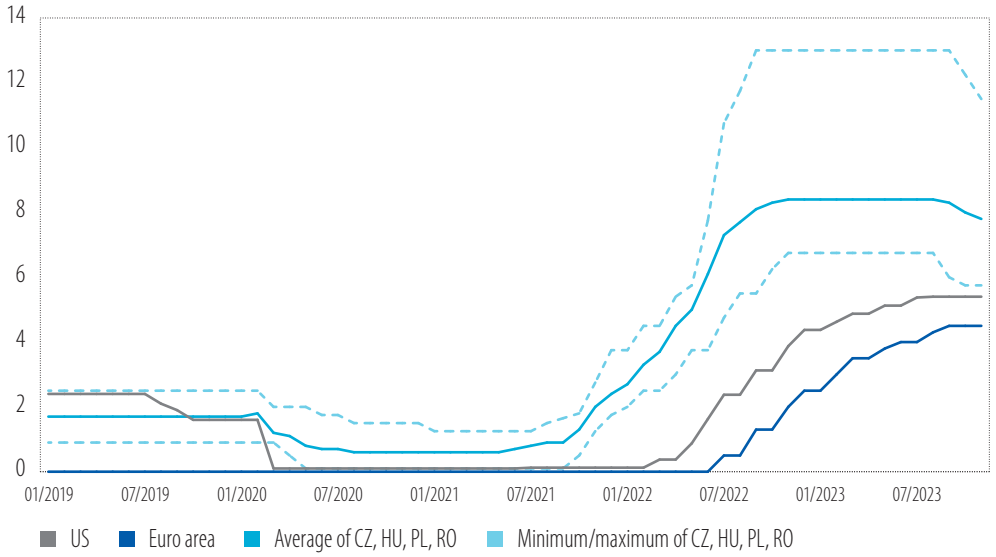
Source: *Eurostat and the European Commission (Directorate-General for Economic and Financial Affairs).*

Tighter monetary policy gradually raised firms' funding costs without provoking wider financial instability

As inflation soared above targets, central banks tightened monetary policy. Most central banks outside the euro area had already begun raising rates in late 2021, and a few in Central and Eastern Europe have already started to cut rates. The European Central Bank (ECB) started later (in mid-2022) and, in just over a year, raised its key policy rate from zero to 4.5% (Figure 11). In July 2022, the central bank also stopped buying bonds (Figure 12). It continued to reinvest assets purchased under the Pandemic Emergency Purchase Programme, which it began at the outset of the pandemic to counter risks to the monetary

policy transmission mechanism and the outlook for the euro area. However, reinvestments under its Asset Purchase Programme, which was initiated in October 2014 to reduce longer-term interest rates, ended in July 2023. Winding down bond buying is likely to have pushed up longer-term interest rates (Schnabel, 2023).

Figure 11
EU central bank policy rates (in %)



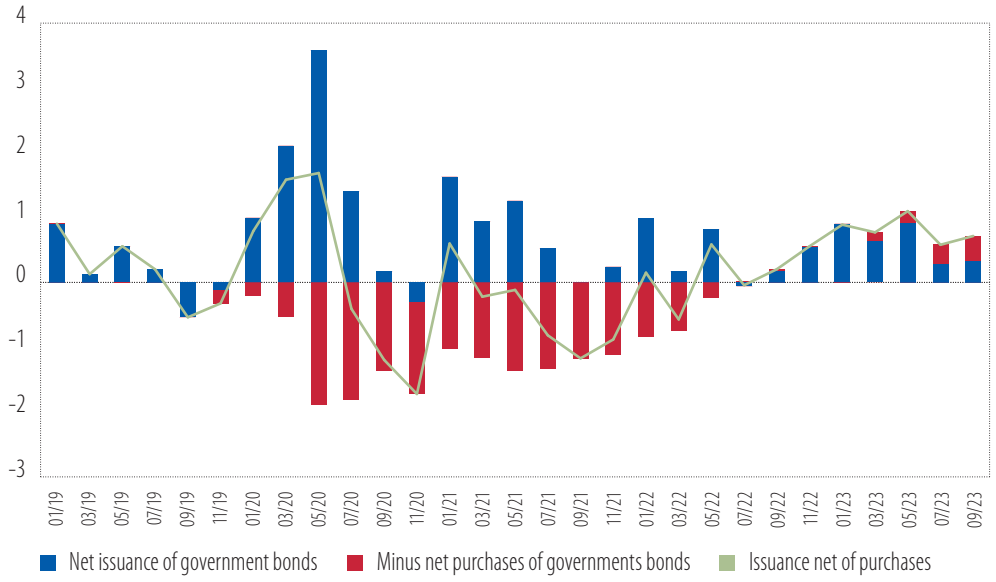
Source: *Bank for International Settlements.*
Note: *The blue lines indicate the range of policy rates for four Central and Eastern European countries, the Czech Republic, Hungary, Poland and Romania. The maximum is given by Hungary during the recent tightening and corresponds to the base rate set by the country's central bank. However, this underestimates the degree to which the central bank tightened monetary policy from October 2022 to September 2023, when the overnight loan rate exceeded the base rate by up to 12 percentage points.*

Banks benefited from higher interest rates while non-performing loans remained at record lows. Banks raised the interest rates charged on loans considerably faster than those paid on deposits, meaning that their net interest rate margins widened and profits increased (Figure 13). Meanwhile, the quality of their assets remained good, as unemployment remained low and non-financial firms' profits high. By mid-2023, banks' average capital ratios had not changed substantially, the ratio of non-performing loans was lower than at the start of the pandemic, and there was no sign that the share of loans overdue between 30 and 90 days was starting to increase.

Banks raised the interest rates on loans and applied higher credit standards as the economic outlook darkened. Banks curtailed lending to the corporate sector in response to greater uncertainty, lower risk tolerance and higher funding costs. Not only did they raise interest rates for loans to the corporate sector, but they also tightened credit standards. Surveys suggest that the credit supply contracted more in Eastern and Southern Europe than in Western and Northern European countries (Figure 14).

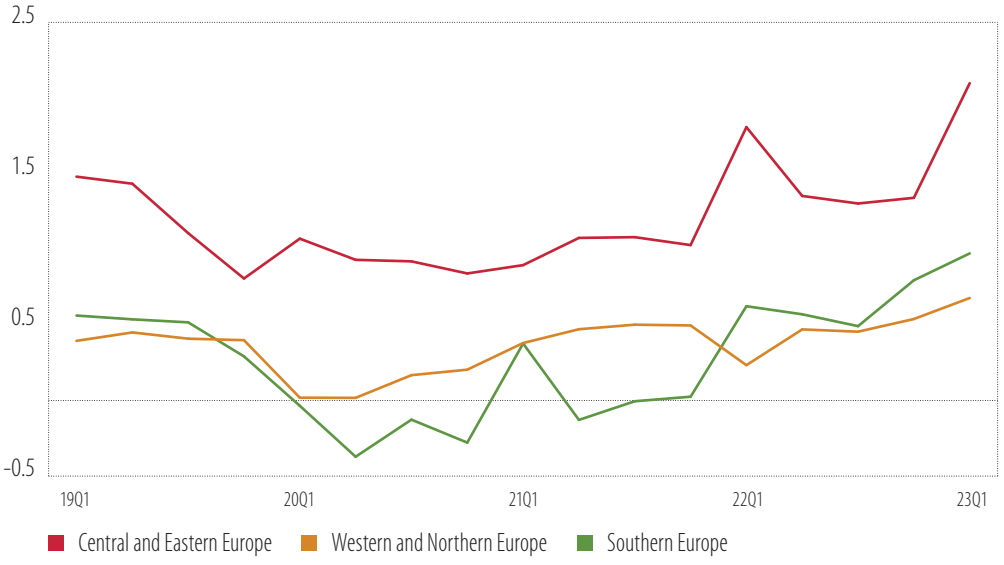
Corporate borrowing costs, particularly for new loans, increased accordingly, rising more quickly in some Southern and Eastern European countries. On average, around 80% of bank loans to non-financial corporations in the euro area have an interest rate that is fixed for less than a year, meaning that changes in policy interest rates feed through quickly to borrowing rates. However, the average loan tenor varies depending on the country, resulting in different speeds of transmission. Interest rates for existing loans increased much less than the cost of new lending in Germany, whereas both changed by about the same amount in the Baltics (Figure 15).

Figure 12
Issuance net of purchases of euro area government bonds (% GDP)



Source: *Eurostat, ECB, EIB staff calculations.*
Note: *Asset purchases are the sum of purchases under the ECB's Public Sector Purchase Programme and the Pandemic Emergency Purchase Programme. Data are aggregated every two months. Estimates for GDP for 2023 are taken from the European Commission's annual macro-economic database (AMECO), which reflects the spring forecast.*

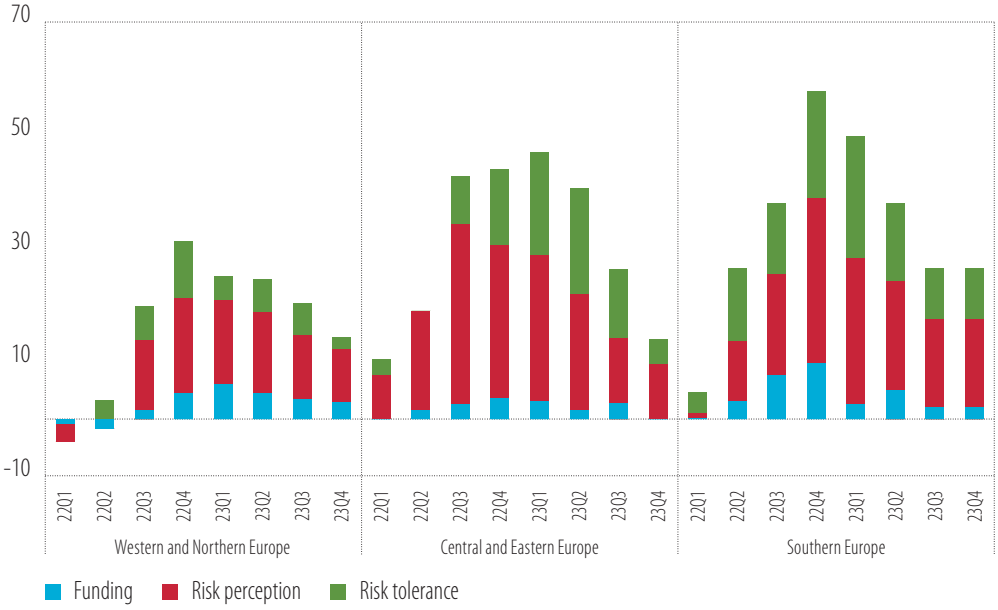
Figure 13
Bank profits as a share of total assets (in %)**, by region**



Source: *ECB.*
Note: *The line for reach region represents the simple averages of countries using the euro.*

Figure 14

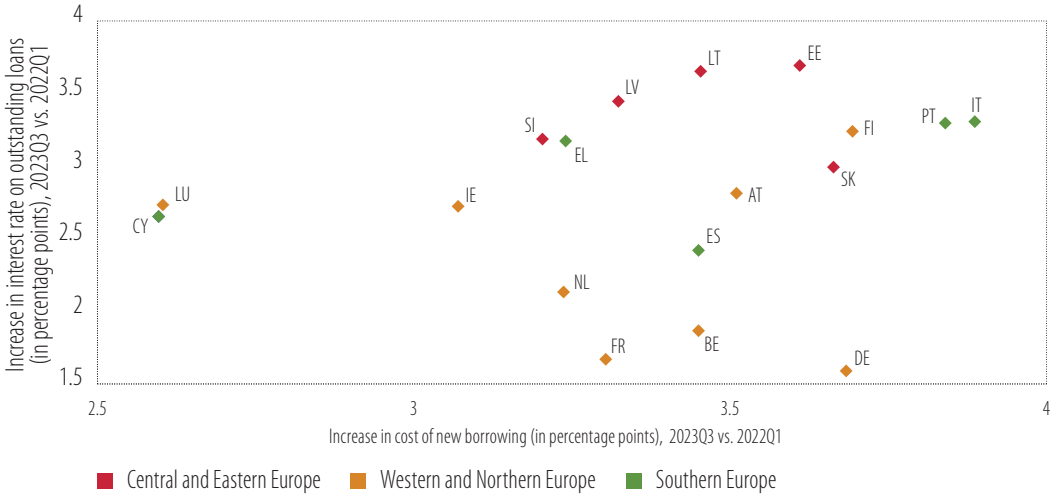
Factors contributing to tighter credit conditions for non-financial firms (net balance of respondents, in %)**, euro area countries only**



Source: *ECB Bank Lending Survey.*
Note: *The bars for each region represent the simple averages of countries using the euro.*

Figure 15

Cost of new borrowing and interest rates on outstanding loans in the euro area



Source: *ECB.*
Note: *Cost of new borrowing includes overdrafts.*

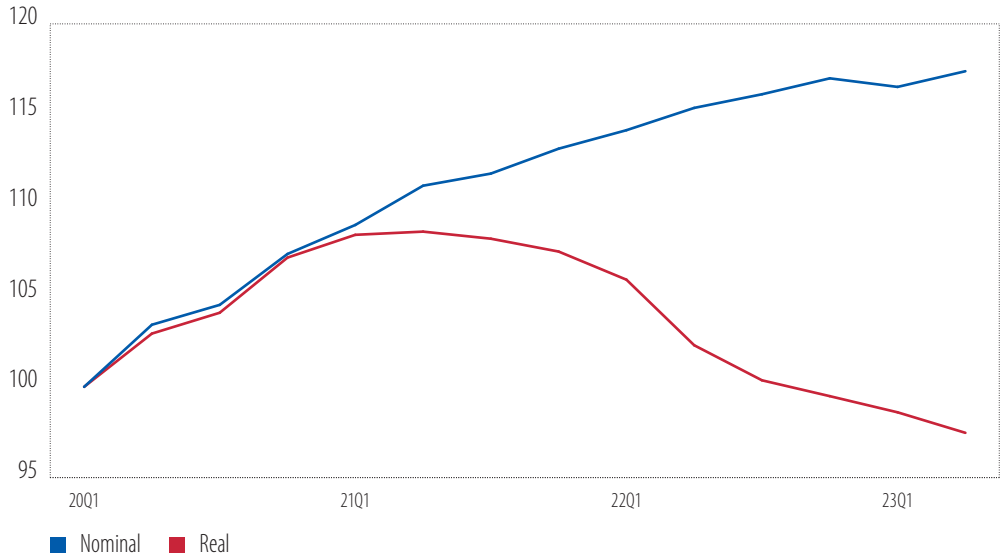
Domestic demand supported investment but started to fade

Domestic demand proved surprisingly resilient given the rapid rise in inflation and monetary tightening. The following section discusses three reasons. First, households were willing to draw down savings accumulated during the pandemic. Second, the labour market remained tight, and firms were reluctant to let staff go while profits were abundant. Third, fiscal policy offset some of the inflationary shock to households' income. That said, none of these factors are likely to persist.

Households tapped their savings to pay for increased spending, but those savings now appear to be exhausted

Consumption grew rapidly right after the pandemic, then gradually weakened. The energy crisis peaked in the winter of 2022-2023, and until then EU households continued to increase their consumption despite declining real incomes. Consumption only dipped earlier in Central and Eastern European countries (where inflation had risen faster), particularly in those outside the euro area (where central banks had tightened monetary policy earlier than the European Central Bank). One reason was that fiscal policies had limited the impact of surging energy prices on household budgets. Another reason was that households were willing to use the excess savings accumulated during the pandemic to pay for their increased spending, which was primarily on services. Excess savings were probably wound down by the end of 2022. By that time, inflation had eroded their real value. Figure 16 illustrates households' holdings of deposits and cash to moving zero as a proxy for the most liquid part of their savings, which is most likely intended to be used for consumption (Figure 16).

Figure 16
Euro area households' nominal and real holdings of cash and deposits (2020Q1=100)

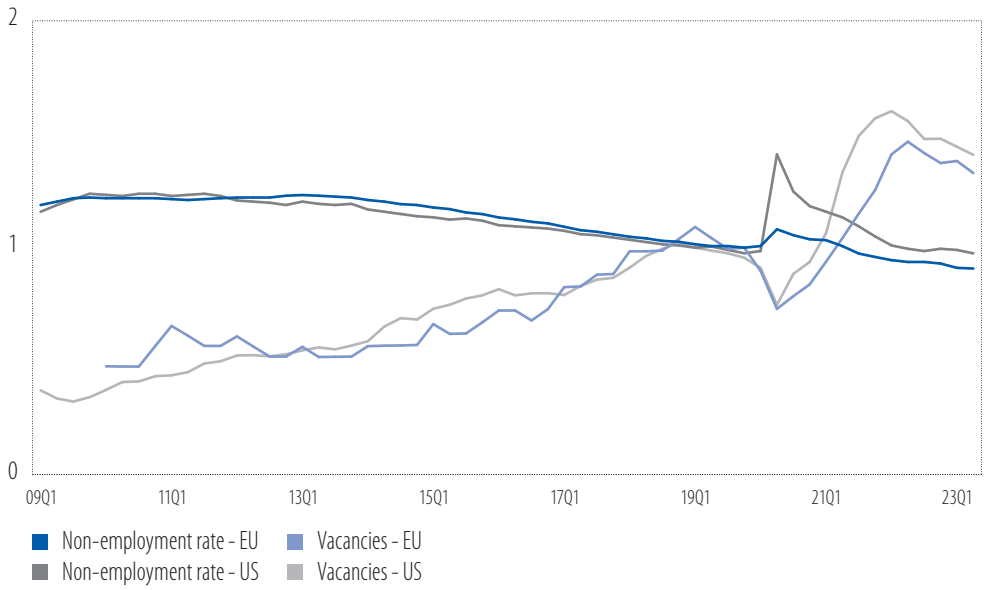


Source: *ECB.*

Unemployment remains low but job openings are starting to dry up

In most EU countries, tight labour markets supported domestic demand by providing a reliable source of income and encouraging inactive households to take up employment. During the pandemic, policies designed to prop up the economy had enabled EU firms to keep employees even though hours worked per employee declined. The opposite was true in the United States, where firms laid off staff but kept hours worked per employee constant. When growth picked up in 2021, labour markets recovered quickly. Job openings rose to record levels in the United States and the European Union, and the share of the population not in employment continued to decline (Figure 17). EU employment rates increased, particularly for women and older employees (Figure 18). Within the European Union, unemployment fell most sharply in Southern European countries, where it remained. However, it was about twice as high as in the rest of the European Union.

Figure 17
Vacancies and share of population not in employment (an index, 2019Q4=100), **European Union vs. United States**



Source: Eurostat and the Federal Reserve Bank of St. Louis.

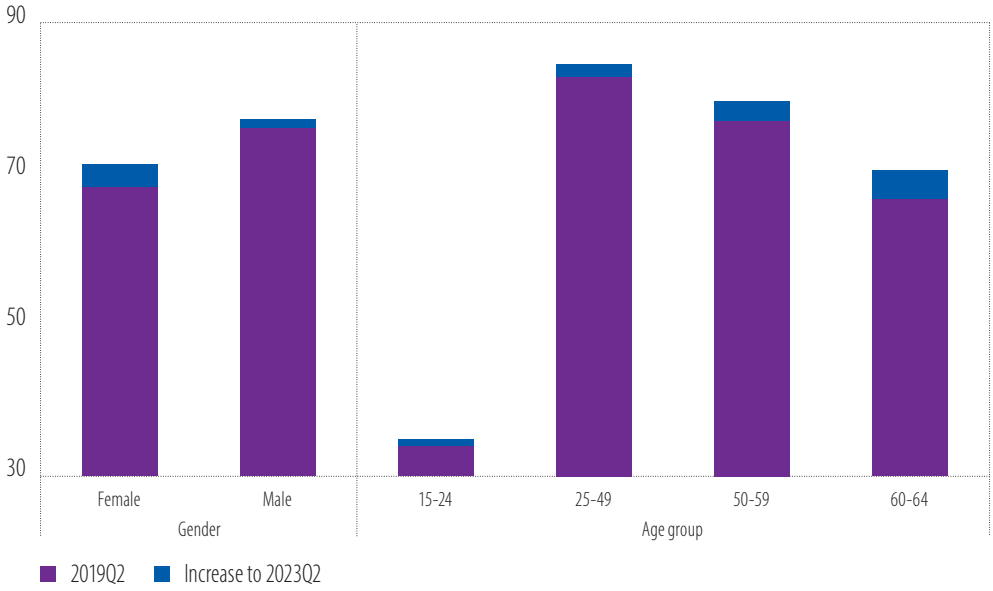
A widespread shortage of skilled employees encouraged firms to hold on to staff even as the economic outlook darkened. Investment by EU firms had been constrained for years by their inability to find employees with the right skills (Figure 19), partly because of cyclical economic conditions (Germany) but also for structural reasons in countries like Bulgaria and Croatia, where emigration had caused a sharp decline in the labour force. Shortages were particularly high in industries related to the green and digital transition, and they delayed public investment programmes (see Chapter 2). Staff shortages are likely to persist, given the projected decline in the European Union's working-age population (Figure 20) (Stemmer, forthcoming). The supply of skilled labour would benefit from creating better conditions for part-time and remote work and from improving labour market access for immigrants.

Immigration (particularly from Ukraine) has started to alleviate labour shortages in some EU countries over the past year. Since the Russian invasion of Ukraine, most new immigrants coming from beyond the European Union are Ukrainian citizens. In contrast to refugees from other non-EU countries, Ukranians were able to join the EU labour market because the temporary protection scheme allowed them to

choose where in the European Union they wished to live and work (European Commission, 2022).[1] Most opted for countries with a Ukrainian diaspora (International Organization for Migration (IOM), 2023a) and tight labour markets, namely Germany, Poland and the Czech Republic. Working-age Ukrainians increased the labour force by 2.5% in Central and Eastern Europe, 1% in Western and Northern Europe and 0.5% in Southern Europe.[2] Ukrainian immigrants often face language barriers inhibiting their ability to integrate into labour markets (IOM, 2023b and 2023c). Since surveys point to migrant employment rates of about one-third (IOM, 2023b), Ukrainian refugees are likely to have contributed about 0.5% to the GDP of Central and Eastern European countries in the short term, and proportionately less in the rest of the European Union.[3] The longer these refugees stay and the better the policies facilitating their integration, the more of them will take up employment and the higher their contribution to GDP will be.

Figure 18

EU employment rates (% of population)



Source: *Eurostat.*

1 See https://home-affairs.ec.europa.eu/policies/migration-and-asylum/common-european-asylum-system/temporary-protection_en

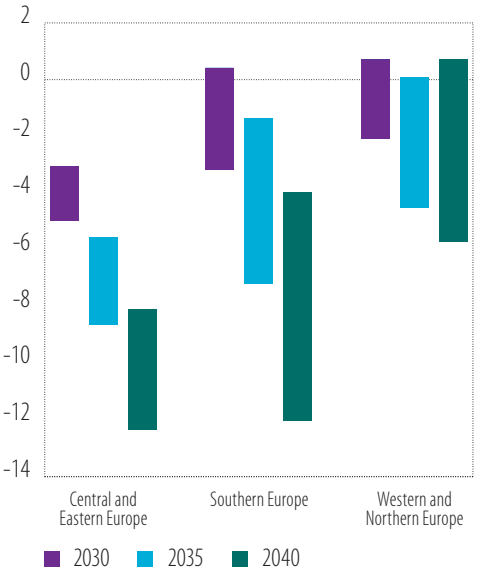
2 Approximated using the share of 18-65 year old Ukrainians having sought temporary protection relative to the active population aged 20-65.

3 Calculated assuming a Cobb-Douglas production function: GDP growth = employment growth * 2/3 elasticity with respect to labour. For an overview of the literature on the economic impact of migration, see Chapter 3 in OECD (2016).

Figure 19
Share of EU firms reporting that a lack of qualified staff is a major investment obstacle
(net balance, in %)

Source: *EIBIS 2016-2023.*
Question: *Thinking about your investment activities, to what extent is the availability of staff with the right skills an obstacle?*

Figure 20
Forecast decline in the working-age population by 2030, 2035 and 2040
(% change relative to 2022)



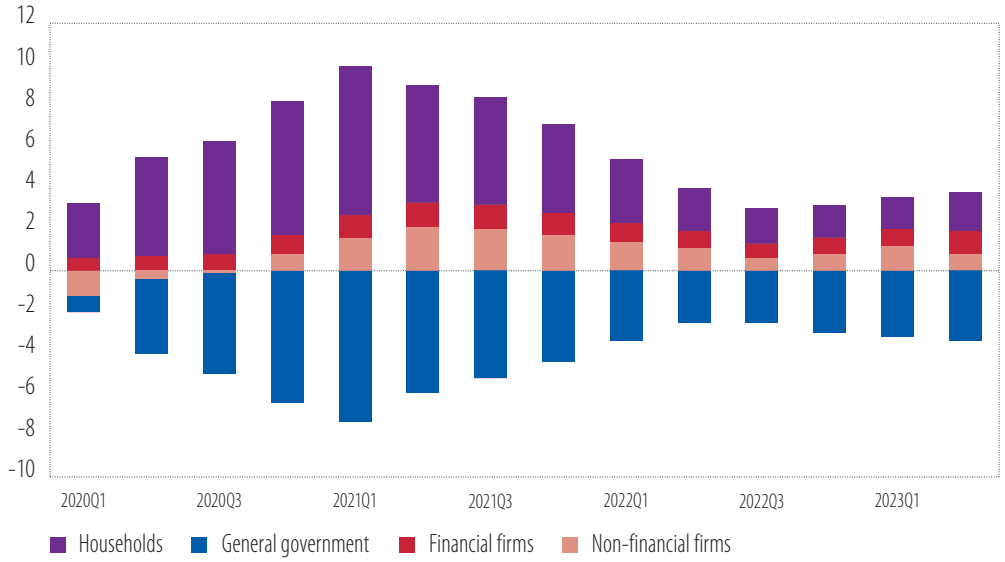
Source: *Eurostat.*
Note: *The scenarios on migration vary immigration from non-EU countries by +/- 33%; this corresponds to the upper and lower ends of the vertical bars. See Population projections in the EU - methodology - Statistics Explained (europa.eu).*

Public spending softened the energy shock, but EU members are now cutting back

Expansive government and EU fiscal policies helped to buoy the economy during recent crises. The activation of the general escape clause of the European Union's Stability and Growth Pact in 2020, which provides EU members a temporary reprieve from normal budgetary requirements in the event of a severe economic downturn, gave governments the fiscal freedom they needed to shield household incomes from the economic consequences of the COVID-19 crisis. Governments intervened again during the energy crisis, and debt bloomed, prompting fiscal consolidation and monetary tightening. As interest rates increased, the net savings of financial institutions rose in line with the higher interest they were earning on average on their assets (Figure 21).

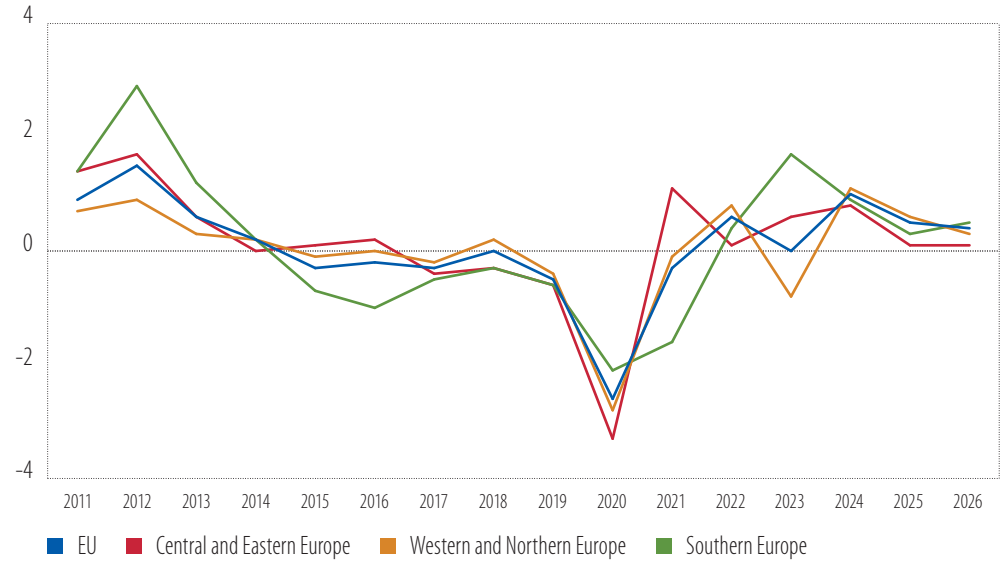
The jump in inflation in 2022 lowered the value of debt relative to GDP, providing some fiscal leeway despite governments' efforts to support firms and households. Governments moderately tightened budgets, and the European Union announced the deactivation of the general escape clause from 2024. Figure 22 shows the dynamics of the structural primary balance, which shows what the government's budget balance would be if the economy were operating at its full potential for the European Union (and in the broader regions). It measures the first difference (the value at time t minus the value at time t-1). This is the easiest way to measure the fiscal policy stance. If the balance adjusted for the cycle and one-off measures (the structural balance) worsen, the difference will be negative, meaning that the fiscal stance is expansionary compared to the previous year.

Figure 21
EU domestic net savings (% GDP, four quarter moving average)**, by institutional sector**



Source: *Eurostat.*
Note: *The latest data available are for the second quarter of 2023.*

Figure 22
Changes in the structural primary balance according to stability and convergence programmes (% GDP)



Source: *Eurostat.*
Note: *The latest data available are for 2022. Figures from 2023 onwards are forecasts.*

As Figure 22 clearly shows, fiscal policy was dramatically expansionary in 2020. It remained expansionary in 2021 and became slightly contractionary in 2022. The picture for 2023 is varied. EU countries' stability and convergence programmes[4] describe a return to a slightly expansionary stance for Northern and Western Europe. In Central and Eastern Europe, and particularly in Southern Europe, fiscal policy is consolidating. These differences are expected to fade from 2024 on, when the general EU stance should be only slightly contractionary.

The degree of support fiscal policy can provide to the economy depends on the reform of the EU fiscal framework and the evolution of the interest rates countries pay to refinance their debt. The European Union was already debating the appropriateness of its fiscal framework before the current crises hit (Thygesen et al., 2018; Eyraud et al., 2015; Andrle et al., 2015). The European Commission opened a public consultation on reforming fiscal governance at the beginning of 2020 (before the pandemic) and resumed it in 2022. Recent events have added urgency to the debate. The sharp rise in public debt and the activation and deactivation of the general escape cause provides an opportunity to re-open the debate. After the public consultation, the European Commission formulated a proposal that aims to replace the rule-based approach with one using debt sustainability analysis (see Chapter 2).

The debate around a new EU fiscal framework frequently referred to two topics: establishing a central fiscal capacity and increasing the provision of EU public goods[5]. A central fiscal capacity calls for creating a stable, centralised mechanism to determine the fiscal stance to be taken when addressing a generalised economic shock that affects EU countries differently, as well as idiosyncratic shocks. The EU instrument known as Support to Mitigate Unemployment Risks in an Emergency (SURE) was modelled on these grounds. So was NextGenerationEU. The provision of EU public goods is based on the idea that there is an increasing need for investment that is better sourced, financed, produced and distributed at the EU level rather than by individual countries. These needs are related to defence and security, to achieving industrial security (or strategic autonomy) and to the common infrastructure related to energy.

The Recovery and Resilience Facility is helping to protect public investment (as shown in Chapter 2), but there are reasons to believe that EU investment needs are growing. The eighth wave of the EIBIS shows that the share of firms saying climate change is already affecting their business has jumped 7 percentage points in a year, with 64% of firms now facing physical risks associated with global warming. Tightening credit conditions are also threatening innovation. Innovative firms seeking to scale up are facing a strong contraction in funding available from venture capital firms. While EU businesses have accelerated investment in advanced digital technologies, they still have to maximise the return on this investment. Energy costs are a concern for 83% of EU firms, with 68% of them experiencing a significant increase (of more than 25%) in energy costs, compared with only 30% of firms in the United States. Companies also continue to say that regulatory barriers are blocking investment. As shown in Chapter 2 of this report, synergies between public and private investment are significant and growing, particularly for the green transition. Addressing these issues requires policy coordination and often justifies major and coordinated public investment.[6]

Meanwhile, sovereign refinancing costs are gradually increasing. Higher policy interest rates and the gradual unwinding of asset purchases have pushed up governments' refinancing costs. That said, the effect of ending asset purchasing appears to have been relatively benign. The spreads between the sovereign bonds of different EU countries reacted when fiscal forecasts were adjusted or changed, such as in the case of Italy, but did not rise in response to the general tightening of financial conditions, despite substantial uncertainty about the impact of changes in monetary policy and geopolitical developments

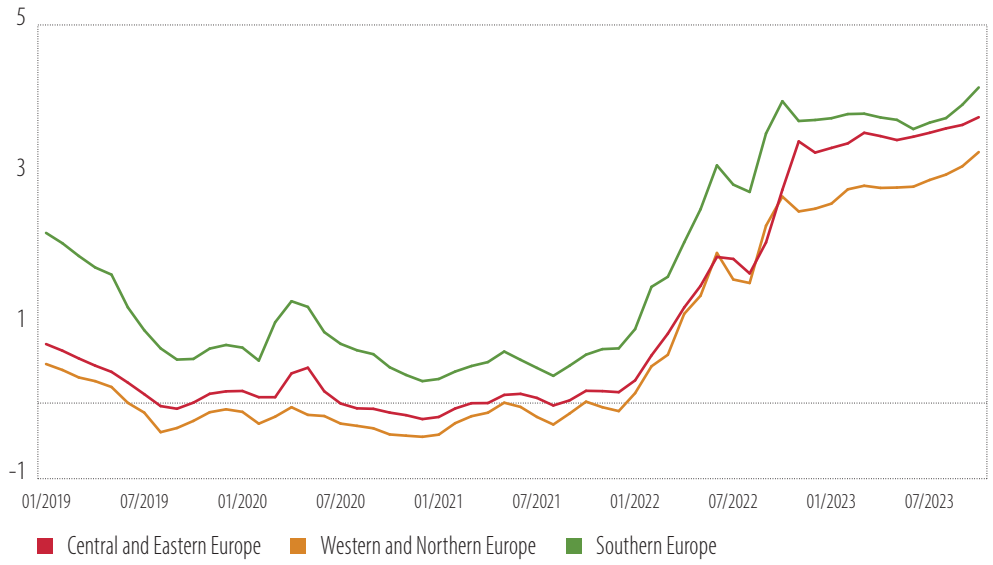
4 The Stability and Growth Pact requires EU countries to submit in April each year their macroeconomic policy and fiscal plans for at least the next three years. EU members that use the euro submit plans known as Stability Programmes, while members not yet using the euro submit Convergence Programmes.

5 See for example Fuest, C., & Pisani-Ferry, J. (2019). A Primer on Developing European Public Goods and Beetsma, R., Cimadomo, J., & Spronsen, J. (2022). One scheme fits all : a central fiscal capacity for the EMU targeting eurozone, national and regional shocks.

6 The case for EU central fiscal capacity was strongly made by Panetta (2023) in one of his last speeches as an ECB board member: "A European fiscal capacity is essential to finance the common investments that are key to maintaining and expanding Europe's economic potential. Without it, we will not be able to meet the financing needs, reap the economies of scale and trigger the private investment needed to drive Europe's energy transition, digital transformation and security architecture. We need to start thinking now about what comes after NextGenerationEU, or risk taking a step back instead of forward."

(Figure 23). One reason may be that many governments had increased the maturity of their debt while interest rates were very low. Another may be that inflation eroded the real value of public debt, so that relative to GDP, public debt did not increase despite deep budget deficits. For euro area countries, yet another reason may be that the ECB created an instrument, the Transmission Protection Instrument, to smooth the process of monetary tightening, which allows it to purchase bonds on markets where risk spreads appear to be out of sync with fundamentals. That said, tighter financial conditions will gradually feed into higher interest rates for government debt and further reduce the ability of governments in highly indebted economies to spend.

Figure 23
Euro area sovereign bond yields (in %)**, by region**



Source: *Eurostat.*
Note: *The latest data available are for the second quarter of 2023.*

A lesson recently learned is that even a global or common shock will play out differently across the European Union. Fiscal discipline is necessary to maintain equilibrium and justice among EU members and generations, and it cannot be abandoned. However, the need for more intensive policy coordination is clear, as is the heightened role of EU public goods (common infrastructure for energy, skills, a unified capital markets union and coordinated innovation policies). That does not mean that policies have to be the same in all countries. One size does not fit all and a coordinated approach to economic policy is of essence. Private sector investment needs are growing as economies need to transition to greener energy sources and, in the European Union, tackle the competitive challenges arising from the energy shock by Russia's invasion of Ukraine. Public investments (or capital transfers) can be used effectively to catalyse private investment.

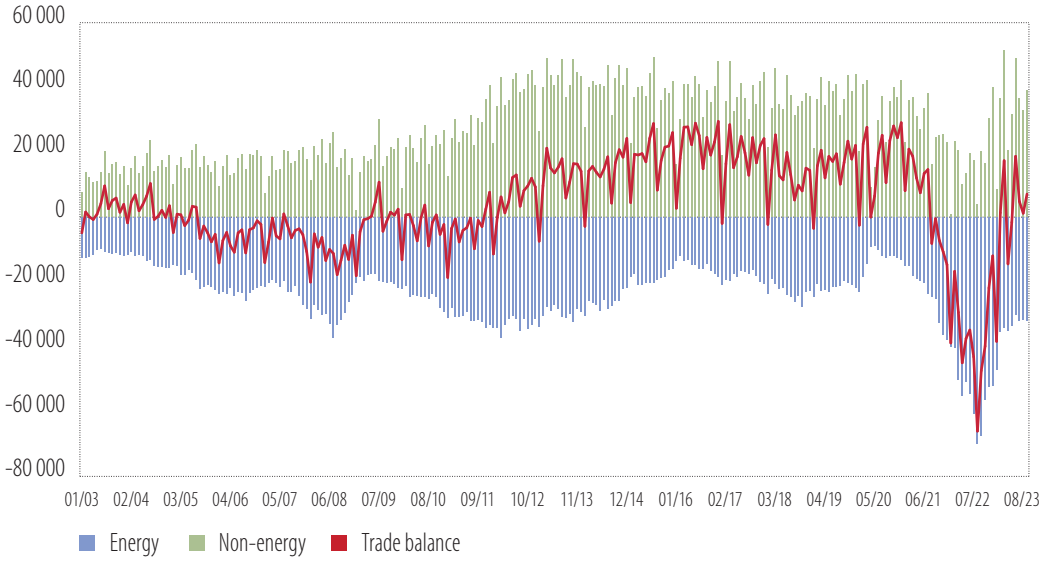
External demand has stalled, but may recover soon

The 2022 shock was unique in that it had two simultaneous implications for EU external demand: eroded terms of trade and reduced global demand. The first was a shock to the terms of trade caused by a spike in the price of energy that the European Union imports. The second was a generalised shock on global demand caused by higher prices for primary goods such as food and energy. The below section focuses on how this shock unfolded. Chapter 4 discusses EU firms' exposure to their trading partners and their attempts to manage risks in their supply chains.

Although higher energy prices initially tipped the European Union into a trade deficit, the situation stabilised and trade eventually returned to a surplus (Figure 24). Broadly speaking, the trade balance went through three distinct periods over the last two decades. The EU trade balance was marginally negative from 2003 to 2011 (by around EUR 3 billion per month, or EUR 36 billion per year), but then moved clearly towards a large surplus (EUR 14.2 billion on average per month, EUR 170 billion per year, from January 2012 to December 2021). After the Russian invasion of Ukraine, the trade balance moved into a deficit, which stood at EUR 420 billion for 2022. In 2023, the prices of many commodities declined with respect to the peaks hit in 2022. In the first nine months of 2023 the trade balance was still negative, but only marginally (EUR 0.6 billion per month, on average). It is still unclear whether the coming months will be more comparable to 2003-2011 or 2012-2021. However, a quick look at export and import figures confirms that the economic shock is still being felt.

Figure 24

Energy and non-energy trade balance with countries beyond the European Union (% GDP)



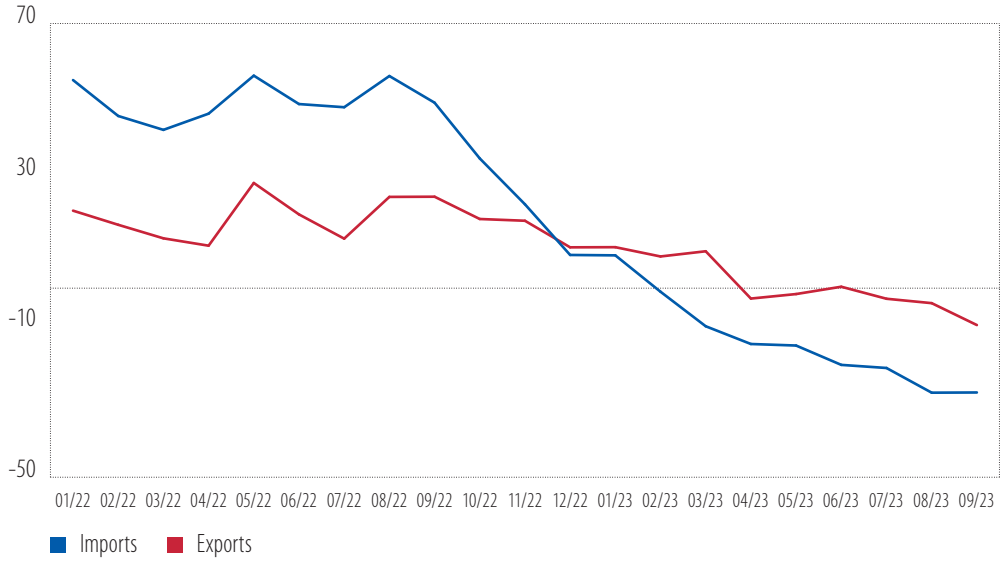
Source: Eurostat.

While imports are declining quickly – mainly due to falling commodities prices – exports are slowing in line with decelerating world trade volumes. A cursory glance at an import-export graph confirms that the share of global demand normally flowing to EU firms has suffered (Figure 25). The volume of worldwide trade in goods in fact declined by 1.9% in the first eight months of 2023, according to Netherlands Bureau for Economic Policy Analysis data. EU exports did better and continued to rise, but they are now declining. According to Eurostat, EU exports grew 0.7% in the first nine months of the year, but declined a hefty 9.8% in September compared to a year ago.

According to IMF forecasts, global demand should soon normalise. Figure 26 shows that growth in world trade has tapered off in recent years, compared to the steep increases that characterised the first decade of the 2000s. According to data from the International Monetary Fund's World Economic Outlook database, growth in world trade (measured in the volume of goods and services) exceeded world GDP growth by 1.3% from 2001 to 2010 and 0.5% from 2011 to 2017, while it was about equal from 2018 to 2023. IMF projections suggest that the growth in world trade volumes will be in line with GDP growth from 2024 onwards. Even though the euro has appreciated in real terms[7] since mid-2022, EU exports performed slightly better than the world trade, but the situation among EU members varies considerably (Figure 27).

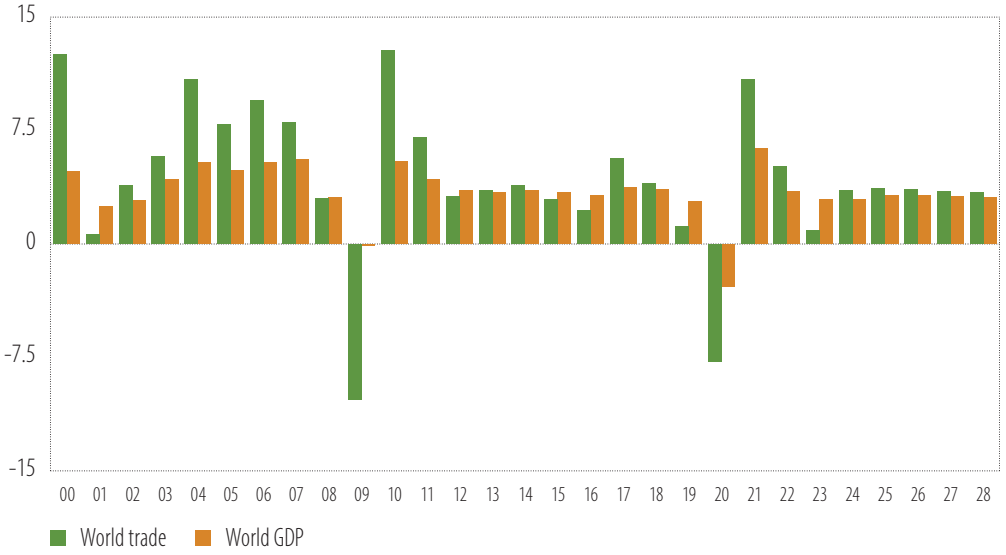
7 This uses a nominal effective exchange rate vs. a broad group of 42 countries, deflated with the harmonised index of consumer prices.

Figure 25
EU imports and exports with countries beyond the European Union (% change from the previous year)



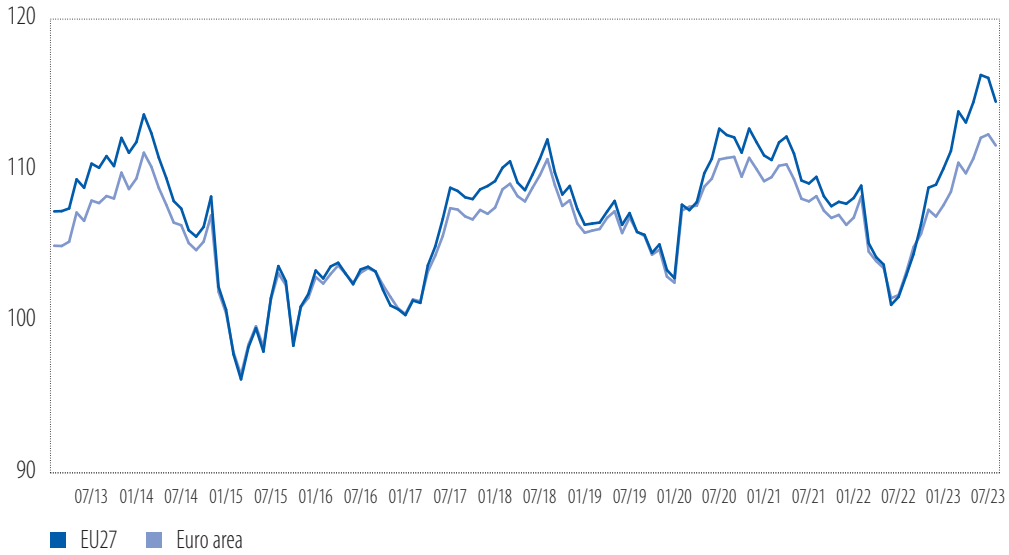
Source: *Eurostat.*

Figure 26
World trade volume (goods and services) **and world GDP** (% change from the previous year)



Source: *The IMF's World Economic Outlook for October 2023.*

Figure 27
EU exports vs. a broad group of countries (an index)**, real effective exchange rate**



Source: *European Commission price and cost competitiveness indicators.*
Note: *The numbers are adjusted for differences in inflation based on HICP figures.*

Looking more closely, the most natural explanation for the varied international trade performance of EU countries is the competitive pressures being felt by producers of energy-intensive products.[8] Table 1 presents the four-digit NACE[9] sectors where production has fallen or risen the most in the last year. The sectors losing at least 10% of their production are all energy intensive.

Table 1
Changes in industrial output for specific manufacturing sectors

	January-August 2023 vs. same period 2019	September-February 2023 vs. same period 2022	January-August 2023 vs. same period 2022
Manufacture of other ceramic products	-29.5	-33.0	-23.9
Manufacture of other organic basic chemicals	-21.1	-26.1	-20.8
Manufacture of dyes and pigments	-16.1	-23.2	-18.0
Manufacture of synthetic rubber in primary forms	-19.1	-20.1	-17.8
Manufacture of plastics in primary forms	-16.9	-20.4	-17.4
Manufacture of paper and paperboard	-20.4	-14.6	-17.4
Manufacture of paper stationery	-33.1	-12.7	-15.5
Manufacture of bricks, tiles and construction products, in baked clay	-12.7	-5.8	-15.0
Manufacture of ceramic tiles and flags	-11.3	-13.1	-14.3
Other printing	-26.2	-13.7	-13.3
Aluminium production	-15.0	-12.9	-12.5

8 See Figure 7 on energy-intensive production in Germany.
9 Nomenclature of Economic Activities (NACE) is the European statistical classification of economic activities.

	January-August 2023 vs. same period 2019	September-February 2023 vs. same period 2022	January-August 2023 vs. same period 2022
Manufacture of knitted and crocheted fabrics	-21.0	-9.4	-12.4
Manufacture of plastic plates, sheets, tubes and profiles	-13.5	-11.7	-11.9
Production of abrasive products	-20.4	-13.7	-11.8
Cold rolling of narrow strip	-23.7	-13.7	-11.7
Manufacture of soap and detergents, cleaning and polishing preparations	-12.6	-10.2	-10.8
Manufacture of steel drums and similar containers	-12.3	-12.8	-10.6
Manufacture of non-wovens and articles made from non-wovens, except apparel	-8.2	-11.8	-10.5
Manufacture of electric domestic appliances	-9.1	-5.2	-10.2
Printing of newspapers	-35.4	-10.3	-10.1

Source: *Eurostat.*
Note: *Classifications are based on four-digit categories under NACE.*

These are also the sectors for which the trade balance worsened substantially after the shock, as shown in Table 2.

Table 2
Trade balance for specific trade categories (EUR billion)

	January-August 2023 vs. same period 2019	September-February 2023 vs. same period 2022	January-August 2023 vs. same period 2022
Organic chemicals	-2 810	-39 402	-16 051
Inorganic chemicals	830.90	-7 551	-2 893
Plastics in primary forms	11 664	7 180	3 707
Iron and steel	947	-17 891	-51 90
Non-ferrous metals	-3 393	-28 449	-13 537

Source: *Eurostat.*
Note: *Based on the SITC, standard international trade classification. Figures include the first eight months of 2023.*

A question in the European Commission's business survey of manufacturing asks firms to summarise their competitive position outside the European Union. As Figure 28 shows, these perceptions worsened noticeably after 2022 and remain at a very low level, comparable to the global financial crisis. For Germany, the reading sunk to its lowest level since 2002 in the third quarter of 2023 before recovering slightly in the fourth quarter.

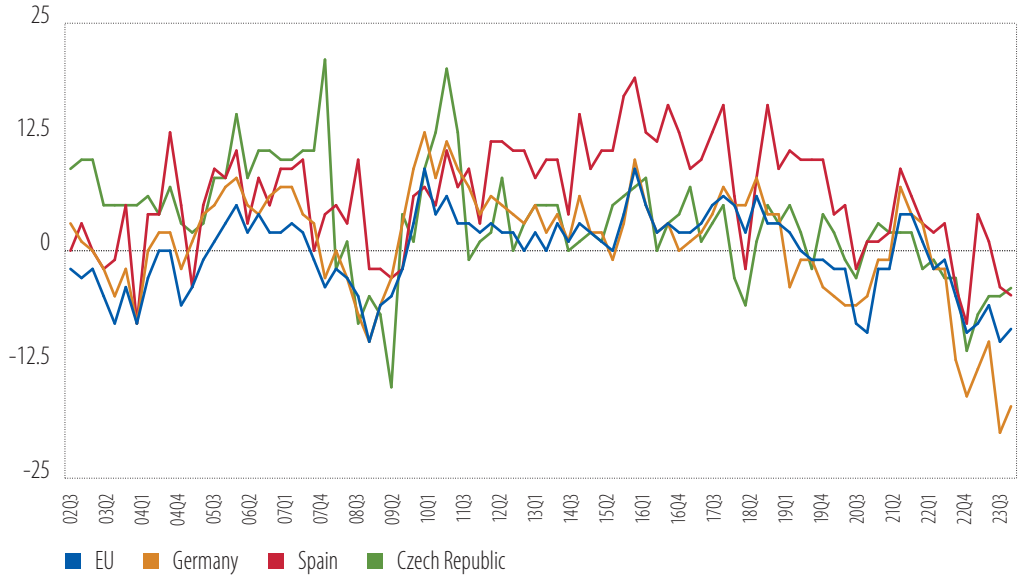
In conclusion, external demand for EU products and services is still suffering, weakened by exceptionally high energy costs on one side, and by the drag on global demand stemming from higher energy and food prices on the other. The slowdown in global demand should vanish progressively, and demand should normalise in 2024. The impact on energy-intensive production and trade may be more structural and could continue to affect the European Union for a long time.

The impact of these two shocks on investment by EU firms is not clear. Global demand could soon normalise, providing some comfort for European producers. High energy prices may push businesses to invest in energy efficiency measures and transform (in a best-case scenario). At the same time, higher costs hurt EU competitiveness and reduced globalisation could push EU firms to substitute domestic

production with imports from countries with cheaper energy costs (a worst-case scenario). Public policies might be able to help with investments in energy efficiency, but as Box B shows, it may be more difficult to use policy to address the structure of global value chains.

Figure 28

Firms' perception of their competitiveness beyond the European Union (net balance of respondents, in %)



Source: *European Commission's industrial survey.*
Question: *How has your competitive position on foreign markets outside the EU developed over the past three months? Has it improved (+) remained unchanged (=) or deteriorated (-)?*

Box B

Trade reallocations: appearance and reality

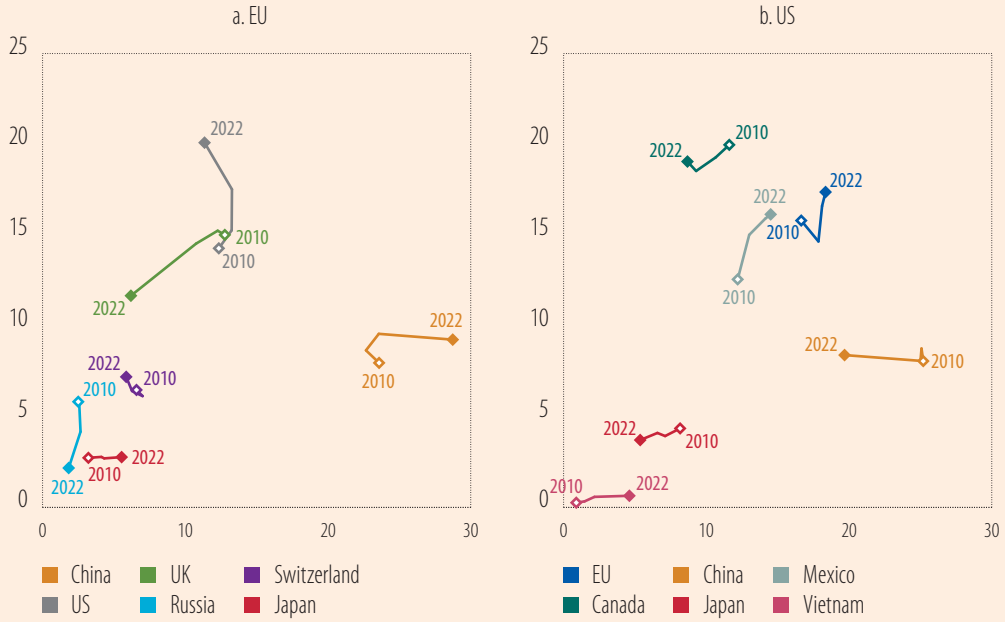
Recent decades have seen structural changes in international trade. The role of China in international trade increased rapidly after it joined the World Trade Organization in 2001 and as the Chinese economy grew. It has become an important supplier to many economies, including the United States and the European Union.

The share of Chinese manufacturing goods and raw materials in the total goods imported by the 27 EU members rose significantly from 2018 to 2022, as shown in the left-hand panel of Figure B.1. The share of other countries (notably that of the United Kingdom, Japan and Russia) declined over the same period. The large concentration of Chinese goods, along with supply chain disruptions after the pandemic, led EU policymakers to focus on enhancing Europe's self-reliance, otherwise known as strategic autonomy. In addition, access to materials that are key to the green transition has been placed at the heart of trade policy considerations in the Critical Raw Materials Act, a set of actions that ensure the European Union has access to the raw materials needed for the energy transition and for strategic industries such as aerospace and healthcare.

At the same time, in 2018 the United States introduced several waves of tariff increases on specific products and trading partner countries, including China. As a response, the share of Chinese exports to the United States started to decline and trade shifted towards other exporting countries, such as Mexico and Vietnam. This shift is visible in the right-hand panel of Figure B.1. Fajgelbaum et al. (2020) and Alfaro and Chor (2023) explore other developments in US trade.

The increase in Chinese exports to the European Union and their simultaneous fall in the United States can be seen at the level of individual products. As Figure B.2 shows, China's share of EU27 imports has increased by more than 5% for several goods. The highest increase was for products such as road vehicles, electric machinery and chemicals. China's share of organic chemical imports increased by more than 20% in recent years. In the United States, the Chinese share in imports of these products has grown only slightly, while most products show large declines (see also Organisation for Economic Co-operation and Development (OECD), 2023).

Figure B.1
Change in the share of imports held by the top EU and US trading partners (in %), **2010-2022**



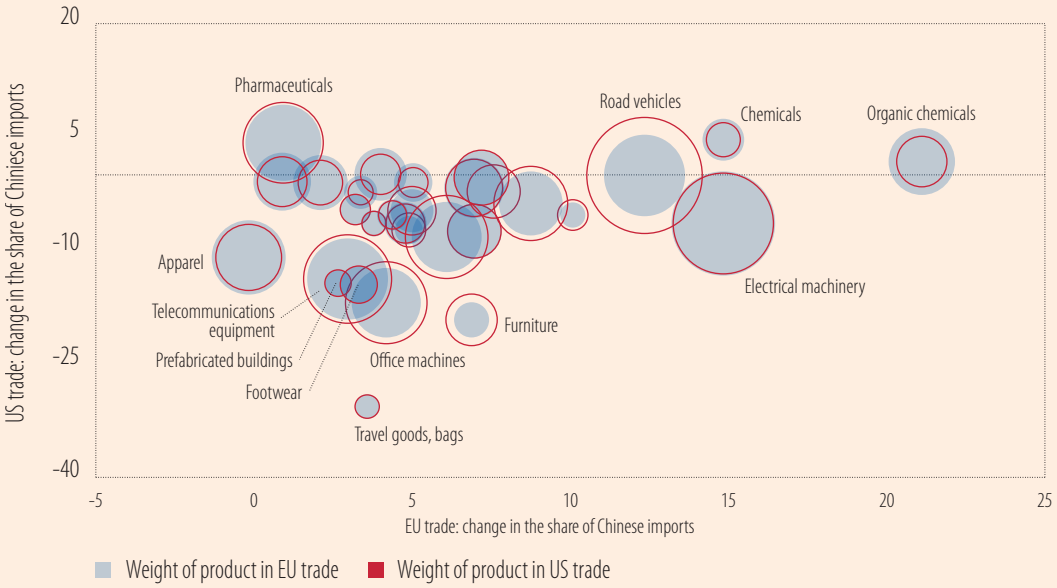
Source: *EIB staff calculations based on Eurostat (Comext) and Census Bureau data.*
Note: *Export and import figures are shown for the six major trading partners for 2010, 2014, 2018 and 2022 for the European Union (left) and the United States (right). Only trade in goods of SITC 10 to 89 are considered, excluding gas and petroleum trade (SITC 33, 34).*

The share of US imports of Chinese manufacturing products has declined in several areas. These include not only lower-tech industries such as apparel, footwear and accessory production, but also goods produced by high-tech industries, such as office machines and telecommunications equipment. The Chinese share of EU imports of all of these products has increased.

The rebalancing of US imports in strategically important industries may not have decreased dependence on China. Countries whose share of US imports increased (such as Vietnam, Thailand and South Korea) in turn increased their imports from China. As Figure B.3 shows, there is a positive association between countries increasing their share of the US import basket and their contribution to the export growth of China over the same period. For example, the increase in Chinese exports to Vietnam contributed 6% to all Chinese export growth in the period, while Vietnam is also the country that increased its share of US imports the most. This phenomenon of Chinese products and value added flowing into the United States via a third country is also corroborated by the analysis of Freund et al. (2023), who find evidence that countries that saw faster growth in exports to the United States in strategic sectors also had more intense intra-industry trade with China in those same sectors. These complex, indirect changes in trade patterns suggest that implementing an EU plan to reduce dependence on China may prove difficult to achieve.

Figure B.2

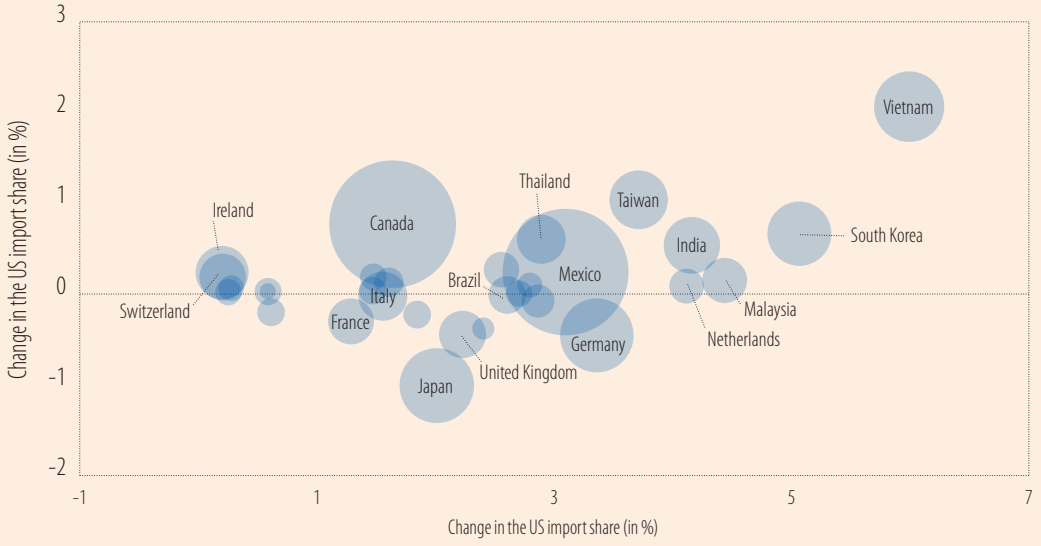
The share of Chinese imports in selected products, (change in %)**, European Union vs. United States**



Source: *EIB staff calculations based on Eurostat (Comext) and Census Bureau data.*
Note: *Exports and import share figures are shown for the six major trade partners for 2010, 2014, 2018 and 2022 for the European Union (left) and the United States (right). Only trade in goods of SITC 10 to 89 are considered, excluding gas and petroleum trade (SITC 33, 34).*

Figure B.3

Changes in US imports vs. Chinese export growth (in %)**, 2018-2022**



Source: *EIB staff calculations based on Eurostat (Comext) and Census Bureau data.*
Note: *Export and import figures are shown for the six major trade partners for 2010, 2014, 2018 and 2022 for the European Union (left) and the United States (right). Only trade in goods of SITC 10 to 89 are considered, excluding gas and petroleum trade (SITC 33, 34).*

Conclusion and policy implications

Macroeconomic conditions for private investment deteriorated across the European Union during 2023. Factors that initially supported public investment are starting to fade, and the investment outlook has turned rather bleak. Tighter monetary policy is feeding through to the real economy and slowing the growth of domestic demand. Firms are gradually spending more on servicing their debt and credit is less accessible. The savings households built up during the pandemic now look depleted. A shortage of skilled labour is weighing on firms' investments, but job vacancy rates appear to have peaked. Governments will have to tighten fiscal policy.

The challenges for Europe's cohesion policy have increased. The impact of the energy shock varied depending on a country's position in the business cycle and the structural issues facing its economy. Countries in Southern and Central and Eastern Europe appear have been more affected. Southern Europe is dealing with a higher increase in financing costs. Central and Eastern Europe, however, is facing a loss of competitiveness, partly because its economies are energy intensive and therefore highly exposed to the rise in energy prices. This loss of competitiveness risks slowing these countries' economies or preventing them from reaching living standards on a par with with the rest of the European Union.

The asymmetric nature of recent shocks highlights the need for EU members to coordinate fiscal policies within a common fiscal framework. Southern European countries are struggling with high levels of debt, which limits their ability to invest to transform and modernise their economies. But even countries with greater means, such as Germany, are struggling to find sufficient resources for green investments within their current fiscal frameworks.

Faced with the rapid ageing of the population, the European Union sorely needs policies that increase the supply of labour, which will enable firms to grow and to create the resources needed for the green and digital transition. The shortage of skilled staff has an ambiguous impact on investment. When investment in machinery or technology could reduce the demand for staff, it might have encouraged firms to invest. But skills shortages were also one of the main obstacles to investment, particularly when companies had difficulties finding the skilled personnel needed to install or operate the new machinery or technology. The supply of skilled labour could benefit from creating better conditions for part-time and remote work and from easing access to the labour market for non-EU immigrants.

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Chapter 2

Government investment

Government investment has remained resilient since the start of the COVID-19 crisis. It has grown each year since 2020 – both in real terms and as a share of gross domestic product (GDP) – with EU government investment performing better than after previous crises. Government investment grants (mostly targeting the private sector) also grew substantially in recent years. Public and private investment in infrastructure has been strengthening since 2018.

The European Union's decision to put budget rules on hold during the pandemic buoyed investment, and it will be further fuelled by the availability of financing under the Recovery and Resilience Facility, which will provide sizeable funds for some countries. While progress is being made on measures and targets for the EUR 723 billion Recovery and Resilience Facility[1], it has been slightly slower than planned because of high inflation, a lack of administrative capacity and long planning leads for some projects.

Local and regional governments are key players in planning and implementing government investment. They therefore have an important role to play in sustaining the current investment surge. Investment by regions and local governments is beneficial in countries with a high quality of governance and more developed financial systems, but it is hindered by a lack of available workers with the necessary skills (including administrative skills) and by economic turbulence.

Maintaining the current high level of government investment is crucial. EU governments might find it challenging to sustain public investment in the medium term, as they will face difficult trade-offs when they once again have to adhere to EU budget rules. The general escape clause of the Stability and Growth Pact, which paused the budget rules, will be deactivated in 2024. At the same time, government investment is key to achieving policy goals like net-zero carbon emissions and digitalisation. Furthermore, experience shows that public investment has a catalytic effect on private investment, meaning that a slowdown in government investment could weigh on private investment in general and, importantly, on spending to address climate change.

1 The Recovery and Resilience Facility is the centrepiece of NextGenerationEU, the European Union's recovery plan following the COVID-19 crisis. Through the facility, the European Commission raises funds by borrowing on the capital markets. These funds are then made available to EU members to implement ambitious reforms and investments.

Introduction

Government investment in the European Union has remained resilient over the past three years, despite a series of crises such as the COVID-19 pandemic, disruptions in global supply chains, surging energy prices and political instability caused by Russia's invasion of Ukraine. Overall, government investment has recovered from the protracted slump caused by the fiscal consolidation that followed the euro sovereign debt crisis. The lessons learnt in that episode – along with the activation of the general escape clause of the Stability and Growth Pact – led governments to move to protect investment in the wake of the COVID-19 pandemic. The added pressures on government finance caused by the energy crisis acted as a drag on government investment, but did not derail it.

The big structural challenges of climate change and digitalisation require even more significant investment to transform the economy. While most investment will have to come from the private sector, government investment has a role to play in providing public goods and catalysing private investment. The looming reintroduction of EU fiscal rules in 2024, higher levels of government debt and a weak economy all present governments with difficult trade-offs.

This chapter consists of four sections and three boxes. The first section reviews the evolution of government investment since the COVID-19 pandemic, focusing on the aftermath of the energy crisis. The second section looks at subnational government investment (regional and local), emphasising its importance in public investment and outlining the obstacles that various municipalities or regional authorities face when making investments. The third section underlines the importance of the plans EU members submitted under the Recovery and Resilience Facility and the likely effect those plans have had on government investment and the overall economy from 2021, as well as in the medium term.

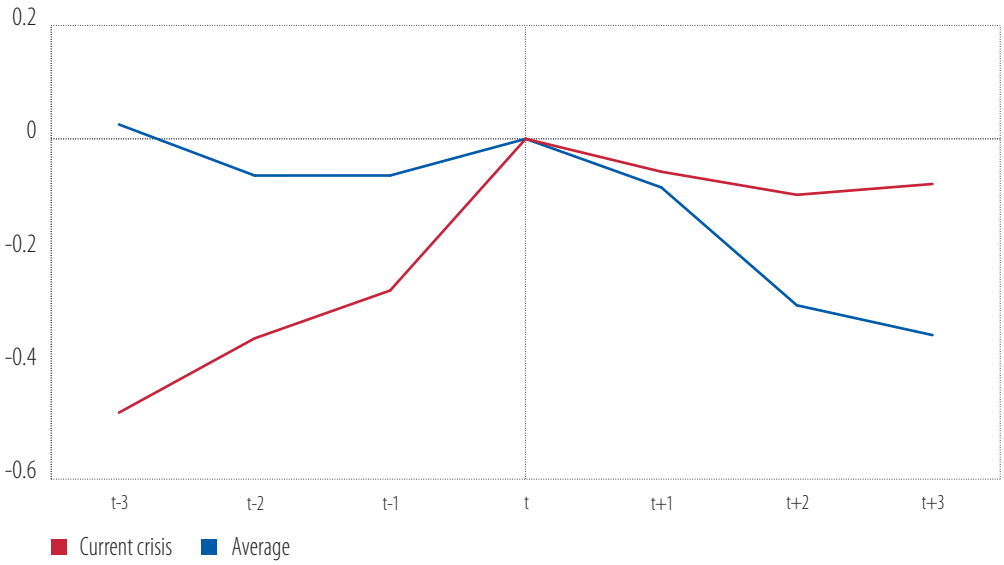
The analysis stresses how important it is for EU governments to accelerate national investment plans to take full advantage of the substantial funding available not only through the Recovery and Resilience Facility, but also through the European Structural and Investment Funds and the Just Transition Fund, which was created to protect regions and countries that risk being negatively affected by the green transition. All levels of government need to address a variety of obstacles impeding the rapid and effective implementation of important investment projects. The fourth section outlines the risk that pressure to stabilse country finances will have hurt public and private investment. The last section concludes with policy implications.

Government capital expenditures remain resilient despite challenges

Compared to previous crises, government investment remained remarkably resilient from 2020 to 2023. Using a panel dataset of 26 Organisation for Economic Co-operation and Development (OECD) member countries since 1970, Larch et al. (2022) show that government investment declines following major economic downturns. The authors estimate an average decline of about 0.3 percentage points of GDP three years after an economic crisis (Figure 1).[2] The strength of EU government investment since the COVID-19 pandemic therefore appears remarkable. Investment remained muted during the 2020 pandemic shock, with investment as a share of GDP increasing before recording a very marginal decline relative to its unusually high 2020 level. The overall decline in the share for the first half of 2023 is less than one-third of the average decline observed by Larch et al. Overall, EU government investment after 2020 remained well above the level in the three years preceding 2020.

2 This equates to an 8% decline in the investment rate.

Figure 1
Government investment around economic crises (% GDP)



Source: *Larch et al. (2022), EIB staff calculations based on Eurostat and OECD national accounts.*
Note: *Economic crisis is defined as a decline of real GDP relative to the previous by more than one standard deviation, computed on the sample of Larch et al. (2022). The red line plots the difference of EU general government investment each year with its value in 2020, as a share of GDP. The blue line plots the average difference between general government investment each year, as a share of GDP, with its value in the year of a major economic downturn. The computation is based on the dataset of Larch et al. (2022). Data for 2023 (t+3 on the current-crisis line) are for the first half of 2023.*

Strong government investment despite a string of crises

The post-pandemic period has been challenging for fiscal policy in the European Union. The pandemic stimulus, the war in Ukraine and the energy crisis, which fuelled a burst of inflation, put a serious strain on government budgets. While high inflation raised more tax revenue than expected, costly policies to address the energy crisis and a slowing economy meant that countries across the European Union had to revisit spending planned in 2022 budgets. In these challenging conditions, government investment and capital expenditures more generally continued to grow, but at a progressively slower pace.

Despite these challenges, nominal government investment in the European Union increased by nearly 10% in the first half of 2023 compared to same period in 2022. This increase continues a gradual acceleration from 4.7% in 2020 to 7.3% in 2022. The increase in 2023 was particularly strong in Central and Eastern Europe, where it reached 23.5% (Table 1).[3] In Southern Europe, nominal investment grew by 13.9%, following a soft patch in 2022. These growth rates were above the rate of nominal GDP growth (Table 1), thereby pushing up the investment rates in 2023. By comparison, government investment rates in 2022 were broadly stable in the European Union as a whole and declined slightly in Southern, Central and Eastern Europe (Figure 2), but they were still well above their 2019 levels.

3 Figures for 2023 refer to the percentage change in the first half of 2023 relative to the same period in 2022.

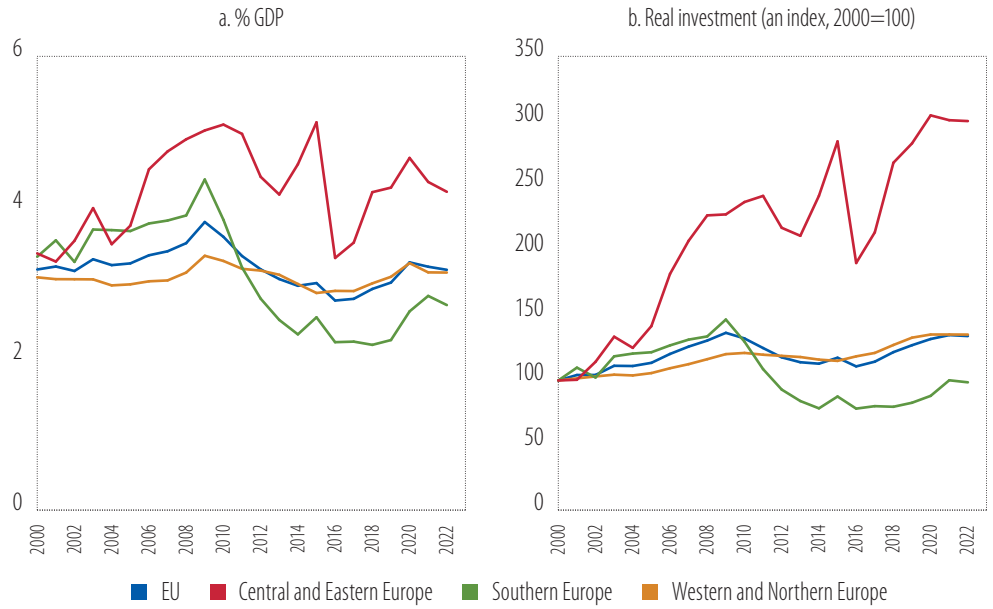
Table 1
Nominal government investment and GDP (% change from the previous year)

	2019	2020	2021	2022	2023
			Government investment		
European Union	6.5	4.7	6.5	7.4	9.9
Western and Northern Europe	6.4	3.3	3.8	7.6	6.0
Southern Europe	5.4	6.9	18.9	4.6	13.9
Central and Eastern Europe	8.9	6.8	2.9	10.8	23.5
			GDP		
European Union	3.6	-3.9	8.7	8.7	7.2
Western and Northern Europe	3.5	-2.4	8.1	7.6	6.1
Southern Europe	2.4	-8.5	9.5	8.8	7.6
Central and Eastern Europe	7.1	-2.4	10.5	14.6	13.8

Source: *EIB staff calculations based on Eurostat national accounts.*
Note: *Values for 2023 are for the first half of the year compared to the same period in 2022.*

Real investment in the European Union also grew strongly in the first half of 2023 (4.1%) after slowing in 2021 and 2022.[4] This relative slowdown to some extent reflects unexpectedly high inflation. In 2022, prices paid for investments in the European Union rose by 7.9% and the GDP deflator rose by 5.1% – well above their values in 2021.[5] The estimated real investment of the general government in 2022 stagnated in two EU countries and declined in 12 others.

Figure 2
General government investment



Source: *Government finance statistics, Eurostat and EIB staff calculations.*
Notes: *Real government investment is calculated by deflating gross fixed capital formation (GFCF) for the government in current prices using the implicit price deflator for total investment.*

4 In the absence of a deflator for government investment, real government investment is computed using the implicit price deflator for total investment, which arguably has a different composition to that for government investment.

5 Investment price inflation is measured by the growth rate of the implicit price deflator for total gross fixed capital formation.

Government investment for 2022 fell short of forecasts, recording a slightly disappointing figure given its strong performance since 2020. Surprise inflation and a vigorous response from central banks meant that government forecasts quickly became outdated in the course of 2022. At a time when most EU governments had just set their budgetary plans for 2022, the European Commission's 2022 winter forecast expected average inflation of 3.9% for the year. It turned out to be 9.2%. Even in its spring forecast in May 2022, the European Commission had expected 6.8%. The main driver of inflation in the European Union was skyrocketing energy prices (see Chapters 1 and 5 and EIB, 2023a).

Table 2

Government investment and inflation in 2022 (annual % change)

	Government investment		GDP		Inflation	
	EC forecast	Actual	EC forecast	Actual	EC forecast	Actual
European Union	13.7	7.3	6.9	8.6	6.8	9.2
Western and Northern Europe	10.3	7.6	6.5	7.6	6.0	8.2
Southern Europe	22.2	4.1	6.8	8.8	6.0	8.6
Central and Eastern Europe	17.7	11.2	9.4	14.5	10.6	13.7

Source: *Government finance statistics, Eurostat, the European Commission's annual macroeconomic (AMECO) database and EIB staff calculations.*

Note: *EC forecast refers to 2022 spring forecast of the European Commission. Inflation is measured as the annual rate of change of the harmonised index of consumer prices (HICP).*

Large, unexpected shocks can force governments to reprioritise spending outlined in current budgets. Governments typically finalise their budgetary plans in the second half of the preceding year and parliaments turn them into law by the end of that year. When times are calm, budgets are implemented with little or no change to plans. Otherwise, governments must reshuffle spending or go back to their parliaments to amend budgets.

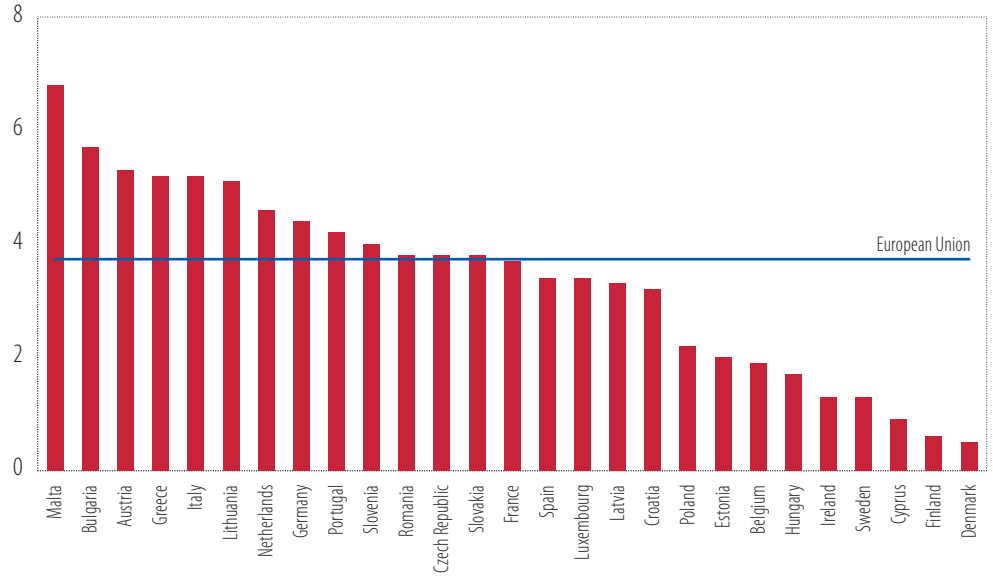
The energy shock in 2022 and subsequent policies to offset the impact on households and businesses arguably pushed EU members to reprioritise spending. Original budgets at the start of the fiscal year can be compared with actual revenues and expenditures at the end of that year to gauge the extent of this reprioritisation. The European Commission's spring forecast can be used to approximate original budgets, as it incorporates budgetary plans for the current year in its projections. The forecast is also made early in the year, so its projections have not yet been influenced by changes to planned revenues and expenditures.

The sizeable policy response to the energy crisis was not budgeted by national governments for 2022. As electricity and gas prices rose sharply in 2022, EU governments began deploying compensation packages for households and businesses to mitigate the shock. Most EU countries pledged and spent substantial resources (Figure 3), a large portion of which had not been foreseen. Higher inflation helped to some extent as tax and other revenues were also higher than expected, but this was generally not enough to finance unexpected spending. Governments were therefore forced to shuffle spending.

Spending on subsidies and transfers deviated the most from 2022 forecasts. Comparing the European Commission's 2022 spring forecast to the final reality shows that the share of subsidies in total expenditures in the European Union was 0.5 percentage points higher than projected, meaning that overall subsidies increased 13%. The difference is higher in Southern Europe (1.2 percentage points) and smaller in other countries (0.3 percentage points in Western and Northern Europe, and 0.5 percentage points in Central and Eastern Europe). Other transfers were also significantly higher than forecast, such as compensation provided to businesses for losses caused by extraordinary events. For the European Union as a whole, the share of these transfers in total expenditures rose 0.8 percentage points, while in Southern Europe they increased 1.5 percentage points compared to the original forecast.

Figure 3

Earmarked and allocated funding to shield households and businesses from the energy crisis (% GDP)**, from September 2021 to January 2023**



Source: *Bruegel. See also Sgravatti, Tagliapietra, Trasi, & Zachmann (2021).*
Note: *The authors only include measures that are provisional and motivated by the energy crisis while they exclude pre-existing ones. Estimated numbers also include funding earmarked but not yet allocated. All figures are relative to 2021 GDP.*

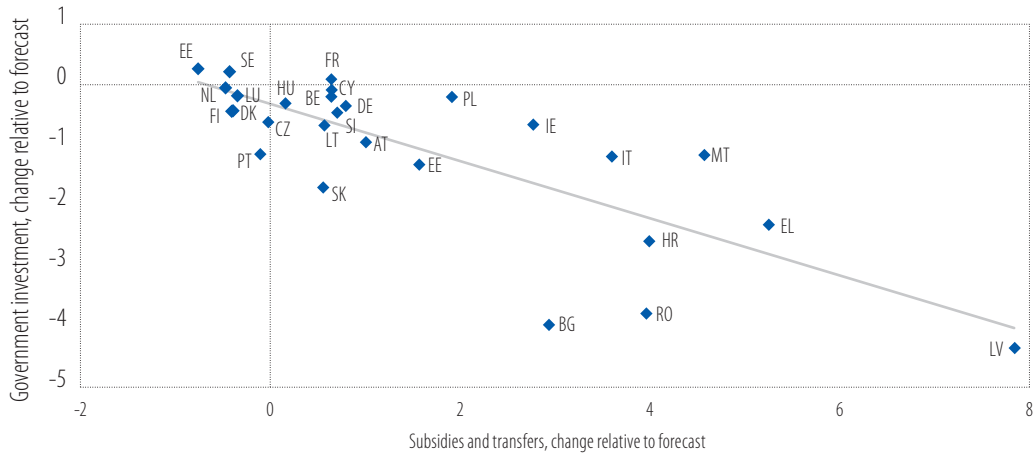
In parallel to these increases, investment as a share of total expenditures decreased 0.4 percentage points at the EU level. As the share of subsidies and transfers rose, investment's share of total expenditures declined compared to the 2022 spring forecast. The largest decline was in Central and Eastern Europe (1.2 percentage points) and the smallest in Western and Northern Europe (0.2 percentage points). There is also a fair amount of variation within these groups. The size of the decline in investment's share was inversely related to the size of the increase in subsidies and transfers (Figure 4). Despite this reprioritisation and decline relative to expectations, EU government investment for 2022 remained well above its 2019 level, in nominal terms and as a share of GDP.

The relative deprioritisation of government investment in 2022 does not appear to have affected government investment grants. EU government expenditure on investment grants increased substantially for a third consecutive year in 2022. The average annual rate of growth in investment grants since the start of the COVID-19 pandemic is 34%, pushing spending on investment grants to 1.3% of GDP. It was 0.6% of GDP in 2019. The size of this increase equates to 3% of total investment in the European Union or 22% of total government investment.

Investment grants were particularly high in Southern Europe in 2022 (Figure 5). This is due mostly to Italy and, to a lesser extent, Greece. While investment grants are not a substitute for government investment as they typically finance private investment, they do contribute directly to a country's total investment. The high amount of investment grants currently being paid by the general government is consistent with the simultaneously high rates of private investment in late 2022 and early 2023.

Figure 4

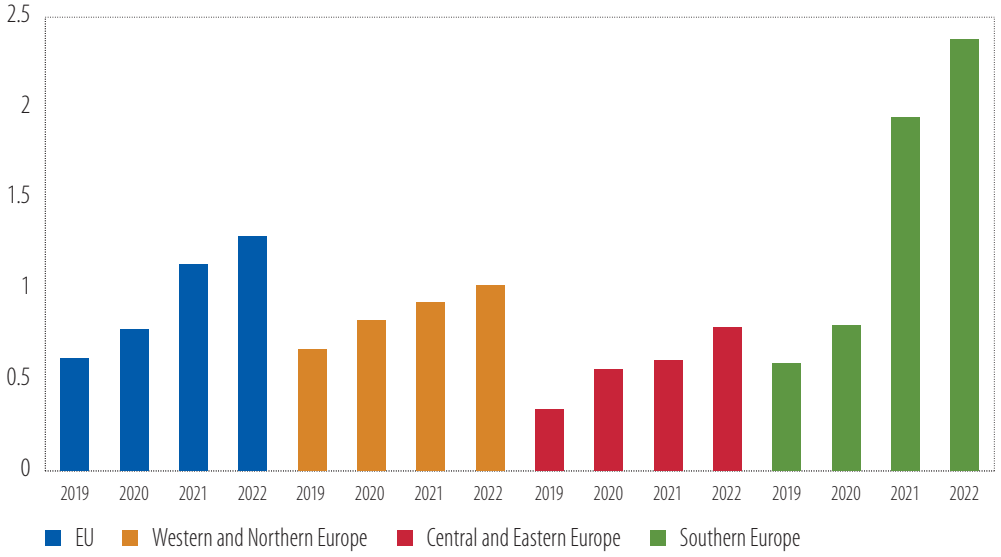
Change in government investment and in subsidies and transfers of general government budgets in the European Union relative to the 2022 spring forecast of the European Commission (% total expenditures)



Source: *AMECO database of the European Commission and EIB staff calculations.*
Notes: *Subsidies and transfers include the following expenditure categories: subsidies, transfers in kind to households and other transfers. Changes are computed between the outcome of a category relative to total expenditures in 2022 and the projected value for this category relative to projected total expenditures in the 2022 spring forecast of the European Commission.*

Figure 5

Investment grants paid by the government (% GDP)



Source: *Government finance statistics, Eurostat. EIB staff calculations.*

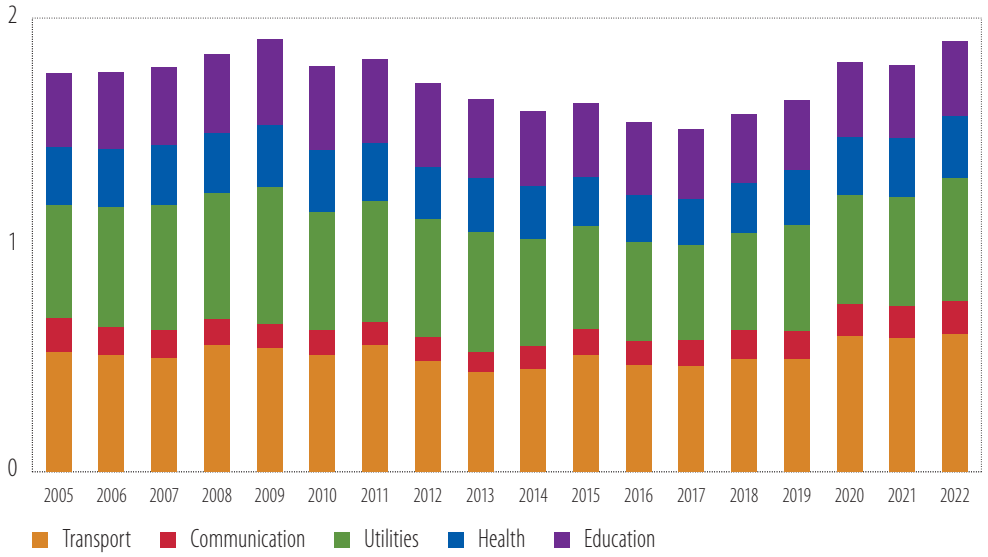
Infrastructure investment has been growing since 2018

Infrastructure stands at the crossroads between public and private investment. Infrastructure is built and financed by the government and the private sector, but the government maintains a crucial role in planning and regulating infrastructure construction. This section presents facts and figures on infrastructure investments and the role of the public and private sectors.[6]

Infrastructure investment increased significantly in the European Union in 2022, returning to the highs reached before the global financial crisis. Infrastructure investment continued to grow in 2022, reaching 1.9% of GDP in the European Union (Figure 6). This increase was particularly strong in Central and Eastern Europe, bringing infrastructure investment in the region back to levels before the global financial crisis. Growth was similarly strong in Southern Europe, but infrastructure investment there remains well below the highs seen before the global financial crisis. Infrastructure investment has also been expanding in Western and Northern Europe.

The relative importance of transport and communications has gradually increased. Infrastructure investment can be grouped into five key activity sectors: utilities, transport, communication, health and education. Three important trends are worth noting (Figure 6). First, the share of transport infrastructure increased since 2020 in tandem with the return of government investment. Second, the share of the communication sector has been growing, albeit gradually, over the past decade. Third, infrastructure investment in utilities is also rising, with particularly strong growth in 2022 (possibly driven by the recent push to improve Europe's energy security).

Figure 6
Infrastructure finance in the European Union (% GDP)**, by sector**



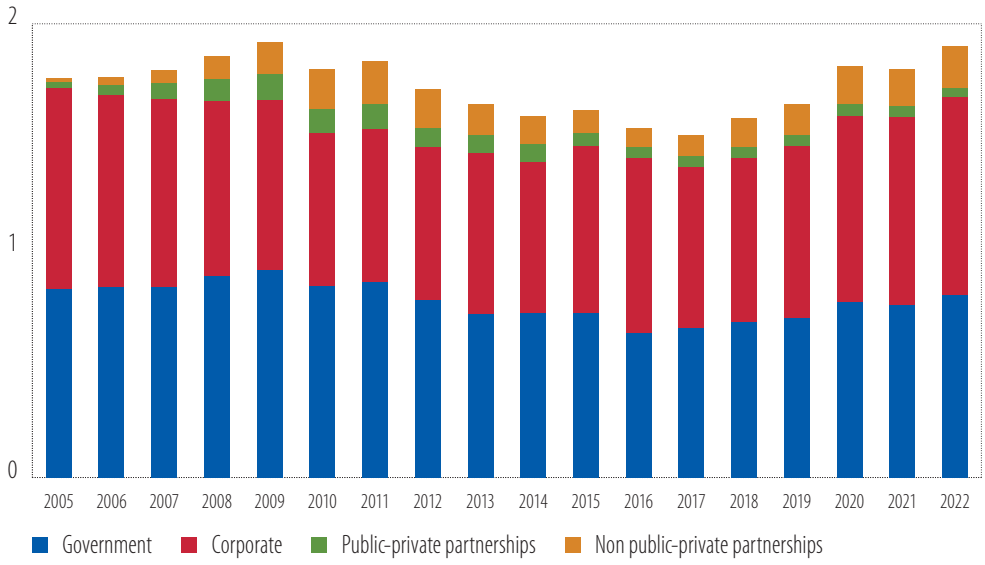
Source: Eurostat, IJGlobal, European PPP Expertise Centre (EPEC), EIB staff calculations.

The recent growth in infrastructure investment comes from the private and the public sector. Strong growth from businesses and the government continued in 2022 (Figure 7). Governments contributed more to the increase in Southern Europe and Central and Eastern Europe. Project financing through public-private partnerships (PPP) and other special purpose vehicles remain at levels similar to those seen in previous years.

6 Data on infrastructure investment are not readily available as infrastructure is not separately classified in national account statistics. More details on the methodology underlying the consistent EU-wide infrastructure finance database used in this section can be found in Wagenvoort et al. (2010) and further enhancements in Revoltella et al. (2016).

Government infrastructure investment is approaching the highs reached before the global financial crisis. This is partly a catch up following a period of fiscal retrenchment across the European Union and particularly in Southern Europe, when many infrastructure assets were inadequately maintained and only a few were upgraded or newly built. The growth of government infrastructure investment also reflects efforts to meet ambitious climate and digitalisation targets. It bodes well for the European economy, as modern and properly functioning infrastructure is crucial for competitiveness and economic growth, yielding social benefits for many years.

Figure 7
Infrastructure finance in the European Union (% GDP)**, by institutional sector**



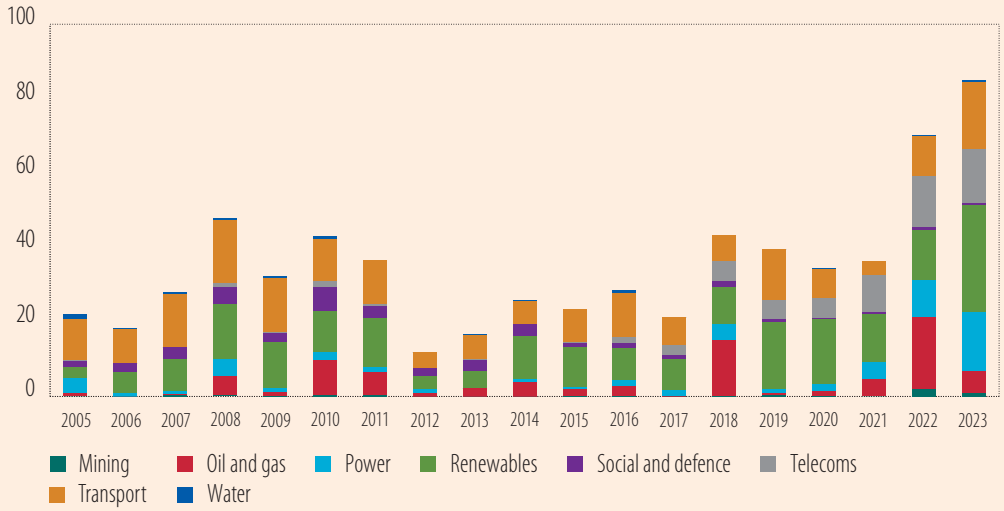
Source: Eurostat, IJGlobal, EPEC, EIB staff calculations.

Box A
Trends in infrastructure project finance

This box explores the trends that can be seen in detailed project-level infrastructure investment data. Over the past decade, an average of 10% of infrastructure investment in Europe has used financing that does not involve public-private partnerships, namely special purpose vehicles. While not fully representative of total infrastructure financing, the granularity of the project-level data does make it possible to zoom in further on sectoral and sub-sectoral trends not visible in the aggregate data. The analysis below considers only projects that have reached financial closure, and can therefore realistically be expected to be completed over the next few years.

Like other types of investment financing, project finance was hit hard by the global financial crisis in 2008 but has regained importance over the past few years (Figure A.1). The first visible sectoral trend is the decline in the relative share of the transport sector and, to a lesser extent, the social and defence sectors. Renewable electricity generation has accounted for a substantial share of investment over the past two decades. The telecom sector, on the other hand, has grown in importance in recent years. More recently, an uptick in the oil and gas sector is noticeable in 2022 after Russia invaded Ukraine. As illustrated below, the energy investments appear to be primarily driven by projects in transmission and distribution. Early data for 2023 show continued growth of project finance in the European Union, with renewable energy playing an important role.

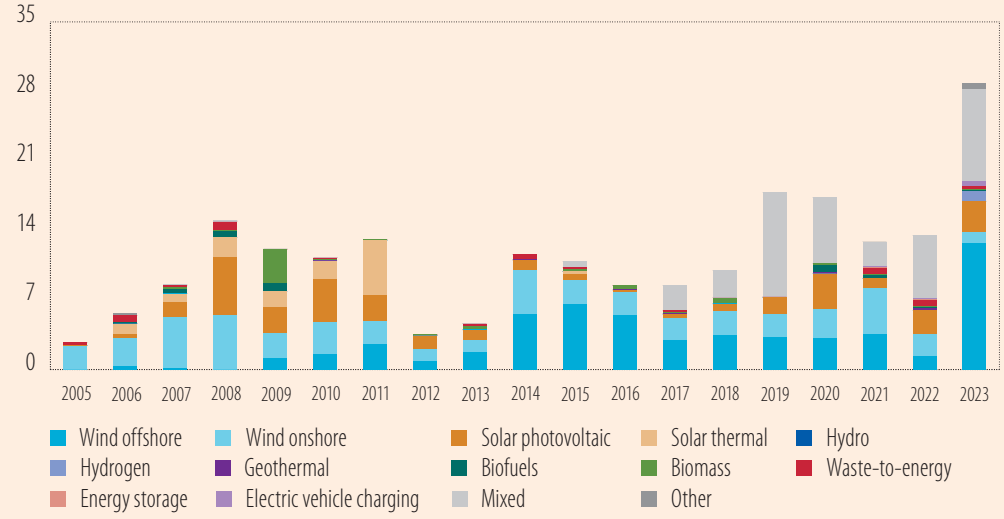
Figure A.1
Total project-financed infrastructure (transaction volumes, EUR billion)



Source: *IJGlobal, EIB staff calculations.*

Figure A.2 breaks down renewable energy into sub-sectors. The overall evolution in project financing of renewable energy follows the trends observed for project-financed infrastructure as a whole. Since the global financial crisis, however, the prevalence of solar projects has decreased substantially, especially for solar projects employing solar thermal energy. Importantly, this does not exclude solar thermal infrastructure being realised via other financing or policies. At the same time, project financing for onshore wind remained relatively stable and offshore wind infrastructure picked up, with four large offshore projects in Poland, Germany and France expected to push up infrastructure investment in renewable energy in 2023.

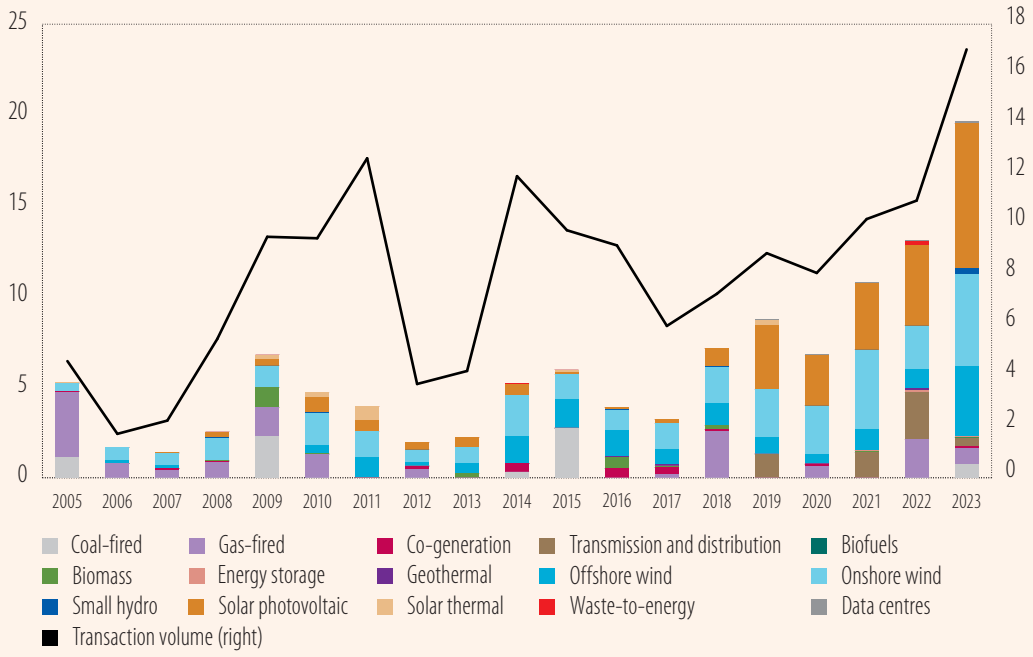
Figure A.2
Project financing of renewable energy (transaction volumes, EUR billion)



Source: *IJGlobal, EIB staff calculations.*
Notes: *Mixed covers projects for which multiple sectors are assigned.*

In addition to the overall monetary values of infrastructure projects, the project-level data makes it possible to map the corresponding capacity for power-generating projects in the power, renewable energy and telecom sectors. Despite a slowdown after the global financial crisis, project-financed power generation has increased more or less steadily over the past decade, with a bigger role for solar photovoltaics and onshore wind technologies. More recently, the Russian invasion of Ukraine and the resulting concerns over energy security have also spurred projects in the more traditional power sector, particularly in transmission and distribution systems.

Figure A.3
Power-generating projects (left axis: capacity in GW; right axis: EUR billion)



Source: *JGlobal, EIB staff calculations.*
Note: *Co-generation refers to a power plant that generates electricity and heat for central heating.*

Local and regional governments play an essential role in public investment

Subnational governments play a pivotal role in reaching the required levels of investment. Understanding the drivers and obstacles that local and regional governments (subnational) face in implementing their investment plans is key to accelerating the implementation of the Recovery and Resilience Facility and, more generally, the ambitious investment plans related to the green transition and digitalisation of the EU economy.

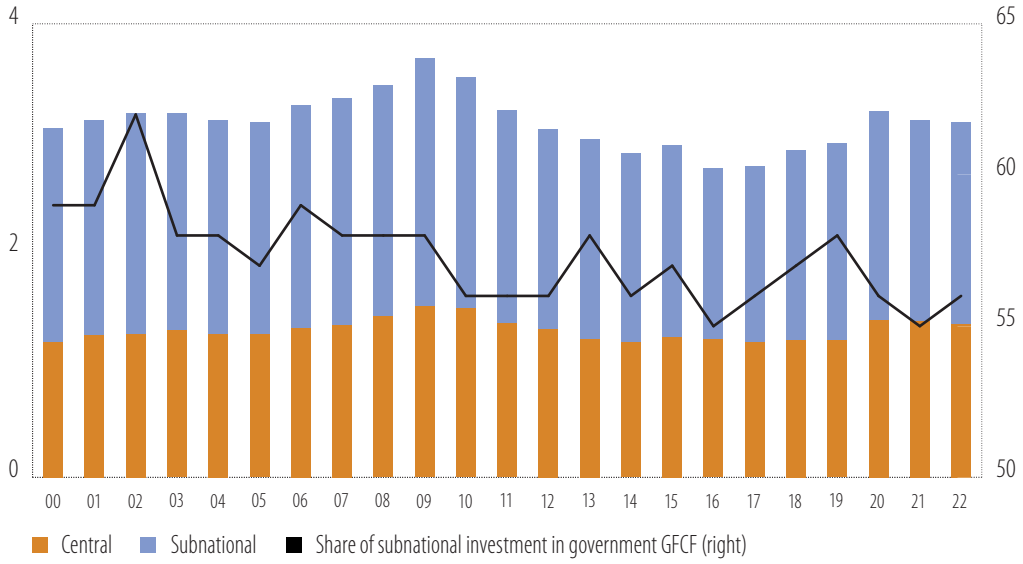
Subnational government investment is substantial and more volatile than central government investment

This investment declined more than central government investment during the fiscal consolidation following the euro debt crisis. On average, subnational governments account for more than half of public investment in the European Union (Figure 8). Their role in total public investment decreased after the

global financial crisis in 2008, as local public investment suffered more cuts.[7] This was particularly true in Western, Northern and Southern Europe. More recently, public investment at the subnational level has followed the upward trend of central government investment in the European Union, increasing from 1.5% of GDP in 2016 to 1.8% in 2022.

Subnational government accounts for a similar share of investment regardless of the region, while central government investment shares are substantially larger in Central and Eastern Europe. Central governments in Central and Eastern Europe report substantially higher levels of investment as a share of GDP than central governments in Western and Northern Europe and Southern Europe (Figure 9). Subnational government investment in different regions are nevertheless comparable. Historically, subnational governments in Southern Europe reported higher levels of investment. However, regional and local investment in Southern Europe fell sharply following the global financial crisis. This has increased again since 2017 in line with the rest of the European Union, but remains below levels seen before the global financial crisis.

Figure 8
Central and subnational public investment (left axis: % GDP; right axis: in %)**, EU average**



Source: *Eurostat.*
Notes: *Public investment as measured by GFCF in the national accounts. Average shares: 59% for 2000-2008, 56% for 2009-2011 and 56% for 2009-2022.*

Central, regional and local investment tend to move together, particularly in Central and Eastern Europe. Central and subnational public investment in Western and Northern Europe shows limited fluctuations (Figure 9). Moreover, changes to investment at each level of government are only weakly correlated. In contrast, government investment in Central and Eastern Europe shows substantial fluctuations, while changes at the different levels of government are strongly correlated. In Southern Europe these shifts are less substantial, but are similarly correlated between the different levels of government.[8]

Sub-national public investments tend to increase as the economy strengthens. Analysis of historical public investment data in the European Union shows that real subnational gross fixed capital formation changes by more than 1% as real GDP grows by 1%, meaning that it moves with the economic cycle.

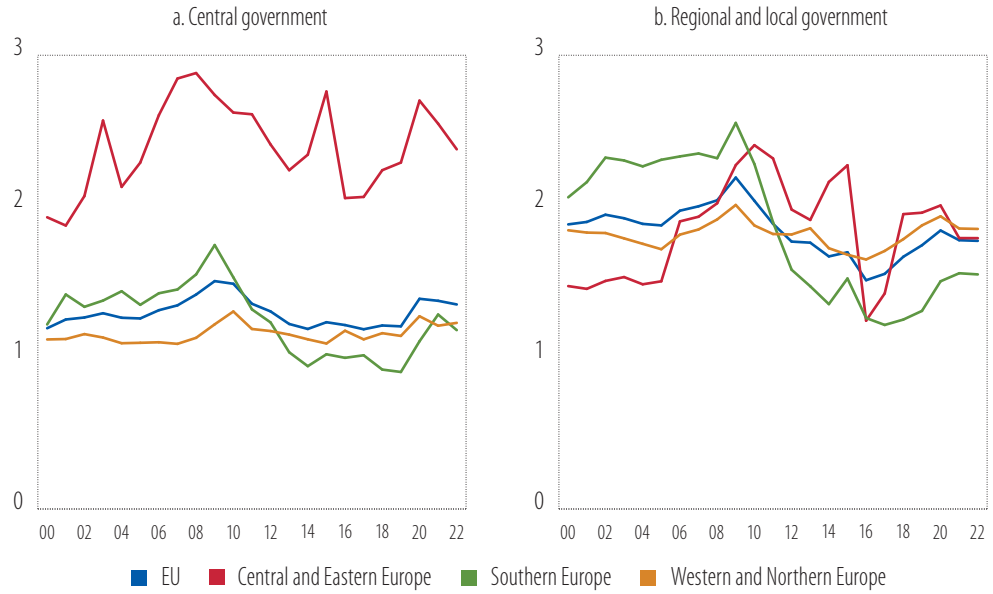
7 The share of subnational governments in capital transfers has also decreased significantly since the global financial crisis: from 37% on average in 2000-2008 to 30% on average in 2009-2022. In many countries, the fiscal consolidation in the aftermath of the global financial crisis limited local governments' fiscal space while economic growth was still weak. Moreover, this was worsened by reductions in fiscal transfers from central governments following austerity at the central level.

8 In-house analysis shows that the co-movement between central and subnational levels of public investment in Central and Eastern Europe and in Southern Europe persists when controlling for the cycle and other controls as well as country and year fixed effects (van der Wielen, 2024).

The effect is stronger in Central and Eastern Europe and Southern Europe. Similarly, evidence supports the earlier observation that investment (as a percentage of GDP) dropped significantly after the global financial crisis (by an average of around 0.5% of GDP in the European Union as a whole). In addition to responding to the business cycle, local and regional investment is also sensitive to electoral cycles. It increases by almost 0.2% of GDP in the year of a national election.

Figure 9

Average public investment (% GDP)**, by region**



Source: *Eurostat.*
Notes: *Public investment as measured by GFCF in the national accounts.*

Given the differences in the institutional set up, the roles of central and local governments in different EU members vary significantly. In addition to differences in the levels of public investment, EU members differ in the degree to which public investment is implemented by lower levels of government (Figure 10).[9] For example, following repeated state reforms further decentralising powers, 78% of government investment in Belgium is now made by local and regional governments. In Malta, Cyprus and Hungary, on the other hand, the majority of public investment in 2022 was made by the central government. Moreover, the institutional setting can diminish co-movements and changes in the short run to investment at the different government levels, with stronger federalism enhancing independence at the various levels and therefore limiting in tandem movements.[10]

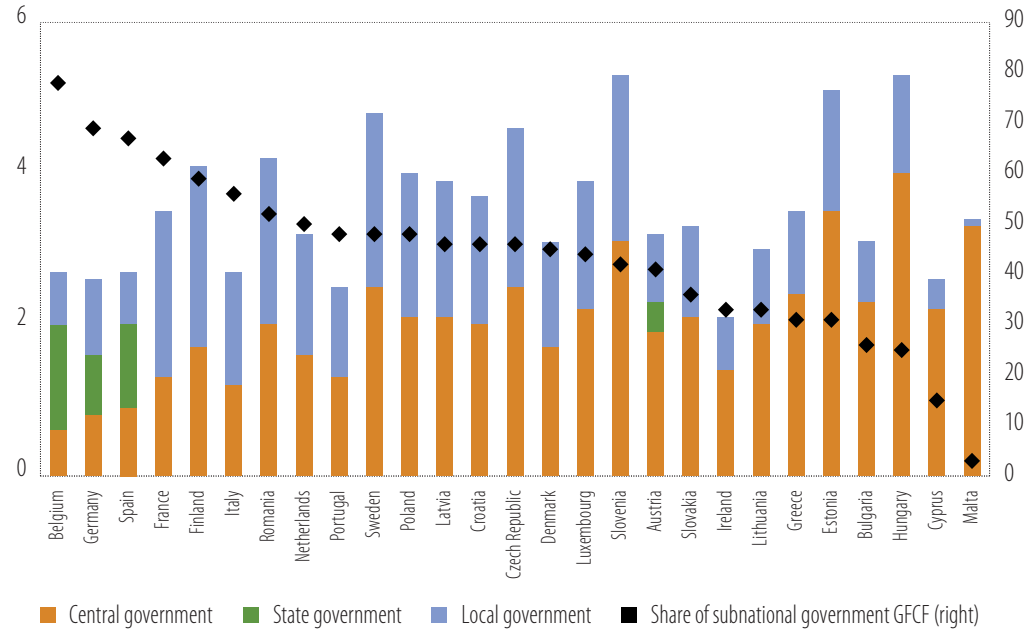
Local and regional investments cover areas that are key to the green transition, further highlighting their importance in making the transition a success. Lower levels of government spend more on investment for environmental protection, housing and amenities, and culture and recreation (Figure 11).[11] Importantly, one-third of subnational public investment focuses on economic affairs (including transport, communications, economic development, energy and construction) and is thus closely linked to the challenges of the transition, emphasising the importance of supporting and maintaining local and regional authorities' ability to plan and execute investments.

9 These institutional differences are also reflected in the share of public spending taken on by subnational authorities. Nevertheless, gross fixed capital formation constitutes a bigger component of a government's spending (excluding transfers) for lower levels of government. For example, gross fixed capital formation makes up more than a quarter of local government spending in Romania, Greece, Ireland, Cyprus and Luxembourg.

10 The analysis in this section draws on van der Wielen (2024).

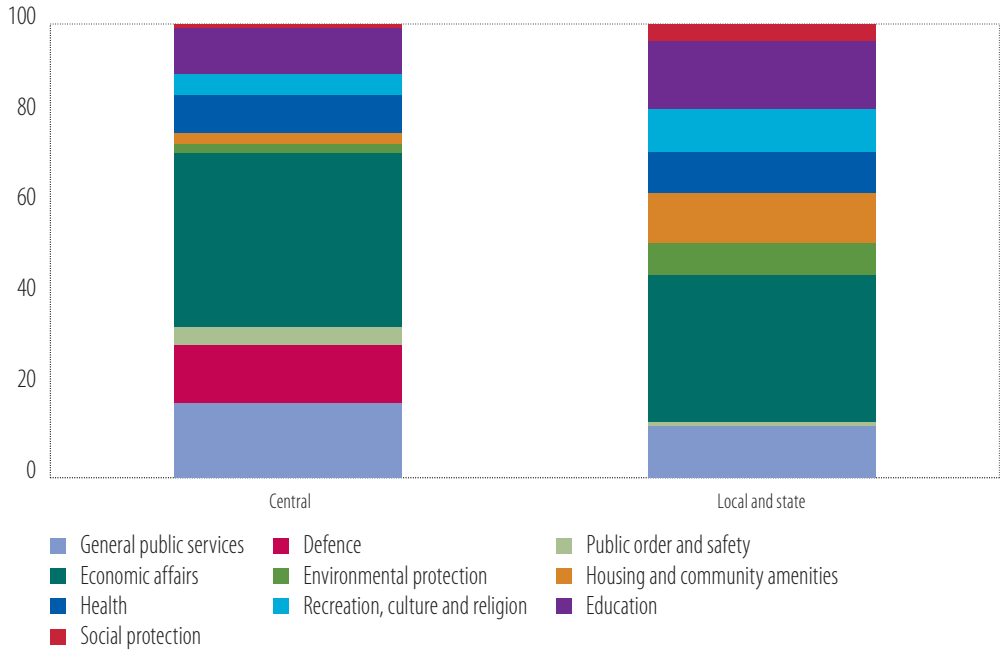
11 Compared to the central government, subnational governments spend less on gross fixed capital formation for defence, public order and safety.

Figure 10
Central and subnational public investment (left axis: % GDP; right axis: in %)



Source: *Eurostat.*
Notes: *Public investment as measured by GFCF in the national accounts. Data for 2022.*

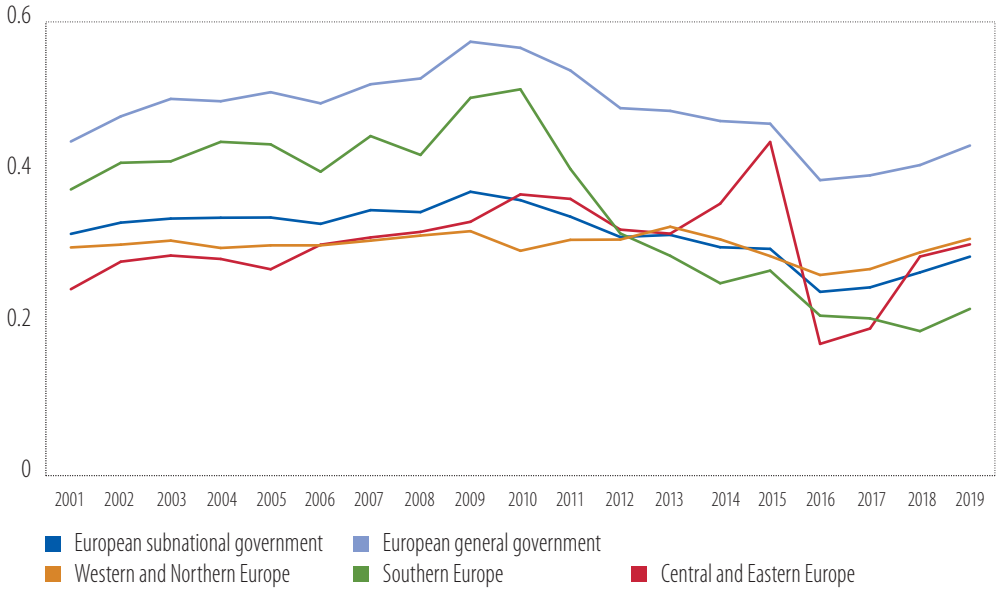
Figure 11
Public investment (in %)**, by economic activity**



Source: *Eurostat.*
Notes: *The latest data available is for 2021.*

Local and regional governments provide an average of two-thirds of public investment directed towards climate change (Figure 12). The trends observed for total subnational public investment also hold for climate investments, with their levels as a percentage of GDP declining after the global financial crisis and increasing again in more recent years.

Figure 12
Subnational climate investment (% GDP)



Source: *OECD, Eurostat.*
Notes: *Climate-significant public investments can be distinguished from non-climate related public investments by linking the functional classification of government spending to the EU taxonomy (OECD, 2022). Doing so, the share of subnational investment in climate-significant investments by the government amounted to 66% of GDP in 2019, the latest year for which data are available. Data on climate-significant investments are unavailable for Cyprus and Malta, and only partially available for Slovakia.*

Nevertheless, more than 60% of municipalities express dissatisfaction with their investment in climate mitigation and adaptation infrastructure (EIB, 2023b). Most municipalities (88%) surveyed for the EIB Municipality Survey view their infrastructure investments in the past three years as insufficient in at least one area. Notably, municipalities are particularly dissatisfied with their investment in climate mitigation and adaptation, although their satisfaction has improved slightly compared to 2020. Municipalities in less developed regions are more likely to consider their past investments in climate change adaptation as substantially lacking.

Administrative efficiency and financial development are crucial for local and regional investment

Understanding the factors supporting or constraining public investment is vital, given the EU focus in recent years on the effective implementation of investment programmes. The efforts to accelerate the disbursement and implementation of investment projects under the Recovery and Resilience Facility and other EU funds (as outlined in further detail below) shows that the success of public investment projects depends on a variety of factors, not all of which are within policymakers' control.

Box B

Analysing subnational public investment drivers and constraints

This discussion on impediments to subnational government investment builds on a two-pronged empirical analysis (van der Wielen, 2024). A dataset is assembled to cover EU countries from 1995 to 2021. It includes public investment expenditure at the national and subnational levels, macroeconomic and financial conditions, and various indicators of institutional features.

First, country-year panel models are estimated to study short-term and long-term determinants of local and regional investment. The analysis studies short-term determinants by gauging the effects of a variety of factors on the annual growth of real investment. It then tests for more structural relations by studying the effect of structural factors on the share of subnational public investment in GDP. This improves the understanding of structural differences between local and regional investment in different countries.

Second, the country-year panel analysis is complemented with a region-year panel study. Instead of relying on regionalised public investment data (which also includes the central government's investment in the region), the analysis relies on regional data collected from national sources (Brasili et al., 2023). It covers 13 EU members: 11 countries with NUTS 2-level data and two countries with NUTS 1-level data.[12] Despite the more limited availability of fully regional public investment data, the panel supports the main findings of the analysis using the country-year panel.

Government efficiency and regulatory quality support the implementation of public investment. Another possible measure of a government's efficiency and business friendliness is the time it takes to perform certain key parts of the investment process. Longer delays in building a warehouse, for example, are associated with lower subnational public investment. An additional week of delay dampens subnational investment 0.03%.[13] Alternatively, subnational investment is typically found to be higher in countries with higher quality regulations.

A one percentile higher rank in the World Bank's World Governance Indicator for regulatory quality is associated with a similar increase in local and regional investment. This point is also supported by the results of the latest EIB Municipality Survey. Challenges posed by the regulatory environment remain one of the primary obstacles to municipalities' infrastructure investment.[14] The survey results indicate that the length of the regulatory process strongly affects 42% of municipalities surveyed, and regulatory uncertainty is a major obstacle for 38% of municipalities (EIB, 2023b).

Higher financial development goes hand-in-hand with higher levels of local and regional investment. A higher degree of financial development, as measured by the International Monetary Fund (IMF) financial development index, supports subnational investments in the short and long run. In the short run, the efficiency of financial institutions appears to be key, with a one point increase in the index increasing the annual percentage change in subnational public investment by as much as 0.5 percentage points. In the longer run, the depth of financial markets plays a role in supporting investment. A one point increase in the index is associated with 0.02 percentage points of GDP more in local and regional investment.

Financial and economic development are also closely linked to the funding sources available to and employed by subnational governments. Municipalities in more developed regions report greater use of capital market finance and commercial bank loans, while less developed and transition regions rely more on national promotional banks and EU-funded financial instruments (EIB, 2023b). This also explains why

12 NUTS refers to the Nomenclature of Territorial Units for Statistics, or La nomenclature des unités territoriales statistiques in French. It is used to reference the administrative divisions of countries for statistical purposes.

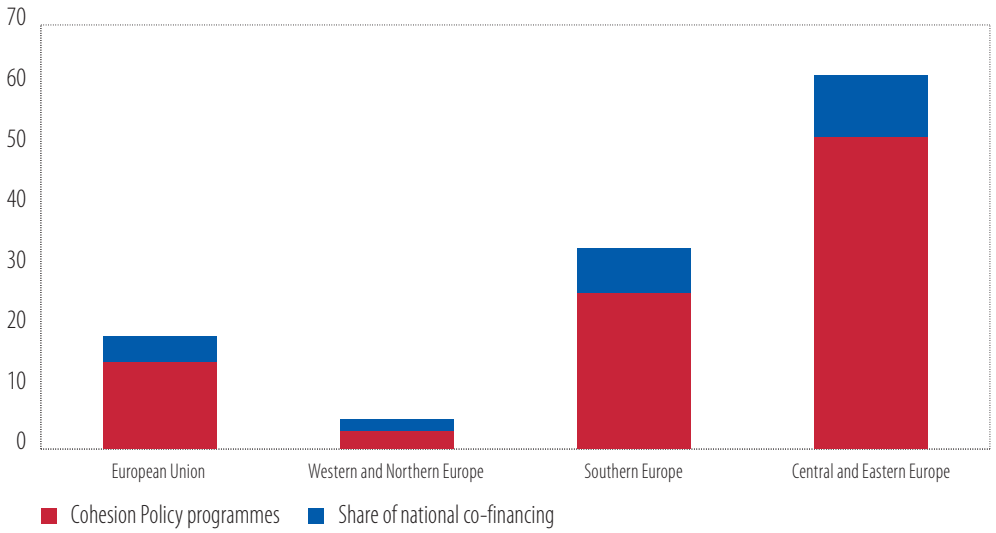
13 It takes an average of 26 weeks to build a warehouse in the European Union.

14 The importance of regulatory barriers is also supported by the case-based evidence (EIB, 2016) and documented for (sustainable) infrastructure investment (OECD, 2023).

the overall reliance on EU funding at the regional level varies considerably between different European regions: from 62% for countries in Central and Eastern Europe to 5% for countries in Western and Northern Europe (Figure 13), with an individual country range of 1.4% in Denmark to 114% in Portugal.[15]

On average, cohesion policy funding represented one-fifth of EU public investment over the 2014-2020 budget period. Cohesion funds are EU funds directly targeted at EU regions. They contribute to the funding of subnational public investment, which, as explained above, is an important component of total public investment. Regional governments across Europe are expressing concerns about their role and involvement in the implementation of the Recovery and Resilience Facility, as this is administered at a national level.

Figure 13
The role of EU-financed programmes (2014-2020 cohesion funds as a % of total public investment)



Source: *EIB staff calculations based on data from the Open Data Portal for European Structural and Investment Funds (ESIF), maintained by the European Commission.*

A lack of skills and economic volatility constrain local and regional investment

Higher national public debt dampens subnational investments. Investment by local and regional governments decreases when countries have higher debt-to-GDP ratios, which leads to lower levels of investment in the longer run. A debt-to-GDP ratio of 1 percentage point higher has been associated with local and regional investment that is 0.01% to 0.02% of GDP lower. The relationship underscores the importance of sound and sustainable public finances. The higher debt burden and corresponding debt service payments limit governments' ability to spend on other priorities.

Recent inflationary pressures are likely to weaken local and regional investments in the short term. Historically, higher prices – measured by price indices for the manufacturing sector – are correlated with annual decreases in real subnational public investment. On average, when inflation is around the central bank's target, subnational public investment is unaffected by prices. However, in times of higher inflation, a 1 percentage point increase in prices is estimated to depress subnational investment by as much as 0.3% from one year to the next.

15 As the share exceeds 100% for some countries, it can be concluded that not all EU-financed projects are classified as public investment. In fact, they include a wide variety of expenditure categories.

The limited availability of skilled labour constrains local and regional investments. Whereas higher public investment is typically observed in countries with older (or ageing) populations, labour markets and their composition do play a role. In the EIB Municipality Survey, municipalities report facing a shortage of experts with environmental and climate assessment skills, hindering local investments (EIB, 2023b). Multicountry analysis confirms this. A higher share of employment in science and technology coincides with increasing local and regional investment. In contrast, societies with a larger share of people in households with lower work intensity, where fewer members work or members work less hours, show lower levels of local and regional investment.

The implementation of the Recovery and Resilience Facility is key

The implementation of the Recovery and Resilience Facility is affecting current and future EU public investment. Created in 2020 as a response to the COVID-19 crisis, the facility was adapted following the Russian invasion of Ukraine, which prompted the energy crisis and fuelled a rise in inflation. A major change was the inclusion of REPowerEU, the EU plan to reduce dependence on Russian sources of energy, under the Recovery and Resilience Facility umbrella. Following the change, EU members were allowed to submit additional chapters to their national investment plans. In total, 20 EU members submitted new chapters relating to energy investments covered by REPowerEU and 25 asked to revise parts of their investment plans to take into account new circumstances, including major price changes.[16] The section focuses on the support the Recovery and Resilience Facility could provide to public investment.

The Recovery and Resilience Facility provides a boost to public investment

Most governments intend to use Recovery and Resilience Facility financing to top up domestic private and public investment. Not all funds from the facility will go to financing investment. National plans also include current spending or capital transfers, which for countries like Spain constitute a major part of the total investment funding. However, the facility plays a distinct role in supporting public investment, particularly for some EU members.

Recovery and Resilience Facility financing will bolster public investment in EU countries. According to official government projections, resources from the facility will raise public investment in Italy, Portugal, Greece, Latvia, Romania, Slovakia and Slovenia (Table 3). For other countries (like Hungary and to some extent Croatia), these resources will likely be used in place of national funding without necessarily increasing the investment rate.

Table 3
Public investment (% GDP) **according to the stability and convergence programmes, by year and programme**

	Year	2019	2020	2021	2022	2023	2024	2025	2026
Greece	2019	3.9	4.1	4.3	4.1				
	2023	2.5	3.1	3.6	3.5	4.8	5.4	5.7	5.5
	2023 RRF financed			0.1	0.3	0.8	1.3	1.5	1.4

16 The European Commission is investing a substantial amount of political capital in this considerable effort, as it is the first time a central European fiscal capacity has been created. For further details, see the outline of the debate on the fiscal framework in Chapter 1 of this report.

	Year	2019	2020	2021	2022	2023	2024	2025	2026
Italy	2019	2.2	2.4	2.4	2.5				
	2023	2.3	2.6	2.9	2.7	3.3	3.8	3.7	3.4
	2023 RRF financed			0.2	0.9	1.2	1.7	1.7	0.7
Latvia	2019	5.1	4.9	4.7	4.4				
	2023	5.1	5.7	5.2	4.4	5.1	5.9	5.7	4.8
	2023 RRF financed				0	0.4	0.8	0.7	0.4
Portugal	2019	2.1	2.3	2.5	2.6	2.6			
	2023	1.8	2.3	2.6	2.5	3.2	3.4	3.5	3.4
	2023 RRF financed				0.1	0.7	0.8	0.8	0.6
Romania	2019	3.5	3.3	3.4	3.3				
	2023	3.5	4.6	4.2	4.2	5.2	5.5	6.3	7
	2023 RRF financed				0	0.8	1.2	1.7	2.2
Slovakia	2019	2.7	2.7	2.5	3.1				
	2023	3.6	3.4	3.1	3.3	5.1	4	3.8	2.9
	2023 RRF financed				0.6	1	0.6	0.4	0.2
Slovenia	2019	4.1	4.1	4.1	4.1				
	2023	3.8	4.1	4.7	5.2	6.4	5.5	5.1	4.3
	2023 RRF financed			0.2	0.1	0.5	0.7	0.8	0.4

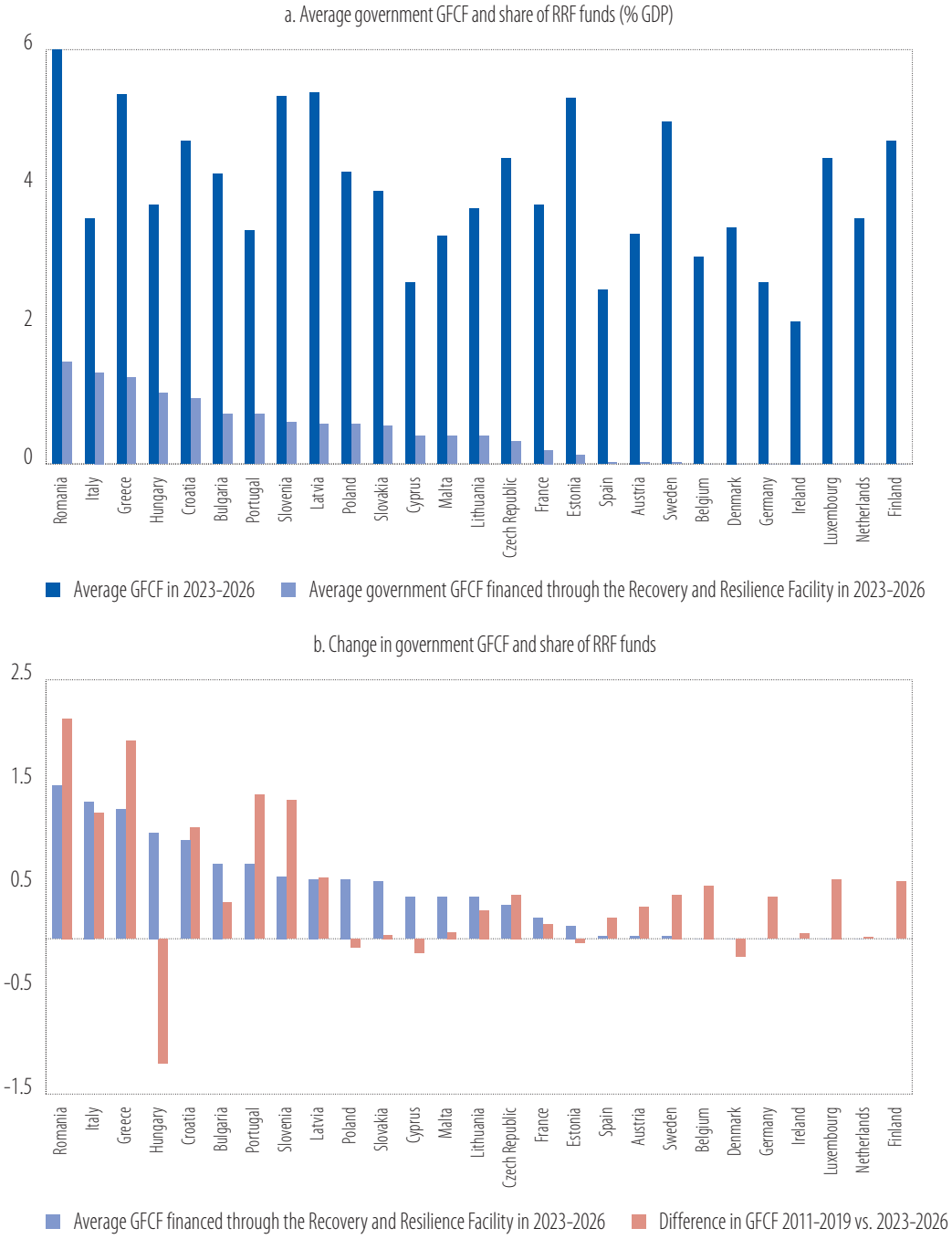
Source: *Stability and convergence programmes 2019 and 2023.*
Note: *RRF refers to the Recovery and Resilience Facility.*

The Recovery and Resilience Facility is expected to fund significant growth in government investment, particularly for larger countries. The additional boost provided by the facility can be assessed by comparing pre-crisis average investment from 2011 to 2019 with the projected average investment in the period during which the financing can be used (2023 to 2026). According to the information included in the stability and convergence programmes of EU members, the Recovery and Resilience Facility will play an important role in supporting public investment in most Southern, Central and Eastern European countries. In these countries, the extra funds will result in an increase in capital spending for 2023-2026 compared to the average for 2011-2019 (Figure 14).

The projected increase in government investment relative to the pre-pandemic average nearly matches the Recovery and Resilience Facility funds committed to Italy, Croatia, Latvia and the Czech Republic. These funds also constitute a very large share of GDP for Romania and Greece, and the share of government investment financed with them exceeds the projected increase for Bulgaria, Lithuania, Slovakia and France. Public investment in Estonia, Cyprus, Poland and Hungary is expected to be lower from 2023 to 2026 compared with 2011 to 2019.

Figure 14

The role of the Recovery and Resilience Facility in supporting public investment, 2023-2026



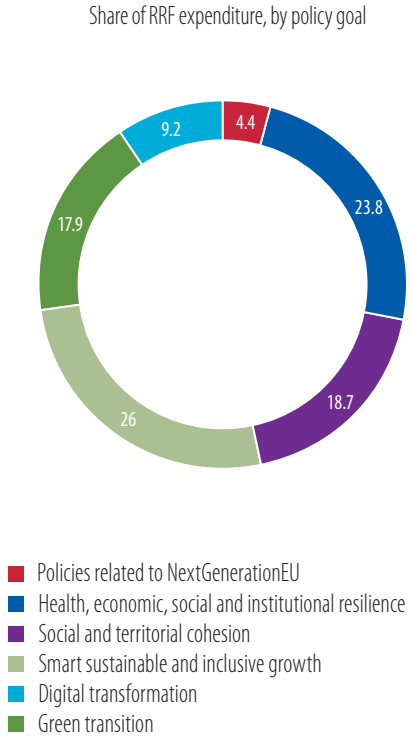
Source: *EIB staff calculations based on EU members' stability and convergence programmes.*

Recovery and Resilience Facility disbursements have experienced delays

By November 2023, 64 payments from the Recovery and Resilience Facility (including early funds not tied to specific projects) had been made, amounting to EUR 176 billion. To put things into perspective, total EU government investment in 2021 and 2022 were EUR 972 billion.[17] The European Commission (2023a) report on the facility includes ongoing disbursements, progress made on common indicators and the allocation of spending to each specific investment area. Spain has already received three instalments for specific projects, while five other countries have received two payments. The rest of the payments have not been tied to specific projects. The European Commission tracks investment for the green transition, digitalisation and education using common indicators, such as additional installed renewable power or the number of additional dwellings with high-speed internet connections. It also includes case studies to illustrate successful investments in different countries.

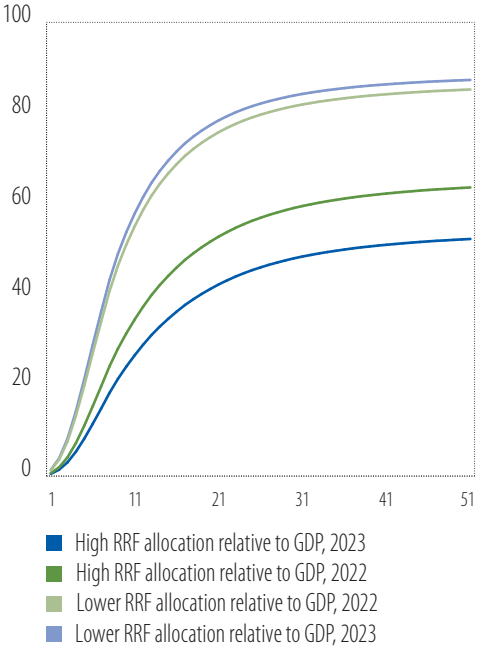
Disbursements for key targets differ from the funds committed at the end of 2023. In the European Commission plans, green investments account for 37% of total Recovery and Resilience Facility financing while digital investments make up 20%. Plans by EU members call for an even larger share of funds to go toward the investment areas: 40% for green projects and 26% for digital projects. However, so far, green disbursements have only accounted for 18% of funds and digital 9%, as shown in Figure 15. This lag is concerning considering the pressing need to invest heavily in these areas, particularly in green projects.

Figure 15
Government spending financed by the Recovery and Resilience Facility



Source: *European Commission RRF factsheet September 2022.*

Figure 16
Cumulative share of contracts signed after the submission deadline
(% of signed offers)



Source: *Tenders Electronic Daily (TED) database and EIB staff calculations.*
Notes: *The X-axis indicates the number of weeks after the submission deadline. See also footnote 18.*

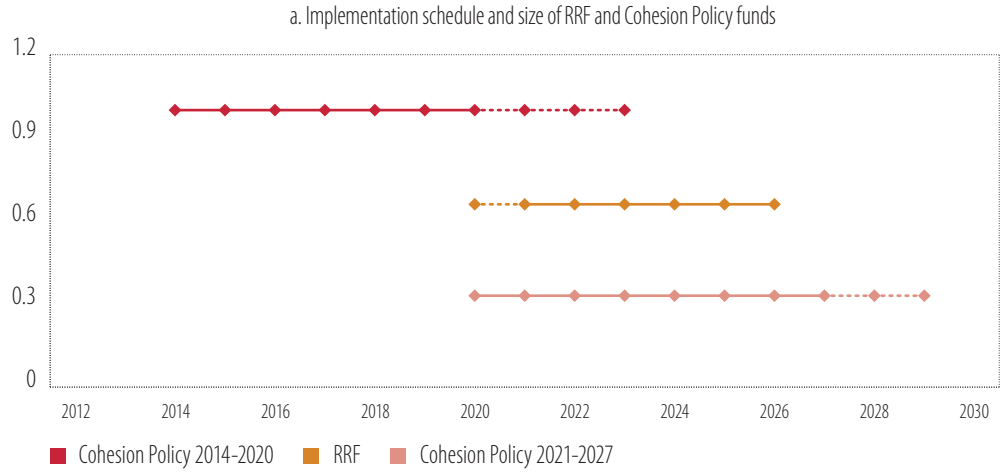
17 Not all Recovery and Resilience Facility-financed spending can be classified as public investment, however, as explained in this report.

In some countries, the sheer volume of Recovery and Resilience Facility financing makes it difficult for country administrators to use funds effectively and on time. Many countries with large allocations from the facility also benefit from large infusions of money from the European Structural and Investment Funds (ESIF). Some countries had already experienced delays in using up ESIF financing from the previous programming period (which ended in 2021 and had a final payment deadline of end 2023). Countries may struggle to put the Recovery and Resilience Facility to use in the allotted time frame, considering that the financing cannot be extended beyond 2026. As of June 2023, EU countries had spent 84% of ESIF resources for the 2014-2020 programming period.

Public procurement data also highlights the difficulties some countries are having in deploying Recovery and Resilience Facility funds. This is particularly the case for EU countries that received a high share of funds from the facility relative to their GDP, namely Bulgaria, Croatia, Greece, Italy, Portugal and Romania. These countries have taken longer to award contracts. The delays in using funds were further aggravated in 2023 compared to 2022. Figure 16 illustrates the problem using the share of contracts signed after the submission deadline for firms' offers.[18] For countries that received a high share of Recovery and Resilience Facility funds, 40% of contracts had been signed after 13 weeks in 2022, but only 31% in 2023.

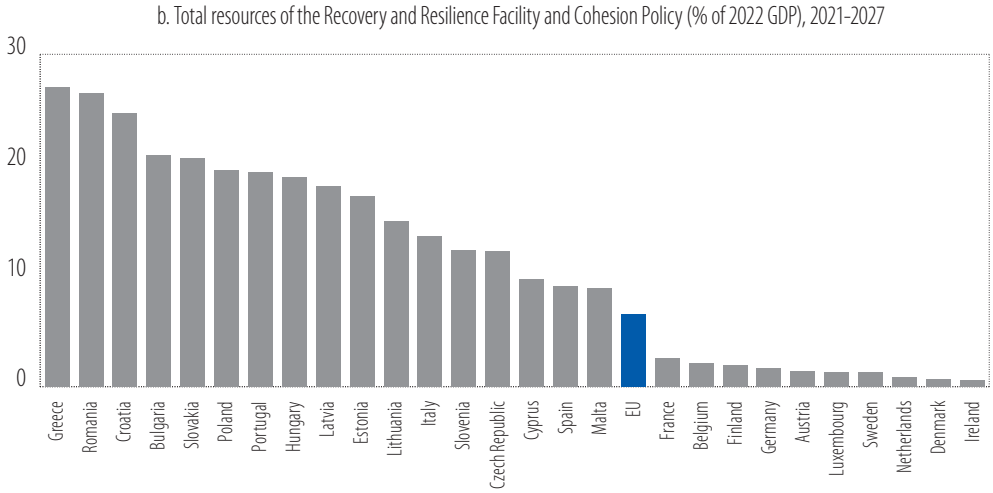
Looking forward, the overlap between various large EU financing sources may further complicate implementation. Investments using cohesion funds available in the 2021-2027 programming period, which need to be spent by 2029 (two years after the end of the programming period), have barely started. While no progress reports are available yet, the sheer size of Recovery and Resilience Facility and 2021-2027 Cohesion Policy funds makes their timely and effective use even more challenging, particularly in some countries.[19] One complication is that the governance of the two programmes is different. The Recovery and Resilience Facility is more centralised and executed in partnership with national governments, while the implementation of Cohesion Policy is more local or regional.

Figure 17
Implementation overlaps between RRF and Cohesion Policy funds (% GDP)



18 The figures are partial effects from a Cox estimation of signature delays on fixed effects for a number of procurement elements: the year in which firms had to submit offers; whether goods, services or work were procured; the type of good, service or work; the level (regional or national) at which the contracting authority operated; the value of the procurement; and the importance of the Recovery and Resilience Facility allocation for the procuring country. The data source is the TED database. The estimates are restricted to the contract notices and contract awards, including by utilities, that result from open tenders for public investment, to make the dataset more homogenous. The data has been further filtered to sift out the types of works, goods and services that are procured for public investment. Contract award values have been cleaned for improbable figures.

19 In five countries the combined amount exceeds 20% of GDP for the total period, keeping in mind that Recovery and Resilience Facility financing should be spent by the end of 2026.



Source: RRF scoreboard, Kohesio database and EIB staff calculations.

Widening gap between plans and achievements

The governance of the Recovery and Resilience Facility focuses on performance. Each EU member must prove the successful achievement of pre-agreed targets before receiving a payment. Payments are semi-annual and follow documented requests by EU members. In addition, each country must provide an analysis of its project implementation every six months.

EU countries reported the results of their Recovery and Resilience Facility monitoring to the European Commission in October 2023. 44% of milestones and targets that were planned to be achieved by the third quarter of 2023 are marked as fulfilled, 38% as completed but not yet assessed, and 18% as not completed. Compared to the previous reporting round, this represents a 1 percentage point decrease in the share of uncompleted projects. Of the milestones and targets due in 2023, 37% were reported to be on track while 25% were completed, and 8% delayed – a 6 percentage point increase compared to the previous reporting round.[20]

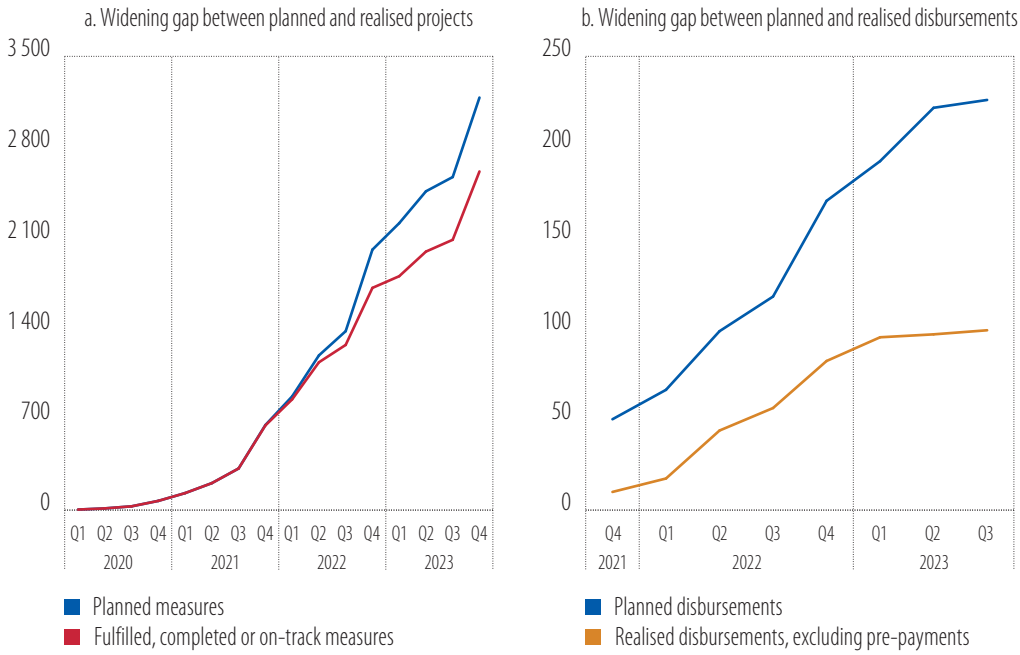
A gap opened between the number of milestones countries planned to hit by the end of 2021 and the reality. The gap has been growing since then (Figure 18, left-hand panel). EU countries send requests for disbursements to the European Commission after submitting a periodic report on the implementation of reforms or investments.[21] The first payments based on agreements between EU members and the European Commission were planned to take place in the fourth quarter of 2021. As shown in the right-hand panel of Figure 18, a gap opened up between planned and completed disbursements at the very beginning. This gap has since widened further, from EUR 40 billion in the fourth quarter of 2021 to EUR 127 billion in the third quarter of 2023.

Countries appear to have been pushing through reforms, while investment is moving more slowly. The higher number of milestones and targets related to reforms that were supposed to be implemented by the end of 2023 signals that investments may take more time to execute. In 2022, the share of uncompleted investments was 21.5% and the share of reforms was 21.7%, a similar result. As Figure 19 shows, more investments were expected to be completed in 2023 than reforms, and the majority were on track (69.2%). In 2023, a higher number of investments were not completed (179) than reforms (134). However, this is because of a higher number of planned investment projects than reforms. In total, 25.9% of investment measures have not been completed, compared with 26.6% of reforms.

20 The analysis focuses on 3 182 measures for all Member States.

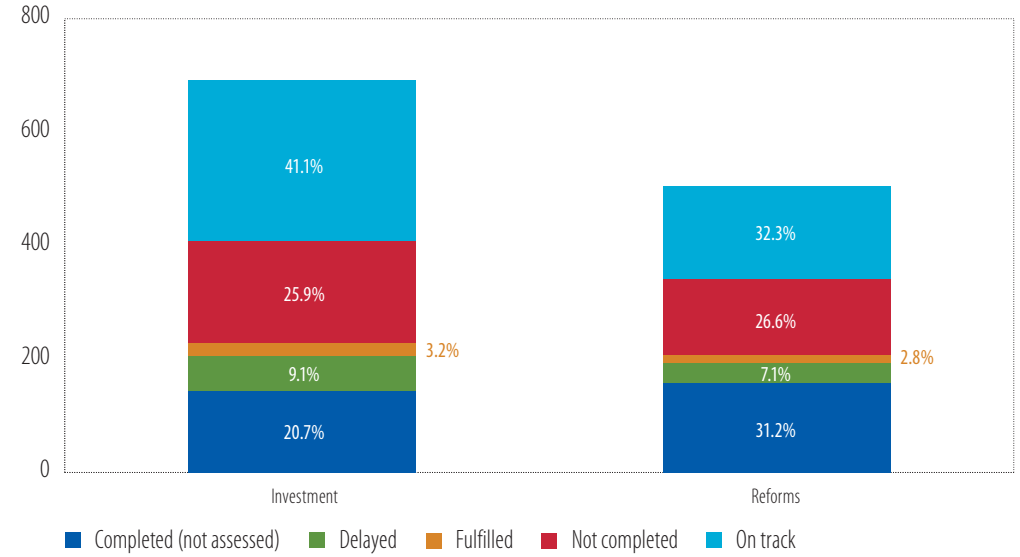
21 Pre-financing payments are an exception as they are not conditional on the implementation of milestones or targets.

Figure 18
Gap between plans and projects realised in RRF implementation



Source: *EIB staff calculations based on data reported by EU members on their implementation of RRF measures, operational agreements and the Recovery and Facility Resilience scoreboard.*

Figure 19
Status of investment and reforms in 2023



Source: *EIB staff calculations based on data reported by EU members on their RRF implementation.*

Table 4
Areas with relatively faster RRF implementation (% of total projects planned)**, 2020-2023**

	Total	Delayed	Not completed
Research	6.2	0	6.6
Innovation	5.9	2	5.5
Next generation or policy	6.3	1	6.2
Green transition	1.6	0	0.6

Source: *EIB staff calculations based on data reported by EU members on their RRF implementation.*
Note: *The calculation is based on text searches using the keywords indicated in the rows.*

Measures related to innovation or the green transition are delayed or not completed less often. A text-based search of national plans makes it possible to detect areas that are under- or overrepresented among delayed and incomplete measures.[22] Research and innovation or policies related to NextGenerationEU are underrepresented among measures delayed in 2022, meaning that they do not seem to suffer excessively from impediments to implementation (Table 4). The green transition and innovation were also underrepresented among incomplete measures, indicating that their implementation had been speedier. However, policies to regenerate the economy were neither under nor overrepresented among incomplete measures in 2022.

Infrastructure-related investment suffers the most from not being completed. The share of not completed infrastructure investment is 7 percentage points higher than infrastructure's overall share of investment (Table 5). When the analysis is extended to include measures related to infrastructure or buildings, the results are similar. Among other things, infrastructure projects can be delayed because of disruptions to the supply chain or price increases, which can cause delays in the tendering process. Not-completed investments are overrepresented in projects related to municipalities or local authorities; solar, wind or hydrogen; and digital transformation. Solar, wind and hydrogen, along with digital transformation, are also overrepresented in delayed measures.

Table 5
Areas with bottlenecks in RRF implementation (% of total projects planned)**, 2020-2023**

	Total	Delayed	Not completed
Infrastructure	11.8	11.1	17.8
Infrastructure or buildings	19.7	20.2	24.4
Local or authority	13.7	11.1	14.2
Solar or wind or hydrogen	3.7	4.4	4.5
Digital transformation	3	4	3.2

Source: *EIB staff calculations based on data reported by EU members on their RRF implementation.*
Note: *The calculation is based on text searches using the keywords indicated in the rows.*

These results point to potential difficulties local governments are facing in planning and executing investments, particularly in the energy transition and in digitalisation. The results echo the findings of the EIB Municipality Survey 2022, in which close to one-third of municipalities (31%) said a lack of expertise in assessing environmental and climate projects were holding back infrastructure investments.

22 Areas are defined based on keywords contained in a project description, such as research, innovation, municipality or solar.

Overall, scaling up investments in specific areas might be slower because of difficulties local and regional governments have in planning and executing investments. Supply chain disruptions and price increases might cause bottlenecks in the implementation of Recovery and Resilience Facility investment projects, which can be illustrated by the visible gap building up between the planned and realised number of reforms and investments and between the planned and actual disbursements.

The ability of the Recovery and Resilience Facility to support EU investment hinges crucially on its governance and functioning. The nature and characteristics of mounting delays in specific areas warrant closer examination. Price increases, for instance, have drastically altered the cost of infrastructure and other construction projects. Other delays relate to the large and varied nature of projects, which involve multiple levels of local and regional governments. Improving the ability of these governing structures to push through investments is crucial if Europe is to maintain move forward in the digital, green and energy transitions.

The resilience of government investment should be a policy priority

The reintroduction of EU fiscal rules in 2024 could push governments to cut spending or look for new tax revenue. Expected weak economic growth in 2024 combined with the growing cost of national debt will put pressure on government budgets. This might force some governments to cap spending growth or increase revenue, or both, to ensure the sustainability of their financing.

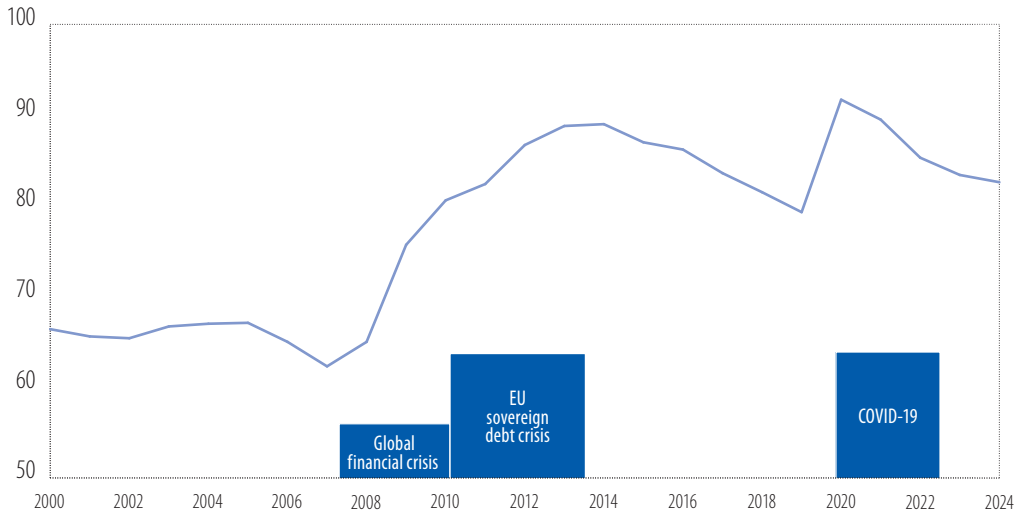
This section shows that government investment is usually particularly hard hit in times of fiscal retrenchment. The spending cuts and other fiscal tightening that followed Europe's sovereign debt crisis hurt competitiveness and economic growth. This section shows that, since public investment is also a catalyst for private investment, scaling back public investment now could result in lower total investment in the future.

The looming reintroduction of EU fiscal rules may jeopardise government investment

Many EU countries have struggled with high levels of government debt since the start of the global financial crisis in 2007. The global financial crisis and Europe's sovereign debt crisis led to a notable increase in EU debt as a share of GDP, although the share started to decline steadily after 2014 as EU governments tightened fiscal policy. Debt levels bounced back again during the COVID-19 pandemic in 2020, but governments quickly took measures to improve the situation, and by 2021 and 2022 debt had fallen back to 2014 levels. That said, 13 EU countries still had debt that exceeded 60% of GDP in 2022, and six of those had debt that surpassed 100% of GDP. Eleven countries had a budget deficit that exceeded 3% of GDP. While this number is much lower than that of previous crises – 22 in 2009 and 25 in 2020 – the debt levels remain close to record highs.

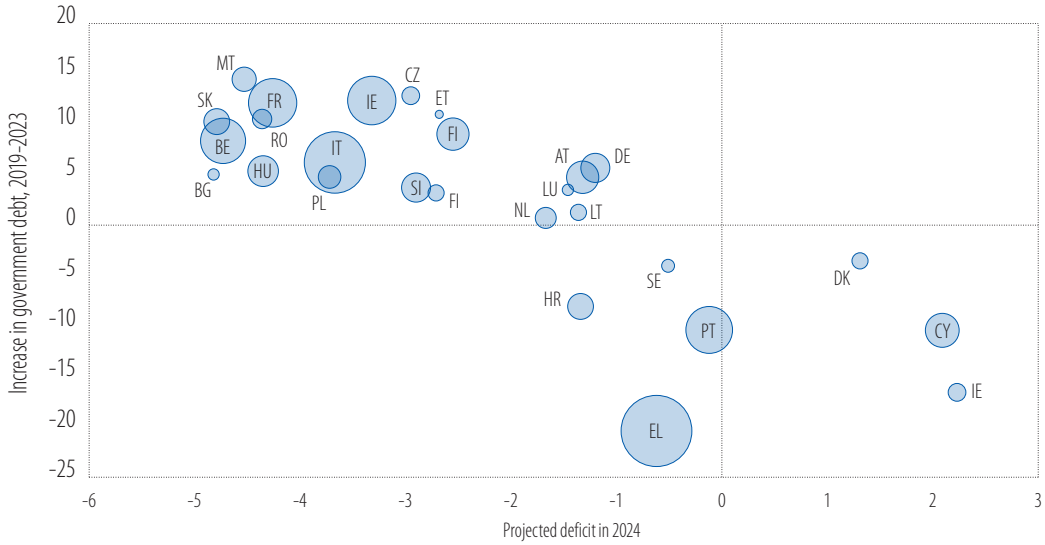
As a result, the deactivation of the general escape clause of the Stability and Growth Pact may prove challenging for some EU members. The reintroduction of – albeit modified – fiscal rules three years after the activation of the general escape clause comes at a time when EU countries have very different pictures of financial health (Figure 21). Those that have kept their deficits under control since 2019 are expected to do better in 2024. They also tend to have smaller debt levels. A few countries that had high levels of government debt in 2019 have increased it further, and they expect to have high fiscal deficits next year as well. Ten countries are expected to have deficits exceeding 3% of GDP, five of which already have government debt that surpasses 100% of GDP.

Figure 20
EU gross public debt and changes in the fiscal framework (% GDP)



Source: *AMECO.*
Note: *The blue boxes highlight the recession/crisis periods.*

Figure 21
Increases in government debt and deficits (% GDP)



Source: *AMECO database of the European Commission, updated with 2023 autumn forecast.*
Note: *The size of the bubble reflects gross government debt at the end of 2023.*

The deactivation of the general escape clause comes with changes to the European Union's fiscal framework. The European Commission opened a public consultation for fiscal governance reform at the beginning of 2020 (before the COVID-19 pandemic) and resumed it in 2022. The reforms focus on several flaws that had become apparent even before the pandemic hit. The framework resulted in fiscal policies that moved with the business cycle, as opposed to making up for the slack in times of slow growth; it treated investment spending similarly to other expenditure despite its importance in supporting future growth; and it had gradually become very complex, making compliance difficult. The large increase in public debt after 2019 increased the urgency of revising the EU fiscal rules.

The agreed framework substitutes the existing approach with one using debt sustainability analysis. According to the proposal, each country whose debt exceeds 60% or whose deficit exceeds 3% should receive from the European Commission a plan (EU Council, 2023) for a fiscal trajectory to follow based on debt sustainability analysis and measured by a single indicator (net expenditure). Each EU member should define on these grounds its multiyear fiscal plan – which will be assessed by the European Commission and agreed upon with the European Council – to set out at least a yearly adjustment of the country's debt and/or the deficit. The time horizon given for the fiscal trajectories can be lengthened from four to seven years if the country undertakes investment or growth-enhancing reforms.

The Recovery and Resilience Facility is temporarily shielding government investment, even under the old fiscal rules. The analysis (see Table 6) shows that Recovery and Resilience Facility grants provide an investment buffer that could result in structural primary surpluses in the European Union. The grants and the primary surpluses are quite similar in size, particularly for Southern, Central and Eastern European countries. With the new rules, investments and reforms related to the Recovery and Resilience Facility automatically qualify certain EU members for a longer adjustment period. However, when the facility expires in 2026, many EU countries may find themselves under pressure to consolidate fiscally. They might resort to cutting public investment, which is usually the first victim of fiscal consolidation. At the same time, investment needs in the European Union are growing to match ambitious climate change and digitalisation targets.

Table 6

RRF grants and the projected improvements in the structural primary surplus (% GDP)

	2022	2023	2024	2025	2026
			Expenditure financed with RRF grants (% GDP)		
European Union	0.41	0.44	0.31	0.25	0.17
Western and Northern Europe	0.22	0.14	0.12	0.06	0.00
Southern Europe	1.08	1.14	0.54	0.51	0.49
Central and Eastern Europe	0.10	0.66	0.86	0.82	0.45
			Change in structural primary balance (% GDP)		
European Union		0.00	1.00	0.50	0.40
Western and Northern Europe		-0.80	1.10	0.60	0.30
Southern Europe		1.70	0.90	0.30	0.50
Central and Eastern Europe		0.60	0.80	0.10	0.10

Source: *EIB staff calculations based on EU members' stability and convergence programmes.*
Note: *Introduced in the EU fiscal framework.*

Rising interest payments on debt are putting additional pressure on government budgets in the medium term. The long maturity of EU countries' debt softened the impact of interest rate hikes in 2023. In the medium term, however, the debt service burden will weigh heavily on government budgets, especially for highly indebted countries. This will further increase the pressure to cut spending, likely with negative consequences for government investment.

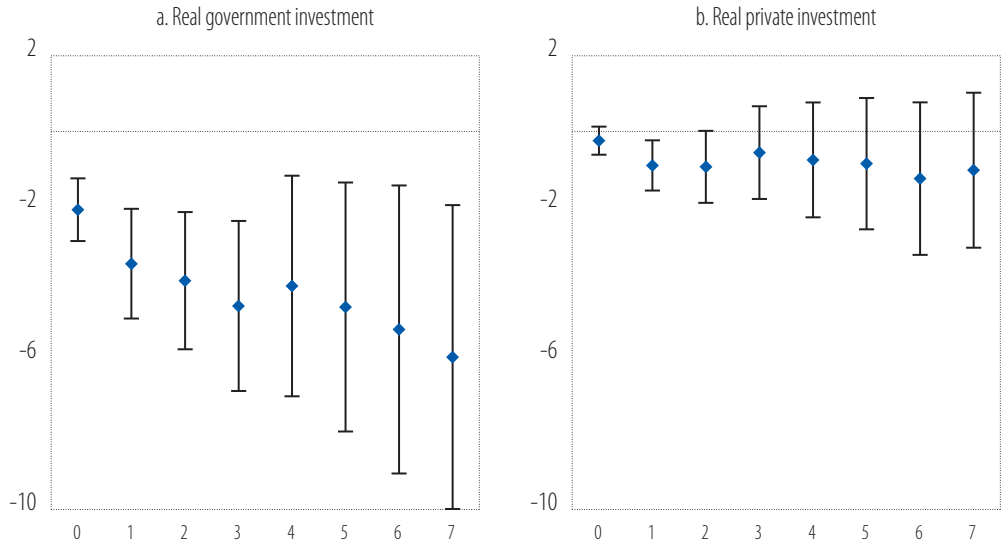
Fiscal consolidation usually results in slashing government investment. Historically, cuts to government investment have played an outsized role in fiscal consolidation. Streamlining budgets usually requires a mix of expenditure cuts and revenue increases, with the revenue being more significant in large-scale consolidations (OECD, 2011). Many fiscal consolidation efforts have concentrated on the largest expenditure items, such as public-sector wages and social security spending. Some smaller expenditures, however, have suffered disproportionately. Government investment is a typical example, as it is reduced significantly, even though it generally comprises only about 5% of spending. For example, Blöchliger et al. (2012) find that government investment spending as a share of GDP was cut in half, on average, during 13 major rounds of consolidation from 1981 to 2000. They posited that investment could be particularly vulnerable to cuts because it encountered less political resistance than reductions in entitlements.

The decline in government investment following fiscal consolidation is not only large, but also long-lasting. A forthcoming paper (Kolev and Schanz, 2024) identifies fiscal consolidations constructed using the historical approach of Alesina, Favero, and Giavazzi (2019). A local projection method (Jordà, 2005) is used to trace out the cumulative response of real government investment to fiscal consolidation in 16 OECD countries from 1978 to 2014. The results illustrate the significant and persistent effects of fiscal consolidations on government investment. Even seven years after the announcement of a fiscal consolidation, real government investment remains below the pre-announcement level, with an overall decline of 6% for a fiscal consolidation of 1% of GDP (Figure 22, left-hand panel).

Fiscal consolidations that focus on cutting spending are more detrimental to government investment. Comparing the response of government investment to fiscal consolidations based on spending with those that are more tax-based reveals that spending cuts result in bigger and longer-lasting declines in real government investment. Government investment recovers in about six to seven years following consolidation based on raising revenue by increasing taxes, while in the case of consolidation based on spending cuts, it remains nearly 8% lower, even seven years after the announcement.[23]

Figure 22

Cumulative response of real investment to a fiscal consolidation (% change), **by number of years after the announcement**



Source: *Kolev and Schanz (2024).*
Note: *The black lines represent 95% confidence intervals. Based on data from 16 OECD countries from 1978 to 2014.*

Private investment is also affected by fiscal consolidations. Spillover effects from government investment to private investment together with reduced incentives to promote investment, such as tax increases or the removal of tax breaks and subsidies, also weigh on private investment (Figure 22, right-hand panel). Real private investment declines about 1% in the year following the announcement of a fiscal consolidation of 1% of GDP. Investment in non-residential construction and equipment investment are most affected. While investment in intellectual property products (which are tightly linked to innovation) is the least affected, it declines significantly only during tax-based fiscal consolidations. The estimated decline is still economically significant – about 3.5% relative to its level before the consolidation announcement – and is delayed, occurring about three years after the announcement.

23 The estimate in tax-based fiscal consolidation after seven years is -2.97%, but it is not significant at a 5% confidence level, whereas in an expenditure-based fiscal consolidation the point estimate is -7.37% and is significantly different from 0 at the same level of confidence.

Government investment can buoy private investment

Public policies can catalyse private investment beyond the direct effects of fiscal incentives. EIB (2023a) demonstrates the role of government investment in stimulating private investment at the level of NUTS 2 regions in the European Union, which have between 800 000 and 3 million inhabitants. A follow-up study focuses on the effects of government investment in a given region on investment by firms in that region. Data on regional government investment come from the Kohesio database (Box C). This source collects data on single projects of public investment at a lower level of aggregation – namely smaller NUTS 3 regions, which tend to have 150 000 to 800 000 inhabitants – including information regarding the characteristics and the motivation of the public policy.

Increasing public investment and/or capital transfers in a firm's neighbourhood positively affects its investment. From the firm's perspective, investment decisions are related to perceived business opportunities and the firm's available resources, summarised by current and lagged profits. In addition, investment growth is related to the change in a firm's leverage, expected to have a negative effect, and the change in the maturity of its debt exposure, with longer debt maturity favouring investment decisions. Raising the level of public investment near where a firm is located has a positive effect on its decision to invest. The same is true when the level of government capital transfers in the same NUTS 3 region increases. The effect of capital transfers in the same region is estimated to be higher than that of public investment, particularly in richer regions.

Public investment and transfers can spur firms' investment. A 1 percentage point change in the public investment ratio is associated, on average, with a 1.1 percentage point change in an average firm's ratio of net investment to total assets a year later. A 1 percentage point increase in the ratio of capital transfers to regional value added is associated with a 3.85 percentage point increase in a firm's net investment to total assets. To put things in perspective, in 2018 the average EU-financed public investment ratio increased by 0.1 percentage points, from 0.56% to 0.66%. The estimated effect of this on the change of the private net investment rate from 2018 to 2019 is 0.11 percentage points. In 2019, the change in average investment rates was -0.2 percentage points. Had it not been for the increase in the public investment rate, the net investment rate would have declined by 0.31 percentage points instead of 0.2.

The detailed breakdown available in the data set makes it possible to investigate the effect of specific categories of public investment on specific themes of private investment. Government policy is key to mobilising the vast resources needed for carbon neutrality. Public investments can develop the framework conditions needed to expand private investment in this area. More public investment in the climate transition makes it more likely for a firm near the public investment project to increase its own climate-related investment. The response is stronger for small and medium-sized firms.

Box C

Illustrating the effect of public investment on firm investment

This box focuses on climate change investments financed with cohesion funds to illustrate the effect of public policies on firm-level investment. The focus is on two key elements: government investment and government capital transfers.

The analysis builds on two data sources. First, the matched EIBIS-ORBIS[24] database provides firm-level data on corporate investment, including areas of investment, obstacles to investment, firms' financial data and other characteristics. Several variables related to firm investment are used as dependent

24 Bureau Van Dijk's Orbis database of companies and other entities.

variables. The measures of firm investment used in the analysis are total firm investment, planned firm investment to tackle climate change, and the various measures adopted by firms that relate to climate change mitigation or adaptation.

Second, the newly available Kohesio database offers comprehensive information on public policies financed with EU cohesion funds. The database contains over 1.9 million projects with their locations and additional in-depth information enabling multiple classifications. For the analysis, projects have been classified into four categories by type of public support: public investment, capital transfers, government consumption or unclassified.[25] On the one hand, projects are classified as public investment when they include investments in infrastructure, education and other tangible assets aimed at promoting economic development and social welfare. On the other hand, projects are classified as capital transfer when they entail a transfer of resources to a private entity.[26]

In addition to the general classification by type, climate change-related projects in the Kohesio database were selected for secondary classification. Overall, slightly less than one-fifth of all projects were classified as climate change-related (18.4%). In turn, projects with "Greener carbon-free Europe" as their policy objective were classified into four sub-categories: climate change adaptation, climate change mitigation, climate change adaptation and climate change mitigation, and unclassified. A project is classified as climate change adaptation when it addresses the effects of climate change and enhance resilience (1.9%). Projects classified as climate change mitigation focus on reducing greenhouse gas emissions and promoting the sustainable use of resources (16.2%). Furthermore, 0.4% of projects were classified as both climate change adaptation and climate change mitigation.

The analysis starts by estimating a baseline econometric specification based on standard firm-level investment models[27] (for instance, Kalemli-Özcan et al., 2022). Investment is affected by current business opportunities and the resources available to the firm, is expected to have a positive impact and is represented by current and past profits over total assets. Other factors are the firm's leverage (measured by total debt over total assets) and the maturity of its debt exposure, with a longer debt maturity favouring investment decisions. As shown in Table B.1, column 1, the estimated relationships are aligned with expectations and the coefficients are statistically significant. To account for additional factors, fixed effects are used for firm size, NACE[28] Rev. 2 two-digit sectors, NUTS 2 regions and years, while NUTS 3 regions are used as a natural clustering mechanism.

The analysis then investigates the impact of public policies on firm investment. Public policies, considered via the change in European Union-financed public investment or capital transfers, are inserted into the baseline relationship (Table B.1, columns 2 to 4). Public policies are measured as the sum of all Kohesio projects' value in a specific NUTS 3 area divided by the region's gross value added. The estimated coefficients on these variables are statistically and economically significant. Firms' investments are positively influenced by recent EU public investment or capital transfers close to them. Capital transfers or investment grants seem to be more effective in supporting private investment. This evidence is hardly surprising, as investment grants are only paid if a given investment occurs.

25 Classifications are based on the field of intervention encompassing more than 120 categories. For countries where the field of intervention was not available for a high share of projects, detailed project descriptions were used for classification.

26 62% of projects are classified as public investments and 21% as capital transfers. Around 20% are classified as government consumption, and the remaining 15% as unclassified.

27 Following Kalemli-Özcan et al. (2021), net investment at firm level is computed as the ratio between net fixed capital stock increase and the initial net fixed capital stock.

28 Nomenclature of Economic Activities (NACE) is the European statistical classification of economic activities.

Table B.1

Net investment of firms as explained by financial variables and public investment

Dependent variable	Firm-level investments	Firm-level investments	Firm-level investments	Firm-level investments
	(1)	(2)	(3)	(4)
Explanatory variables				
D profits/Total assets	0.196 (***)	0.191 (***)	0.187 (***)	0.188 (***)
L D profits/Total assets	0.150 (***)	0.170 (***)	0.176 (***)	0.175 (***)
D debt maturity	0.522 (***)	0.547 (***)	0.557 (***)	0.557 (***)
L D debt /Total assets	-0.471 (***)	-0.454 (***)	-0.465 (***)	-0.463 (***)
L D public investment/Value added		1.274 (*)		1.106 (*)
L D capital transfer/Value added			4.32 (**)	3.854 (**)
Fixed effects				
Year	yes	yes	yes	yes
Size	yes	yes	yes	yes
NACE 2 sector	yes	yes	yes	yes
NUTS regions	yes	yes	yes	yes
(Clustered error, clusters are NUTS 3)	(obs 397K)	(obs 397K)	(obs 397K)	(obs 397K)

Source: *Based on the Kohesio dataset and the 2023 EIB Investment Survey (EIBIS).*

Note: *The dependent variable is D net investment/total assets, which represents the change in investment rate as defined above. In the table, D stands for first difference (Yt – Yt-1) and L stands for lagged one period. NUTS refers to the Nomenclature of Territorial Units for Statistics, or Nomenclature des unités territoriales statistiques in French. Statistical significance: *** p-value<0.01, ** p-value<0.05, * p-value<0.1.*

Finally, the analysis focuses on climate change investments. Public investment with cohesion funding for climate change adaptation seem to positively affect firms' adoption of climate change adaptation measures in the same NUTS 3 region (see Table B.2, columns 2 and 3). The probability of a firm having an adaptation strategy for physical climate risks and purchasing insurance increases with public Cohesion Policy investment in climate change adaptation.[29] It is higher for larger firms and for firms believing that climate physical risk is having a major impact on their activity. Manufacturing firms are more likely to have an adaptation strategy, and together with services firms are more likely to have insurance to offset climate-related losses.

Public investments financed with cohesion funds and contributing to climate change mitigation have a positive impact on firms' adoption of climate change mitigation measures in the same NUTS 3 region (see Table B.2, columns 4 to 6). Three measures of firm-level climate change mitigation investment are used: the incidence of firms investing in (i) new, less polluting business areas and technologies; (ii) onsite/offsite renewable energy generation; and (iii) sustainable transport options.[30] The probability that firms invest in these measures is higher when the NUTS 3 region experienced an above-average public investment for climate change mitigation, financed with cohesion funds in the previous year.[31] Firms that consider the transition to be an opportunity are more likely to implement any of the above measures than firms reporting the climate transition as a risk for their activity, while firms believing

29 The variable used is the first difference of public investment as a share of value added. Standard errors are clustered at NUTS 3 level.

30 The probit estimation includes EIBIS survey observations from two years of surveys, and standard errors are clustered at NUTS 3 level.

31 Cohesion funding is captured as a first lag of the above-average public investment in climate change calculated for the NUTS 3 region covering the 2014-2020 programming period.

that the climate transition has no impact on their activity are less likely to do so. The larger the firm, the higher the probability that they will implement the climate change mitigation measures.

Table B.2
Public investment in climate change is encouraging firms to invest in climate measures

	Climate change	Climate change adaptation		Climate change mitigation		
Dependent variable	Firms' planned climate investments	Firm adaptation strategy	Firm insurance	Firm investment in new solutions	Firm investment in renewable energy generation	Firm investment in sustainable transport solutions
	(1)	(2)	(3)	(4)	(5)	(6)
Explanatory variables						
D public investment in climate change/Value added	20.15 (***)	52.995 (***)	39.594 (***)			
L above-average public investment in climate change mitigation				0.025 (***)	0.017 (**)	0.024 (**)
Major impact by physical climate risk	0.249 (***)	0.595 (***)	0.322 (***)			
Energy costs as an obstacle	0.237 (***)			0.081 (***)	0.095 (***)	-0.041
Climate transition						
Transition will have no impact on firm				-0.306 (***)	-0.146 (***)	-0.217 (***)
Firm well positioned to gain from transition				0.302 (***)	0.246 (***)	0.207 (***)
Size						
Small	0.208 (***)	0.144 (***)	0.116 (***)	0.132 (***)	0.283 (***)	0.118 (***)
Medium	0.514 (***)	0.317 (***)	0.239 (***)	0.322 (***)	0.665 (***)	0.320 (***)
Large	0.798 (***)	0.622 (***)	0.332 (***)	0.522 (***)	0.889 (***)	0.548 (***)
Sector						
Construction	-0.122 (***)	-0.033	-0.135 (***)	-0.170 (***)	-0.201 (***)	0.171 (***)
Services	-0.105 (***)	0.057 (*)	0.069 (***)	-0.155 (***)	-0.164 (***)	0.152 (***)
Infrastructure	0.013	0.024	-0.103 (***)	0.035	-0.276 (***)	0.430 (***)
Standard errors clustered at NUTS 3	(obs 45k)	yes (obs 23k)	yes (obs 23k)	yes (obs 17k)	yes (obs 17k)	yes (obs 17k)

Source: *Based on the Kohesio dataset and the EIBIS.*
Note: *In the table, D stands for first difference (Yt – Yt-1) and L stands for lagged by one period. Statistical significance: *** p-value<0.01, ** p-value<0.05, * p-value<0.1.*

The probability of investing in new, less polluting solutions or in renewable energy increases when firms report energy cost as a barrier to investment, while the probability of investing in sustainable transport is lower when firms perceive access to finance to be an impediment to investment. Manufacturing firms are more likely to invest in renewable energy and less likely to invest in sustainable transport than firms in the services, construction or infrastructure sectors. Service or construction firms are less likely to invest in new, less polluting solutions than their peers in manufacturing or infrastructure.

Public investment in climate change adaptation, financed with cohesion funds, seems to positively affect firms' adoption of these measures in the same NUTS 3 region. The probability of firms having an adaptation strategy for climate physical risks and buying insurance increases with cohesion-financed public investment in climate change adaptation.[32] It is also higher for larger firms and for firms that consider that the physical risks of climate change have a major impact on their activity. Manufacturing firms are more likely to have an adaptation strategy, and together with services firms, they are more likely to have insurance to offset climate-related losses.

A NUTS 3 public policy variable may be a strong signal for all the firms located in the same region, however, the policy variable's coefficient is positive and significant, and the results regarding other variables are reasonable, aligning with the literature. Lagging regional variables addresses endogeneity issues between public and private investment. More in-depth analysis involving firm-level and public policy data could be informative regarding the areas where public investment is most efficient or most needed to bring in private investment.

32 The variable used is the first difference of public investment as a share of value added. Standard errors are clustered at NUTS 3 level.

Conclusion and policy implications

Governments across the European Union paid a heavy price for reducing public investment in the aftermath of the euro debt crisis. This experience led governments to maintain public investment during and after the COVID-19 crisis, demonstrating governments' understanding that public investment is not just an expenditure item in the current budget, but rather benefits society for many years.

The European Union and its members need to find ways to protect government investment from temporary shocks. Despite the fiscal challenges of the past three years, government investment has continued to grow, helped by European Union-wide initiatives, most notably the Recovery and Resilience Facility. However, government spending to address the energy crisis may have caused a slowdown in government investment in 2022, which could foreshadow a bigger hit to investment when fiscal rules return in 2024. To prevent another prolonged period of low government investment, the European Union needs a strong commitment or mechanism to protect government investment spending, particularly when fiscal rules are reintroduced.

Addressing impediments to government investment is also important. Delays in absorbing European structural and investment funds and money from the Recovery and Resilience Facility show that the availability of funds and clear investment priorities are not enough to promote investment. Local and regional governments need support and reforms to help them plan and execute needed investments.

Strengthening the European Union's ability to support public investment and provide public goods complements other efforts to improve investment. The resilience of government investment over the past two years is arguably underpinned by the availability of Recovery and Resilience Facility funds. The European Union could use lessons learned from this experience to come up with new ways to effectively deliver on EU policy goals, such as addressing climate change or digitalising the economy.

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Chapter 3

Corporate investment

European firms have just come through an unprecedented array of crises in a relatively short time. First they were hit with COVID-19 pandemic, then tensions with global supply chains, the energy crisis, Russia's invasion of Ukraine, and then war between Israel and Hamas. These crises caused surges in uncertainty and shaped a challenging environment. However, the real economy fared better than expected up to mid-2023, with firms' health and investment surprisingly resilient. Much of that resilience reflects the massive policy support deployed during the COVID-19 and energy crises, and it prepares the ground for a soft landing as the economy slows.

Firms' resilience and investment spending remained surprisingly strong during the energy crisis, but the energy shock is not yet fully absorbed. Energy bills rose more than one-quarter for 68% of EU companies – well more than in the United States (30% of firms). But this rise was still lower than expected, and a strong government response was able to prevent the worst-case scenario of blackouts and economic shutdown. The crisis also pushed firms to find ways to save energy and to invest in energy efficiency. However, international energy prices are well above pre-crisis levels, and higher prices caused by higher production costs are increasingly being passed on to clients as policy support is phased out. Uncertainty about the new, long-term level of energy prices prevails, which may affect certain parts of the EU economy.

During a period of high inflation, firms increasingly tapped their own internal means for any financing needs. The reopening of economies after the pandemic caused supply bottlenecks and the subsequent skyrocketing prices for raw materials and energy has triggered inflationary pressures not seen for a long time. Firms are confused about the nature and persistence of high prices. Some firms raised selling prices by more than input prices, increasing corporate profits and further fuelling inflationary pressures. At the same time, the profits firms made helped finance their capital expenditure.

The resilience of investment to sharp monetary policy tightening and the weak economic environment will be tested. An abrupt tightening of monetary policy and rising interest rates continued for most of 2023. Combined with tightening credit standards, the increase in interest rates has begun to negatively affect firms' financial conditions. In certain instances, firms were able to pay for investment with profits they had built up, substituting external finance. But cracks are showing, like the rise in corporate bankruptcy rates and the slowdown in investment.

The response of investment to these challenges is uncertain, in the present and the longer term. As capital spending is more geared towards the structural transformation of the economy, it may show some resilience to cyclical downturns. However, investment is threatened by looming uncertainty and structural bottlenecks. Government policies to support the economy will inevitably become more targeted as pressure on public spending increases. Those policies need to be directed to areas where the impact is stronger and catalyses investment, and they need to be complemented by measures to alleviate structural barriers and bottlenecks.

Introduction

This chapter focuses on corporate investment and resilience in the wake of the unprecedented array of crises that have hit the EU economy over the last few years: first the COVID-19 pandemic, then tensions in global supply chains, the energy crisis, Russia's invasion of Ukraine and, more recently, the war between Israel and Hamas. Government policies put in place to address some of these crises have successfully supported firms, and the result is that firms' investment reacted less than expected to the slowdown in economic activity. It continued to progress throughout 2022 and the first half of 2023. As of late 2023, EU corporate investment was above where it was before the pandemic struck, but well below the pre-crisis trend.

During the energy crisis, differences emerged between countries – even larger ones – and the increase in prices was clearly more pronounced in Central and Eastern Europe than in other regions. Looking ahead, countries will once again have to adhere to EU budget rules when the general escape clause of the Stability and Growth Pact is deactivated. The reinstating of fiscal and competition rules will likely call for much more targeted government intervention. On the one hand, investment needs are much clearer and substantial. There is a need to invest for the green transition, innovation or digitalisation, and to limit Europe's exposure to global supply chain disruptions.

On the other hand, firms' ability to continue investing is unknown, as their internal funding capacities are shrinking and their access to external finance is tightening. This chapter devotes special attention to whether firms will continue transforming in these challenging times, and how government intervention can best support this transformation when pressure on government finances is mounting.

The chapter consists of three sections and three boxes. The first section gives an overview of the ability of firms to invest and their vulnerabilities following the recent crises. It includes a box on electricity prices and their impact on competitiveness. The second section elaborates on the strength of firms' internal financing and discusses how it can soften the impact of worsening financial conditions for investment. It also includes a box on the impact of inflation on their investment. The third section discusses the need to remove structural impediments to unlock investment, while assessing the effectiveness of financial instruments and grants in supporting innovation and the green transition. It also looks at small and medium enterprises (SMEs) and the lack of financing for firms trying to scale up. It includes a box presenting the results of the European Investment Fund (EIF) Venture Capital Survey.

Legacies of the crises

The slew of crises of the past four years has shaped a novel environment of massive public support, inflationary pressure and sharp monetary policy tightening. This section reviews the latest developments in firm vulnerabilities and investment as European businesses navigate this challenging environment.

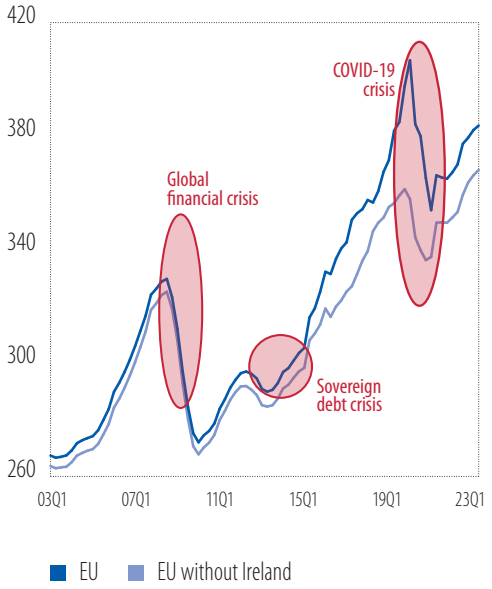
The worst-case scenario predicted last year during the energy crisis did not materialise, but the crisis did weaken firms. The slowdown in economic activity since the beginning of 2022 has also intensified, and fragilities have developed unevenly across sectors and countries. The corporate investment outlook remains cloudy in the short run and uncertain in the long run, with sources of energy shifting and new energy costs emerging.

The rise in energy prices has hit firms, albeit less than expected

Corporate investment continued growing in the first half of 2023. Firms' investment collapsed in 2020, then recovered from the COVID-19 crisis and returned to pre-crisis levels in the second half of 2022. Investment increased during the energy crisis (in contrast to the COVID-19 crisis), as the economy continued to grow during most of it (Figure 1). If anything, EU investment has remained surprisingly

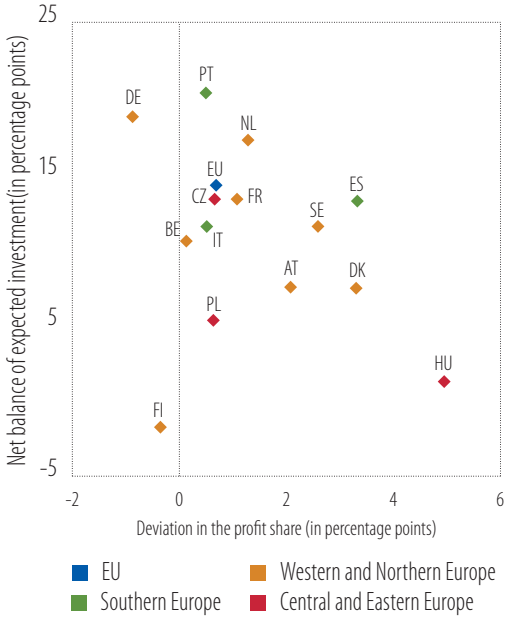
strong since the energy crisis began in mid-2021 (Kramer et al., 2023; Moll et al., 2023). In real terms, it is around 2% above levels right before the pandemic (from 2019) as of the second quarter of 2023.[1] As EU real gross domestic product (GDP) is 3% above the 2019 level, the share of corporate investment is only slightly below pre-crisis levels (at which time it was above the historical average).

Figure 1
Corporate investment (in real terms, 2005 EUR billion)



Source: *EIB staff calculations based on Eurostat data.*
Note: *Four-quarter moving average. The last data available are for the second quarter of 2023.*

Figure 2
Investment plans and deviation in the profit share



Source: *EIB staff calculations based on Eurostat and the EIBIS 2023.*
Note: *The deviation in the profit share of firms is measured as the difference in gross entrepreneurial income over value added between the second quarter of 2023 and the historical average over 2005-2019.*
Question: *Y-axis: For the current financial year, do you expect your total investment spend to be more than last year?*

This overall performance masks substantial disparities between and within regions. In Northern and Western Europe, corporate investment is now more than 5% above pre-crisis levels in Finland, France, Denmark and Sweden, but still below them in Belgium and Germany. In Southern Europe it is well above: 17% in Italy, and 5% in Portugal. In Central and Eastern Europe fewer countries report timely corporate investment data, but real corporate investment is 2% above pre-crisis levels in Poland, and on a par in Hungary.

There is evidence of investment trends normalising across countries. In Figure 2 we associate the deviation in a firm's profits compared to the historical average and the share of firms across EU countries expecting to accelerate investment, according to the EIB Investment Survey (EIBIS) for 2023. In the second quarter of 2023, the share of profit in EU GDP was 1 percentage point above the historical average. The share of profit in GDP is above the historical average in most EU countries, with the exception of Germany and Finland. Firms in most countries expect to accelerate investment, but there are large disparities. The

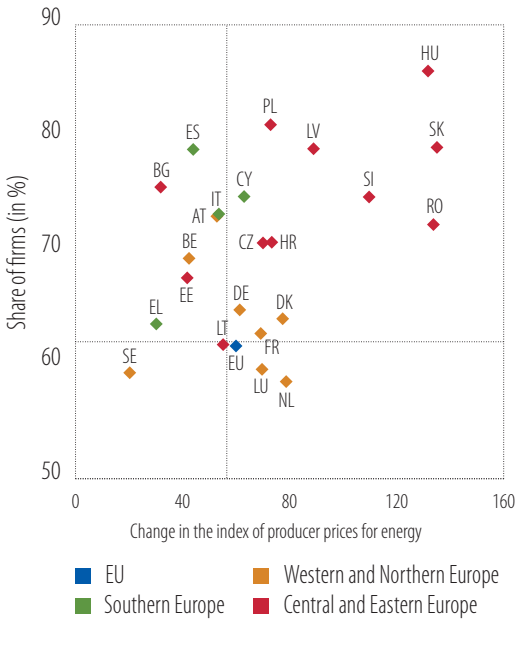
1 Investment in Ireland is influenced by specific factors that pushed up investment before COVID-19, so removing it from the European aggregates enables more accurate analysis. See Investment Report (2022), Chapter 2.

lower the profits share compared to historical average, the higher the net balance of firms expecting to raise investment across countries as the economy strengthens. Countries in Central and Eastern Europe tend to have more conservative investment plans. By contrast, investment in Southern European countries is set to accelerate.

The energy price rise was more pronounced in Europe than in the United States, with 62% of EU firms experiencing more than a 25% increase in their energy bill. Figure 3 plots the rises in energy prices as measured with hard data together with the results of the EIBIS. The signals received from the two sources are well correlated. Across countries, the stronger the increase in energy prices, the higher the share of firms reporting an increase above 25%. In Europe, in the second quarter of 2023, the energy price for firms was 60% above its 2021 level (before the energy crisis began), and 62% of EU firms were facing an increase of more than one-quarter of their energy bill – well above the 25% of US firms. Among firms recording any increase at all, the difference between the European Union and the United States is smaller: 93% of EU firms compared with 83% of US firms. Thus, larger increases were much more frequent in Europe than in the United States.

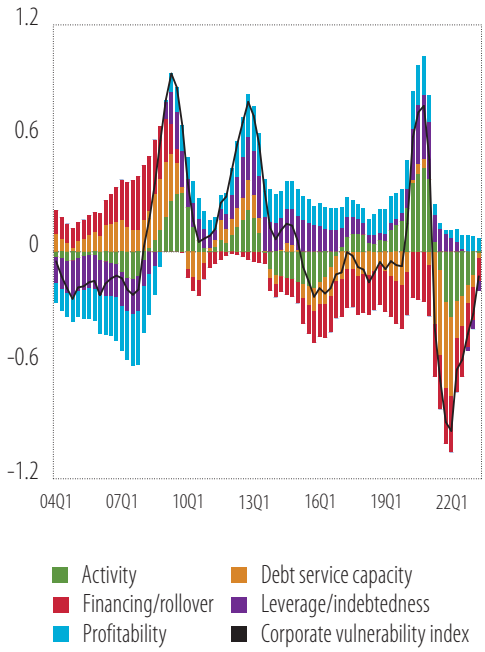
International energy prices have affected local prices differently from one country to the next. Changes in domestic energy prices paid by firms vary dramatically between EU economies, despite the common underlying changes in the international prices of energy from coal, gas and oil. The increase was clearly more pronounced in Central and Eastern Europe than in other regions. Figure 3 shows that energy price increases range from a low of 20% in Sweden to highs of above 130% in Hungary, Slovakia and Romania. This variety is partly explained by differences in the energy mix, but also by other factors like price settlement contracts, taxes, regulation, transportation costs and local margins. Finally, the intensity and the form of the policy support deployed during the energy crisis also made a difference.

Figure 3
Recent evolution in corporate energy costs



Source: *EIB calculations based on the EIBIS 2023 and Eurostat.*
Note: *The change in the producer price of energy is computed between the second quarter of 2023 and 2021. Y-axis is the share of firms reporting a more than 25% increase in the energy bill.*

Figure 4
Corporate vulnerability index



Sources: *EIB staff calculations based on Eurostat, see Alvares et al. (2024).*
Note: *Last data available are for the second quarter of 2023. The corporate vulnerability index is obtained as a weighted average of more than 20 data series related to EU firms' performance and balance sheet structure.*

Energy costs may continue rising in some countries. As shown in Figure 3, the propagation of changes in international energy prices to domestic prices has been uneven across economies. The impact of international prices on domestic prices was dampened and delayed by government support (International Monetary Fund (IMF), 2023). International energy prices have receded from their peaks, but they are still above pre-crisis levels. Comparing the level in the third quarter of 2023 to that in 2019, international prices of gas are 78% higher, of coal 63% and of oil 37% (see Box A for a focus on electricity prices). Thus, energy costs may well continue to increase in some countries, albeit at a much slower pace, as policy support is removed (Alessandri & Gazzani, 2023).

Fragilities have risen unevenly, weighing on the investment outlook

Corporate vulnerability has increased since the energy crisis began. Figure 4 plots the vulnerability indicator, a synthetic aggregator based on 24 data series related to corporate profits and losses and balance sheet structures reported at the country level for businesses (see EIB, 2022, for more details). As shown in the figure, the series assemble components related to activity, profitability, financing and the rollover of debt, the ability to service debts and overall indebtedness. During the COVID-19 crisis, the indicator rose to a level not seen since the sovereign debt crisis, as firms could not operate properly during economic shutdowns. However, the policy support deployed during the crisis enabled firms to tap loans and accumulate cash, fuelling the strong recovery in demand. Underpinned by the strong post-COVID-19 recovery, corporate vulnerability receded sharply. But at the beginning of the energy crisis the direction changed, and the indicator started rising again in late 2021. As of the second half of 2023, it is somewhat above the average since 2003.

The vulnerability indicator has evolved differently among countries. Figure 5 plots the level of and change in the vulnerability indicator from the end of 2021 (the start of the energy crisis) to the second quarter of 2023. Over this period, corporate vulnerability increased in most countries, especially those in Central and Eastern Europe. A stronger rise in vulnerability is recorded in countries where firms were already weaker at the start of the energy crisis.

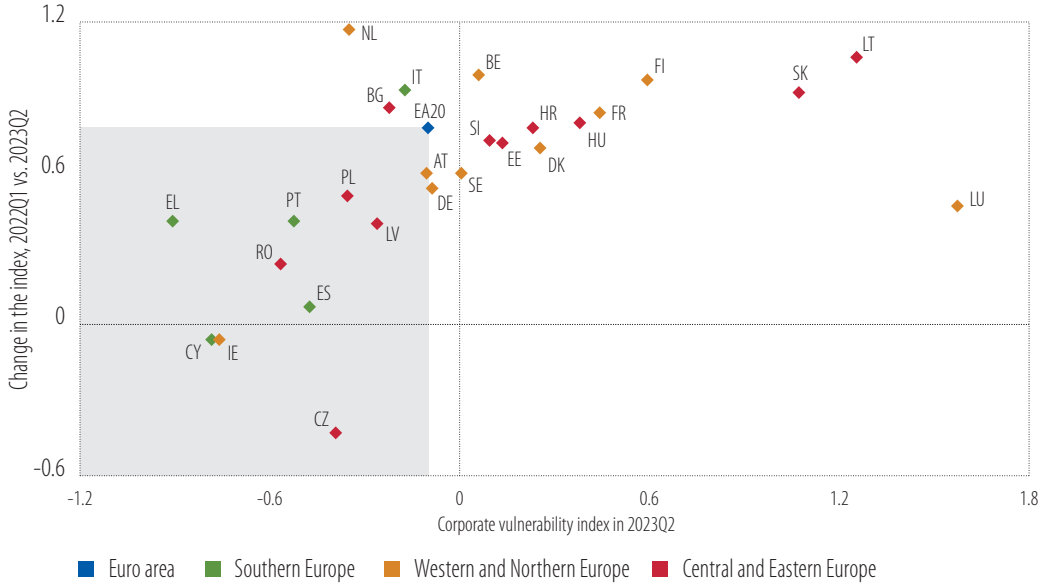
Insolvency and default risks are below expectations, but still above pre-crisis levels. Granular balance sheet data are released with a delay, and at the time of writing were available until 2021. Figure 6 plots the discrepancies among real data and previous expectations. During the beginning of the COVID-19 crisis in 2020, firms' profitability mainly declined due to the sharp drop in sales, just as expected – however, policy support helped stabilise the situation. Alongside strong subsidies for wages and deferred taxes, the moratorium on loan repayment implemented in all EU countries kept interest payments at sustainable levels (significantly lowering default risks based on the interest coverage ratio). Moreover, growth in firms' sales also exceeded expectations during the 2021 recovery, likely driven by stronger demand and higher prices (firms were able to pass on higher production costs caused by supply shortages).

The surge in energy prices affected firms' profitability, through higher costs and lower sales. As a next step, we simulate the changes in insolvency and default risks[2] for 2022 and 2023.[3] We rely on sector-level sales statistics from 2022 to mid-2023 to simulate firms' profits, thereby accounting for the net impact of higher prices on total sales. The change in sales balances out the direct impact of passing through costs to customers (the increase in the nominal value of sales through higher final prices) and its indirect impact through sales elasticity (lower demand and drop in sales because of higher prices). Despite being able to pass on higher costs to customers, the sharp rise in energy prices in the first year and sales drop in the second year weigh on firms' profitability, which is expected to decline. That will increase the risk of insolvency and default.

2 Insolvency risk is measured as the share of firms falling into negative equity when losses surpass the equity base. Default risk is measured as the share of firms for which profits and available cash do not suffice to cover financial expenses.

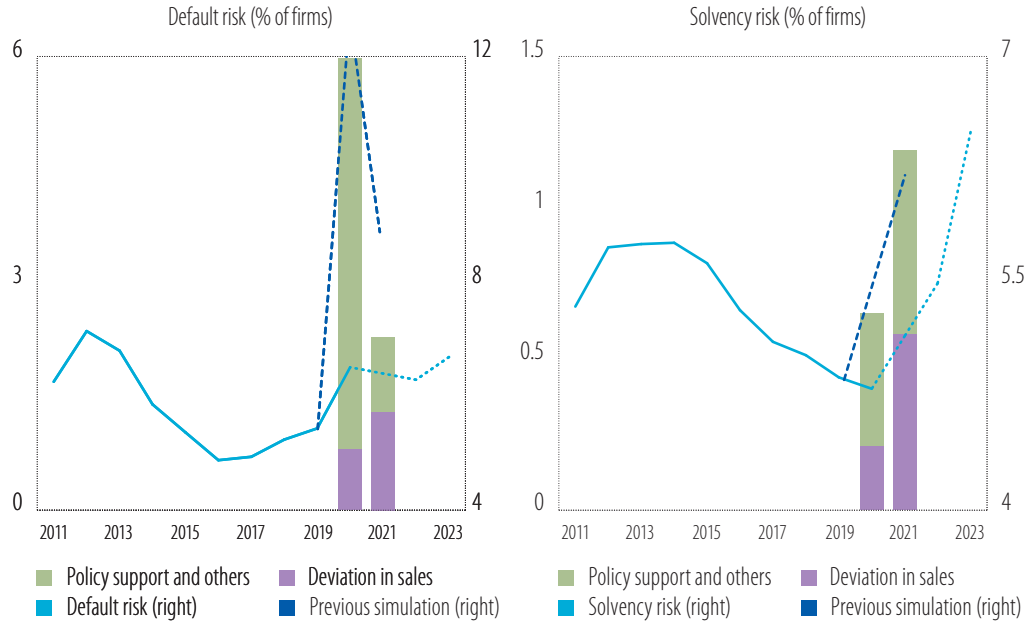
3 Granular balance sheet simulations based on price and demand assumptions are produced to simulate the change in risk metrics in the sample (Maurin & Pál, 2020 and Harasztosi et al., 2023).

Figure 5
Cross country dispersion of the corporate vulnerability index



Source: *EIB staff calculations based on Eurostat, the European Central Bank (ECB) and Alvares et al. (2024).*
Note: *The last data available are for the second quarter of 2023. The gray box covers countries with a lower vulnerability index compared to overall euro area and a lower change in the index compared to the euro area.*

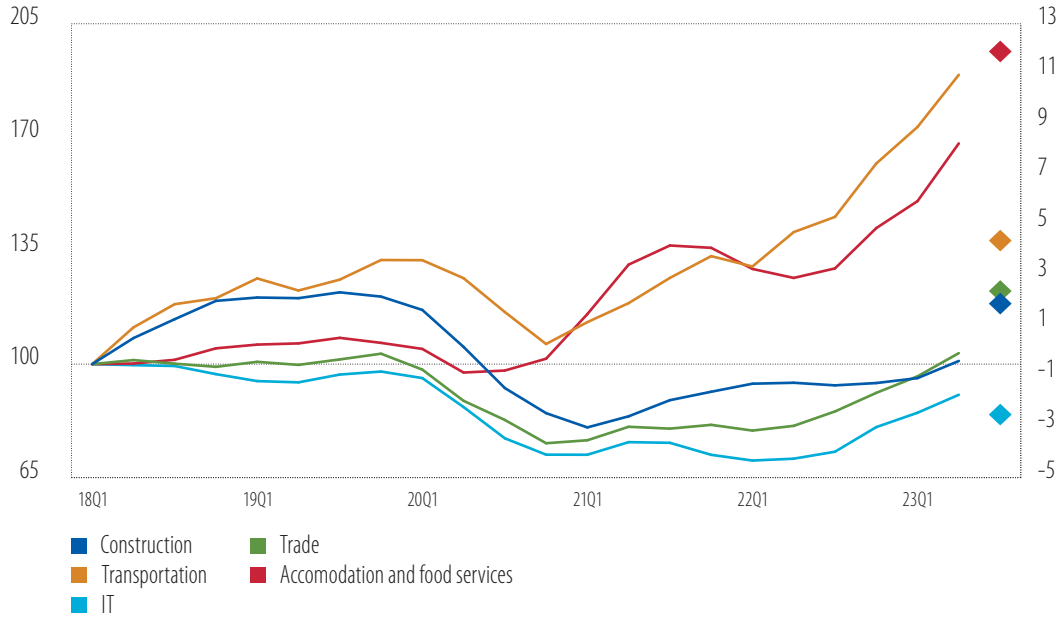
Figure 6
Risk metrics: history and simulations



Source: *EIB staff calculations based on Eurostat, EIBIS 2016-2023 and the Orbis database, Maurin and Pál (2020).*
Note: *Solvency risk is the share of firms with negative equity. Default risk is the share of firms with an interest rate coverage ratio below 1.*

Figure 7

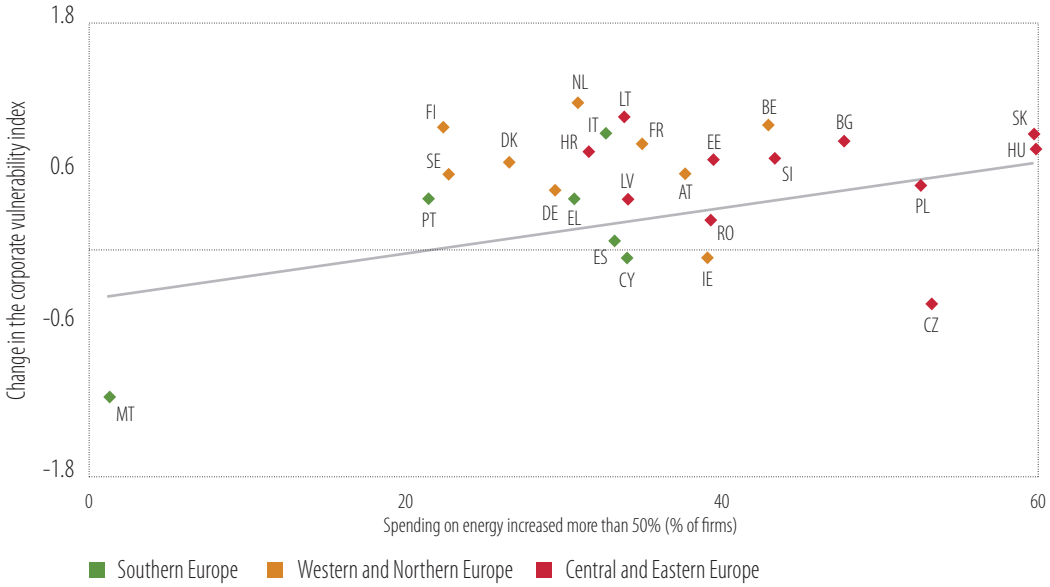
Firms ceasing to operate (left axis: an index, 2018Q1=100) **and weak firms across sectors** (right axis: percentage point change in share of firms at risk of default)



Source: *EIB staff calculations based on Eurostat.*
Note: *Four-quarter moving average. Firms ceasing to exist tracks the number of bankruptcies, which is indexed to the first quarter of 2018.*

Figure 8

Rise in the energy bill compared to corporate vulnerabilities



Source: *EIB staff calculations based on Eurostat, ECB and Alvares et al. (2024).*
Note: *The indicator replicates the EU indicator portrayed in Figure 5 at the country level. The last data available are for the change from the first quarter of 2023 compared to the same period a year earlier.*

Bankruptcy rates are rising. Figure 7 shows that bankruptcies declined during the COVID-19 crisis – despite the rise in vulnerability and risk metrics – because insolvency procedures were suspended in most EU countries. As normal procedures have been reinstated, weak firms are being wound down, and bankruptcies have been on the rise again since the beginning of 2022. In mid-2023, bankruptcies surpassed the rate before the pandemic as government support was removed and the decline in economic activity began to be felt.[4] Albuquerque and Lyer (2023) show that unproductive and unviable firms have been rising worldwide, especially since the global financial crisis and COVID-19.

The impact of COVID-19 continues to materialise across sectors, but the effect is now blurred by the energy crisis. Figure 7 focuses on five sectors and examines the evolution of bankruptcies since 2019 and sales losses due to COVID-19 expected in 2021. The higher the increase in the simulated default risk, the stronger the rise in bankruptcies. Clearly, in the sectors that were expected to be immune to the crisis (such as wholesale trade) or in those that benefited from it (such as information and communication), bankruptcies decreased. Conversely, the sectors most affected (such as accommodation and food service or transport) recorded an increase in bankruptcies compared to before the crisis (EIB, 2022). The energy crisis has tended to affect manufacturing sectors more. While tourism was the hardest hit by COVID-19, other sectors, such as transportation, show a deterioration in bankruptcies and in the simulated default risk indicator. Wholesale and retail trade sectors were also affected, while other sectors like information and telecommunications came through these two shocks relatively unscathed. Cross-sectoral results reinforce the concentration of vulnerabilities in specific sectors and regions (Archanskaia et al., 2022).

Box A

Electricity prices and perspectives on competitiveness

While natural gas prices dropped significantly in 2023, after surging in 2022 when Russia invaded Ukraine, the EU electricity prices remain considerably higher than those in the United States or China. The lower cost of producing renewable energy should start to bring down electricity prices in Europe around 2030.

Europe is struggling with high energy prices

In the summer of 2023, wholesale natural gas prices were EUR 30 to EUR 40 per MWh[5] and were much more stable than in 2022, a year marked by the volatility stemming from Russia's withholding of natural gas supplies. In the 15 years prior to the 2021-2022 crisis, prices were EUR 5 to EUR 35 per MWh. EU electricity prices for 2023 (driven by coal and gas) are EUR 120 to EUR 150 per MWh, vs. EUR 40 to EUR 60 per MWh from 2010 to 2021.

The gap between the prices European firms pay for electricity and those of their main international trading partners has increased (Figures A1 and A2). The energy crisis and the war in Ukraine has led to an exponential increase in natural gas prices and a convergence of the prices paid in Europe and Asia. It also led to a temporary exacerbation of high prices in European Union compared to the United States. Even before the peak in the summer 2022, EU electricity prices were two to five times higher than US prices, and gas prices were three to five times higher.

The deployment of renewable energy needs to be accelerated so that Europe can remove natural gas from the electricity mix as soon as possible. Under current projections under REPowerEU and Fit for 55, EU gas prices will continue to increase until 2030 as Europe weans itself off of foreign sources.[6]

4 The percentage of firms going bankrupt declines or increases with activity after some time. Under normal economic conditions – when GDP is around its full potential – 6% of firms typically record losses above the book value of their equity base, becoming technically insolvent. But although a corporation is technically insolvent when it has zero or negative equity, it may be still able to meet its payment obligations (see EIB, 2022).

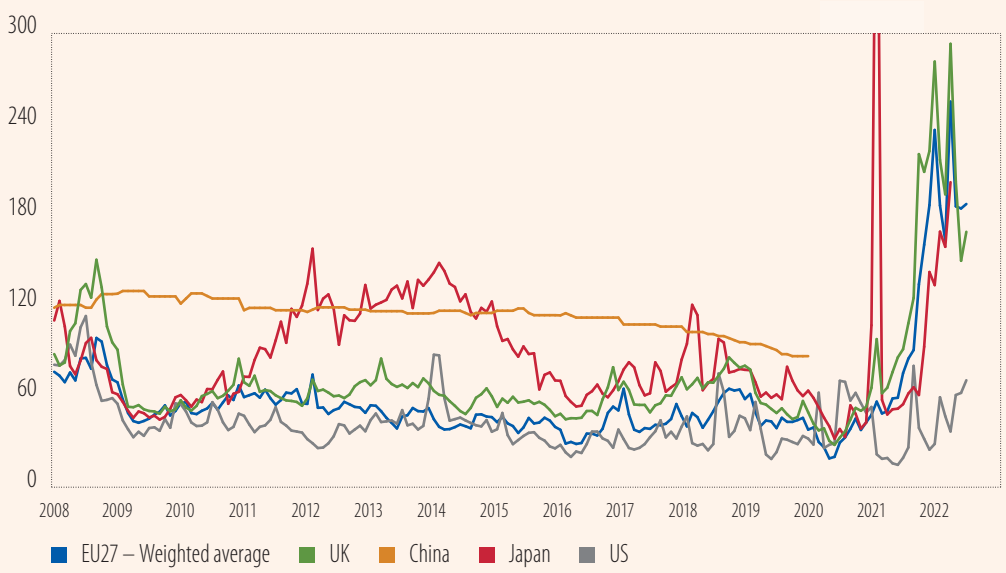
5 ACER liquified natural gas price assessment and benchmark at: Price assessments; Platts (S&P Global Commodity Insight) tracking Dutch Title Transfer Facility gas prices.

6 See the European Commission impact assessment.

Markets also anticipate that EU prices will remain above historical averages until 2025-2026, partly because of a tight global market for liquified natural gas. This means that the price difference with the United States (while much lower than during the crisis) could grow over time, with cheaper abundant gas relatively uninfluenced by liquified natural gas markets.

Figure A.1

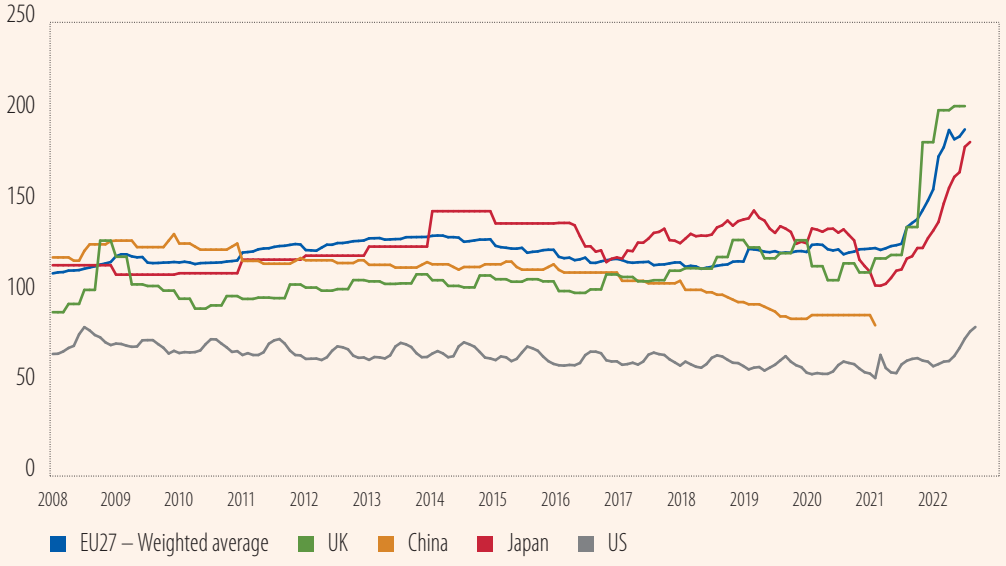
Differences in EU energy prices vs. global trading partners (EUR 2021/MWh)



Source: *2022 Energy Prices and Costs Report (forthcoming study by Trinomics et al., based on Eurostat, US Department of Energy, Enerdata and International Energy Agency (IEA)).*

Figure A.2

Industrial retail electricity prices: European Union vs. United States, United Kingdom, China and Japan (EUR2021/MWh)



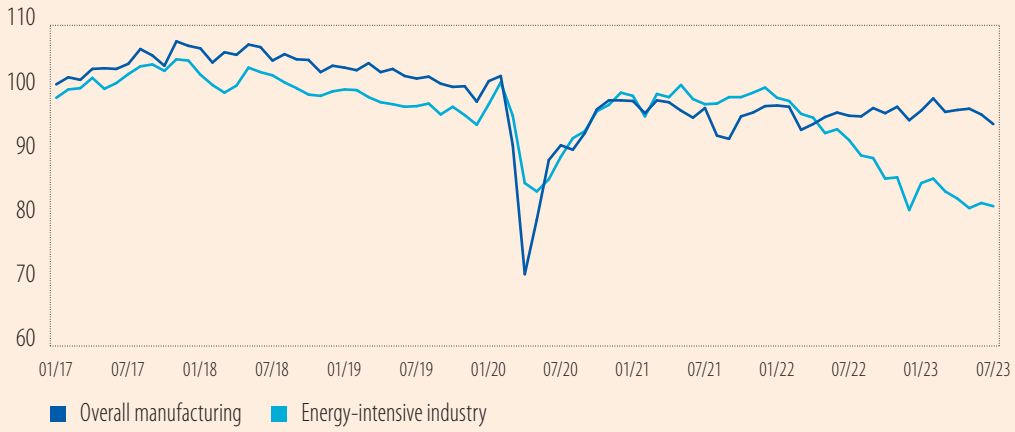
Source: *2022 Energy Prices and Costs Report (forthcoming study by Trinomics et al., based on Eurostat, US Department of Energy, Enerdata and IEA).*

Obviously, high prices hurt energy-intensive industries. The energy crisis has caused a drop in production in gas-hungry sectors that seems partly structural in nature, as there is no sign of it reversing even if prices decrease.

Demand has not only declined in industry, it has also weakened from consumers. While measures to save energy, in addition to reduced production of gas-intensive goods, are behind decreased demand for industry, the deployment of heat pumps and changing behaviours have contributed to the decrease in household energy consumption.

And yet overall manufacturing output remained relatively stable (Figure A3). National data from Germany show that from August 2022 to July 2023, the 20% average monthly reduction in gas consumption in industry came with just a 3% average monthly reduction in production. For energy-intensive industries, however, monthly output fell much more (on average 14% over the same period).

Figure A.3
Industrial production in manufacturing and energy-intensive industries in Germany (production index, 2015=100)



Source: *The Federal Statistics Office of Germany.*

The energy crisis in 2021-2022 could have fuelled structural changes on EU electricity markets. The crisis has shown that EU members using a higher share of gas for electricity generation, like Italy, pay higher prices than those relying on other sources, such as the Nord Pool power exchange in Northern Europe, which relies heavily on hydropower and wind. The rapid rise in natural gas prices has also widened the gap in electricity prices between countries, as prices are higher for those that rely more on natural gas.

EU countries that introduced measures to limit high natural gas prices being passed on to electricity markets managed to contain the spike in electricity prices, especially when natural gas was historically high. At the worst points of the crisis, the large differences in the prices of wholesale electricity gave a competitive advantage to Spain and the Nordic countries.

It will take a while for renewable energy to bring down electricity prices

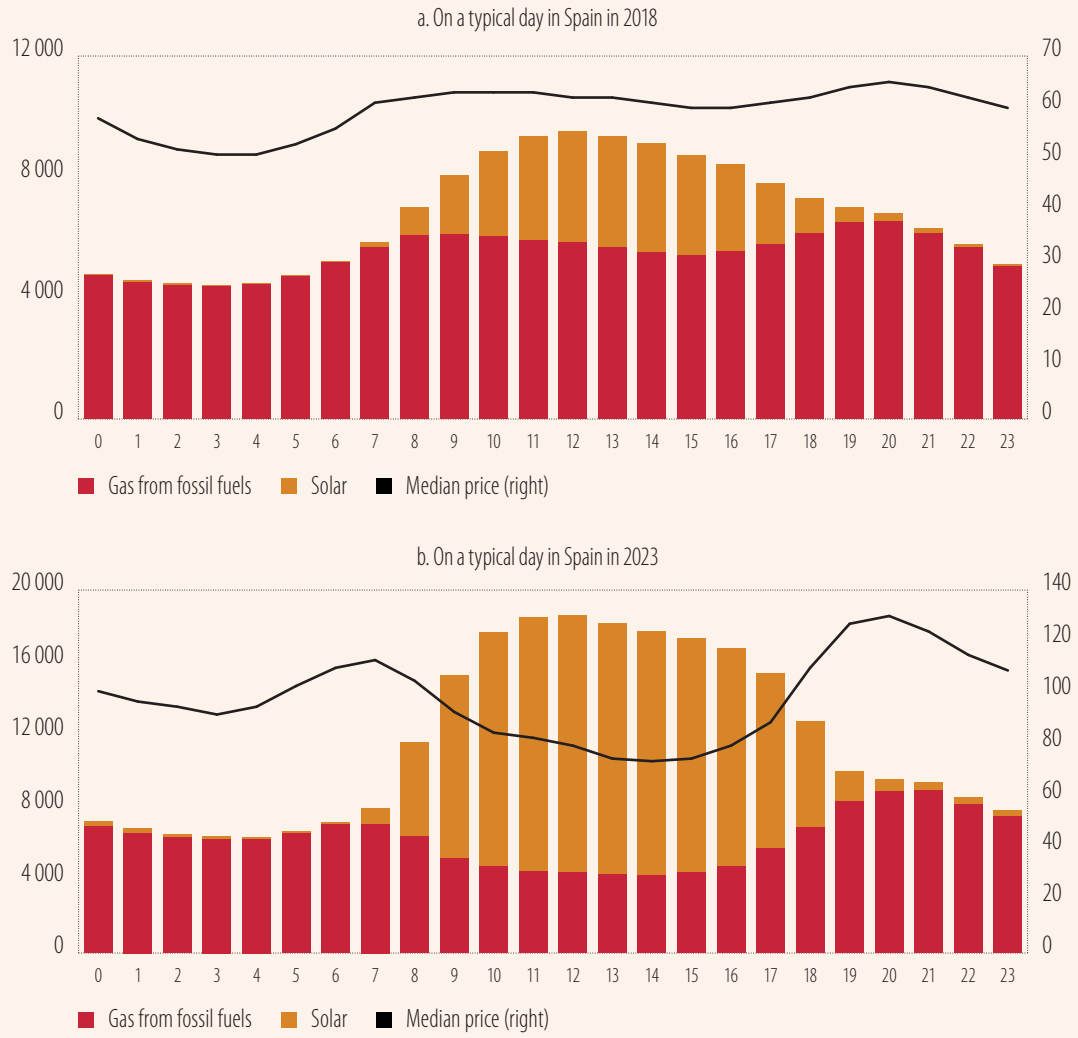
Europe's future competitiveness will depend on the speed with which it deploys renewable energy. At the current rate, renewable energy will not be able to replace fossil fuels until the 2030s, at least for the majority electricity consumption (Gasparella et al., 2023). However, pushing through the transition to clean energy as fast as possible will deliver clear benefits.

EU members that can remove fossil fuels from the electricity mix earlier will have a massive competitive advantage (Figure A4). While renewable energy generation is projected to grow from 46% to 67%

during the current decade (Gasparella et al., 2023), lower wholesale prices will take longer to materialise, partly because of limited storage capacity and the need for more flexibility in energy systems. The influence of renewable sources will become more apparent in the future, when projected renewable generation is able to fully meet EU demand.

Figure A.4

Price fluctuations in the daily production of natural gas vs. solar power (left axis: MWh; right axis: EUR/MWh)



Source: The European Commission's Directorate-General for Energy, based on the ENTSO-E Transparency Platform.

The future evolution of electricity prices in different EU members may affect where industry locates. Available data[7] suggest that from 2021 to the first quarter of 2022, energy-intensive sectors could see their energy costs increase 20-55% on average (like ferroalloys and silicon, primary aluminium, ceramics, container glass or zinc). Industries particularly dependent on electricity could suffer the most in the short term.

7 From the forthcoming 2023 Energy Prices and Costs Report by the European Commission, which is based on the upcoming Trinomics et altri (2023) study.

In the longer term, lower-cost renewable energy and corresponding lower electricity prices could support the production of hydrogen, which will be essential for decarbonising energy-intensive industries, especially gas-intensive ones. There will be economic incentives to produce and locate gas-intensive (and in the future hydrogen-intensive) manufacturing in countries with lower electricity prices – countries that have managed to deploy renewable energy on a large scale. That is unless hydrogen transport costs are low enough to ensure similar prices for manufacturers that are physically far away from renewable energy sources.

Uncertainty about the future prevails as the economy undergoes structural changes

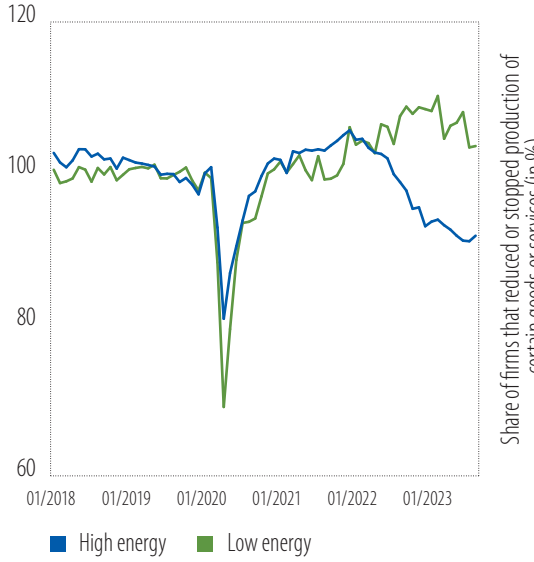
The recent rise in corporate vulnerabilities clearly reflects the energy crisis. The price of natural gas in Europe increased five-fold after Russia's invasion of Ukraine. The negative shock to gas supplies caused a decline in economic activity and a sizeable impact on companies (Alessandri & Gazzini, 2023). In Figure 8, we correlate the change in the vulnerability indicator with the share of firms in the EIBIS that report a more than 50% rise in their energy bill. The higher the share of firms reporting a large increase in energy costs, the stronger the rise in vulnerabilities. Countries in Central and Eastern Europe tend to have a larger manufacturing sector and an energy mix more reliant on gas and coal. Hence, most of them (such as Poland, Hungary, Slovakia, Bulgaria and the Czech Republic) reported a bigger increase in energy prices. As energy dependence is higher, they also recorded a sharper rise in corporate vulnerabilities.

Production paths have diverged according to energy dependence. As explained above, energy dependence varies from country to country. But overall, the energy bill has risen by 60% for EU firms during the energy crisis, clearly more than for the United States and other major trading partners.[8] Figure 9 looks closely at manufacturing, distinguishing high energy-intensive sectors from low energy-intensive sectors. The rise in energy costs had a greater impact on higher energy-intensive sectors (see Box A). In the second quarter of 2023, their production was still 14% below 2019 levels, much worse than the 4% for sectors that are not energy intensive.

Increases in the relative price of brown energy sources, like coal, reduce energy consumption in the short term. Barci and Maurin (2024) build a Brown Energy Price Index (BEPI) for EU economies and sectors. This index is then incorporated into panel vector autoregression (PVAR) models to analyse reactions to price shocks, impacts on economic activity and changes in the energy mix.[9] At the macroeconomic level, a positive shock to the BEPI triggers some substitution between brown and green energy. In fact, the EIBIS 2023 shows that energy efficiency investments have increased with the change in energy prices. As the substitution falls short of the energy needs, output contracts. Looking at the sector level confirms the substitution effect and an adverse impact on activity. Moreover, the magnitude of the response is correlated with the intensity of the sector's dependence on brown energy.

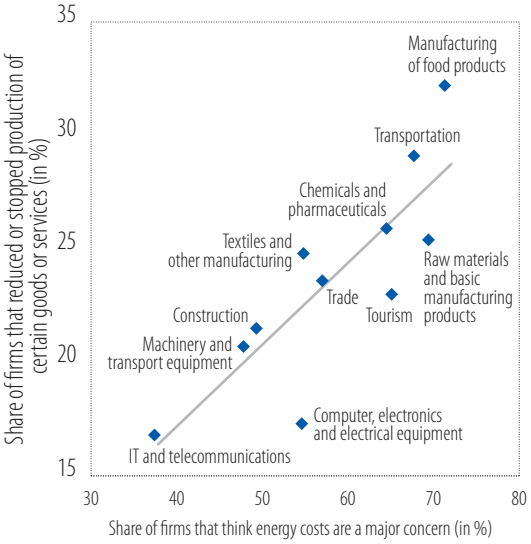
8 In 2023, the value of EU energy imports more than doubled compared to the pre-pandemic period, rising to EUR 776 billion in 2023 from EUR 328 billion in 2019.
9 The panel dimension comes from the 13 EU economies, and it is applied to five economic sectors.

Figure 9
Production of high and low energy intensive sectors (an index, 2019=100)



Source: *EIB staff calculations based on Eurostat.*
Note: *High energy intensive sectors are pulp and paper, coke, refined and petroleum, chemicals, non-metallic minerals, such as cement, basic metals and refinery. The other sectors are classified as low energy intensive. Last data available are for August 2023.*

Figure 10
Energy price as major concern and whether it caused firms to reduce or stop production



Source: *EIB staff calculations based on the EIBIS 2023.*
Question: *X-axis: Thinking about the energy shock, to what extent is your company concerned about energy prices?*
Y-axis: For the current financial year, do you expect your total investment spend to be more than last year?

As the green transition continues, higher energy prices may cause economic specialisations to change. Depending on energy intensity and on the nature of the energy mix, changes in energy prices ripple unevenly through sectors and countries (Barci & Maurin, 2024). As most EU energy is imported, a rise in prices resembles a negative supply shock. On the one hand, it harms the competitiveness of the most energy dependent sectors. If it is long lasting and perceived as permanent, heavily energy-dependent sectors may see their export performance weaken in the long term, and the sectoral structure of the economy may change. On the other hand, firms may record stronger productivity gains in the longer term. André et al. (2023) show that a shock corresponding to a 10% increase in energy prices is associated with an overall rise in productivity of around 0.9 percentage points four years after the shock. These gains are more likely in less energy-intensive sectors, but they tend not to materialise for larger shocks. There is some evidence that previous investments explain the productivity gains, since they are larger for firms that had invested in capital just before the shock. Energy prices in Europe will almost certainly stay above pre-crisis levels, as building renewable energy capacity takes time. In the long run, however, substituting renewable energy for brown sources should drastically reduce energy costs (see Box A).

Across sectors, energy crises may alter the structure of production. In Figure 10, we associate the share of firms reporting energy prices as a major concern with these firms' plans to stop or reduce certain goods or services to cope with recent energy developments. There is a clear positive association across sectors. Hence, production plans are shaped by energy concerns. Some changes in the production structure is therefore likely but it may be temporary, as firms expect energy prices to lower in the long term (when Europe begins to produce most of its energy from renewables). In fact, de Santis and Tornese (2023) show that energy supply shocks have a non-linear impact on output and prices.

External finance is harder to come by, but profits are higher

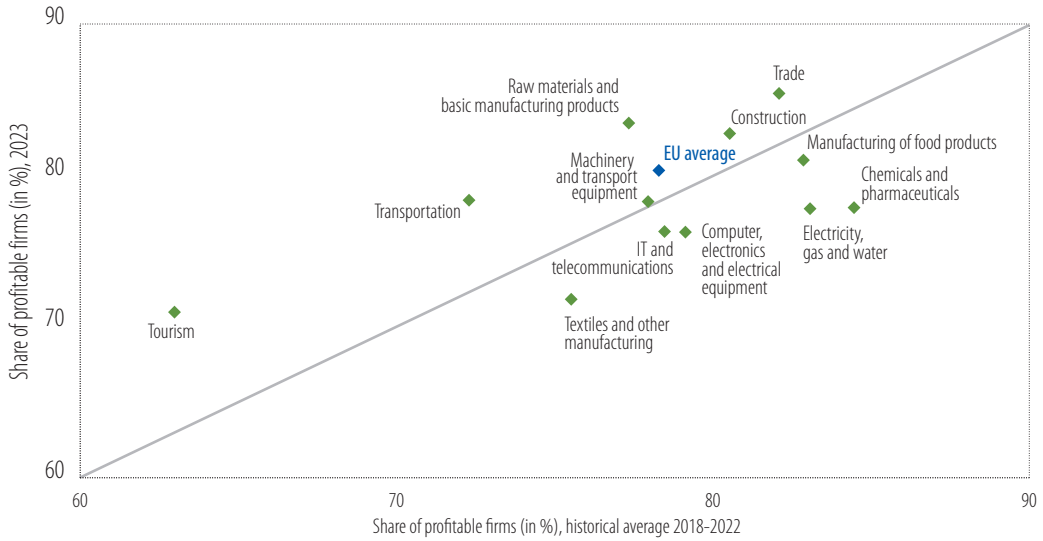
We review the latest developments in internal and external finance to show that internal funding sources have proved resilient, underpinned by strong government policies. This support has paved the way for capital expenditure to rebound strongly. However, the sharp tightening in monetary policy is likely to take a toll on corporate investment as firms burn through cash. In particular, we analyse how internal finance can cushion the impact of adverse conditions for external finance.

Firms recorded strong profits by passing cost increases on to clients

Profits rose strongly in the first half of 2023. In Figure 11 we report the historical average of profitable EU firms vs. the share of profitable firms in 2023 for 12 sectors of the economy. In 2023, 80% of European firms were profitable, compared with 78% historically. Thus, the 2023 share is 2 percentage points above historical average for the EU economy overall. This is consistent with statistical data showing that in the middle of 2023, the profit share of the EU firms was 1 percentage point above its historical average (Figure 2). The strong recovery in profits that started in 2022 (EIB, 2023a) a continued in the beginning of 2023.

Still, performance varies by sector. In Figure 11, the strong profit performance is particularly evident in the sectors that fall well above the 45-degree line, like tourism, food manufacturing or trade. Conversely, electricity, gas, and chemicals and pharmaceuticals fall well below the line. The first group of sectors benefited from reopening external trade and relaxing tensions in global supply chains, while the second group was hit hard by the energy crisis because production was highly dependent on energy.

Figure 11
Profitable firms in 2023 compared to the historical average



Source: EIB staff calculations based on the EIBIS 2018-2023.

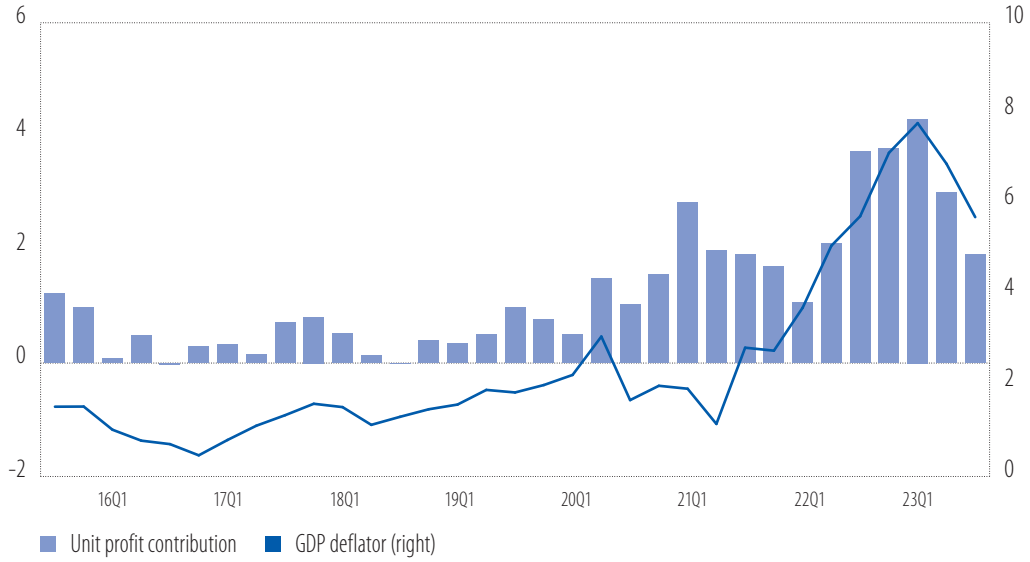
Profits have been buoyed by rising prices, but at the cost of fuelling inflation. Figure 12 shows the evolution of the value-added deflator together with a proxy for the contribution of profits represented by unit margins.[10] It appears that since the beginning of 2022, firms have been able to expand their unit

10 The GDP deflator reflects the evolution of the price of one unit of good consumed domestically. It results from changes in unit labour costs (compensation of employees per unit of real GDP), unit taxes (reflecting taxes on production, net of subsidies, per unit of real GDP) and unit profits (gross operating surplus per unit of real GDP).

profits in an environment of strong demand, despite rising energy prices. We see that since the beginning of 2022, the contribution of unit profits has been well above recent history, as the shock of higher costs has so far been neutralised, and unit margins have increased (see Box B) (Schnabel, 2023). While from 1999 to 2022, unit profits contributed around one-third to the GDP deflator, on average, over 2022 they contributed an average of two-thirds (Arce et al., 2023). Rising prices of final goods mitigate trade shocks and higher input prices and boost corporate profits. Higher costs are passed on to selling prices, thereby limiting the impact on profit margins and strengthening corporate balance sheets.

Figure 12

How profits contribute to inflation (left axis: unit profit contribution, in percentage points; right axis: GDP deflator, in %)



Source: *EIB staff calculations based on Eurostat.*
Note: *Last available data is for the second quarter of 2023. The GDP deflator is based on the EU value-added defalator.*

Box B

Investment decisions under high inflation

The high inflation that began in the second half of 2021 has started to affect real incomes, depleting household savings and depressing demand. This is expected to affect investment. Pressure on demand, as well as expectations of a worsening economic outlook, will likely prompt firms to pull back on planned investment (EIB, 2023a; Kolev & Randall, 2023). Past studies have shown that inflation rates above 10% are more likely to reduce investment (Asab & Al-Tarawneh, 2018; Fan et al., 2023).

Inflation can affect investment in two ways. First, higher inflation can directly hurt profitability, weakening internal financing (the main source of investment financing). Unless firms manage to adjust prices immediately, inflation will increase their material and labour costs compared to their revenues, squeezing profit margins and leaving fewer liquid assets available to finance investment.

Secondly, with central banks increasing interest rates to fight inflation, external financing is also challenging. The higher financial costs caused by higher interest rates directly affect firms' profitability and their ability to access external funding. Indirectly, the decelerating demand, tempered by tighter monetary policy, results in lower sales and therefore lower profits.

Thus, although high inflation and investment tend to share a negative relationship, a few drivers will maintain or even accelerate investment short-term, even when inflation is rising. These drivers explain the current situation of relatively resilient investments in a time of historically high inflation and tightening financial conditions.

The effect of inflation on investment is tested both across the whole sample (EIBIS 2016-2022) and separately for the post-pandemic period (EIBIS 2021-2022). We regress the probability of a firm in country i and sector j expecting more investment in the current financial year (compared to the previous one) on the inflation rate in the sector and the country, as measured by producer prices, lagged by two-quarters;[11] a matrix of firm-specific controls like profitability, external financing constraints, reporting uncertainty about the future as a major investment barrier, and the effect of government support; a matrix of country-level macroeconomic controls like GDP growth rate and monetary policy rate; and a set of country-, year- and sector-specific fixed effects. Empirical findings are summarised in Figure B1.

The empirical findings indicate that for 2016-2022, inflation at "very high" levels (annual rates of over 20%) presents a statistically significant and positive association with a firm's decision to invest. The probability of a firm increasing investment is 3.7 percentage points higher than in the baseline situation of "low" inflation (between 0% and 5% inflation) – rising from around 32.8% to 36.5%. This significant association persists even if the analyses are restricted to the post-pandemic period, when inflation rates began to surge (2021-2022). In the following paragraphs we provide some explanations for this positive relationship.

First, the recent inflation spike has been strongly driven by higher prices for energy and other inputs (like raw materials), which have pushed firms to invest in energy efficiency to save costs. We find evidence of a positive and statistically significant association between "very high" levels of inflation (over 20%) and higher probabilities of investment in energy efficiency in 2022 (a 9.2 percentage point increase compared to a "low" inflation period). Firms that view energy prices as a major obstacle are also more likely to invest in energy efficiency measures – by 7.1 percentage points in 2022. This is in line with previous studies showing that increased energy costs can prompt firms to invest in energy efficiency, and that energy-intensive firms are more likely to invest in energy efficiency (EIB, 2023a; Kalantzis & Niakaros, 2020). Moreover, policies like the European Green Deal have boosted investment in green measures, which may help explain the positive association (European Commission, 2021).

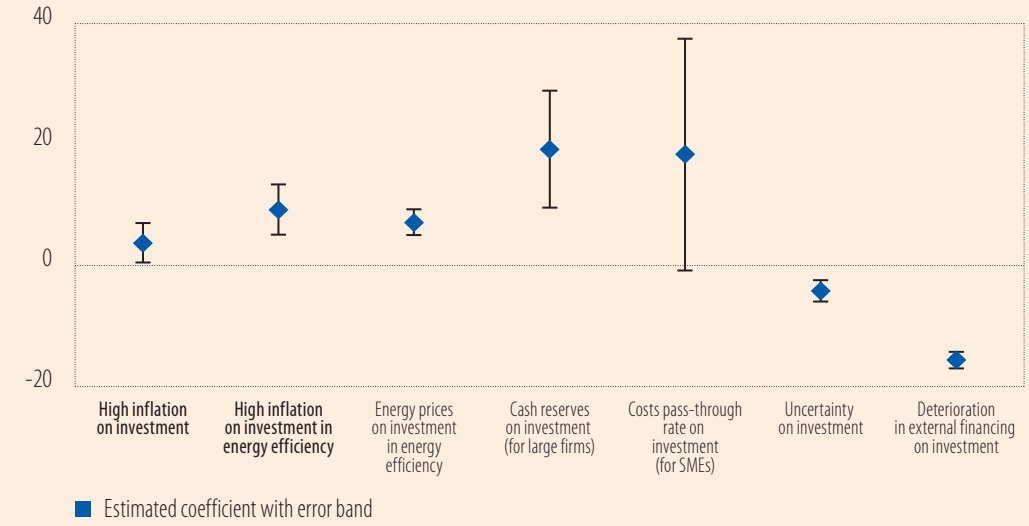
Second, firms with large cash reserves or easier access to external financing may weather this high inflation environment better (Cleary, 1999; Cleary et al., 2007). Liquid assets are more vulnerable to the negative impact of inflation, so investing them may protect from devaluation (Ferrando & Pál, 2024). Statistical data shows that European firms substantially increased their cash buffers before the energy crisis hit, helped in part by the massive COVID-19 support. These higher cash reserves might enable current investments to continue or necessary investments in energy efficiency to be made (Ampudia et al., 2023). Analyses show that 1 percentage point higher cash to total assets is associated with an increased probability of increasing investment of 18 percentage points for large firms, while the association is statistically insignificant for smaller businesses.

Third, we find a positive association between firms' ability to pass higher costs on to customers (pass-through) and the probability of making more investment in selected areas of manufacturing and infrastructure. The ability to pass through costs reduces the immediate negative impact on profitability, and internal sources of financing are less affected. The average marginal effect is to increase the probability of undertaking more investment in the current financial year by 11.3 percentage points across all firms and 18.4 percentage points for small and medium firms, and to decrease it

11 Producer prices are lagged by two quarters to allow firms to update their strategies. Producer price indices were collected for every quarter to create a lagged variable, and then aggregated at the annual level. Consumer prices, as measured by the harmonised index of consumer prices, is only available for months, so it was first aggregated quarterly to match the Producer Price Index, Services Producer Price Index, Consumer Price Index, and Labour Cost Index, and then annually, to be merged with the EIBIS dataset.

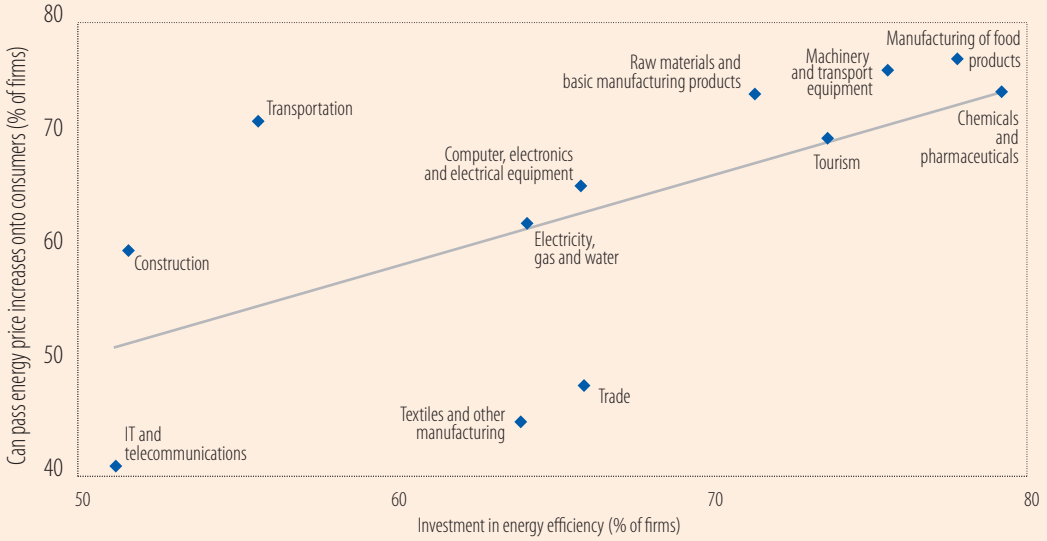
by 14.7 percentage points for large firms. This may suggest that because smaller firms do not have large cash reserves, they are more reliant on continuously generating revenue, which could be used to internally fund investment. Confirming the empirical results, Figure B2 presents the positive relationship between firms' passing on the energy price to customers and their capacity to invest in energy efficiency, based on EIBIS 2023.

Figure B.1
Determinants of increased investment or investments in energy efficiency



Source: *Schito et al. (2024).*

Figure B.2
Investment in energy efficiency and the ability of firms to pass energy costs onto consumers



Source: *EIB staff calculations based on the EIBIS 2023.*
Question: *X-axis: Is your company investing or implementing any of the following, to reduce greenhouse gas emissions? Answer B: Investing in energy efficiency. Y-axis: Which, if any, of the following, are your priorities/strategies to deal with the recent developments in the energy market? Answer D: passing increasing energy costs to customers*

Firms with the advantage of having accumulated cash or fixed-rate borrowing before monetary tightening took hold could continue investing in the short term. However, negative effects are expected to emerge in the medium to long term as financing sources diminish, even though the green and digital transformations will remain a priority. Moreover, once cash buffers thin and current financing matures, external financing for new investments would only be available at a cost significantly higher than in the previous period (more than double), and only projects with high profit margins would be eligible for new financing. Overall, the analyses show that the by-products of inflation – including higher interest rates, tighter external financing conditions and higher uncertainty – have a significant negative impact on firms' investment. That impact may become visible when economic conditions deteriorate.

Moreover, certain groups of liquidity-poor firms face structural bottlenecks (on top tighter monetary policy) that impede their investments. Firms that are small, young and innovative and have a higher share of less bankable intangible assets, or those that cannot pass higher cost onto their customers, may have more limited investment sources to turn to, resulting in delays or gaps in their development and transformation. Finally, some firms might be more affected by more difficult conditions for external finance because of weaker finances, like high leverage or lower profit margins, which can make it hard for them to afford new loans or other sources of external financing (Ferrando & Pál, 2024).

More challenging external financial conditions are affecting firms unevenly

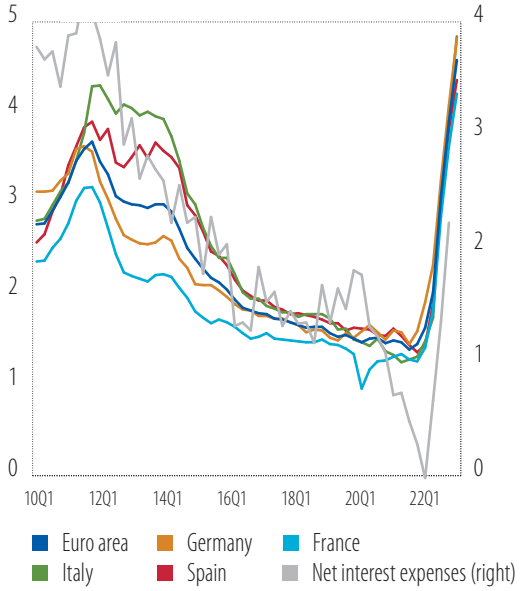
The abrupt move to tighter monetary policy that began in mid-2022 continued into late 2023. The relatively young euro area has come through just one previous cycle of tightening, from 2005 to 2008, and the current cycle is much sharper. Short-term rates in Central and Eastern European economies increased by more than 800 basis points, well above the 450 basis points for the euro area as a whole since July 2022.

Rising market rates spread to corporate bank borrowing, in line with historical patterns. Figure 13 reports the composite cost of bank borrowing for businesses in major euro area economies. From mid-2022 until the third quarter of 2023, monetary policy rates rose by 450 basis points in the euro area. Over the same period, the cost of corporate bank borrowing increased by 300 basis points. At close to two-thirds, the pass-through rate is in line with historical patterns (Lane, 2023). Although the sharp increase in borrowing cost is impressive for such a short period, it merely reflects the speed of the monetary policy tightening, which is unprecedented for the euro area.

Firms' borrowing costs beat their ten-year high and are set to exceed historical records. Borrowing costs reached their highest level of 6% in August 2008 when the rate on marginal refinancing operations rose to 425 basis points, after increasing 225 basis points during the cycle. Assuming monetary policy rates remained at September 2023 levels, the cost of bank borrowing for euro area firms would plateau at more than 6% in the beginning of 2024. So far, the transmission of monetary policy has proceeded very similarly across the major euro area economies.

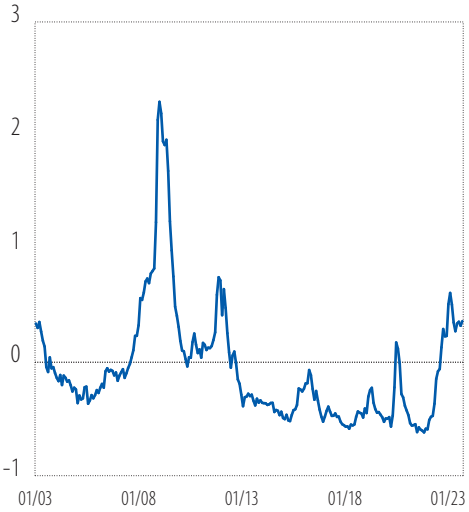
Following rate increases, net interest expenses started to surge, but remain below historical highs. Figure 13 plots the net interest expenses of non-financial firms as a share of GDP. As firms also receive interest revenue, for example from intra-trade credit, expenses must be netted out to analyse the impact on profit. Net interest expenses have risen from a low of close to zero in the beginning of 2022 to more than 2% of GDP in mid-2023. The percentage has now returned to the level recorded in 2014, well below the recent high of 4% reached in 2010. The delayed response reflects firms' having increased the share of fixed-rate financing when rates were ultralow (Figure 19). Net interest expenses will likely keep increasing as firms refinance loans at higher rates (Ampudia et al., 2023).

Figure 13
Corporate bank borrowing costs and interest expenses (left axis: in percentage points; right axis: net interest expenses, % GDP)



Source: *EIB staff calculations based on the ECB and Eurostat.*
Note: *Borrowing costs are based on a three-month moving average. Net interest income is interpolated from quarterly data. Lastest data for the cost of borrowing is the second quarter of 2023, and for net interest expense the first quarter of 2023.*

Figure 14
EU financial condition index (de-meaned)



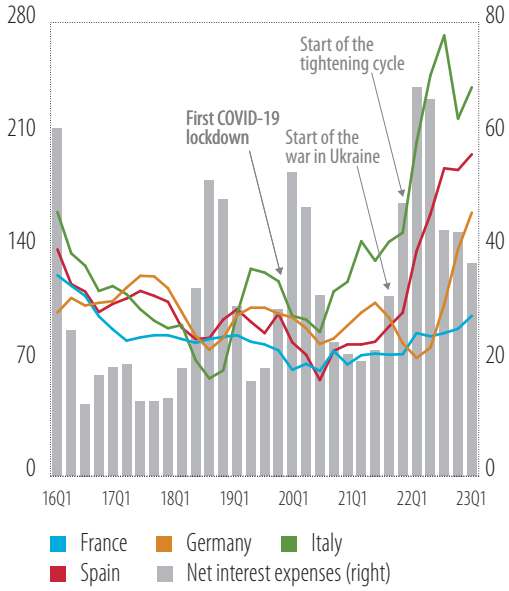
Source: *EIB staff calculations based on Andersson et al. (2021).*
Note: *An increase reflects a tightening. The values are de-meaned over the period 1999-2023. Last data available are for June 2023.*

Financial conditions tightened. Figure 14 reports an estimated index of financial conditions based on a large set of series related to financial prices and quantity (Andersson et al., 2021). From the start of 2022 until the very beginning of 2023, the index rose from softer-than-historical conditions to slightly tighter ones. The neutral line – the plotted historical average since 1999 – was crossed in September 2022. The latest record, 0.4, is slightly in tightening territory, but well below the high of 2.4 recorded during the global financial crisis.

The financial system withstood tightening financial conditions. First, as shown in Figure 14, financial market tensions recorded around the bankruptcies of Silicon Valley Bank and Credit Suisse in February and March 2023 are largely overlooked by the indicator. The pessimistic scenario of a large financial crisis that was depicted by some analysts did not materialise, as the regulatory reforms implemented since the global financial crisis have strengthened the resilience of banks and the financial system.

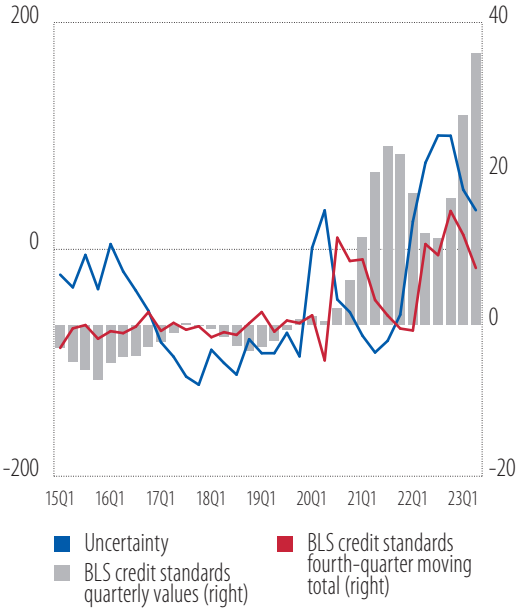
Risk premiums fell back from the highs recorded after the Russian invasion in Ukraine. Figure 15 shows that the spread between 5-year A and BBB bonds increased from 20 basis points to 70 basis points in mid-2022, when the risks of the war in Ukraine escalating were at their worst and when central banks started to tighten monetary policy. Since then, it has receded to around 40 basis points as investors realised that firms were adjusting to monetary tightening and were withstand higher borrowing rates for longer than initially thought.

Figure 15
Risk and size spreads (left axis: spread in borrowing costs, in basis points; right axis: spreads on bond yields, in basis points)



Source: *EIB staff calculations based on the ECB and Refinitiv.*
Note: *The size spread is the difference between the cost of borrowing on small and large loans (below EUR 250 000 and above EUR 1 million, respectively). The risk spread is measured as the yields on 5-year BBB corporate bonds minus that of A-rated corporate bonds issued in the euro area. Last data available are for the third quarter of 2023.*

Figure 16
Credit standards applied to corporate loans (left axis: uncertainty, in basis points; right axis: credit standard, in basis points)



Source: *EIB staff calculations based on ECB and Refinitiv.*
Note: *Uncertainty is calculated using the weighted average of bond and stock volatility and the ECB Composite Systemic Risk Indicator. Last data available are for the second quarter of 2023. BLS stands for Europe's Bank Lending Survey. An increase in the survey indicator reflects a net tightening.*

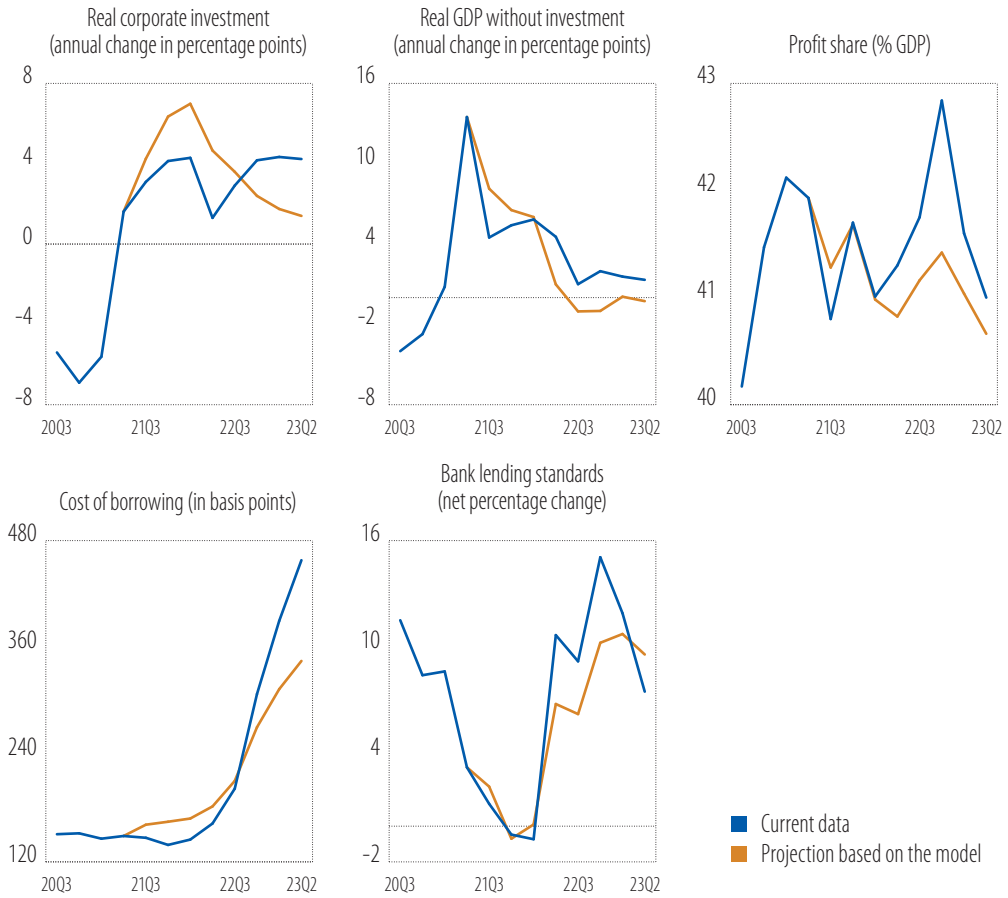
The spreads between the rates of euro area sovereign bonds widened but remain contained. As of the third quarter of 2023, compared to the last quarter of 2021, 10-year spreads with respect to the German sovereign bond are 10 basis points higher for France, 30 basis points for Spain and 50 basis points for Italy. Widening sovereign spreads could impair the European Central Bank's ability to influence monetary policy, fuel risk aversion and have varying effects on small and large bank borrowers.[12] Figure 15 shows that the size spread – the spread between the borrowing costs for small loans and large loans – ticked up until the end of 2022 (especially in Italy) and has stabilised or declined since then. The changes recorded in Italy and Spain are well below what was recorded during Europe's sovereign debt crisis in 2010-2012.

Bank lending surveys indicate a tightening in credit standards across European countries. Since the end of 2021, in cumulative terms, euro area banks reported more onerous standards for loans or credit lines (Figure 16). From the end of 2022, the tougher conditions have been linked to the more restrictive monetary policy, as banks have become more concerned about firm risks and asset quality. The EIB's Central, Eastern and South-Eastern Europe (CESEE) Bank Lending Survey also shows that banks in the region that have tightened conditions are expecting to continue to do so (EIB, 2023b).

12 Andersson et al. (2021) show that when driven by a financial shock, as during the previous crisis, tightened financial conditions impair loan provision, widening borrowing spreads by country and by borrower size.

Investment has remained relatively resilient so far, outperforming historical trends. Figure 17 shows the projection of investment starting in mid-2021. From mid-2022 until mid-2023, firms' investment exceeded expectations. This is partly explained by more resilient economic activity (real GDP also outperformed expectations over the same period), and stronger investment that took place despite higher borrowing costs, which also exceeded expectations. The sharp increase in the firms' profits, which rose up to 2 percentage points above expectations in early 2023, explains these developments. In parallel, tougher credit standards align relatively well with the expectations derived from the model.

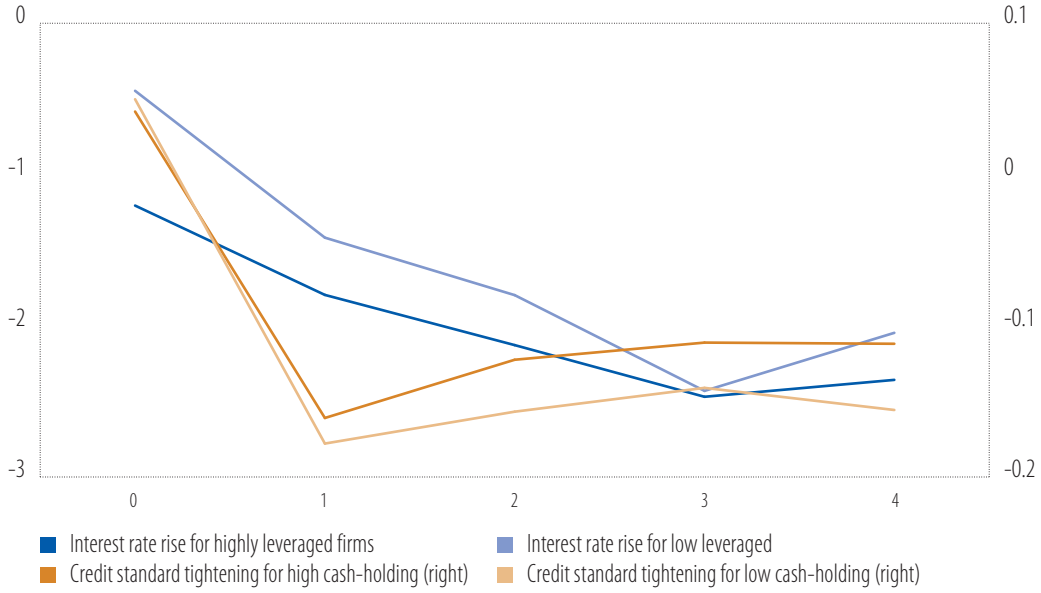
Figure 17
Impact of monetary policy tightening on investments and main financing variables



Source: *EIB staff calculations based on the ECB and Andersson et al. (2021).*
Note: *Bayesian vector autoregression (BVAR) estimations based on Andersson et al. (2021). The unconditional projection starts in the second quarter of 2021.*

The reaction of firms' investment to tighter monetary policy varies by type of firm. Figure 18 represents how investment reacts when interest rates rise 100 basis points or when the net balance of firms reporting tougher credit standards increases 10 percentage points (Alvares et al., 2024). In both cases, investment is negatively affected, but the response to interest rates is quicker. The investment rate decreases up to 3 percentage points the first year after the interest rate increase, and up 1.5 percentage points in the third year of tightening conditions. It is also interesting that in both cases, the negative response is more muted for firms with a stronger balance sheet, as these firms are less leveraged or have bigger cash holdings. Hence, the tightening in financial conditions is likely to hurt weaker firms more. Durante et al. (2020) also show that young firms and those producing durable goods are hit harder by monetary policy tightening.

Figure 18
How investment responds to interest-rate rises or credit tightening (left and right y-axes: the change in the probability of investing in percentage points; x-axis: years)



Source: *EIB staff calculations.*
Note: *See Alvares et al. (2024). The investment rate is measured as the relative change in firms' total assets.*

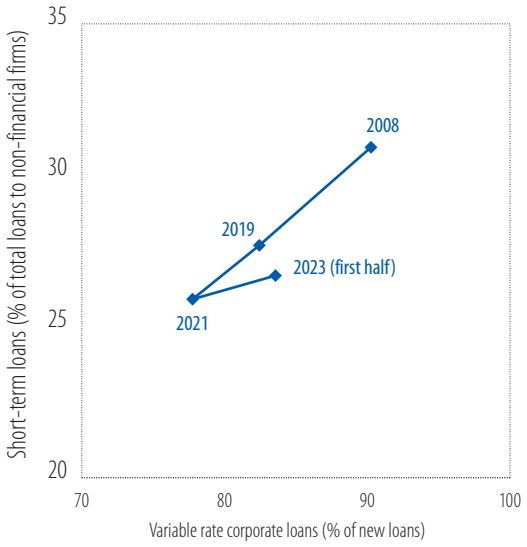
Finding alternatives to internal funding

Firms optimised their financial structure when rates were low, reducing their exposure to interest rate increases. Figure 19 shows the change in the shares of variable-rate loans and short-term loans. During the period of ultralow rates, firms restructured their bank loans to increase their maturity and lock them in at fixed rates. From 2008 to 2021, the share of variable rate loans declined from about 90% to 76%, and the share of short-term loans fell from 31% to 26%. Companies mainly have fixed rates with maturities of three to six years, which will gradually be refinanced at higher rates over time. Debt payments were less affected during the first period of monetary tightening[13] but the figure masks differences among EU countries. Fixed-rate loans are the norm in most euro area countries, while loans in Eastern Europe are more often based on variable rates, so the impact of tightening is more pronounced.

Firms' cash holdings are back to pre-COVID-19 levels. Figure 20 plots the cash position of firms over GDP. Following the pandemic support measures, firms tapped bank loans and built up cash in bank deposits (EIB, 2022). As the opportunity costs of holding cash rose, firms shifted into less liquid assets with better returns than bank deposit rates. Together with accumulated profits, cash and liquid asset holdings have financed the investment recovery, decreasing the cash firms have on hand. As of the first half of 2023, cash holdings are back on their pre-COVID-19 trend, down by 2 percentage points of GDP in late 2022.

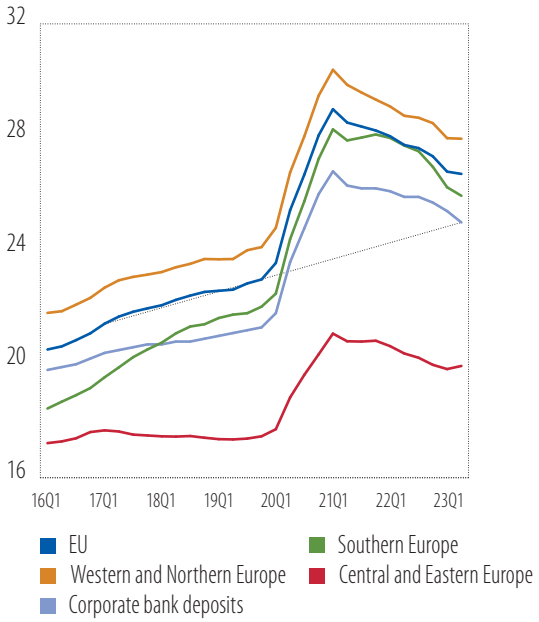
13 Ampudia et al. (2023) argue that the change protects firms against a sharp increase in financial costs/default and allows existing investment projects to continue. However, it still prevents new projects with substantially higher interest rates from being started.

Figure 19
Rates and maturities of corporate loans



Source: *Eurostat and EIB staff calculations based on the ECB.*
Note: *Short-term loans have an original maturity of less than one year.*

Figure 20
Cash and liquid-asset holdings
(% GDP)



Source: *EIB staff calculations based on Eurostat data.*
Note: *The light blue line expands the pre-COVID-19 trend.*

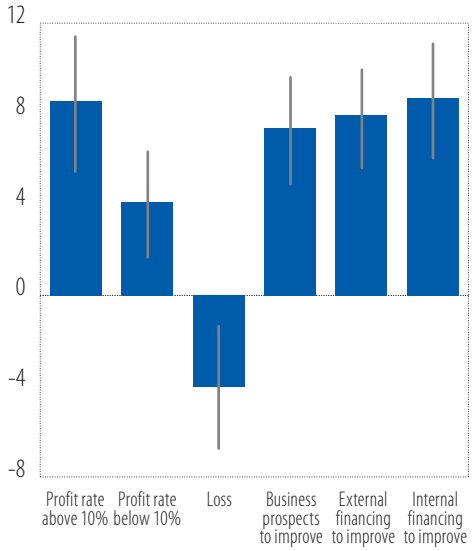
Firm characteristics influence the investment outlook. We use probit models to estimate the impact of financial indicators on investment plans, after controlling for several factors. The results are reported in Figure 21. Profitable firms are more likely to accelerate investment – up to 8 percentage points more for firms with high profits (of above 10% of turnover). Conversely, those that record losses are 4 percentage points less likely to raise investment. The impact of improving business prospects, access to external sources of finance and internal funding capacities are all positive and of a similar magnitude, around 8 percentage points. These effects, which are significant, confirm the role internal and external finance conditions play in investment decisions.

We look at two indicators of funding difficulties: one related to external funding and the other related to internal funding. Funding difficulties have a structural and a cyclical dimension. Structural barriers include how developed financial sectors are, or firm-specific characteristics like transparency, credibility, profitability or the share of tangible assets. But difficulties also vary with financial cycles. The "external funding difficulties" indicator is the share of profitable firms that need a loan but either were discouraged, did not receive it or received less than they needed, and the share of firms reporting that their external financing conditions worsened.[14] The "internal funding difficulties" indicator is the share of profitable firms reporting that their internal financing conditions worsened.[15]

14 When analysing for deteriorating external financing conditions, we account for financial viability by excluding firms if they have not been profitable for three consecutive years, as their lack of investment is likely the result of internal issues.

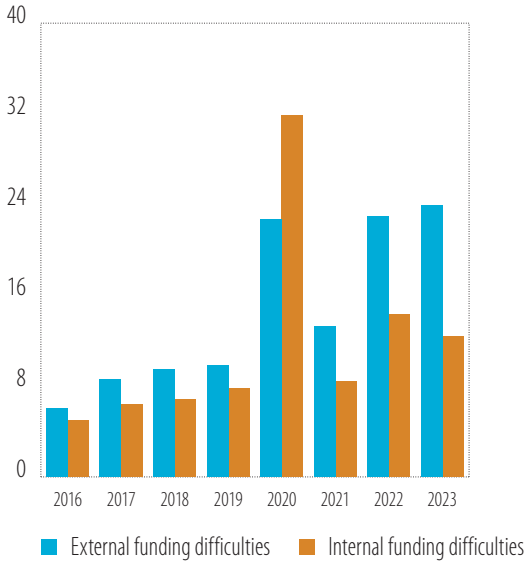
15 Again, to exclude the impact of unviable "zombie" firms, which are less likely to invest, only firms that have been profitable for three consecutive years are considered when analysing worsening financing conditions.

Figure 21
Impact on the probability of accelerating investment (EU estimates, percentage-point change in a firm's propensity to accelerate investment)



Source: *EIB staff calculations based on the EIBIS 2018-2023.*
Note: *For each impediment, a probit model is estimated to fit investment plans next year and over the three next years. Country, size, and sector dummies are used as controls.*

Figure 22
External and internal funding difficulties (% of firms)



Source: *EIB calculations based on the the EIBIS 2016-2023.*
Note: *See Ferrando and Pál (2024).*

External and internal funding difficulties evolve differently. Figure 22 shows the substantial variations in the indicators over time. The indicators tend to move in tandem. They react counter-cyclically with economic activity. Most of the time, external funding difficulties are more pronounced – except for in 2020 during the COVID-19 crisis, when profits slumped while external finance was supported by government guarantees. External funding conditions deteriorated even more recently, affected by sharp monetary tightening. This was much more pronounced than the deterioration in internal funding. Interestingly, the gap has widened since 2022 when the tightening started. In 2023, 14% of firms face internal funding difficulties, well below the 24% of firms facing external funding difficulties.

Both internal and external financing conditions have a bearing on investment. Ferrando and Pál (2024) estimate models with treatment effect methods to analyse the impact of internal and external funding difficulties on firm investments. The models control for firm characteristics and major investment barriers like uncertainty.[16] The results are reported in Figure 23. Firms facing external funding difficulties are 5 percentage points to 7 percentage points more likely to report an investment gap than those with no external funding difficulties. The effect is higher for firms with smaller cash holdings. In fact, a firm with external funding difficulties and low cash is 10 percentage points more likely to report an investment gap than one with external funding difficulties but a large cash buffer. The strongest impact is registered by firms with internal funding difficulties that are, on average, 14 percentage points to 23 percentage points more likely to report a funding gap.

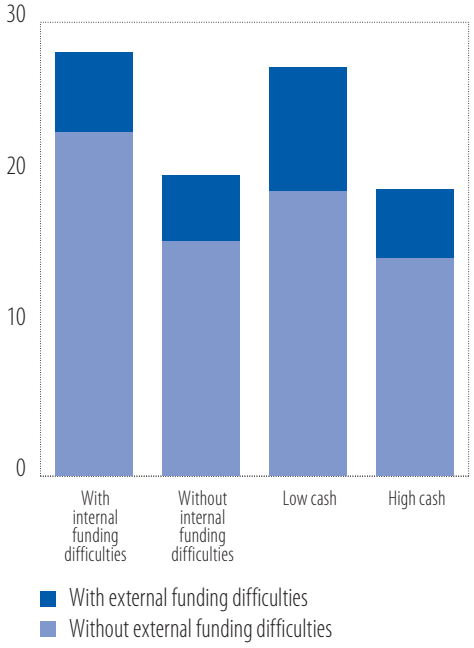
The combination of internal and external funding difficulties magnifies the impact on investment. Internal funding has supported investment, but that is changing. Figure 23 shows that internal funding

16 The investment gap is constructed from the EIBIS 2023 with the value one if the investment over the last three years was "too little." This can be considered a loss to potential investment or potential growth (although the firm may still have positive and increasing investment compared to the previous year).

conditions and the availability of cash are important drivers of investment. The negative impact of deteriorating external financing conditions on investment is magnified for firms with internal funding difficulties and low cash holdings. Thus, internal financing conditions and cash holdings soften the impact of external funding difficulties on investments, but cannot compensate fully. This impact is statistically significant even for cash-rich firms and those whose internal financing capacities have not deteriorated.

Figure 23

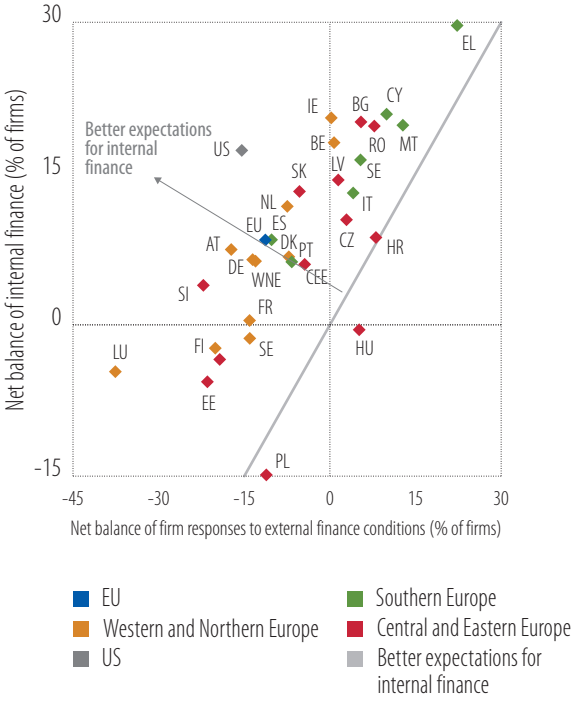
Impact of funding difficulties on the investment gap (% of firms)



Source: *EIB staff calculations based on the EIBIS 2016-2023 and Ferrando and Pál (2024).*
Note: *Estimation based on the treatment effect of external funding difficulties on the investment gap. Control variables include profitability, equity share, financial leverage, cash holdings and innovativeness and the main investment barriers, such as uncertainty, availability of skilled staff, market demand for products and access to digital infrastructure.*

Figure 24

Outlook for internal and external financing



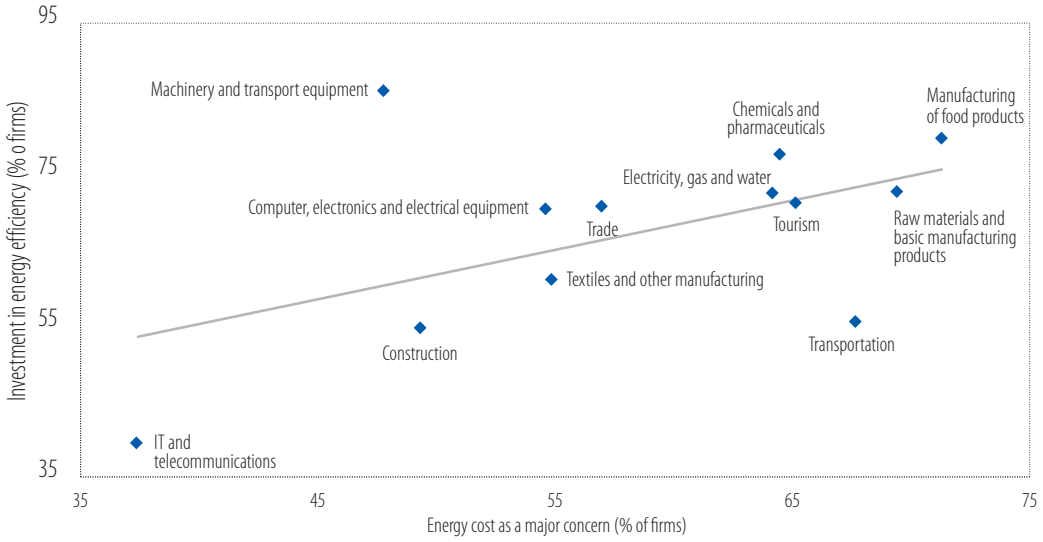
Source: *EIB staff calculations based on the EIBIS 2023.*
Question: *Do you think that each of the following will improve, stay the same, or get worse over the next 12 months?*

The outlook for external finance is bleaker. Figure 24 shows that for financing, expectations regarding the availability of external credit are more negative than those regarding internal profits. The willingness to rely on internal financing has increased in most countries across the European Union, from 16% in 2021 to 25% in 2023. This willingness is supported by strong profits. Firms' stronger reliance on internal funds is likely to continue as access to external funding toughens – however, cash buffers have shrunk.

Investment will become less cyclical and will be supported by the needs of the green transition. Corporate investment will slow down as tougher financing conditions take hold, and could possibly decline in 2024. But many firms view the green transition as an opportunity to increase investment, largely because those investments are boosted by national and EU strategic targets and support packages like the European Green Deal. Moreover, concerns over energy costs incentivised green investments, especially for energy efficiency. Figure 25 correlates the share of firms that see energy costs as a major concern and the share planning to invest in energy efficiency and generation for 12 sectors. Energy concerns increase the need for green investment, supporting investment to reduce the energy bill.

Figure 25

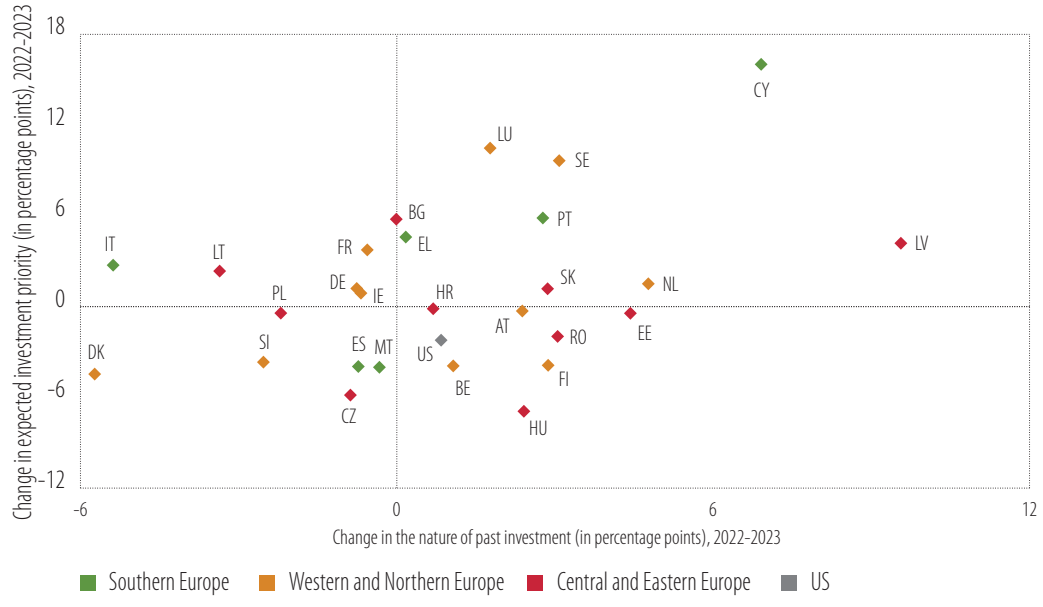
Energy prices as a major concern and investment in energy efficiency and/or energy generation



Source: *EIB staff calculations based on the EIBIS 2022-2023.*
Question: *X-axis: Thinking about the energy shock, to what extent is your company concerned about. A. Energy prices. Y-axis: Is your company investing or implementing any of the following, to reduce greenhouse gas emissions? B. Investing in energy efficiency; C. Onsite/offside renewable energy generation.*

Figure 26

New products: past change in the share of investment and expected to be a new investment priority



Source: *EIB staff calculations based on the EIBIS 2023.*
Question: *X-axis: What proportion of the total investment in last financial year OR the 2022/23 financial year OR the 2021/22 financial year was for. A. Developing or introducing new products, processes or services; Y-axis: And looking ahead to the next three years, which of the following is your investment priority. B. Developing or introducing new products, processes or services.*

Competitiveness and innovation also create a protective barrier for investment. Harasztosi et al. (2023) show that crisis can be catalyst for change, forcing firms to reprioritise investment. And firms have strengthened investment in digitalisation since the deployment of policies during the COVID-19 crisis. Figure 26 plots the past changes in the share of investment in new products against the change in priorities looking forward. The two dimensions are correlated. Firms that have invested more in new products want to continue doing so, as they are conscious of the need to transform their business. In 2023 most firms did, in fact, increase the share of investment in new products despite the economic slowdown, as this type of investment is less cyclical and more oriented towards the longer term.

Structural changes could make investment less sensitive to business cycles. Lagarde (2023) emphasises that in recent years global economies have undergone three shifts. First, profound changes in the labour market and the nature of work have altered the supply of workers and the composition of jobs. Second, the energy transition and accelerating climate change are triggering profound transformations in global energy markets. And third, a deepening geopolitical divide is causing the global economy to fragment into competing blocs, with rising levels of protectionism. Whether these shifts will be permanent is not yet clear. What is clear is that, in many cases, their effects have been more persistent than initially expected. These shocks can also trigger policy responses, which move the economy as well. Ploughing investment into the energy transition, the digital transformation and defence, for example, would make it largely insensitive to the business cycle.

Investment impediments and structural bottlenecks

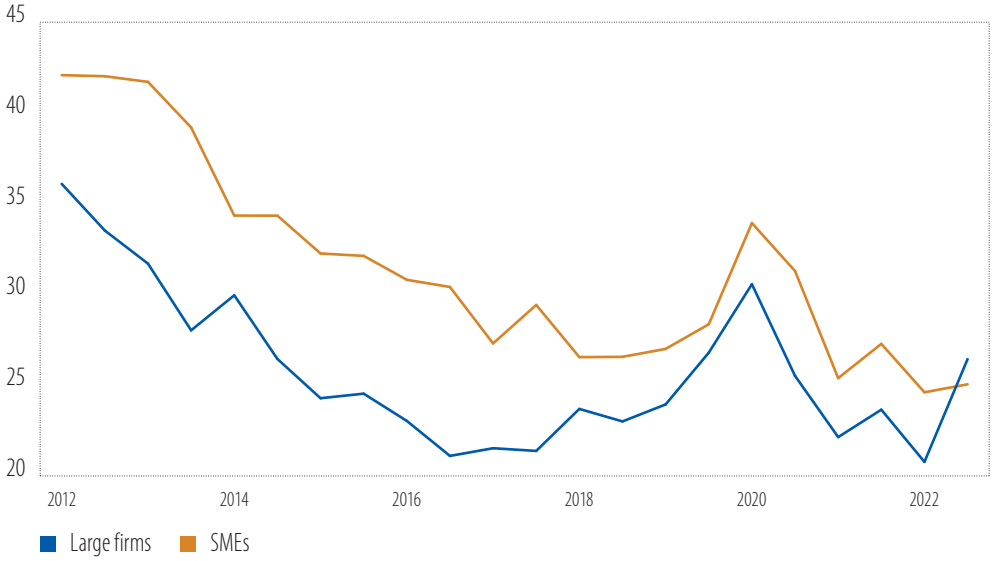
We show that the European economy is structurally more adverse for smaller firms, and that firms scaling up have a hard time finding finance. Part of the problem is that the EU financial system is underdeveloped for some types of products and markets when compared to more market-based financial systems like the United States. In parallel, firms surveyed in the EIBIS 2023 report structural barriers to investment. Some types of barriers are concentrated among firms with very strong capital expenditures, but the removal of these impediments would result in even higher growth for these already well-performing companies. However, most of the impediments limit capital spending resulting in low performance and below average growth, and their removal would unlock investments.

A proper securitisation market can improve small firms' access to finance

Access to finance is a structural problem for smaller firms. Financing providers are generally more reluctant to extend uncollateralised credit to SMEs, even at high interest rates. As a result, many smaller firms with economically viable projects cannot obtain the necessary financing from financial institutions. This phenomenon is often referred to as the SME financing gap – a market failure whose outcome is a sub-optimal equilibrium. It is rooted in the existence of information asymmetries, which lead to the rationing of credit either through the selection of low-quality borrowers or moral hazard issues, such as firms' taking on more risk when they receive loans, assuming part of the cost of default will be borne by the bank (Akerlof, 1970; Jaffee & Russel, 1976; Stiglitz & Weiss, 1981).

The extensive support programmes significantly improved the availability of finance after the pandemic (Figure 27). In the immediate aftermath of the pandemic, public support ensured that external finance remained available (attesting to the effectiveness of these policy initiatives). The majority of smaller European firms had access to some sort of government measure to ensure liquidity. These programmes mostly helped firms to finance working capital needs and meet their short- and medium-term obligations. Nearly half of SMEs reportedly tapped these programmes to pay for salaries (ECB, 2022).

Figure 27
Share of euro area firms that say access to finance is an important issue (in %)



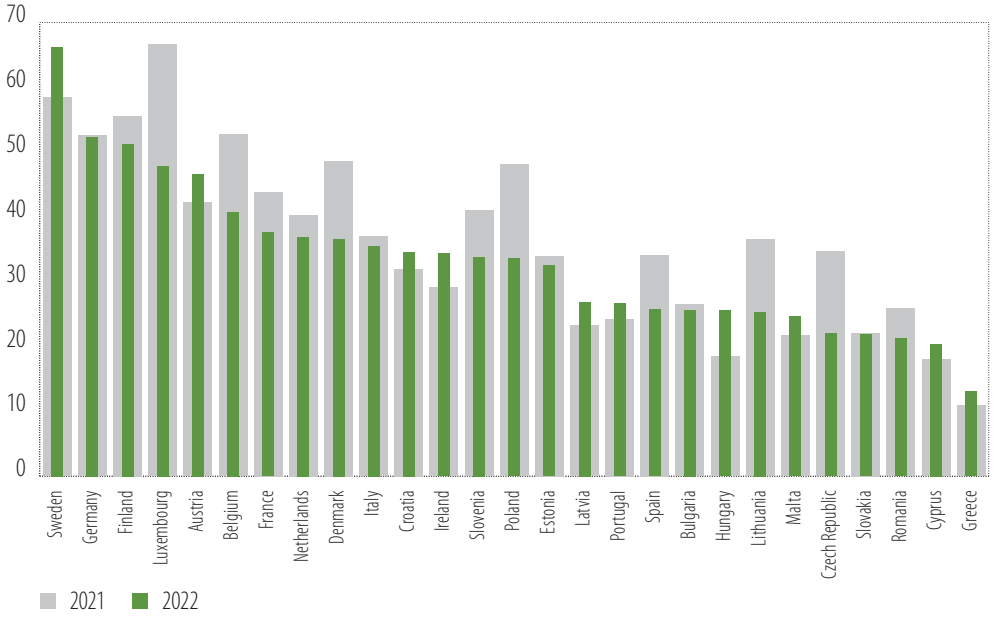
Source: *European Small Business Finance Outlook (Kraemer-Eis et al., 2023a) based on data from the Survey on Access to Finance for Enterprises by the ECB and the European Commission.*
Note: *Share of firms that ranked access to finance as an issue in the six preceding months, giving it at least a seven out of a maximum of ten.*

Small and medium firms' access to finance differs markedly across countries, as evidenced by the EIF SME Access to Finance Index. While smaller firms have better access to finance than in the past, mid-caps and large firms are encountering problems. During the second half of 2023, the share of firms ranking access to finance as highly important issue jumped nearly six percentage points, to 26.5%, the largest rise recorded in a single period since measurements began. However, the EIF SME Access to Finance Index (ESAF) shows that financial conditions differ markedly between countries (Figure 28).[17] Lately, the negative economic outlook and lack of public financial support have driven fluctuations in the index (European Central Bank (ECB), 2023).

European SMEs rely strongly on debt in general, and on bank lending specifically. Figure 29 shows the financial sources used by smaller firms. Overdrafts remain the most popular source of financing, with 27% of small and medium firms having used it during the last half of 2022. After support measures were introduced following the pandemic, subsidised financing products such as loans and grants briefly overtook leasing as the second most widely used source of external financing, with one in four SMEs in the euro area reportedly having used them in 2020. This share declined strongly as support programmes were phased out, but it appears to have stabilised in the course of 2022 (albeit above levels before the pandemic). The share of euro area SMEs using equity financing declined during the second half of 2022, from 1.3% to less than 1%, the lowest figure since the first Survey on Access to Finance for Enterprises (SAFE) was conducted in 2009.

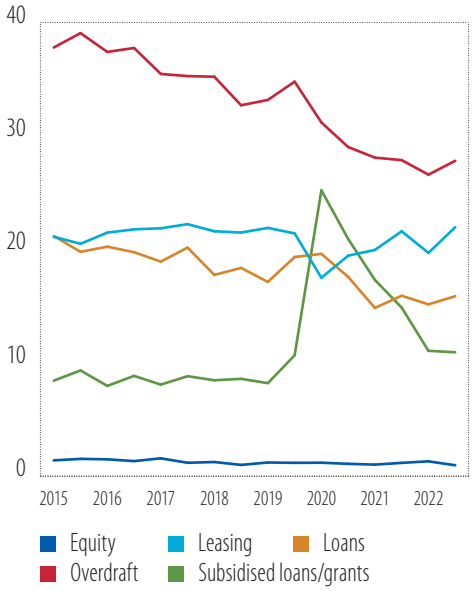
17 The ESAF is a composite indicator that summarises the state of SME financing for each of the EU Member States and covers different aspects of SME access to finance. It is composed of four sub-indices, three of which cover a specific SME financing instrument. The fourth sub-index covers the general macro-environment. See Torfs (2023).

Figure 28
EIF SME Access to Finance Index (% of firms)



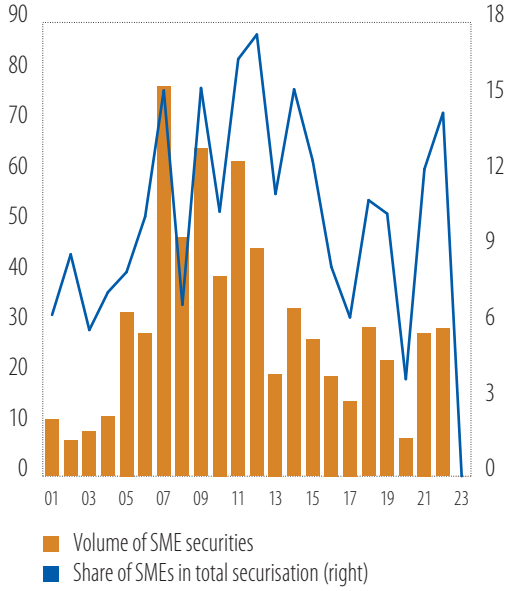
Source: *European Small Business Finance Outlook (Kraemer-Eis et al., 2023a) based on Torfs (2023).*

Figure 29
Sources of finance for small businesses in the last six months (% of firms)



Source: *European Small Business Finance Outlook (Kraemer-Eis et al., 2023a) based on SAFE data.*

Figure 30
Issuance of securities by small businesses (left axis: volume, in EUR billion; right axis: share of total securitisation, in %)



Source: *European Small Business Finance Outlook (Kraemer-Eis et al., 2022b) based on data from Invest Europe.*
Note: *Firms located in Europe only.*

A smoothly functioning securitisation market can transform illiquid SME loans into assets with sufficient market liquidity. SME securitisation grants smaller firms indirect access to capital markets, as it allows financial institutions to transfer credit risk from their SME loans to investors. In turn, it enables investors to access a diversified portfolio of SME loans, spreading risk across multiple borrowers and sectors. This securitisation can therefore improve the availability of finance. Securitisation transactions can be backed by a variety of debt instruments like SME loans, leases or other products.

Following a strong dip in issuance during the initial phase of the pandemic, the SME securitisation market quickly recovered to levels before the crisis (Figure 30). Market issuance volumes in 2022 (EUR 29.3 billion) matched those of 2021 (EUR 28.4 billion), driven entirely by activity in the fourth quarter. 2023 got off to a slow start, with no issuances in the first half of the year. However, it should be remembered that recent years have seen a significant rise in the number and volume of synthetic SME securitisation[18] transactions not visible in these official statistics (unrated bilateral transactions, for example).

European SME securitisation activity remains historically subdued. Issuance was still suffering from the after effects of the global financial crisis when COVID-19 broke out. This is unfortunate, as the resulting stain on the securitisation market's reputation is largely unjustified. This market has the potential to grow and help address the negative economic effects of the series of crises that have hit the EU economy (the COVID-19 crisis, Russia's war against Ukraine and related consequences). Securitisation can also play an important role in the green transition.

Driven by investor demand, but also by risk concerns, sustainable financing in compliance with environmental, social and governance criteria is gaining importance in securitisation, and in structured finance generally. The sustainable securitisation market is still in its early days, but has the potential to play a significant role in the green transition. On 5 October 2023, the European Parliament adopted a regulation creating a European standard for green bonds. For a bond to meet this standard, its proceeds must be used for green purposes, as defined in the EU taxonomy.[19] A bond must also be verified by a new type of agent, to be regulated by the European Securities and Markets Authority. Securitisations can be awarded the EU Green Bond Standard label, and therefore can be considered "green" for investment purposes regardless of the "greenness" of the securitised assets.

The lack of private equity and venture capital finance is weighing on promising firms

Private equity and venture capital are very important sources of finance for companies trying to scale up, but they are underdeveloped, and risk being hurt by high interest rates. Private equity is a form of equity investment in private companies not listed on the stock exchange.[20] It is a medium- to long-term investment characterised by active ownership – for example, by strengthening a company's management, improving operations and helping companies access new markets. Venture capital is a type of private equity focused on startups with high growth potential. It finances entrepreneurs who have innovative ideas for a product or service, and who need investment and expertise to grow their companies.

Some important EU sources of finance are underdeveloped

Young European firms need more financing to grow. Venture capital investment in fast-growing US firms, or scale-ups, is six to ten times greater than in their European counterparts. Controlling for the size of the economy, venture capital investment in EU scale-ups is about 2% of GDP, vs. 6% in the United States and 7% in the United Kingdom. While China currently invests only 1% of GDP in venture capital financing for scale-ups, this figure is bound to grow. The lack of financing in Europe has translated into fewer scale-ups,

18 In synthetic securitisation, the ownership of the securitised exposures remains with the originator, that is, the exposures remain on the balance sheet, and the credit risk is transferred with the use of credit derivatives or financial guarantees.

19 The EU taxonomy is a classification system for economic activities that are aligned with the European Union's net-zero carbon goals.

20 See Invest Europe .

fewer unicorns and fewer deals. European scale-ups are also less able to rely on venture capital financing than their US counterparts, and resort to other sources (such as private equity). In addition, they suffer from smaller capital markets. These constraints can push firms to relocate or search for foreign buyers.

The financing needs of firms scaling up remain large. While EU investment has remained resilient so far, the tightening of financing conditions has affected scale-ups disproportionally, further increasing the financing gap. Targeted support for this market segment would soften the effects of the cyclical contraction in investment and better equip scale-ups to compete on the global scene, while providing the innovation needed to support European goals like the green transition.

The gaps in scale-up financing are difficult to fill. The smaller European venture capital industry with its shorter track record (16% of EIF survey respondents), and the underdeveloped initial public offering (IPO) market (15% of survey respondents), were cited as the key reasons that fast-growing companies were not getting the funding they need. These respondents considered increased engagement by large institutional investors to be the most effective factor in bridging the late-stage financing gap.

The difficulties firms face in accessing venture capital finance limits their innovation and growth. Scale-ups are typically innovative firms, with high growth potential and the possibility of improving productivity and creating new businesses and industries. Underfinancing these companies has implications for growth in the European Union as a whole. In addition, the slowdown in venture capital investment observed recently in connection with tighter monetary policy has affected scale-ups more severely.

The difficult economic environment is causing venture capital and private equity to shrink

Venture-backed startups are historically vulnerable to recessions and economic slowdowns. The dot-com crisis in the early 2000s and the global financial crisis of 2007-2008 led to significantly lower fundraising and investment volumes. This caused a near collapse of the European private equity market, as fundraising and investment declined by up to 75% of levels before the global financial crisis (Figure 31). Similar events occurred on the venture capital markets.

The latest waves of the EIF Venture Capital Survey and the EIF Private Equity Mid-Market Survey confirm that market sentiment deteriorated further in 2023. Geopolitical and macroeconomic uncertainties are straining the European private equity and venture capital markets. However, the EIF survey results also suggest that markets may have already hit bottom, and that a moderate upturn could be expected going forward. See Box B for details of the most recent results of the EIF Venture Capital Survey.[21]

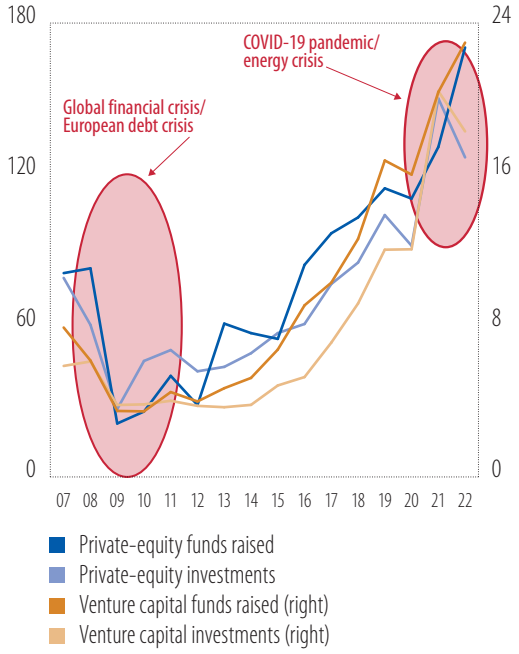
Investment in EU venture capital and private equity markets declined in 2022 (Figure 31). Compared to 2021, Europe's private equity investments declined 16% to EUR 127 billion. Venture capital investments evolved similarly, totalling EUR 18 billion in 2022. Although fundraising continued to grow significantly for both markets during this time, by the end of the year fundraising had dried up. Their multiyear upswing came to an abrupt halt amid high inflation and the resulting tightening in monetary policy and tougher financial markets.

Monetary tightening has caused venture capital investment to contract severely. In 2021, venture capital investment grew strongly, spurred by high liquidity and cheap financing (Figure 32, left side). Venture capital financing expanded 43% in 2021 compared to the previous year in the European Union (close to the 49% recorded in the United States), as non-EU investors and non-traditional investors like asset managers and private equity funds looked for attractive deals. A similar pattern can be observed for private equity financing. But venture capital and private equity investment pulled back in 2022, contracting 20% in the European Union, and 52% in the United States (Figure 32, right side). The higher cost of financing and a lower appetite for risky investment dampened interest. The negative impact of monetary tightening on venture capital investment continued in 2023, globally and in the European Union.

21 The EIF Private Equity Mid-Market Survey 2023 was performed in parallel to the EIF Venture Capital Survey 2023. The results of the EIF Private Equity Mid-Market Survey 2023 are being prepared for publication.

Figure 31

Funding provided by private equity and venture capital (left axis: private equity, in EUR billion; right axis: venture capital, in EUR billion)

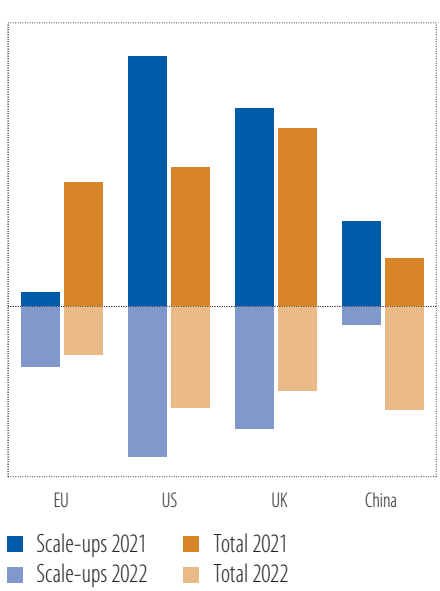


Source: *European Small Business Finance Outlook (Kraemer-Eis et al., 2023a), based on Invest Europe figures.*

Note: *Venture capital divestments are based on the European portfolio companies of private equity or venture capital firms worldwide, dependent on the availability of data.*

Figure 32

Venture capital investment based on firms' evolution (% change from a year earlier)



Source: *EIB staff calculations based on PitchBook data, Inc.*

Box C

Findings from the EIF Venture Capital Survey 2023

The EIF Venture Capital Survey and the EIF Private Equity Mid-Market Survey are unique sources of insight. When combined, they form (to the best of our knowledge) the largest regularly recurring survey of private equity and venture capital fund managers in Europe. The 2023 wave focused on market sentiment, financing for firms scaling up, human capital and skills. The survey results provide insights into the current market situation, developments in the recent past, and market participants' expectations for the future. The results are also summarised and compared over time and across crises.

Venture capital market sentiment deteriorated significantly

The venture capital survey results shed light on how the current macroeconomic environment affects the market sentiment of venture capital fund managers. The respondents' perceptions of the fundraising environment and the possibility of exiting investments are the lowest since the first EIF Venture Capital Survey in 2018. In 2023, the exit environment has become a big

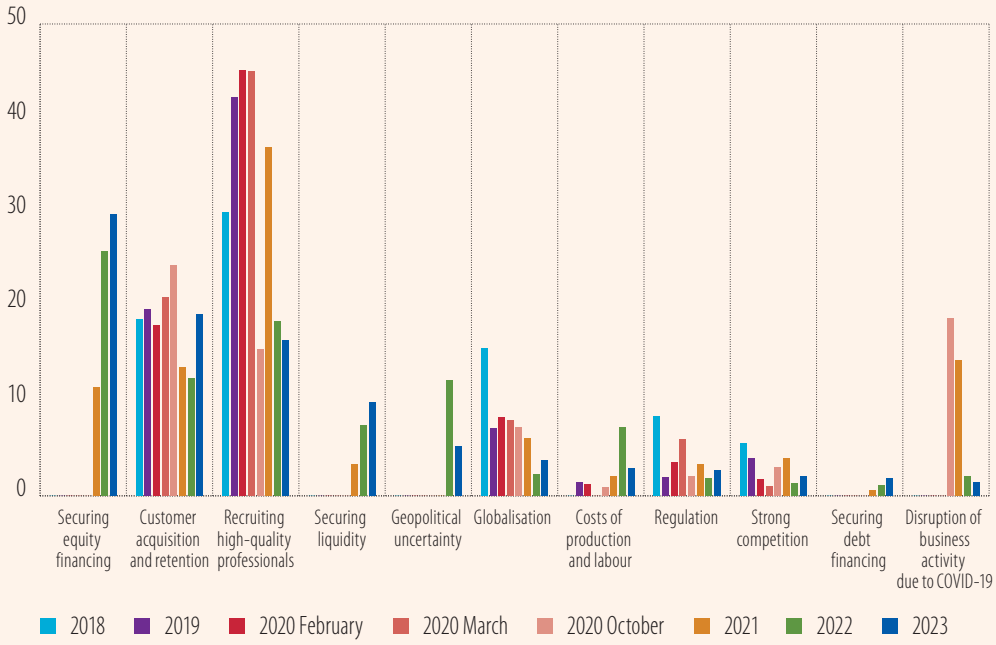
challenge for these fund managers. According to the majority of respondents, exit prices have further decreased, and they are suffering from insufficient liquidity in the IPO market and difficulty finding potential buyers.

This is compounded by the impact of interest rates on investment preferences. Venture capital fund managers are concerned that high interest rates will cause major investors to shift their focus to asset classes that offer better risk-reward. They also warn of the negative impact of rising rates on portfolio companies' performance. At the same time, they fear that a prolonged increase in interest rates could dampen investors' appetite for venture capital funds, as investors are lured by sectors and companies that are less sensitive to interest rate movements. While these results generally hold across sectors, venture capital fund managers investing in clean-tech companies, which provide the solutions and innovation needed for the green transition, are slightly more concerned about high interest rates hurting performance, and investors preferring activities that are less sensitive to interest rates.

While on average, respondents still reported a higher number of new investments, the pace has slowed considerably. In the same vein, a large share of venture capital fund managers cited difficulty finding co-investors. Consistent with these findings, the majority of respondents reported decreases in competition among investors and prices paid for investments in companies. High valuations of companies looking for investment are no longer a prominent challenge.

Figure C.1

Biggest challenges faced by venture capital portfolio companies over time (% of firms)



Source: *European Small Business Finance Outlook (Kraemer-Eis et al., 2023a).*

Companies in venture capital fund portfolios performed worse than they did during the COVID-19 crisis, and respondents anticipate more insolvencies than in the previous year. Portfolio companies' access to external finance has worsened significantly. A record two out of three venture capital respondents reported a decrease in valuations of portfolio companies. Securing equity financing remains the biggest challenge for portfolio companies, followed by recruiting skilled professionals and customer acquisition and retention.

Investments are difficult to exit

The exit environment worsened significantly in 2023 according to almost 75% of venture capital fund managers. In fact, alongside fundraising, it has become their biggest obstacle. Regarding exit routes, the relative importance of IPOs and trade sales decreased, while insolvencies, secondary sales and sales to financial investors increased[22] IPOs and sales of listed shares were largely based on listings outside the European Union.

The key challenges of the exit environment are insufficient liquidity in the IPO market and difficulty finding potential buyers. Venture capital exit prices continued to decrease according to 77% of respondents (and as anticipated in last year's survey). Nevertheless, one in three managers expects prices to recover over the next 12 months.

In fact, although many market sentiment indicators from the 2023 survey had deteriorated further since 2022, expectations for the next 12 months have improved for most of the categories. However, time, confidence in the venture capital industry's long-term growth prospects declined in 2023.

Firms have difficulties finding scale-up financing

In addition to the above challenges, venture capital fund managers say they are facing severe fundraising issues and having difficulty finding private investors for their funds. Insufficient scale-up finance for venture-backed companies, as well as limited investments by partners, are further exacerbated by the difficult exit environment. Respondents say that for firms to effectively scale up, they need more global investors in EU venture capital markets and better options for taking companies public.

European firms trying to scale up are particularly squeezed by monetary tightening. In the United States the 2021 expansion and the 2022 contraction in venture capital investment were driven by deals with scale-ups. But the abundant liquidity of 2021 passed EU scale-ups by, with venture capital investment in these firms growing just 5% that year (well below average for previous years). Then in 2022, the drying up of liquidity caused venture capital investment to decrease more than the rest of the market, as the number of deals and venture capital funds shrank.

The lack of exit options for investors will likely hit scale-ups harder. Barriers to finding alternative financing present another challenge for scale-ups. Those barriers include the general indebtedness of firms and less lucrative exit options linked to a 50% decline in IPO activity in 2022 and lukewarm activity in 2023. Mergers and acquisitions were a relatively attractive exit option in 2022, and they remained stable, with large firms seizing on reduced market valuations and liquidity that was available to acquire smaller ones.

Capital raised for scale-up firms has also decreased. Capital raised by venture capital funds specialising in the European Union – a leading indicator for future venture capital financing – decreased by 34% in 2022, and particularly slumped for later-stage funds. Thus, while venture capital expectations for the next 12 months have improved, the current decline in fundraising will likely continue to affect venture capital-backed companies (and especially scale-ups) going forward.

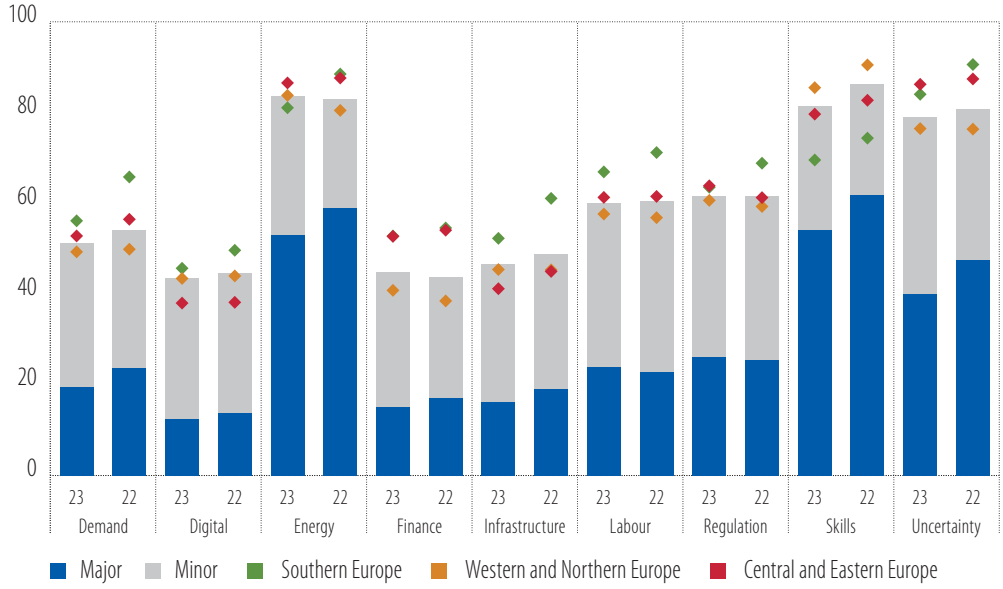
Overall, the gap in finance for firms scaling up reflects delays in the Europe's capital markets union. Limited exit options, as well as the limited size and strength of funds for scaling up companies are constraining the development of a robust private equity market.

22 See Kraemer-Eis et al. (2023a). Definitions of the exit routes are available at www.eif.org/research.

Removing structural impediments would unlock investments

We investigate the link between firms' investment and the obstacles they perceive. It is unclear whether investment obstacles can explain investment gaps. First, there is no one-to-one relationship between the business environment and how it is perceived. An environment that is perfectly acceptable to an entrepreneur in one country may be viewed as problematic by an entrepreneur in another. Furthermore, while all obstacles can constrain investment, there are questions of causality, as firms that see opportunities to invest may encounter more obstacles. This subsection documents the association between investment obstacles and corporate investment behaviour. To set the stage, it first describes the investment obstacles considered in the EIBIS 2023.[23]

Figure 33
Investment obstacles (% of firms)



Source: *EIBIS 2022-2023.*
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?*

In 2023, the most frequently cited investment obstacle is a lack of staff with the right skills. Figure 33 shows that in 2023, 54% of companies viewed skills as a major obstacle to investment, down from 62% in 2022. This is consistent with tight labour markets as reflected in a historically low EU unemployment rate. The decline from the last survey likely reflects a slightly reduced demand for skills as the EU economy has softened. Access to skills is a particular concern in Western and Northern Europe (59%), compared with 44% in Central and Eastern Europe and 43% in Southern Europe, where labour markets have greater slack.

Firms also cite energy costs and uncertainty about the future as major obstacles to investment. The share of firms concerned about energy costs has declined to 53%, down from 59% last year. Energy costs became a major concern after Russia invaded Ukraine, but they are now the most frequently cited major investment obstacle in Central and Eastern Europe (60%) and Southern Europe (58%). As for uncertainty, around 40% of firms view this as a major obstacle to investment, down from 47% last year. Logically, the share of firms citing uncertainty as an obstacle is high in times of crisis. In 2020, the first year of the

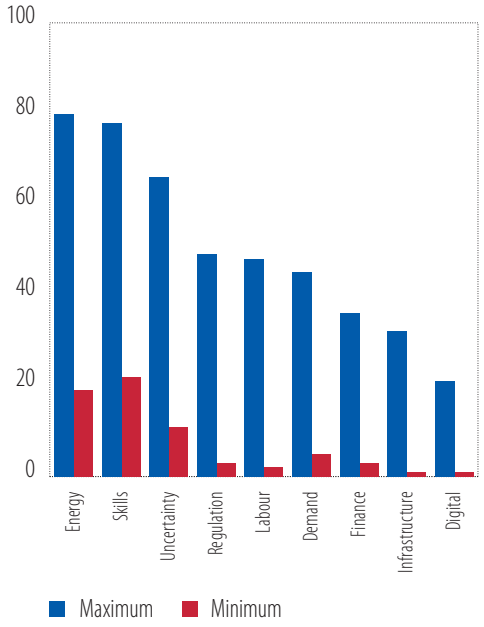
23 Every year the EIBIS survey has asked to what extent respondents view the following as obstacles to investment: (1) demand for products and services; (2) availability of staff with the right skills; (3) energy costs; (4) access to digital infrastructure; (5) labour market regulations; (6) business regulations and taxation; (7) availability of adequate transport infrastructure; (8) availability of finance; and (9) uncertainty about the future. This is asked with respect to investment activities in the country of interview. Respondents indicate whether each item is a major obstacle, a minor obstacle or no obstacle at all to investment.

COVID-19 pandemic, more than 50% of firms considered uncertainty a major obstacle to investment. The reading this year is comparable to 2021. However, more firms are concerned about uncertainty as a major obstacle in Central and Eastern Europe (45%) and Southern Europe (56%) than they are about skills.

The importance of investment obstacles differs from country to country. Figure 34 compares the largest percentage of firms citing each obstacle (whether as major or minor) with the smallest percentage. For example, in the country where energy costs are most frequently cited, 80% of firms in total consider it a major or minor obstacle. In the country where energy costs are least important, only 19% of firms view them as a major or minor obstacle. This variation is perhaps unsurprising, given that the survey question specifically refers to investment obstacles in the relevant country, and business environments typically vary more between countries than within them.

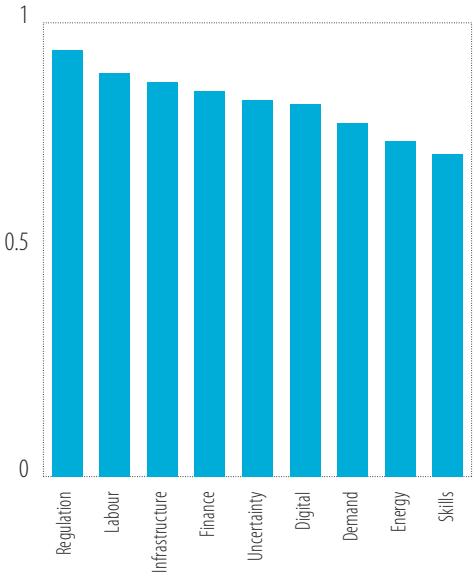
In sharp contrast, the ranking of obstacles is rather stable through time. Figure 35 displays the Spearman rank correlation coefficient for each obstacle at the country level. The correlation coefficient ranges from 0.70 for skills to 0.92 for regulation. This suggests that, for better or worse, the investment environment is evolving slowly.

Figure 34
Cross country variation (% of firms)



Source: *EIBIS 2023.*

Figure 35
Persistence of investment obstacles
(Spearman correlation)



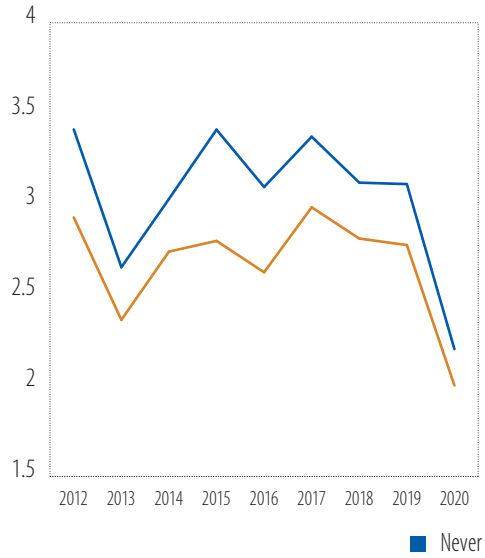
Source: *EIBIS 2016-2023.*
Note: *The Spearman correlation coefficient indicates the persistency of the obstacles over time.*

Firms that view demand as a major investment obstacle invest less. Below, demand is used as an example to discuss the link between obstacles and investment behaviour. Figure 36 presents the median ratio of gross investment to total assets for EIBIS firms. Firms that cited demand as a major obstacle in any survey also invested less than firms that never complained about demand. This pattern is intuitive, and in line with standard models of demand. However, the association also attests to the persistence of investment obstacles documented in Figure 35.

Firms that view skills as a major obstacle to investment invest more. Figure 37 presents evidence on skills shortages as an investment obstacle. Firms that perceive it as a major obstacle have higher median investment rates than firms that do not. In contrast with firms citing lack of demand as major obstacle,

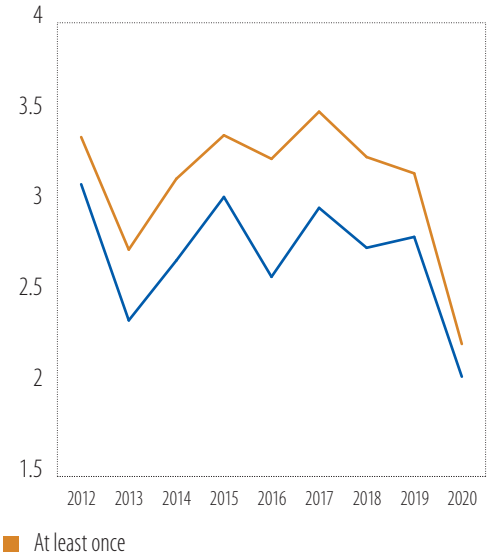
those citing a lack of skills seem to have opportunities to invest, and to more often encounter skills shortages as they try to realise those investment plans. It is tempting to suppose that skills shortages are relatively unproblematic because affected firms invest regardless, but this thinking is flawed. On the contrary, these firms would likely invest even more if the shortages were resolved.

Figure 36
Investment obstacles – demand (investment to total assets, in %)



Source: *EIBIS 2016-2023 and the Orbis database.*
Note: *The plot compares the median ratio of investment to total assets firms that said at least once that demand was an obstacle to investment compared to EIBIS respondents who never said demand was an obstacle.*

Figure 37
Investment obstacles – skills (investment to total assets, in %)



Source: *EIBIS 2016-2023 and the Orbis database.*
Note: *The plot compares the median ratio of investment to total assets for firms that said at least once that skills were an obstacle to investment compared to EIBIS respondents who never said skills were an obstacle.*

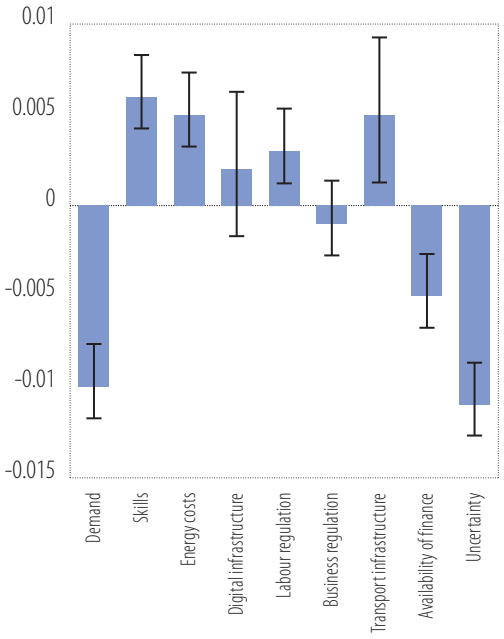
Regression analysis confirms the results on demand and skills. Figure 38 graphically represents a regression of investment obstacles in the previous period. By comparing firms by country, the regression also controls for unobserved factors that vary at the country level and are correlated with the business environment. This gives a more systematic account of the link between investment obstacles and investment than the bivariate evidence presented in Figure 36 and Figure 37. On average, firms that cite a lack of demand as a major obstacle invest 1 percentage point less in the subsequent period, while firms that complain about skills invest 0.5 percentage points more.

The relationship of perceptions and behaviour varies across the investment obstacles surveyed in the EIBIS. Like those concerned about skills, firms that view energy costs or transport infrastructure as major obstacles invest at a rate that is 0.5 percentage points higher than other firms. Those citing labour shortages also have significantly higher investment rates, though the estimated coefficient is smaller. Conversely, investment rates are lower for firms that view access to finance (0.5 percentage points) and uncertainty (1 percentage point) as major obstacles. There is no statistically significant association between investment and digital infrastructure or business regulation.

Economic theory can help clarify the regression results. According to theory, corporate investment policy equates the marginal cost of investment with the marginal increase in the present value of expected profits, typically referred to as marginal q (Hayashi, 1982). Profits accruing over a specific time are given by revenues minus production costs. Under certain assumptions, marginal q contains all information

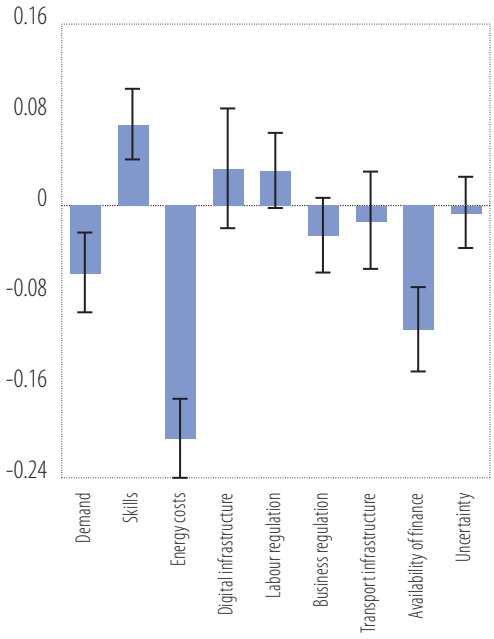
about a firm's investment opportunities. Unfortunately, marginal q is unobservable to the analyst.[24] Still, it can be useful to interpret the regression results through the lens of marginal q.

Figure 38
Investment obstacles – regression results



Source: *EIBIS 2016-2023 and the Orbis database.*
Note: *The chart presents coefficients from regressions of fixed investment to total assets on the respective investment obstacle. The error bars indicate 95% confidence intervals. All specifications control for country-time and country-sector fixed effects. Standard errors are robust with regard to heteroskedasticity.*

Figure 39
Investment obstacles and revenue productivity of capital – regression results



Source: *EIBIS 2016-2023, the Orbis database.*
Note: *The chart presents coefficients from regressions of marginal revenue productivity to total assets on the respective investment obstacle. The error bars indicate 95% confidence intervals. All specifications control for country-time and country-sector fixed effects. Standard errors are robust with regard to heteroskedasticity.*

Investment obstacles affect profits through various channels. A negative shock to demand puts downward pressure on prices, thereby reducing revenues. If skills are scarce, wages are set to rise. The same applies to energy costs. The availability of infrastructure and the quality of regulation affect the efficiency with which capital and labour can be converted into output. The regression coefficients reflect the relative strength of the firm's investment opportunities on the one hand, and of the obstacles on the other. Firms that invest more than the average despite encountering obstacles are likely to have plenty of investment opportunities. Alternatively, the obstacles may have a comparatively weak impact on marginal q. The opposite applies to firms that invest less than the average. Note that the estimates in Figure 38 have not been derived from a structural model of investment, and should therefore be considered purely informational.

The results on access to finance and uncertainty are in line with the literature. Models of credit rationing can generate underinvestment (Stiglitz & Weiss, 1981) as well as overinvestment (De Meza & Webb, 1987). However, a large body of empirical literature (Cingano et al., 2016; Berg, 2018; Ferrando

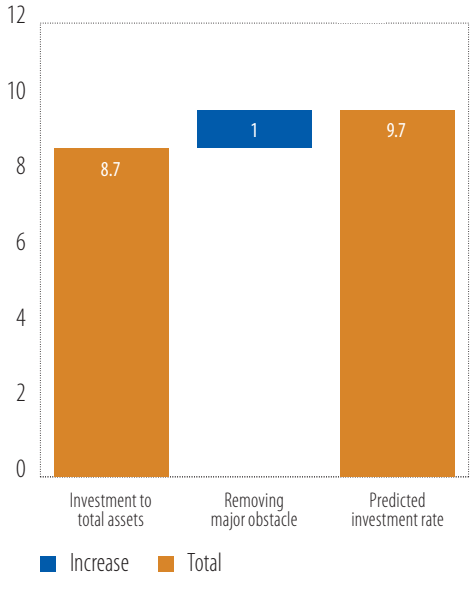
24 For listed companies, Tobin's Q (the ratio of the market value of existing capital to its replacement cost) is observable and, under certain assumptions, equal to marginal q. However, regressing average q on the obstacles is not a viable empirical strategy, as average q is only available for listed companies and the majority of EIBIS companies are unlisted.

& Mulier, 2022) finds that credit-rationed firms invest less. The result in Figure 38 is consistent with the literature. Uncertainty about the future, combined with the irreversible nature of the costs related to some decisions (such as hiring new workers), incentivises firms to postpone decisions until uncertainty is at least partially resolved (Dixit et al., 1994). This prediction is supported by empirical studies (Guiso & Parigi, 1999; Gulen & Ion, 2015) and Figure 39.

Firms that cite demand and access to finance as major obstacles to investment are less productive on average. Figure 39 presents results from a regression of the marginal revenue productivity of capital on investment obstacles. This is a first attempt to explore the link between the investment obstacles and allocative efficiency. In a context of decreasing marginal returns to capital, it is not problematic for a firm that is less productive to invest less. On the contrary, it is desirable for the firm to shrink and, in this way, to free up resources that can be put to more productive use elsewhere. This appears to apply to firms that view lack of demand and access to finance as investment obstacles. Firms that complain about energy costs seem more problematic, exhibiting above-average investment despite below-average productivity. However, it can be shown that these firms have below-average growth of total assets over a three-year horizon. On the other hand, firms that complain about a lack of skills have a higher revenue productivity of capital. For output to grow, these firms should expand. This makes it even more important to address skills shortages.

Figure 40

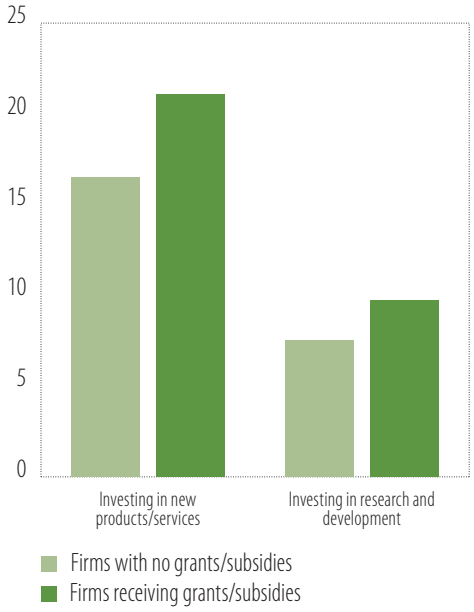
Impact of removing an investment obstacle on investment (in %)



Source: *EIBIS 2016-2023 and the Orbis database.*
Note: *The chart represents the impact of removing a major investment obstacle, derived from an instrumental variable regression of the ratio of investment to total assets on the number of major investment obstacle experienced by the firm.*

Figure 41

Firms receiving grants also invested more in R&D and innovation in the last year (% of total investment)



Source: *EIBIS 2016-2023 and the Orbis database.*
Note: *Limited to firms that invested at least EUR 500 per full-time equivalent employee and further excluding those that did not respond or refused to respond. The statistics are weighted by firms' value-added.*

Removing a major investment obstacle could increase corporate investment by 12%. Figure 40 illustrates the impact that removing a major investment obstacle could have on investment. The results are based on an instrumental variables regression of investment on the number of major investment obstacles that a firm perceives. The instrument is given by an indicator of whether, over the last three

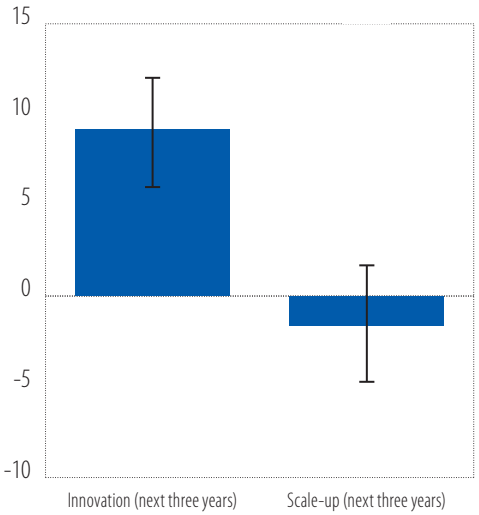
years, the company invested too little to ensure its success going forward. The specification is conditioned on a range of firm characteristics, including size, age, profitability, leverage and past asset growth. The results suggest that one additional major investment obstacle reduces investment by 1.3 percentage points. (Note that around 23% of firms perceive no major obstacles to investment, so their behaviour would not be affected by removing one.) Thus, removing a major obstacle to investment could increase investment by one percentage point. Since the average rate of investment to total assets amounts to 8.7%, removing a major obstacle would push up the average investment rate by 12%. However, as not all firms are affected by the same obstacle, this estimate is best seen as providing an upper bound of the impact.

Targeted support to boost investments and transformation

After years of generalised policy support, government's fiscal constraints will push them to target much more any further intervention. Understanding the basics of what works and what does not, as well as the relevance of EU instruments, is crucial.

Figure 42

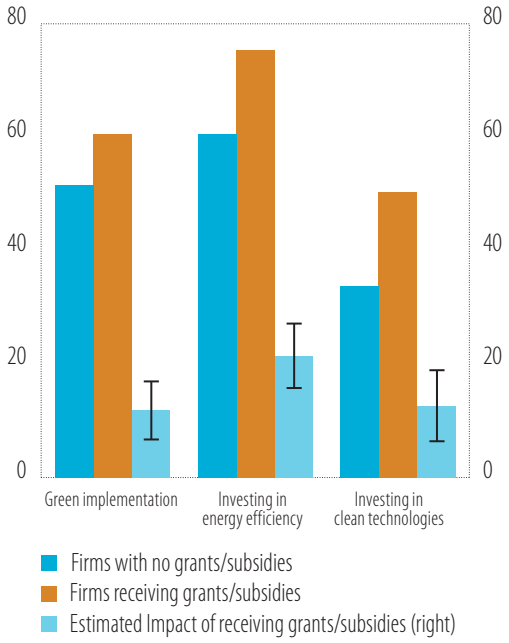
Grants have a positive and significant impact on innovation in the next three years (change in the probability of investing, in percentage points)



Source: *EIBIS 2016-2023 sample, restricted to only firms that invested at least EUR 500 per full-time equivalent employee.*
Note: *Estimated impact of receiving grants on the probability of investing. The black lines represent confidence intervals at the 95th percentile.*

Figure 43

Grants and subsidies have the highest impact on the adoption of energy efficiency measures (left axis: % of firms; right axis: change in percentage points)



Source: *EIBIS 2020-2023 for green implementation and the EIBIS 2022-2023 for investments in energy efficiency and clean technologies, restricted to only firms that invested at least EUR 500 per full-time equivalent employee.*
Note: *Estimates of the impact of grants and subsidies are based on a logistic model that controls for firm characteristics, sectors, countries and years, weighted by firms' value-added. The black lines represent confidence intervals at the 95th percentile.*

Targeted public support in the form of grants and subsidies can lighten the impact on government finances. In Figure 41, we focus on investment to promote innovation. We show that firms receiving grants and subsidies invest more in new products, and in research and development (R&D). These results, based on the large number of answers received in the EIBIS 2023, are unconditional of other factors that can affect investment (such as sector, country or sales expectations). They illustrate how public financial instruments can support specific types of investments.

The impetus from grants is especially pronounced for innovating and growing companies. Figure 41 shows that EU enterprises receiving grants are likely to invest more in R&D than those that do not. Figure 42 distinguishes the impact across company life cycle. Firms in the early stages of investing in new products and services are more likely to benefit from additional grants. Conversely, there is no significant impact of grants on firms that are trying to scale up in the near future. Thus, grants are effective when deployed for young companies.

Government subsidies and grants are important drivers of the green transition, especially for investments in energy efficiency. Figure 43 shows that more than 75% of firms receiving grants and subsidies invest in energy efficiency – well above the 60% recorded for those not receiving them. A similar pattern is found for investment in green projects and in clean technologies, albeit with smaller differences. Regression estimations, controlling for firm characteristics and their specific sectors and countries of operation, confirm the positive impact of grants for climate-related activities. In particular, firms that receive subsidies are 20 percentage points more likely to invest in energy efficiency than those that do not. This figure, shown by the grey bars, is also relatively high for companies investing in clean technologies (almost 13 percentage points) and those implementing green investment (12 percentage points).

Conclusion and policy implications

EU businesses came through the energy crisis better than feared, but vulnerability is on the rise as government support is progressively being removed. Investment continued to increase until the first half of 2023. This relatively favourable development is explained by national policies to support firms, which dampened the impact high energy prices had on firms. Still, firms' vulnerability and exposure to risk rose too, and will continue to rise as policy support is removed and firms feel the pinch of higher energy costs.

Firms' own funds, which increased during the COVID-19 crisis, have supported investment in a time of monetary policy tightening. Since the tightening began, corporate bank borrowing costs have risen sharply and credit standards have become stricter, in line with historical patterns. Supported by internal financing, investment has outperformed. But firms' cash buffers are dwindling and external finance is becoming more difficult to obtain as tighter monetary policies push up rates. Investment could slow if economic activity weakens, uncertainty persists about long-term energy prices and geopolitical risks rise.

Europe's support for top priorities, such as the green transition and digitalisation, could build a protective wall around investment and dampen the impact of a weaker business cycle. On the one hand, the difficult environment increases the risk of gloom among entrepreneurs and investors, and fears of entrenched inflation. On the other hand, the huge economic challenges of cohesion, innovation, competitiveness, greening and resilience will persist for years, and should catalyse a structurally higher rate of investments.

The challenging environment could bring about needed change, but policy support needs to be better targeted. The policy support deployed during the COVID-19 crisis spurred the lasting digitalisation of firms. The support from the energy crisis has cemented green investment. But as this support now comes at a higher opportunity cost for public finance, it is important to better target and condition it.

It is important to support the funding firms need to scale up, now and in the future. The overall difficult funding environment is weighing on private equity and venture capital finance. As these sources are key to financing promising, innovative companies, proper policies are needed to support firms that are crucial to long-term EU economic growth. These policies must overcome structural market weaknesses. This includes deeper involvement by private, long-term investors who stay in the market even during downturns; initiatives to encourage the financing of fast-growing European firms; and better conditions for exiting investors, which would support a thriving, resilient venture capital market that can nurture the tech champions of tomorrow.

The European Union and its members need to provide firms with long-term guidance, and push through important structural reforms. Clear, credible policies are needed that signal the EU commitments and paths to firms and investors. This is especially important in times of uncertainty and/or technological change. Structural bottlenecks to investment must also be removed to create a more business-friendly environment. Finally, the structure of the financial system must be improved, as some critical areas important for businesses to grow and transform remain woefully underdeveloped.

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PART II

Accelerating transformation for competitiveness

32% **of EU firms consider access to commodities or raw materials to be a major business obstacle.**

European firms account for **18%**

of top R&D companies globally, but only **10%**

of new innovation leaders since 2017 (the United States contributed **45%** and China **32%**).

The European Union invests **0.05%**

of GDP in firms trying to scale up, compared with **0.14%** **in China** and **0.32%** **in the United States.**

The gap between EU firms affected by climate risks and those that **have implemented adaptation measures exceeds** **40** percentage points.

More than **90%** of manufacturing firms covered by the EU Emissions Trading System **are concerned about uncertainty surrounding regulation, energy and carbon prices.**

A **1%** **increase in the price of carbon allowances is associated** with a

0.2% **drop in the emissions intensity** of firms' production, a

0.14% **rise in investment** and a

0.18% **increase in R&D spending.**

Chapter 4

Innovation in the global context

EU policy is increasingly emphasising the need to enhance and preserve the global competitiveness of European firms. The focus is on innovation, the diffusion of innovation, and the resilience of global supply chains against a backdrop of strategic dependencies in critical sectors. The ability of the European economy to adjust and transform itself for the green and digital transition will also depend on the supportiveness of the operating environment.

The European Union may be at the forefront of clean technology, but it lags the United States and China in digital innovation. A successful transition will require sustained efforts in innovation and the widespread uptake of new green and digital technologies, as they are key drivers of European competitiveness and resilience to economic disruption and climate change.

The gap in digital adoption between the United States and the European Union is narrowing. EU firms are catching up with their US peers in the use of digital technologies. However, Europe should remain vigilant and invest more, particularly in the adoption of big data analytics and artificial intelligence. The adoption of these technologies is positively associated with firm performance and job creation and can be a catalyst for green innovation and transformation.

The adoption of digital and green technologies by EU businesses depends on internal and external factors. These include digital infrastructure, a dynamic innovation environment, adequate regulations and the availability of skills, as well as management decisions and investment in employee training. Access to finance also plays an important role, with innovative and fast-growing firms often reporting constraints. Difficult conditions for external finance, such as a lack of finance for innovative firms, can exacerbate market failures.

The European Union is well integrated in the global economy, which enables it to import the resources needed to produce the goods and services consumed by EU members and those sold abroad. However, experience in recent years has shown that fragile supply chains can expose firms and countries to trade disruptions, and that strategic dependencies may emerge. Difficult access to the resources needed for production, and disruption to logistics and transport, can be major obstacles for EU businesses. The most innovative firms were more likely to react to recent disruptions in global trade. They acted to make their global value chains more resilient, working with a broader and more diverse range of trading partners, expanding their stocks, and investing in digital inventory and input tracking.

To stay competitive, European firms need a strong mix of innovation, technological adoption, resilient supply chains and an efficient operating environment. Striking the balance of policies is a complex process for the European Union, as it is caught between societal and regulatory constraints, national preferences and global players that define the cutting edge of digital technologies.

Introduction

EU policy is increasingly emphasising the need to enhance and preserve the global competitiveness of European firms. The focus is on innovation, spreading innovation, and the resilience of global value chains against a backdrop of strategic dependencies in critical sectors. The ability of the European economy to adjust and transform itself sufficiently for the green and digital transition will also depend on support from the environment in which companies operate.

The European Union may be at the forefront of clean technology, but it lags the United States and China in digital innovation. A successful transition will require sustained efforts in innovation and the widespread uptake of green and digital technologies, as they are key drivers of Europe's competitiveness and its ability to withstand economic disruption and climate change. Europe also needs to develop resilient supply chains and look closely at the products and services for which it is strategically dependent.

This chapter is organised into four sections. The first section assesses the position of the European Union in global innovation and highlights current trends in the development of green technologies, biotechnologies and digital technologies. The second section discusses firms' investment in new products, processes or services and the adoption of digital and green technologies. It stresses how vital digital infrastructure and the innovation environment are to accelerating the twin digital and green transition. The third section discusses recent global trade disruptions and the action taken by firms to enhance the resilience of their value chains. The last section presents policies needed to support innovation in the European Union.

The European Union's place in global innovation

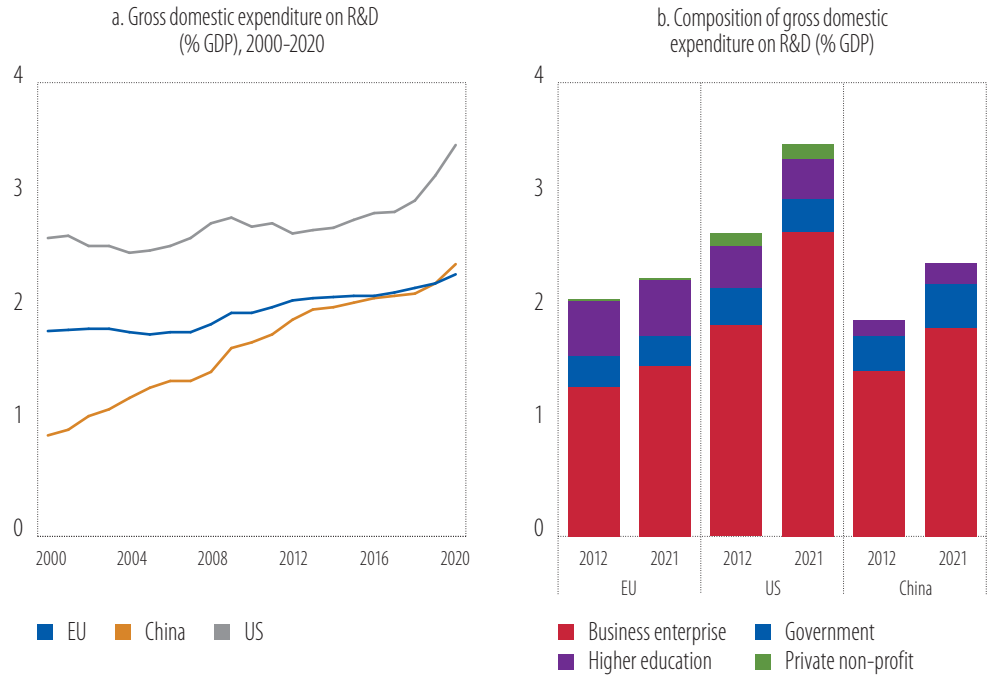
Investment in innovation is recognised as a key driver of productivity, long-term prosperity and economic growth for advanced economies such as the European Union and the United States. It fosters competitiveness, resilience and structural transformation. It is needed to address pressing policy and social challenges – including an ageing population, climate change, and numerous health and environmental issues.

Innovation is a broad term that covers several components, all of which require major investment. Innovation activity is usually seen as grouping research and development (R&D) spending, patenting activities and investment in new products, processes or services. This creates growth opportunities for firms, together with new skill needs and job opportunities for workers. Investment in innovation differs from capacity replacement (investments in existing buildings, machinery, equipment or information technology), or capacity expansion (investments in new buildings, machinery, etc.), as the returns are less cyclical but more uncertain and typically have a longer time horizon.

The European Union sets goals for investment in research and innovation for the public and private sectors. The European Commission has acknowledged the crucial role of creating and improving the dissemination of knowledge and technologies. A key goal is for the European Union to invest 3% of its gross domestic product (GDP) in R&D, 2% of which is expected to come from the business sector and 1% from the government, higher education and private non-profit organisations.

Global R&D expenditure has increased rapidly over the past two decades, but Europe has been losing ground. With an R&D intensity of 2.3% of GDP in 2021, the European Union is currently investing less in R&D than the United States or China (Figure 1a). The private sector has been driving the rapid increase in R&D spending in China and the United States over the past ten years (Figure 1b). If policy measures are not taken to support R&D, some highly innovative EU firms may lose their competitive advantage over firms based in other countries. Lagging EU companies may also find it difficult to catch up and adopt technologies developed elsewhere.

Figure 1
R&D expenditure



Source: *Eurostat and the Organisation for Economic Co-operation and Development (OECD).*
Note: *For China, 2021 is an estimate based on 2020 data, and no data on the private non-profit sector are available.*

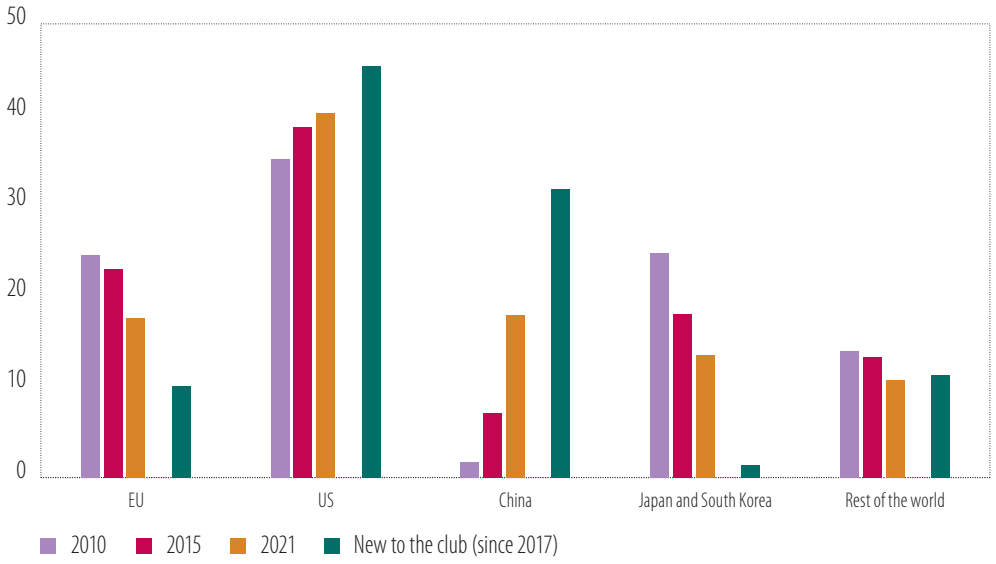
The rise of digital firms among the top global R&D companies

Europe is at risk of being overtaken in global innovation, particularly in digital technologies. R&D investment and patenting activities are highly concentrated among a small number of companies, sectors and countries. The world's top 2 500 R&D investors account for close to 90% of global business R&D expenditure and 60% of patent filings for all technologies (Amoroso et al., 2021). This concentration of innovation is particularly pronounced in high-tech sectors such as software and computer services, pharmaceuticals and biotechnology, and electrical equipment and technology hardware, as well as in industries like the automotive sector. Compared to sales or employment, R&D investment and patenting activities are more concentrated among a small number of firms that have grown bigger over time.

The European Union remains a major global player in R&D and innovation, but the share of EU firms in the top global R&D investors has fallen over time. The share of firms from the European Union and Japan in the list of the top 2 500 R&D investors decreased from 2010 to 2021 (Figure 2). This decline is largely attributable to the emergence of Chinese firms. While the United States remains an innovation leader, the number of Chinese companies included on the list of big R&D spenders has risen fast.

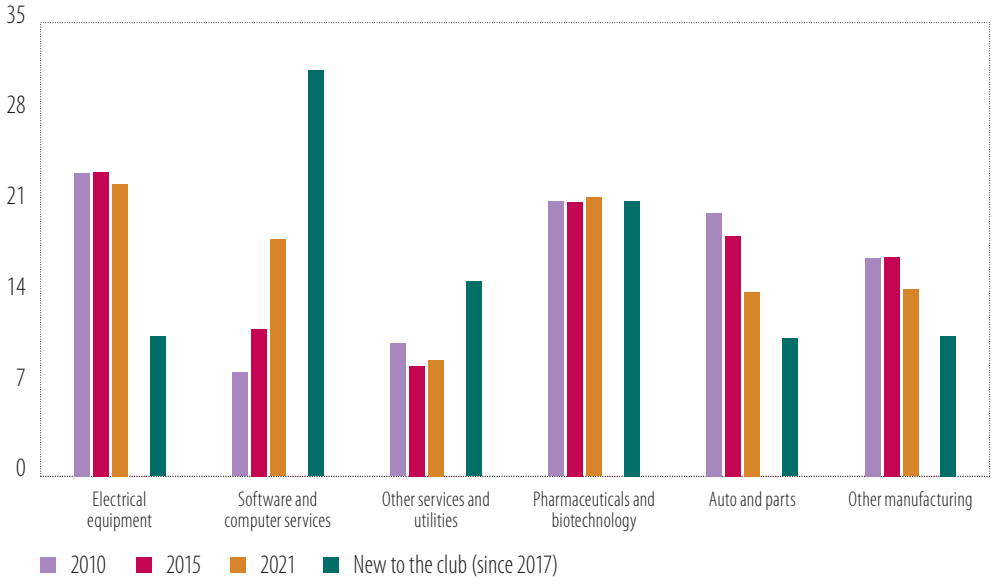
The global R&D landscape changed rapidly over the past decade as the digital economy increased in importance. Electrical equipment and hardware represent 23% of total R&D spending by the top 2 500 companies, followed by pharmaceuticals and biotechnology, which account for 22% (Figure 3). R&D spending by companies selling software and computer services has risen sharply over the past decade, with their share rising to 18% in 2021, from 8% in 2010. At the same time, the share of the automotive industry in R&D expenditure has declined, to 14% in 2021 from 20% in 2010.

Figure 2
Top global R&D companies (% of firms)**, by region**



Source: *EIB staff calculations based on EU Industrial R&D Investment Scoreboard.*
Note: *New to the club refers to firms that entered the list of top global R&D investors after 2017.*

Figure 3
Top global R&D companies (% of R&D expenditure)**, by sector**

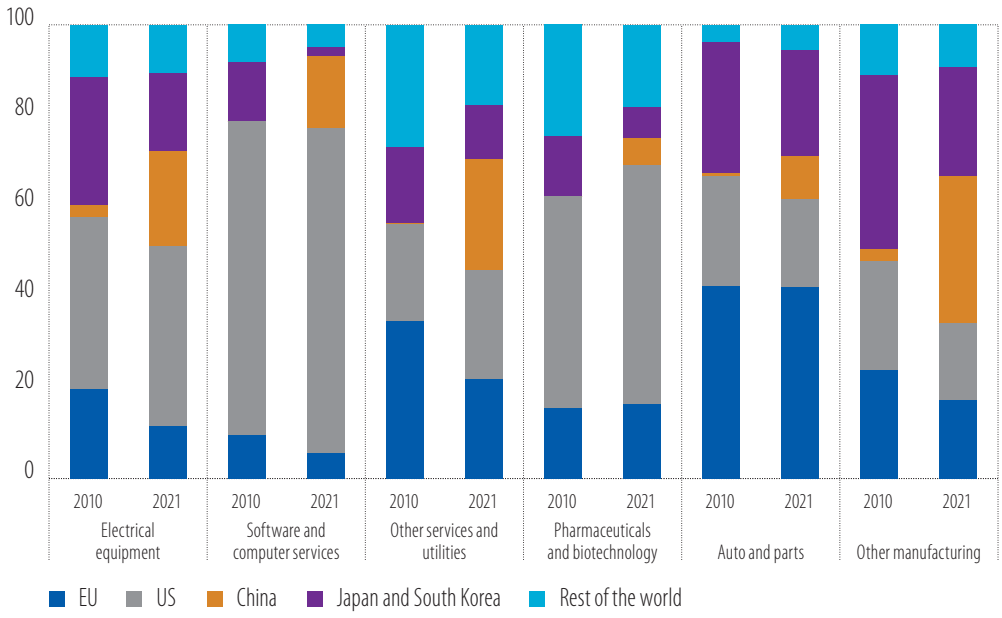


Source: *EIB staff calculations based on EU Industrial R&D Investment Scoreboard 2022.*
Note: *Electrical equipment includes electronic and electrical equipment and technology hardware and equipment. Other services and utilities includes fixed line telecommunications, mobile telecommunications, food and drug retailers, general retailers, industrial transportation, travel and leisure media, banks, equity investment instruments, life insurance, non-equity investment instruments, non-life insurance, real estate investment and services, support services, alternative energy, electricity, gas, water and multiutilities, industrial metals and mining, oil and gas producers, oil equipment, services and distribution. Pharmaceuticals and biotechnology includes healthcare equipment and services. Auto and parts includes aerospace and defence, automobile and parts. Other manufacturing includes beverages, food producers, tobacco, chemicals, construction and materials, forestry and paper, general industrials, industrial engineering, household goods and home construction, leisure goods and personal goods.*

Pharmaceuticals and biotechnology and software and computer services have a higher R&D intensity than other industries and are dynamic sectors with new players. In these two sectors, R&D investment by global leaders represents close to 15% of turnover, which is significantly higher than for the electrical equipment or automotive industries. This reflects the major investment and ongoing R&D efforts needed to stay competitive in critical digital technologies and biotechnologies. In addition, R&D expenditure by companies that are new to the club (firms that recently joined the list of R&D global leaders) is largest among software and internet firms, followed by pharmaceuticals and biotechnology.

The European Union specialises less in software and computer services than the United States and China. The European Union only represents 6% of R&D expenditure among the leading companies in software and computer services, compared with 72% for the United States and 16% for China (Figure 4). Similarly, the European Union accounts for 12% of R&D expenditure among leading companies producing electrical equipment and technological hardware, compared with 40% for the United States, 19% for China, and 19% for Japan and South Korea.

Figure 4
Share of R&D expenditure in 2010 and 2021 (in %)**, by sector**



Source: *EIB staff calculations based on the EU Industrial R&D Investment Scoreboard 2022.*
Note: *See Figure 3 for sector definitions.*

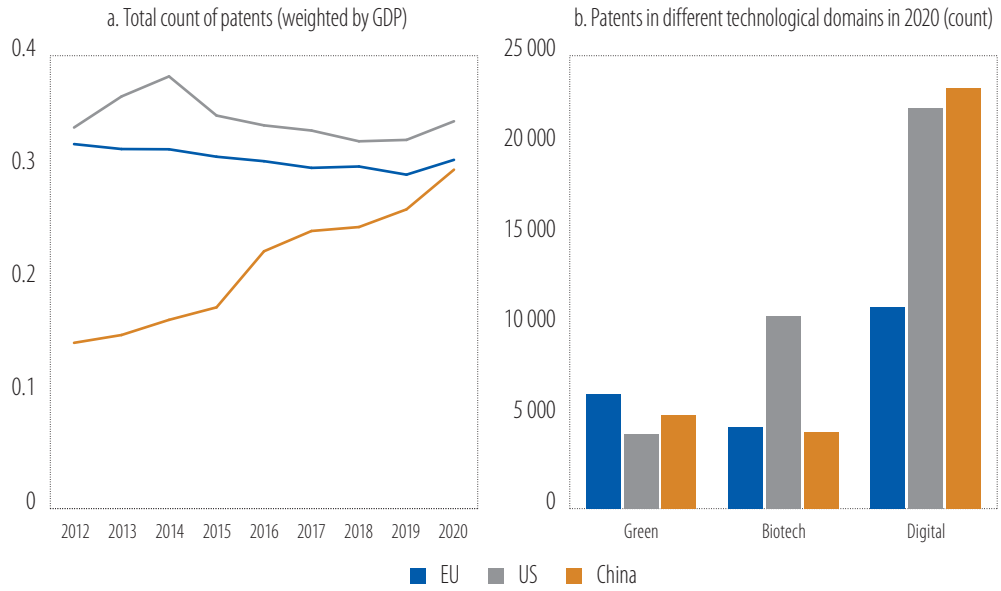
Patenting activities in digital technologies, green technologies and biotechnologies

The European Union is at the forefront of the development of new technologies – together with the United States – but China is catching up. This is reflected in innovation measures other than R&D, such as the stock of international patents. Patents protect novel inventions and technologies used in industries. They are important components of the innovation chain, giving inventors the exclusive rights to their knowledge for a specified period. At the same time, patents foster competition as they support the dissemination of knowledge by mandating the disclosure of technical details, thus promoting further advancements. They are therefore a good indicator of the competitive position of different markets.

Chinese patenting activities are beginning to vie with those of the European Union. While China's R&D spending has been similar to that of the European Union for several years, patent activity lagged until very

recently (Figure 5a). The narrower gap indicates that China's competitive position in innovative output is improving as years of increasing R&D expenditure pay off, especially in digital technologies (Figure 5b).

Figure 5
Patenting activities in the European Union, the United States and China



Source: *EIB staff calculations based on Patent Cooperation Treaty (PCT) patents (PATSTAT) in collaboration with the Research and Development Monitoring Research Centre (ECOOM) at KU Leuven university.*

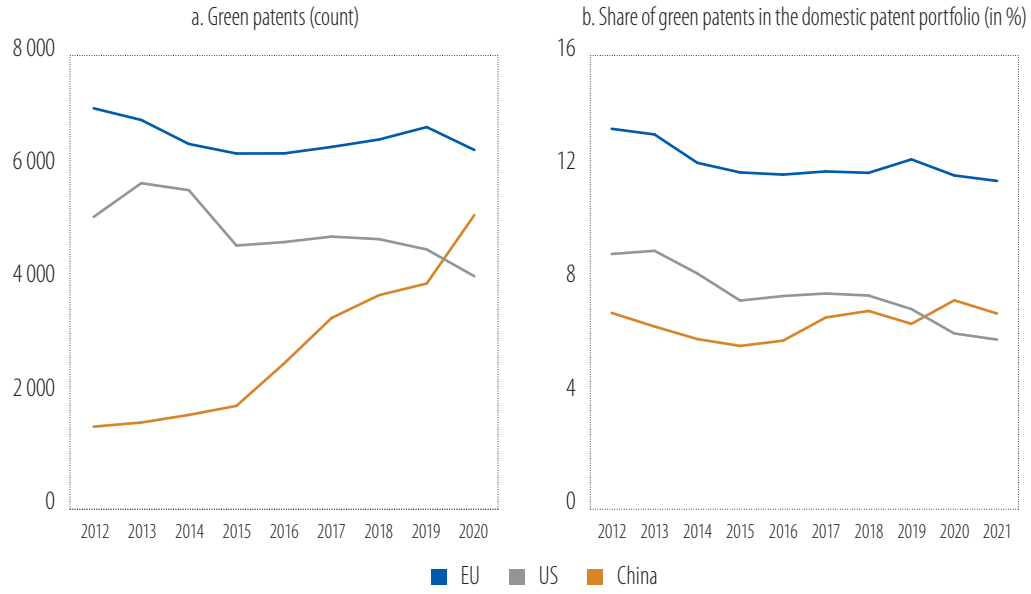
Note: *GDP, USD, constant prices, constant purchasing power parity, reference year 2015, millions (source OECD), count of PCT patents (PATSTAT). Patents weighted by GDP is a common way to measure the innovative activity in a region, correcting for its economic size (OECD, 2009). Patents in green technologies are measured based on the methodology of Haščič and Migotto (2015), with further adjustments implemented by ECOOM. The patent classification in biotechnology is based on the classification established by KU Leuven. The biotechnology domain is the combination of Fraunhofer technology classes 15 (biotechnology) and 16 (pharmaceuticals). The digital patent classification is based on the European Patent Office (EPO) (2017).*

The European Union leads in green technologies. Climate is a key focus of EU policy,[1] and green tech is the only strategic technological area where the European Union is excelling. The European Union has a higher number of patents in green technologies than the United States and China (Figure 6a). It also has a higher share of patents in green technologies, reflecting its specialisation in the development of these technologies (Figure 6b). Box A discusses patenting activities in selected clean and sustainable technologies and the contribution of EU firms.

Venture capital investment in European clean tech, green energy and green tech has increased rapidly in the past few years. These areas benefited from the flow of money to venture capital in 2021, but also remained resilient in 2022. This was a rare exception to the ongoing global contraction in venture capital investment and was enabled by government regulations and subsidies that continued to support these key sectors (Figure 7a). However, the share of venture capital investment in clean tech, green energy and green tech remains small. More investment is needed to achieve Europe's green agenda, especially since EU venture capital flows are expected to be weak in 2024 (Figure 7b).

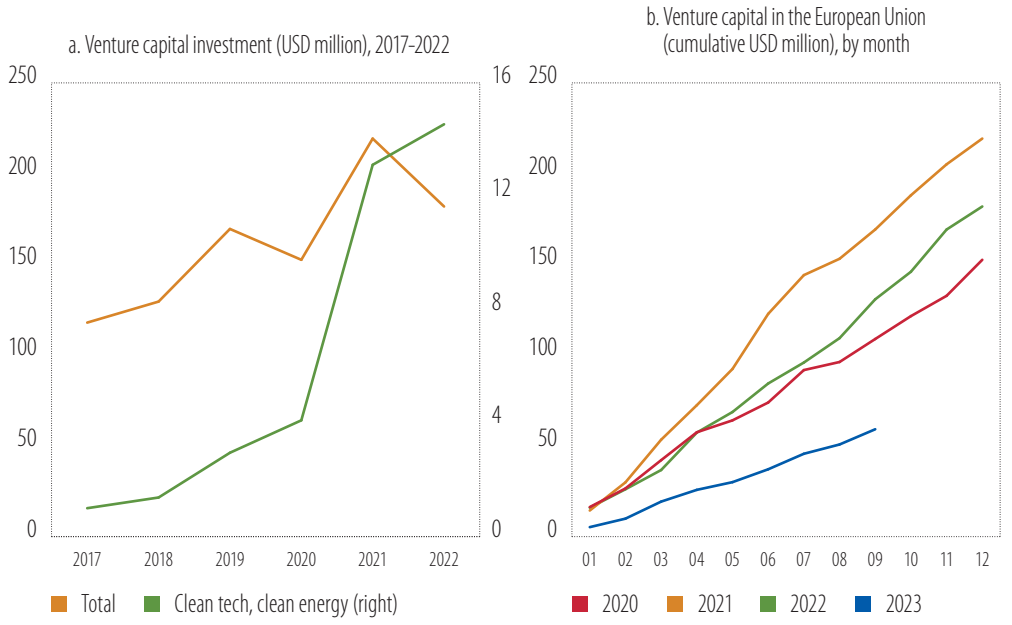
1 For example, the Strategic Technologies for Europe Platform (STEP) is the European Commission's recent proposal for a structural answer to supporting the development and manufacturing of strategic technologies in the European Union. The main technology fields included in this proposal, which will also support investments aimed at reinforcing their values chains, are clean technologies, biotechnologies and digital technologies.

Figure 6
Green tech patents, 2012-2021



Source: *EIB staff calculations based on PCT patents (PATSTAT) in collaboration with ECOOM.*
Note: *Patents in green technologies are measured based on the methodology of Haščič and Migotto (2015), with further adjustments implemented by ECOOM.*

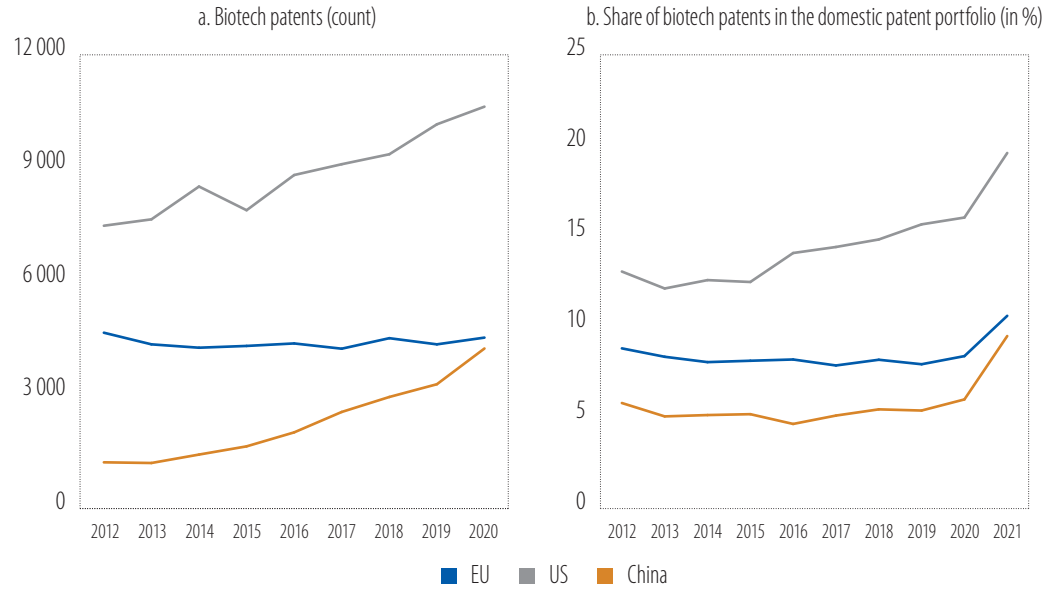
Figure 7
Venture capital investment in clean technologies in the European Union



Source: *EIB staff calculations based on PitchBook data, Inc.*

The United States leads in biotechnology patenting, followed by the European Union and China. The number of biotechnology patents has remained stable in the European Union over the past decade, while it has risen in the United States and China (Figure 8a). China is still lagging the European Union but only marginally, reflecting its increased focus on this domain (Figure 8b).

Figure 8
Biotech patents, 2012-2021



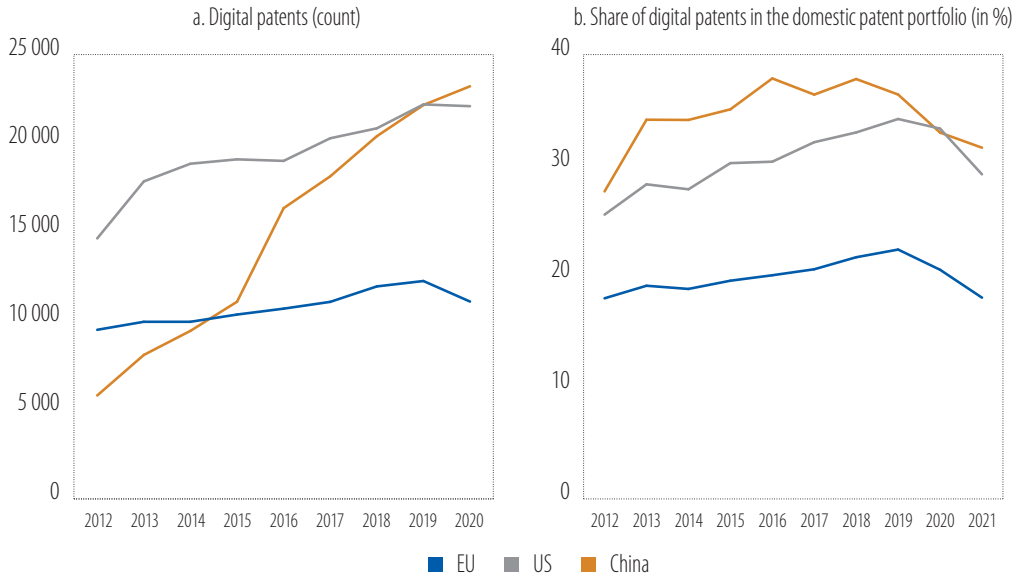
Source: *EIB staff calculations based on PCT patents (PATSTAT) in collaboration with ECOOM.*
Note: *The patent classification in biotechnology is based on the classification established by KU Leuven. The biotechnology domain is the combination of Fraunhofer technology classes 15 (biotechnology) and 16 (pharmaceuticals).*

Compared to the United States and China, the European Union is not well positioned in digital innovation. The number of patented digital innovations has been growing in China more than in the United States and the European Union (Figure 9a), even if the share remains fairly stable (Figure 9b). If Europe wants to remain globally competitive, it must further strengthen and defend its ability to innovate in digital technologies. Box B discusses the position of the European Union, the United States and China in complex technologies.

The European Union is falling behind in innovation in artificial intelligence. Artificial intelligence is increasingly considered a key digital technology, as it has the power to revolutionise various industries. It also could help address pressing global challenges like climate change using data-driven solutions. However, the European Union is behind the United States and China when it comes to patents in this area, especially in recent years (Figure 10). The regulatory framework for artificial intelligence is also a priority for policymakers, as the European Union's AI Act shows.

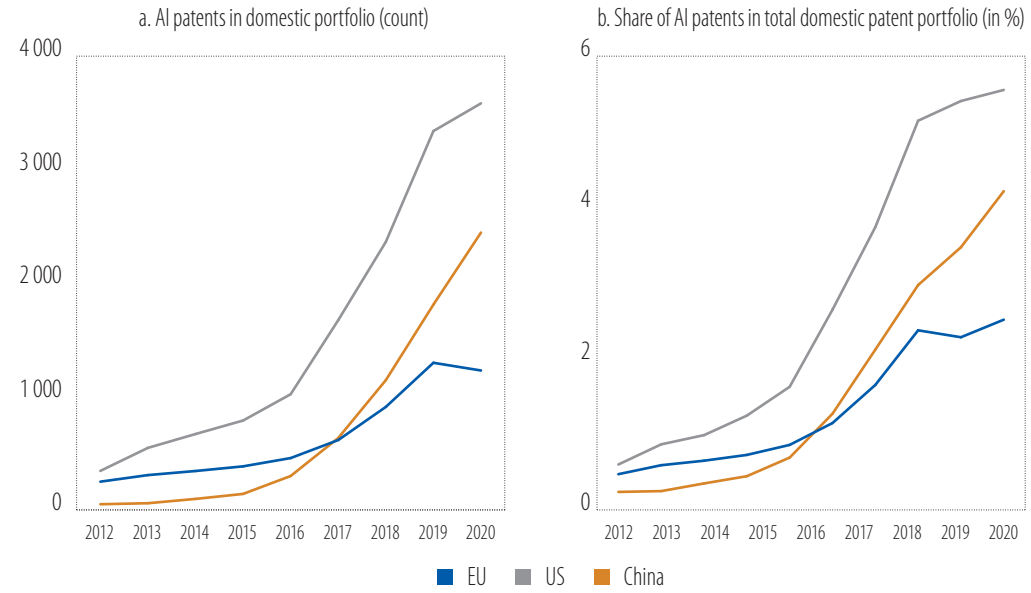
Specialisations in green technology and artificial intelligence seem to reinforce each other in EU countries, particularly in Western and Northern Europe. Green tech and artificial intelligence-related innovation activities in Europe vary significantly depending on the country. Nevertheless, there seems to be a close link between patenting specialisation in these two innovation domains (Figure 11). Combined specialisation could pay off in the future given the growing evidence that artificial intelligence could revolutionise the green transition (Rotman, 2019). The specialisation of the main EU countries in green technologies and artificial intelligence has not changed much over time. The exception to this is Denmark, which has increased its specialisation in green technologies in recent years.

Figure 9
Digital patents, 2012-2021



Source: *EIB staff calculations based on PCT patents (PATSTAT) in collaboration with ECOOM.*
Note: *The digital patent classification is based on EPO (2017).*

Figure 10
Artificial intelligence patents, 2012-2021

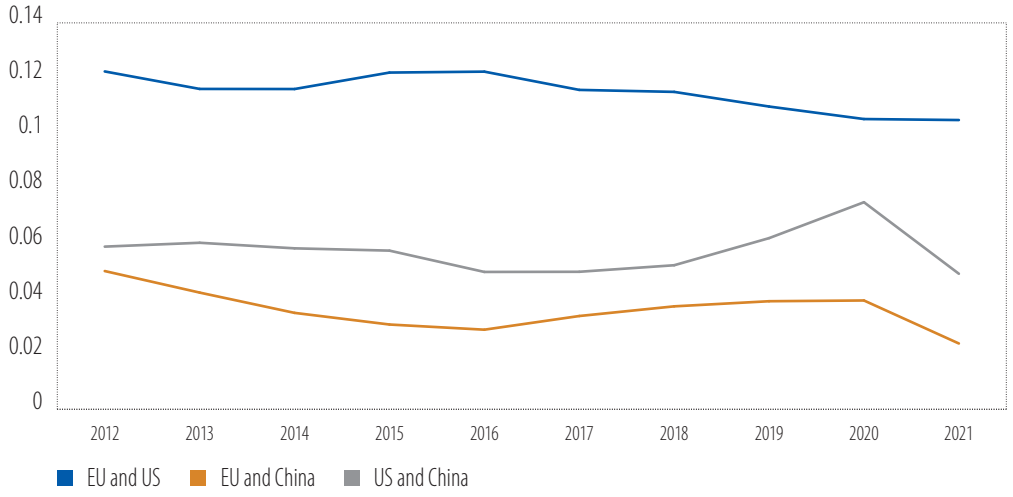


Source: *EIB staff calculations based on PCT patents (PATSTAT) in collaboration with ECOOM.*
Note: *AI patents are a subdomain of the digital patent classification.*

Figure 11
National breeding ground indices of AI and green technologies (logarithm)

Source: *EIB staff calculations based on PCT patents (PATSTAT) in collaboration with ECOOM.*
Note: *Log of National Breeding Ground index (following Leusin et al., 2020), an index multiplying the revealed technological advantage by the number of patents in each domain in a given country.*

Figure 12
Salton index of collaboration between countries



Source: *PCT patents (PATSTAT) in collaboration with ECOOM.*
Note: *The Salton index, r, captures the number of collaborative patents between country i and country j, normalised by the total patent count, n, of both countries:* $r = r_{ij}/\sqrt{n_i n_j}$

The European Union collaborates more closely with the United States than with China. International cooperation plays a pivotal role in driving innovation, paving the way for future advancements with worldwide implications. The European Union and the United States collaborate more closely with each other than with China (Figure 12), but the United States works more closely with China than the European Union does. This is also confirmed by cooperation patterns in green technologies, although EU-China and US-China cooperation is similar in that case.

Box A

Innovation and commercialisation of green and sustainable technologies in Europe

Legally binding since 2021, the European Green Deal delineates Europe's ambitious targets to address major global issues, including climate change, biodiversity loss and pollution. Innovation in clean and sustainable technologies is key to achieving these goals, enabling economies and societies to evolve towards a carbon-neutral future. At the same time, meeting these goals will require substantial investment from the public and private sectors.

Patent data serve as a compelling indicator for tracking advancements in clean and sustainable technologies. The European Patent Office (EPO) examines European patent applications, enabling inventors, researchers and companies from around the world to obtain protection for their inventions in up to 44 countries via a centralised and uniform procedure. The European Patent Office's examiners have devised strategic methods to identify patent documents pertinent to clean and sustainable technologies in various domains, including:

- Low-carbon energy and associated energy storage solutions
- Solutions for plastic recycling and plastic alternatives
- Climate change mitigation technologies (CCMT) in transportation, buildings, information and communication technology (ICT), and manufacturing
- Adaptation strategies for climate change
- Climate-friendly hydrogen-based technologies
- Innovations in waste and wastewater treatment
- Developments in smart grid technology
- Carbon capture and storage methods

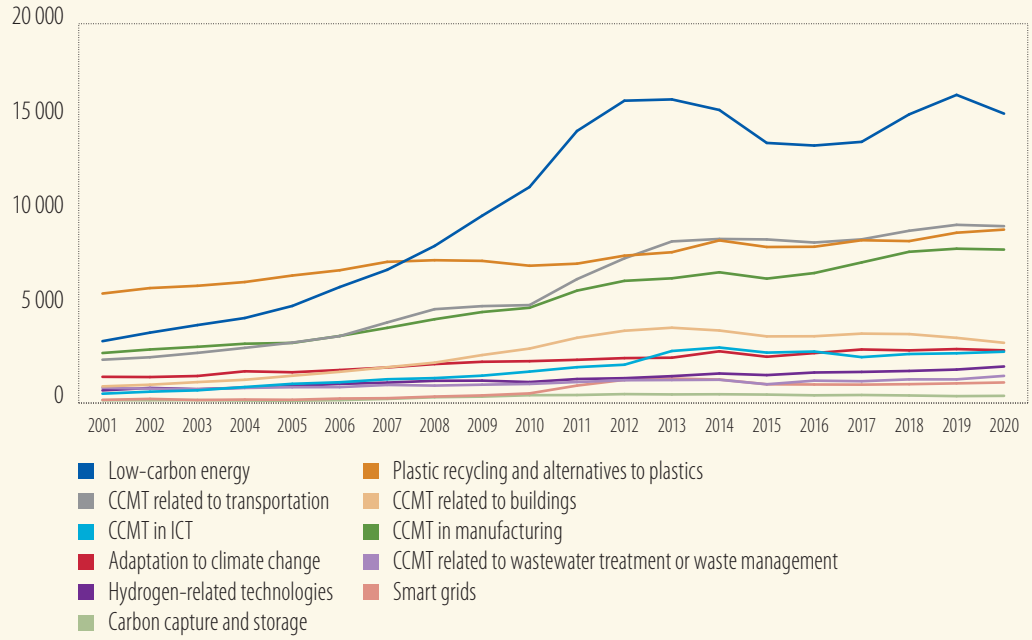
Low-carbon energy is the largest technology field with thousands of new inventions per year, encompassing energy supplies such as renewable energy and supporting technologies like electric batteries (Figure A.1). Following a surge in international patent families until the early 2010s, innovation in low-carbon energy remains very active, but with considerable fluctuations in annual numbers. Carbon capture and storage is currently the smallest of the technology fields examined here, with only a few hundred international patent families per year.

Europe was very present in these technologies from 2016 to 2020, albeit to varying degrees (Figure A.2). Europe excels in climate change mitigation technologies related to wastewater treatment and waste management and transportation, but shows relative weakness in those related to information and communication technologies. Further analysis indicates that Europe's strength mostly lies in more established fields, but it lags in newer technological innovations. For instance:

- Europe leads in the mechanical recycling of plastics (EPO, 2021), which is a mainstream solution for transforming plastic with the major breakthroughs made in the 1990s. However, Europe holds a smaller stake in the newer biological and chemical recycling technologies.
- European chemical industries excel in incremental improvements within well-established processes in hydrogen technology (EPO-International Energy Agency (IEA), 2023). However, Asian automotive and chemical companies are at the forefront of emerging technologies in this domain, such as electrolysis and fuel cell technologies.
- While Europe also boasts a strong position in nearly all renewable energy technologies, especially wind energy (EPO-IEA, 2021), it makes less of a contribution to some important enabling technologies such as those related to batteries, which are dominated by Asian countries.

Figure A.1

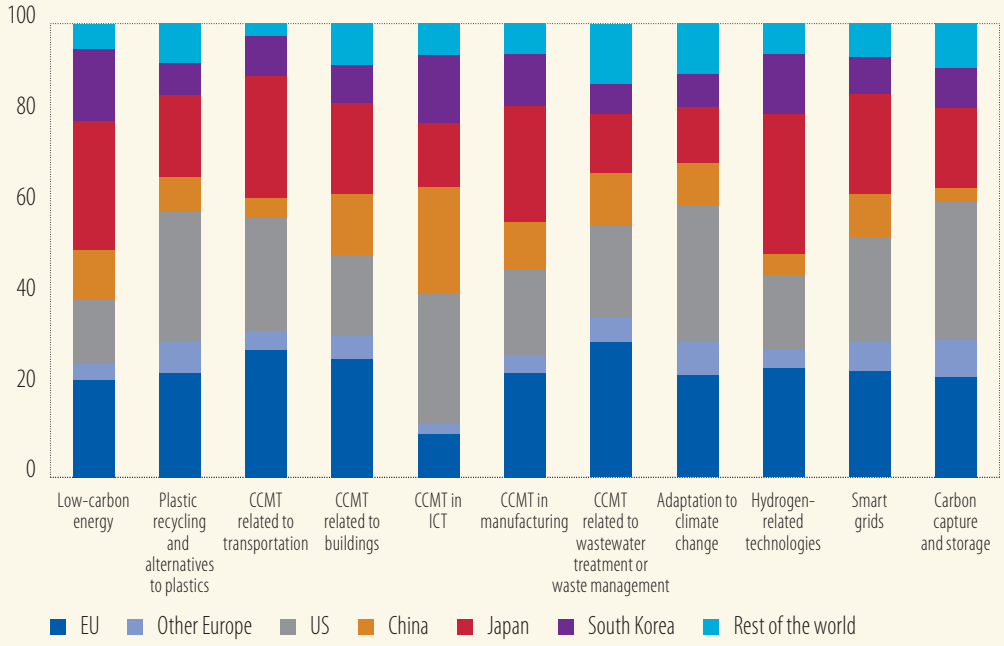
Trends in international patent families in selected clean and sustainable technologies, 2001-2020



Source: *EPO. CCMT refers to climate change mitigation.*

Figure A.2

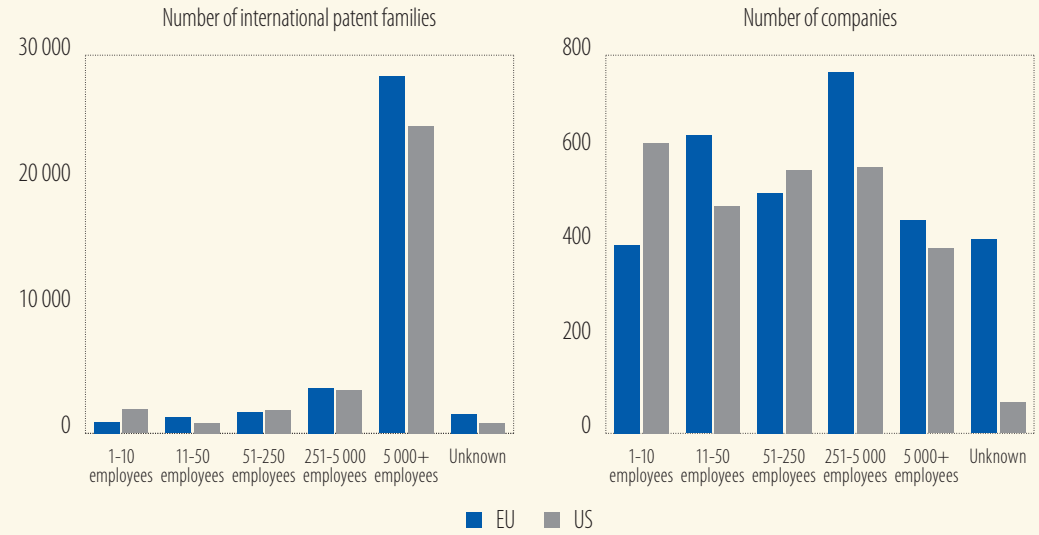
Contribution to international patent families in selected clean and sustainable technologies (in %)**, 2016-2020**



Source: *EPO.*

Figure A.3

Distribution of international patent families and applications, by company size 2016-2020



Source: *EPO.*

Note: *Information on the number of employees is based on the matching of patent applicant data with Crunchbase and LinkedIn databases. For international patent families with applicants from EU countries and applicants from other EPO member states, over 79% and 71% respectively were successfully matched. International patent families with universities and public research organisations as applicants are not presented.*

Although protecting new technologies with patents is an important step, it is often only a first step in the development and introduction of new products and services on the market. Companies of all sizes are at the forefront of the transformation needed to make the economy carbon neutral, yet they encounter unique hurdles in the commercialisation of clean and sustainable technologies, meriting significant policy focus. Although very large companies are responsible for most new patent applications in clean and sustainable technologies, smaller companies also seem to be very active in this field (Figure A.3, left-hand column). While smaller companies may not hold most of the patents, they do represent a large share of businesses active in the clean and sustainable technology domain (Figure A.3, right-hand column).

Box B

The position of the European Union, the United States and China in complex technologies

Understanding the global technological landscape is crucial to deploying strategic research and innovation policies. Technologies vastly differ in value and growth potential. Those that are relatively easy to copy and delocalise typically require a lower number of capabilities, thereby conferring a lower competitive advantage on the countries or regions where they are located. On the other hand, more complex technologies combine a higher number of capabilities, are more geographically concentrated and have greater potential for growth and overall competitiveness (Balland & Rigby, 2016).

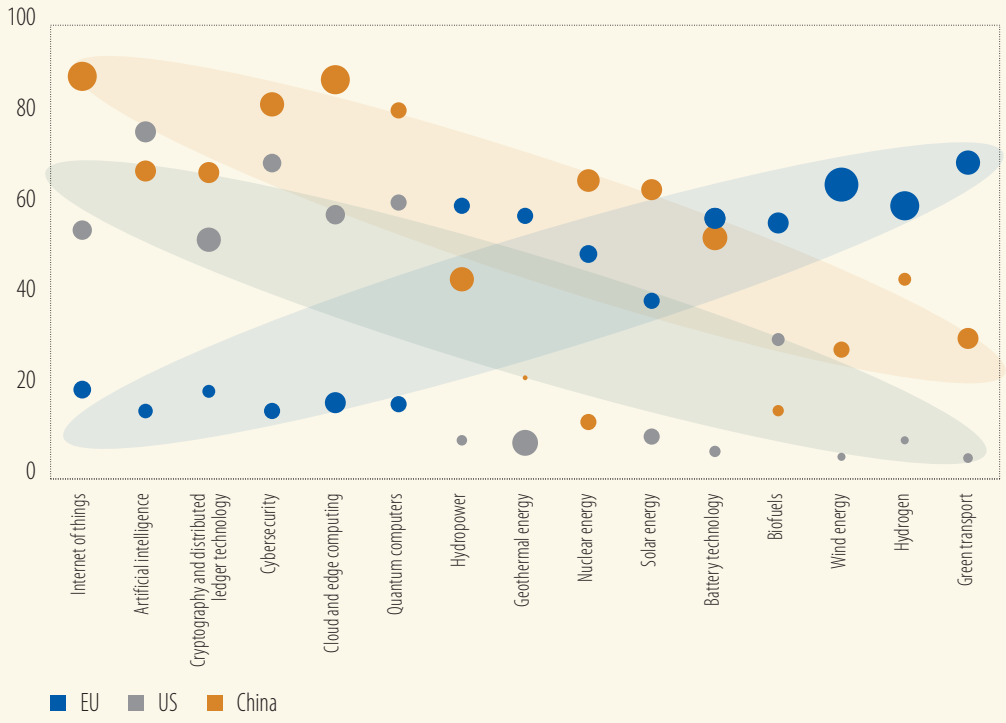
The European Union trails the United States and China in more complex technology fields. Digital technologies emerge as those with the highest technology complexity. Specifically, computer technologies, digital communication, audiovisual technologies, optics, telecommunications and

semiconductors rank at the top of the technological complexity scale (Di Girolamo et al., 2023). However, the European Union is in the lead for green technologies, outperforming China and the United States in areas related to climate adaptation, energy technologies and environmental technologies.

Figure B.1 ranks 15 key digital and green technologies based on their level of complexity. The analysis confirms that the European Union is underperforming the United States and China in digital productivity-enhancing technologies such as artificial intelligence, the internet of things, blockchain technologies and quantum computers. This calls for increased EU efforts to narrow the gap with key competitors.

However, the European Union remains ahead in some green fields, outperforming China and the United States in technologies related to wind energy, hydrogen and green transport, while little difference is observed for biofuels (Figure B.1). Furthermore, although it currently has a lower specialisation ranking in nuclear energy, solar energy, hydropower, geothermal energy and battery technologies, the European Union does have high future specialisation potential in these fields, indicating that the cost to further specialise in these types of technologies would be lower.

Figure B.1
EU position in complex technologies vs. the United States and China, 2019-2022



Source: *European Commission Directorate-General for Research and Innovation, Common R&I Strategy and Foresight Service, Chief Economist Unit based on Google patent data.*

Note: *The x-axis indicates the relatedness density in any of the technology fields considered. On the y-axis, technologies are ranked by complexity, normalised between 0 and 100. The size of the bubble captures the degree of specialisation that each country reports in a given technology field, as measured by the revealed comparative advantage.*

From a policy standpoint, these results should encourage a more structural approach to strategic funding and technological development, targeting EU research and innovation investments bridging the specialisation gap between the European Union and its main counterparts and focusing on technologies more likely to deliver major productivity gains in the long term. The European Union can also use its international relationships to complement its technological capabilities, defining areas of mutual interest as well as division of knowledge with key partners.

At the same time, the European Union can continue to exploit its comparative advantage in green technologies, while increasing its efforts to reduce its dependency on raw materials and pursue other activities necessary for decarbonisation. The EU single market must also be further strengthened to accelerate the roll-out of strategic technologies and thus reduce strategic dependencies. Efforts are needed to avoid brain drain and promote re-training and lifelong learning initiatives, as innovation remains key to reducing skill gaps and ensuring that humans and cutting-edge technologies complement each other well.

Investment in innovation and the adoption of digital and green technologies

This section focuses on corporate investment in innovation and the adoption of green and digital technologies. The latest results of the EIB Investment Survey (EIBIS) show that investment in innovation is positively associated with a range of firm performance indicators. The section also discusses factors that can support or hamper the investment activities of innovative firms, such as access to finance, digital infrastructure, a dynamic innovation environment, business regulations and the lack of skilled workers.

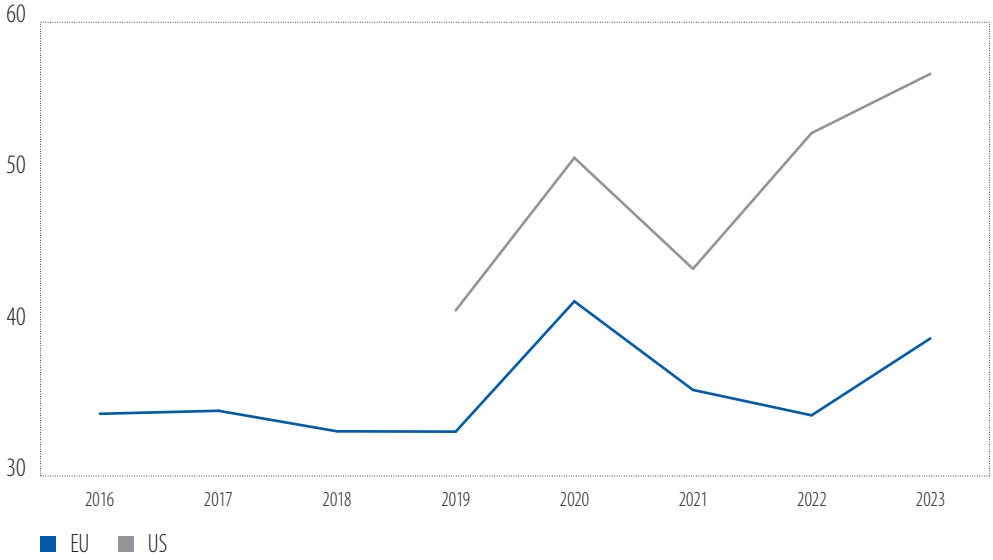
Investment to develop or introduce new products, processes or services

The European Union has a lower share of firms investing to develop or introduce new products, processes or services than the United States. After a slowdown following the COVID-19 crisis, the share of EU firms investing in innovation increased to 39%, compared with 57% in the United States (Figure 13). This evidence from the EIBIS confirms the findings of the European Innovation Scoreboard 2023 (European Commission, 2023) and Organisation for Economic Co-operation and Development (OECD) data, in which the United States scores better than the European Union on several indicators related to R&D and innovation.

Innovation activities are associated with investment in intangible assets. Firms that allocate a greater share of investment to intangibles (R&D, software and data, training of employees and organisational and business process improvements) tend to innovate more (Figure 14). R&D investment is the main driver of this positive correlation between intangible assets and the introduction or development of new products, processes or services.

Figure 13

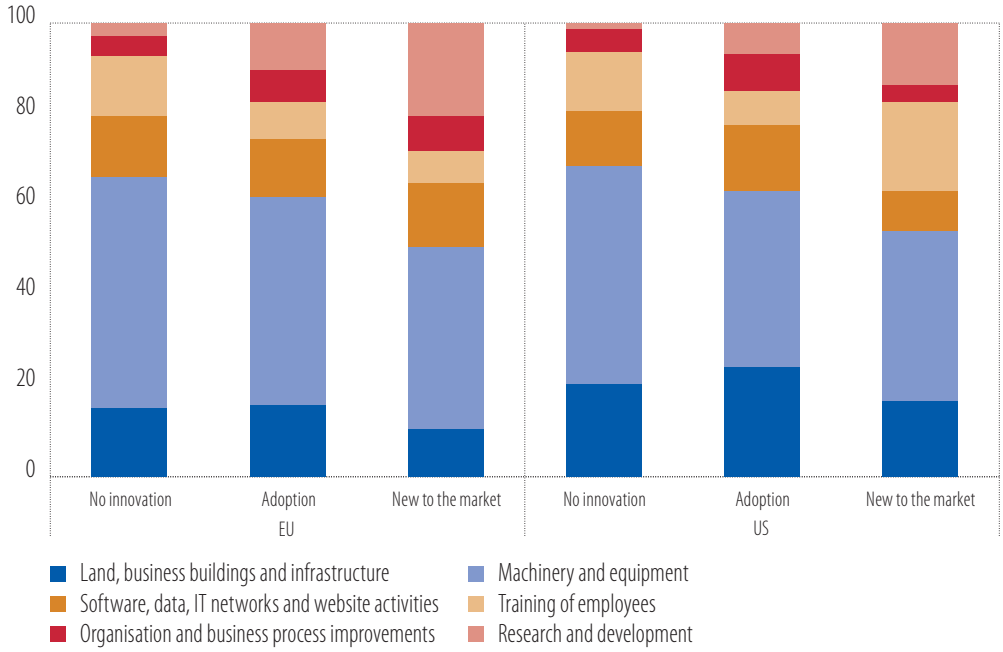
Development or introduction of new products, processes, or services (% of firms)



Source: *EIBIS 2016-2023.*
Note: *Firms are weighted by value added.*
Question: *What proportion of the total investment in the previous financial year was for developing or introducing new products, processes or services?*

Figure 14

Innovation and investment in intangible assets (% of total investment)

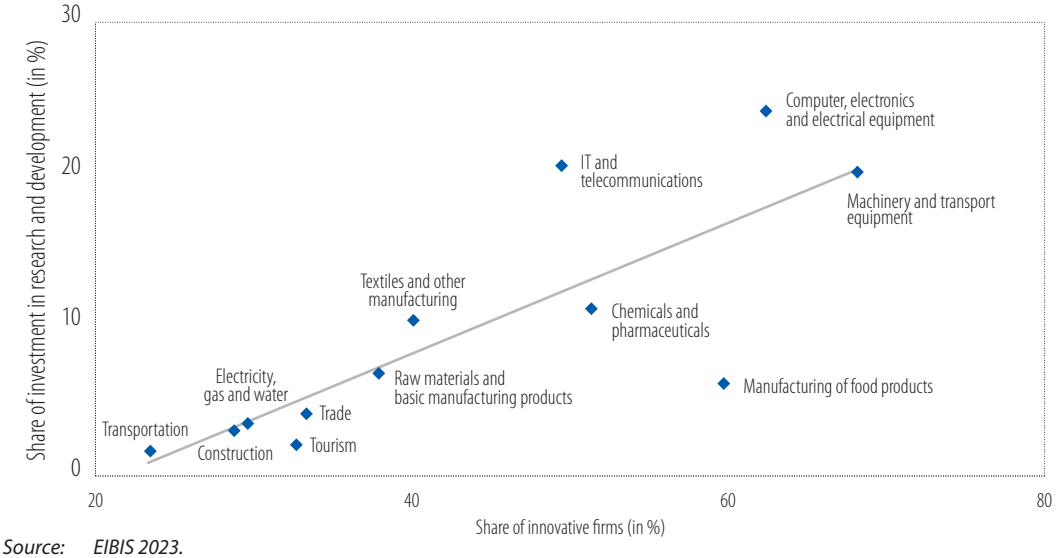


Source: *EIBIS 2023.*
Note: *Firms are weighted by value added.*
Question: *Were the new products, processes or services that you developed or introduced new to the company or new to the country or global market? In the previous financial year, how much did your business invest in each of the following with the intention of maintaining or increasing your company's future earnings?*

Firms in sectors with higher R&D intensity tend to be more innovative. Sectors that invest more intensely in R&D (such as computer, electronics and electrical equipment, machinery and transport equipment, and information technology (IT) and telecommunications) also tend to have a higher share of firms that introduce new products, processes or services (Figure 15). This highlights how different investment needs for supporting innovative firms are, depending on the sector.

Innovative firms tend to perform better. They are more likely to have strong management practices, invest in training their employees, use advanced digital technologies, introduce new green technologies and invest in energy efficiency (Figure 16). They therefore seem more likely to thrive in an environment where investment in all these areas is increasingly important.

Figure 15
Investment in innovation and investment in R&D

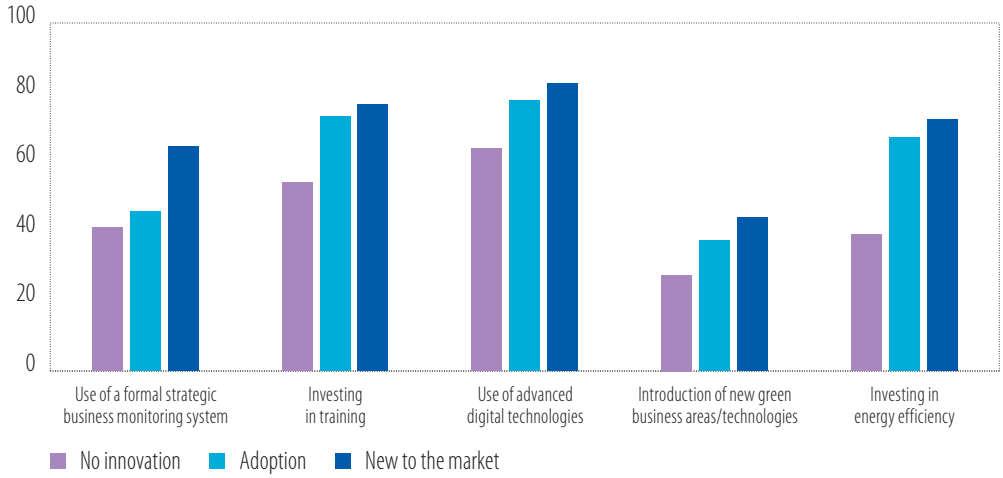


Source: *EIBIS 2023.*
Note: *EU firms. Firms are weighted by value added.*
Question: *What proportion of the total investment in the previous financial year was for developing or introducing new products, processes or services? In the previous financial year, how much did your business invest in research and development (including the acquisition of intellectual property)?*

Highly innovative firms are more pessimistic about the availability of external finance. Over the past two years, there has been a rapid increase in the share of highly innovative firms expecting conditions for external finance to deteriorate (Figure 17a). The current economic context poses several challenges that may negatively affect the investment activities of highly innovative firms. Firms that introduce innovations that are new to the market appear to be the most pessimistic and vulnerable to a cyclical deterioration in financing conditions. This may reflect structurally tighter access to external finance for these firms.

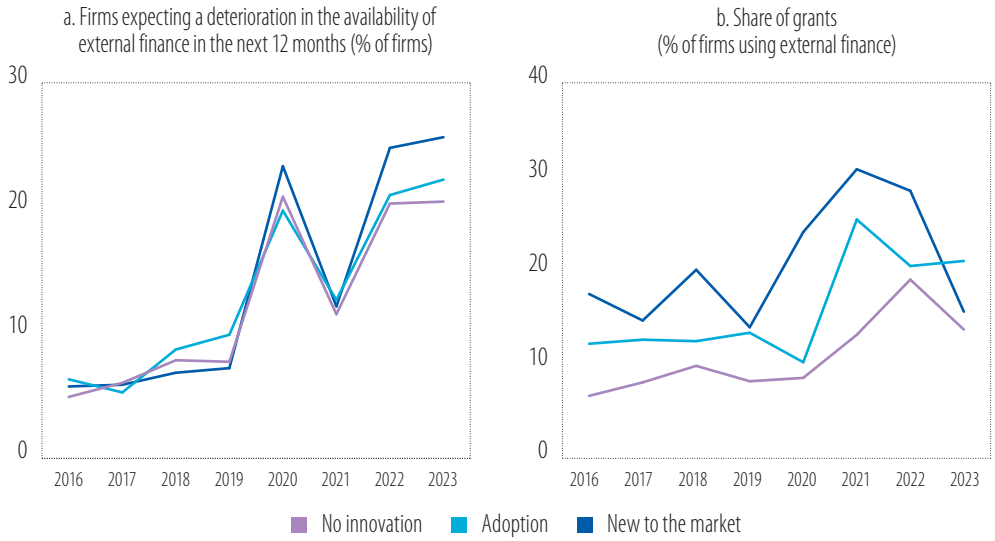
As European policies in 2022 focused on countering the effects of the energy shock, the most innovative companies saw a drop in finance provided by public grants. Even though highly innovative firms saw an uptick in support through grants during COVID-19, they later also experienced a stronger decrease in grant finance (Figure 17b). This could further exacerbate their vulnerability, hindering their ability to weather a difficult external economic environment.

Figure 16
Innovation and firm performance (% of firms)



Source: *EIBIS 2023*
Note: *EU firms. Firms are weighted by value added.*
Question: *Were the new products, processes or services that you developed or introduced new to the company or new to the country or global market? Does your company use a formal strategic business monitoring system that compares the firm's current performance against a series of strategic key performance indicators? In the previous financial year, how much did your business invest in training employees? Are advanced digital technologies used within your business? Is your company investing in new, less polluting, business areas and technologies to reduce greenhouse gas emissions? Is your company investing in energy efficiency (including heating and cooling improvements and energy management (for example, energy smart technologies and Eco-Management and Audit Scheme (EMAS)) to reduce greenhouse gas emissions?*

Figure 17
Innovation and the availability of external finance

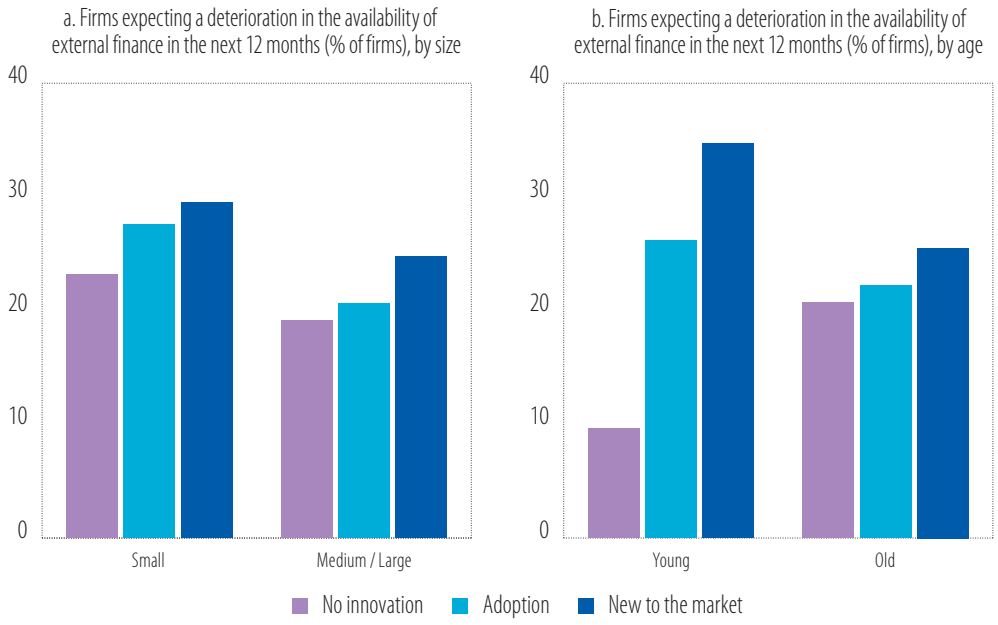


Source: *EIBIS 2016-2023.*
Note: *EU firms. Firms are weighted by value added.*
Question: *Were the new products, processes or services that you developed or introduced new to the company, or new to the country or global market? Do you think that the availability of external finance (such as bank financing, or private or public equity) will improve, stay the same, or get worse over the next 12 months? Did you use grants to finance your investment activities in the previous financial year?*

Investment in innovation could suffer if the prospects of highly innovative companies turn gloomy and their financial buffers deplete. During an economic downturn, tightening financing conditions and financial constraints can have a negative effect on innovation activities, especially for firms in sectors that depend more heavily on external finance (Aghion et al., 2012). In addition to experiencing difficulties tapping into external financing, innovative companies may refrain from investing in innovation, even if they have the financial means to do so. Investments to develop products, processes or services that are new to the market are often risky, with highly uncertain returns. They encompass a large share of sunk costs, and once the investment is made, it is to a large extent irreversible. Innovative firms are also more susceptible to difficulties in accessing finance because of market failures, for example information asymmetries between investors and innovating companies or the inability to appropriate innovation, since knowledge is difficult to own, cannot be protected with insurance, and is not accepted as collateral by banks (Arrow, 1962; Stiglitz & Weiss, 1981; Dixit & Pindyck, 1994).

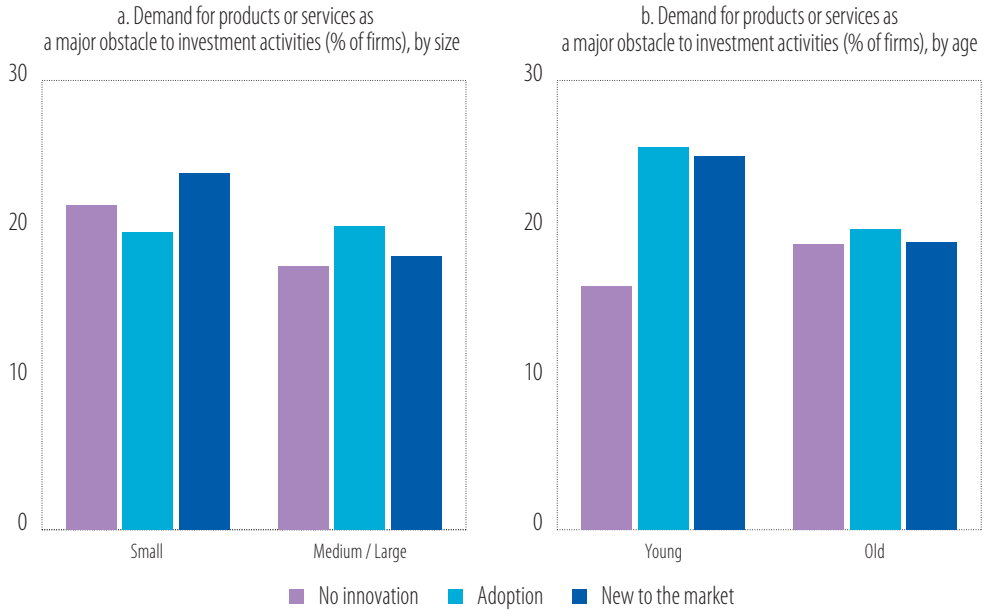
Small and young firms bringing new innovations to the market seem to be more susceptible to the business cycle. They are more likely to expect a deterioration in the availability of external finance in the next 12 months (Figure 18). Compared to larger and older firms, smaller and younger firms with innovations new to the market are also more likely to report that the demand for their products or services is a major obstacle to investment (Figure 19). During economic downturns, market demand may be strongly affected, thereby weighing on investment in innovation, especially for small and young firms (Fort et al., 2013).

Figure 18
Innovation and the availability of external finance



Source: *EIBIS 2023.*
Note: *EU firms. Firms are weighted by value added.*
Question: *Were the new products, processes or services that you developed or introduced new to the company, or new to the country or global market? Do you think that the availability of external finance (such as bank financing, or private or public equity) will improve, stay the same, or get worse over the next 12 months?*

Figure 19
Innovation and demand for products or services



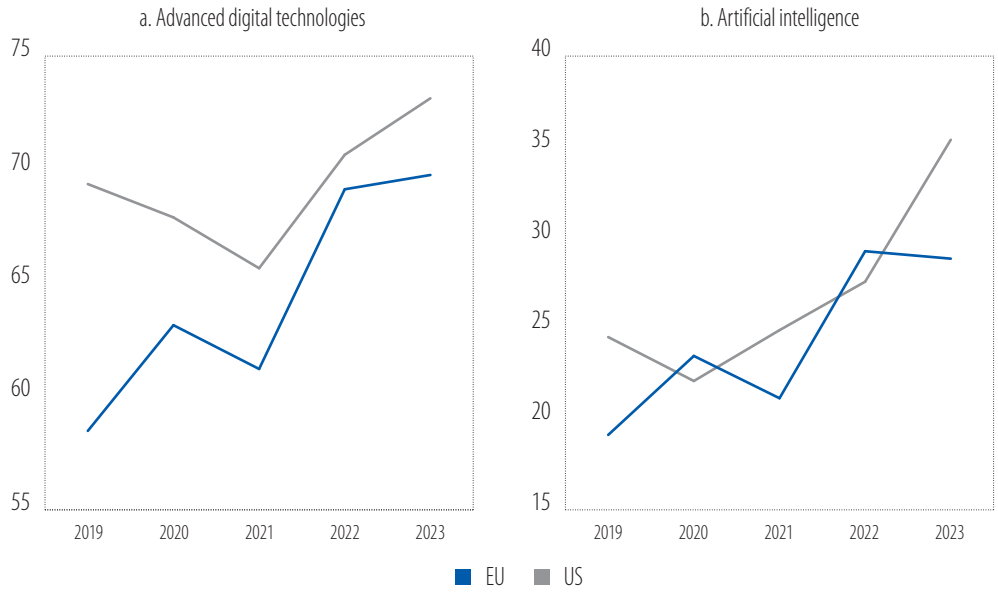
Source: *EIBIS 2023.*
Note: *EU firms. Firms are weighted by value added.*
Question: *Were the new products, processes or services that you developed or introduced new to the company, or new to the country or global market? Thinking about your investment activities, to what extent is the demand for products and services a major obstacle?*

Adopting digital technologies

The digital adoption gap between the United States and the European Union has been narrowing since the pandemic. Strengthening the competitiveness of the European economy through the green and digital transformations will involve cutting-edge innovation and adopting and deploying these technologies more broadly. The latest results from the EIBIS show that EU firms are accelerating the adoption of advanced digital technologies after putting these processes on hold in the first year of the pandemic. The share of EU firms implementing advanced digital technologies reached 70% in 2023, compared with 73% in the United States (Figure 20a). To make sure that no persistent gap is created with their US peers, EU firms need to remain vigilant and increase the use of artificial intelligence, which is a key technology in the digital transformation (Figure 20b).

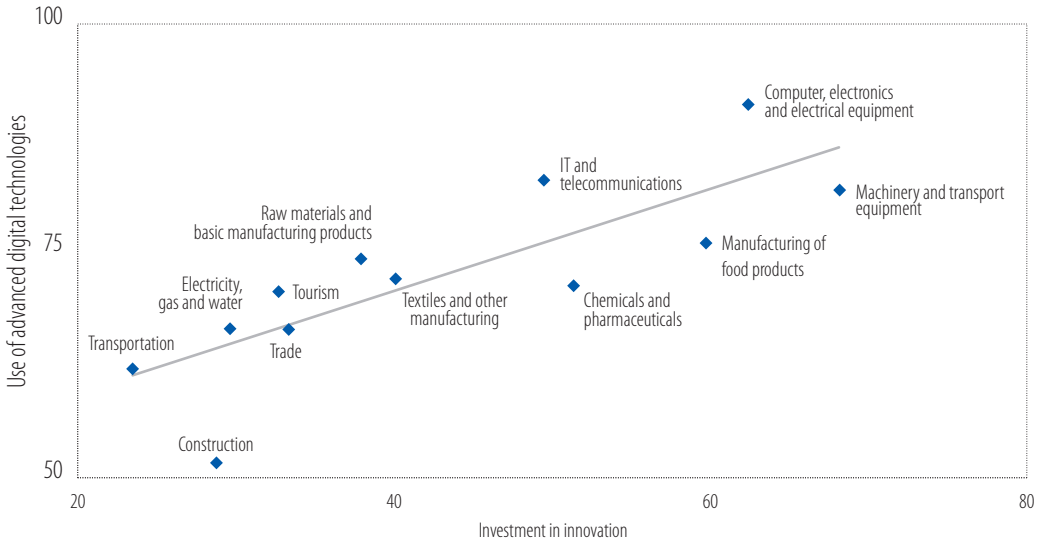
The sectors that invest more in innovation tend to be more digital. Sectors that invest more in the development of new products, processes or services also tend to have a higher share of firms using advanced digital technologies (Figure 21). This also illustrates the fact that advanced digital technologies – such as big data analytics and artificial intelligence, 3D printing, advanced robotics, drones, the internet of things, digital platform technologies, and augmented or virtual reality – are changing the ways new products and services are developed (Cockburn et al., 2019).

Figure 20
Use of advanced digital technologies and artificial intelligence (% of firms)



Source: *EIBIS 2019-2023.*
Note: *The question on the use of advanced digital technologies was only introduced in EIBIS 2019. Firms are weighted by value added.*
Question: *Are advanced digital technologies used within your business? Are Big Data analytics and artificial intelligence used within your business?*

Figure 21
Investment in innovation and the use of advanced digital technologies (% of firms)

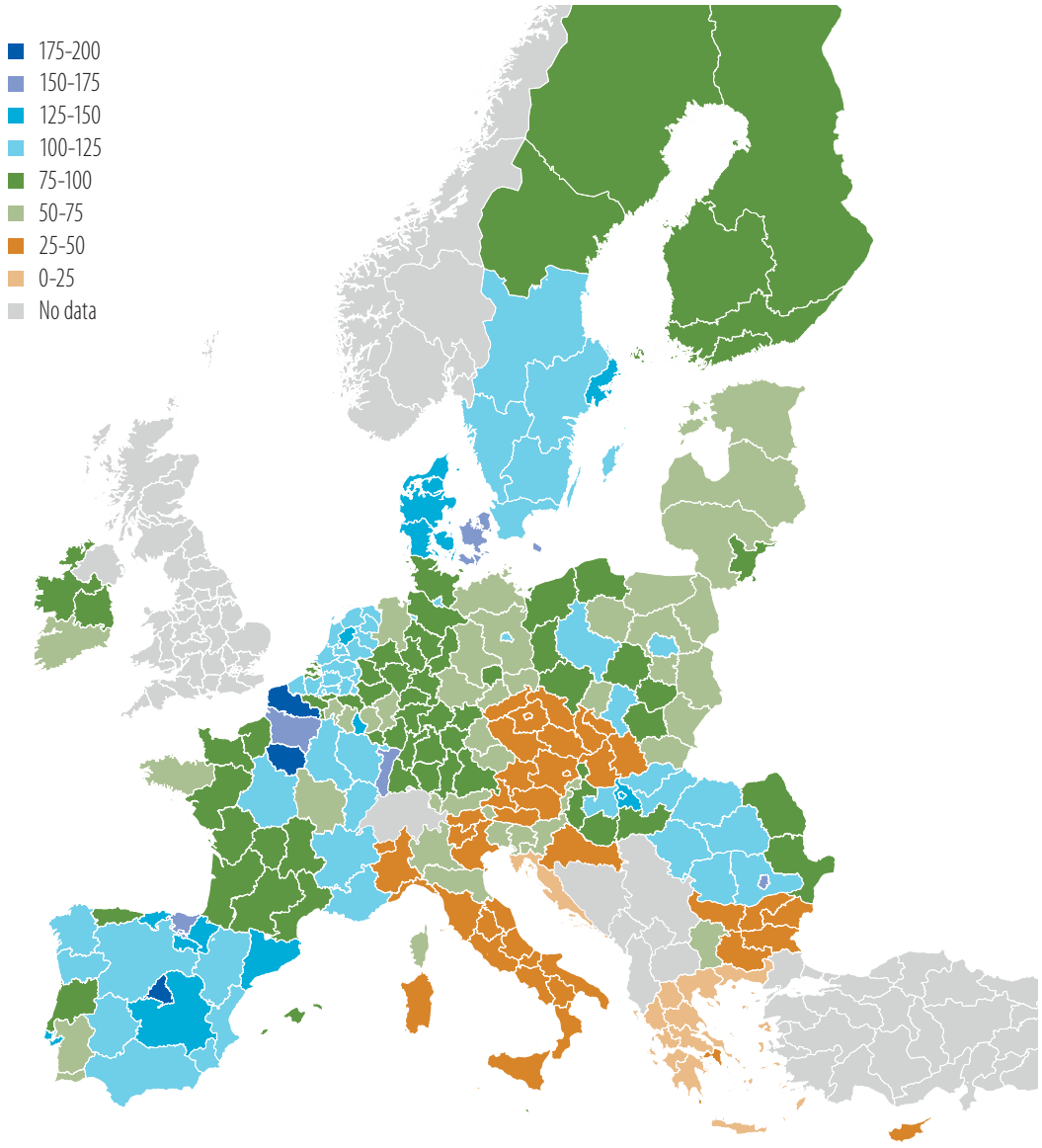


Source: *EIBIS 2023.*
Note: *EU firms. Firms are weighted by value added.*
Question: *What proportion of the total investment in the previous financial year was for developing or introducing new products, processes or services? Are advanced digital technologies used within your business?*

Digital infrastructure plays a critical role for economic activity, particularly for firms using advanced digital technologies. In the latest EIBIS, 12% of EU firms surveyed consider restricted access to digital infrastructure to be a major obstacle to investment. A key problem is internet access and speed. Using data on average internet download speeds, Figure 22 shows that there are significant differences in the quality of digital infrastructure between different EU regions and countries.

Figure 22

Internet download speed in the European Union in 2021 (megabits per second)



Source: *EIB staff calculations based on Ookla.*
Note: *The figure shows data from 2021 and is based on more than 82 million internet speed tests during this period. Average internet download speed in a Nomenclature of Territorial Units for Statistics 2 (NUTS 2) region is based on tests performed using the website Speedtest.net and is measured in megabits per second. The original data is provided at the level of mercator tiles (approximately 610.8 metres by 610.8 metres at the equator), which is aggregated to NUTS 2 level averages, using the number of tests as weights.*

The returns from digitalisation are larger for firms located in regions with better digital infrastructure and faster internet speeds. This is illustrated by the positive interaction between firms' use of advanced digital technologies and high download speeds in a regression analysis (Table 1). These findings illustrate how complementary public and private digital investment can improve firms' performance and economic resilience.

Table 1
Digital adoption, digital infrastructure and firm productivity

Dependent variable	Labour productivity
Use of advanced digital technologies	0.150***
	(0.013)
Regions with high download speed	0.112***
	(0.014)
Digital x high download speed	**0.032***
	(0.018)
Sample size	42 515
R-squared	0.254

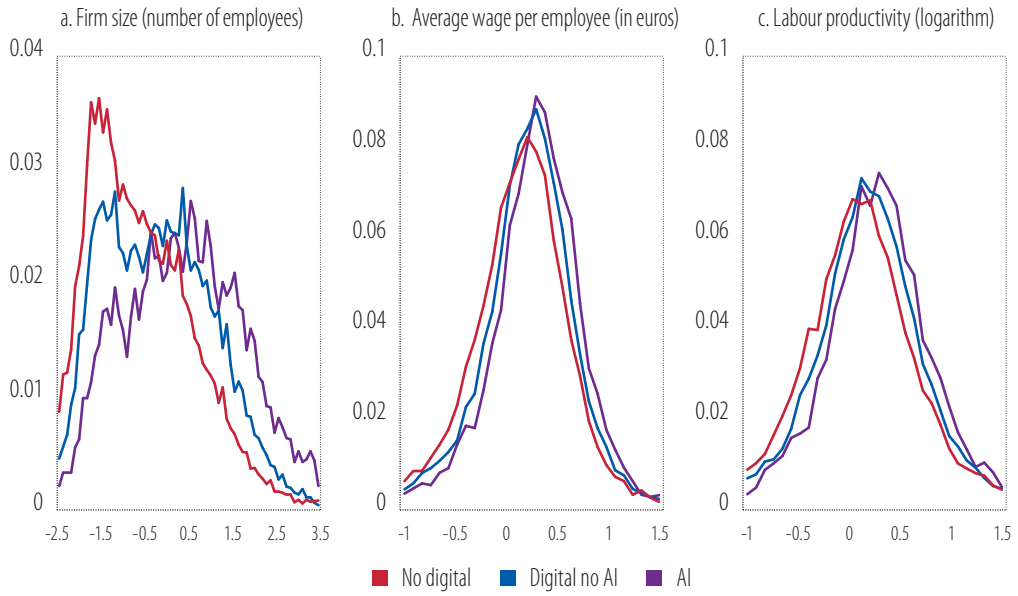
Source: *EIB staff calculations based on EIBIS 2019-2023 and Ookla (2021).*
Note: *EU firms. Labour productivity is in natural logarithm. The ordinary least square (OLS) regression controls for firm size, firm age, country and sector (three groups of EU countries and four macroeconomic sectors). Regions with high download speed: NUTS 2 regions with average download speed higher than the median download speed for all regions (based on Ookla data). Robust standard errors are in parentheses. Statistical significance: *** p-value<0.01, ** p-value<0.05, * p-value<0.1.*

Firms using artificial intelligence tend to perform better than firms using other advanced digital technologies on a number of different performance metrics. Firms that have adopted big data and artificial intelligence technologies are on average larger, pay higher wages to their employees and have higher productivity. Figure 23 compares the distribution of firm size, average wage per employee and total factor productivity for three groups of firms: (i) firms that have not adopted any digital technologies; (ii) firms that use advanced digital technologies (but not artificial intelligence); and (iii) firms that use artificial intelligence. The distribution for firms using artificial intelligence is shifted to the right, which illustrates the benefits for firm performance.

Using artificial intelligence positively affects firm performance. The causal relationship between the adoption of digital technologies and firm performance is identified using propensity score weighting, where the propensity of using artificial intelligence or other advanced digital technologies is modelled based on past firm performance and firm characteristics, such as the capital intensity and the share of intangible investment. The estimates are reported in Table 2 with two panels. The top panel is for firms that used digital technologies but do not use artificial intelligence, and the bottom panel is for firms that use artificial intelligence. The results underline the positive benefits of using advanced digital technologies on firm performance. They also show that firms using artificial intelligence tend to perform even better than firms using other advanced digital technologies, but not artificial intelligence. Overall, this supports previous empirical evidence on the positive effect of digital adoption and the use of artificial intelligence on innovation and firm productivity (Gal et al.; 2019; Acemoglu et al., 2022a; Rammer et al., 2022; EIB, 2023).

Figure 23

Distribution of firm size, average wage per employee and firm productivity



Source: *EIB staff calculations based on EIBIS 2016-2023.*
Note: *EU firms. The graph shows distributions net of country and sector fixed effects.*

Table 2

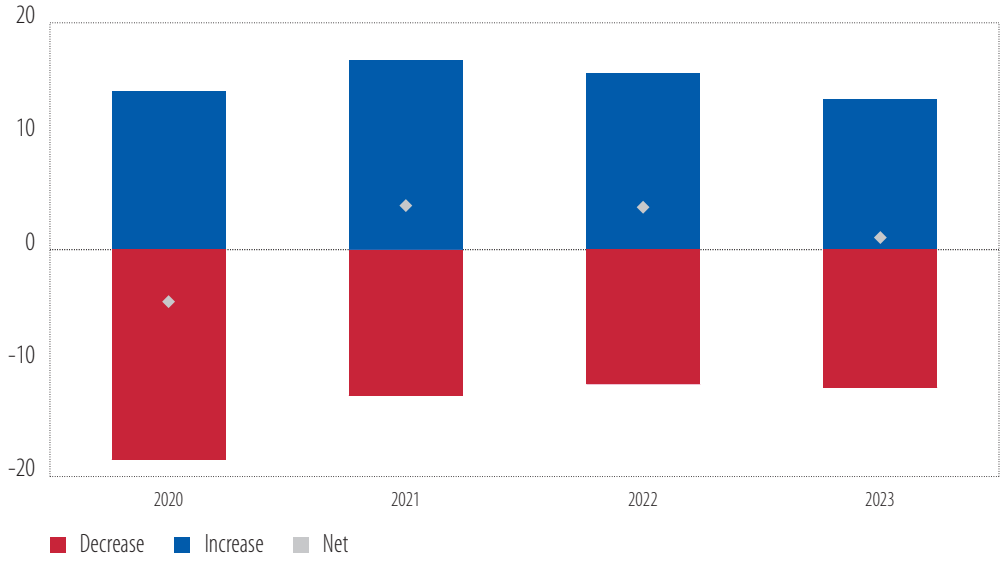
Higher performance of firms using digital technologies and artificial intelligence, compared to non-digital firms

	Binary outcomes			Continuous outcomes			
	Training of employees	Strategic management systems	Innovation (share of firms)	Innovation (share of investment)	Labour productivity	Total factor productivity	Average wage per employee
Digital but not AI	0.276***	0.371***	0.270***	0.033***	0.055***	0.021*	0.032***
	(0.019)	(0.016)	(0.021)	(0.004)	(0.013)	(0.013)	(0.012)
Sample size	32 634	35 846	30 278	30 282	31 694	30 534	34 308
AI	0.269***	0.538***	0.320***	0.056***	0.124***	0.086***	0.095***
	(0.028)	(0.027)	(0.024)	(0.006)	(0.017)	(0.015)	(0.014)
Sample size	30 085	33 267	28 525	28 525	29 660	28 722	31 939

Source: *EIB staff calculations based on EIBIS 2016-2023.*
Note: *EU firms. The upper panel compares non-digital firms to firms using advanced digital technologies but not artificial intelligence. The lower panel compares non-digital firms to firms using artificial intelligence. Robust standard errors are in parentheses. The regressions control for firm size, country, sector and year (27 EU countries and four macroeconomic sectors). Statistical significance: *** p-value<0.01, ** p-value<0.05, * p-value<0.1.*

Many digital firms expect that using digital technologies will result in hiring more employees. The share of firms using digital technologies expecting a positive impact on job creation is higher than the share of digital firms believing that digital technologies will lead to a decrease in employee numbers (Figure 24). However, most firms do not expect the use of digital technologies to have any impact on the number of people they employ.

Figure 24
Expected net effect of digitalisation on employment (% of firms)



Source: *EIBIS 2020-2023.*
Note: *EU firms. Firms are weighted by value added. Net is the share of firms expecting an increase minus the share of firms anticipating a decrease in employment.*
Question: *Over the next three years, what impact do you expect your business's use of digital technology(ies) to have on the number of people your company employs?*

Digitalisation goes hand in hand with a reallocation of resources that can improve productivity. Digital firms tend to be more productive than non-digital firms, especially if they use artificial intelligence. Among digital firms, those in the top quartiles of the productivity distribution are also more likely to expect digital technologies to have a positive impact on the number of people they employ (Figure 25). At the same time, firms that expect a decrease in employment are more likely to be at the bottom of the productivity distribution. These results suggest a reallocation of labour resulting from employment flowing from low to high productivity firms, which can increase the productivity of the economy overall.[2]

Digital technologies and artificial intelligence affect employment differently. On the one hand, digitalisation can reduce demand for labour and push down wages for jobs involving tasks performed by the technology. At the same time, it can increase demand for labour needed to perform other tasks (Acemoglu & Restrepo, 2020; Aghion et al., 2020). Automation does not have negative aggregate effects on employment, but firms adopting digital technologies do shift their new hiring towards digital skills (Acemoglu et al., 2022b; Babina et al., 2022; Grossman & Gene, 2022).

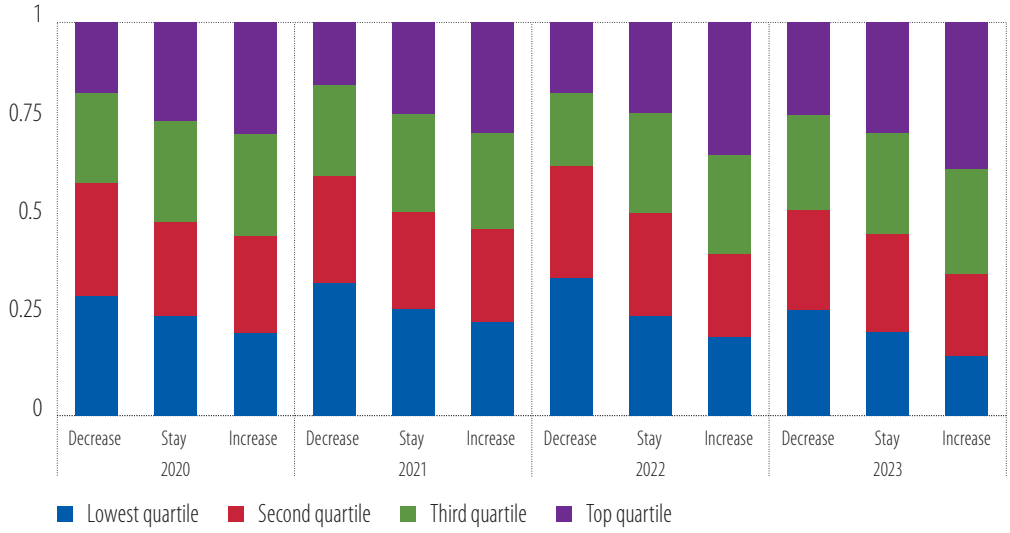
Firms that adopt advanced digital technologies grow faster than non-digital firms. Firms that adopted digital technologies before the COVID-19 crisis have expanded faster than non-digital firms (Figure 26). But these firms were already growing faster than their non-digital peers even before digital adoption – possibly reflecting a selection effect, where fast-growing firms are also firms that decide to adopt digital

2 The results are also supported by the positive correlation between the expectations and reality of digital firms' employment growth. The use of panel data shows that the digital firms that expect to grow are also those that do grow.

technologies. A cohort of firms started using advanced digital technologies in 2020, possibly as a response to the COVID-19 crisis. These new digital adopters began growing faster than non-digital firms only after their digital transformation (Figure 26). Overall, this causal evidence on the positive effect of digitalisation on employment for EU firms corroborates the findings of Acemoglu et al. (2022a) for the United States.

Figure 25

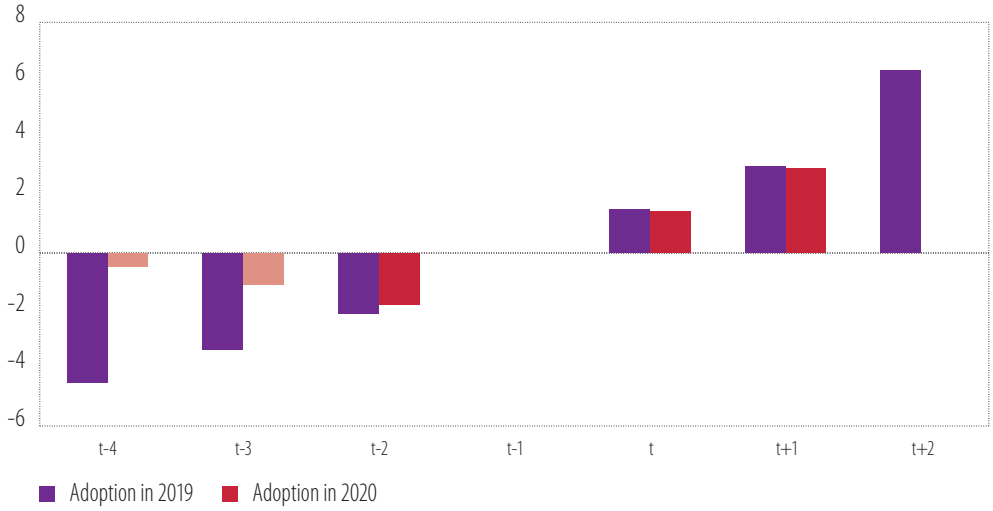
Expected effect of digitalisation on employment (% of firms)**, by productivity quartiles**



Source: *EIB staff calculations based on EIBIS 2020-2023.*
Note: *EU firms. Productivity is measured as the logarithm of total factor productivity. Firms are weighted with value added.*
Question: *Over the next three years, what impact do you expect your business's use of digital technolog(ies) to have on the number of people your company employs?*

Figure 26

Employment growth before and after digital adoption (in %)



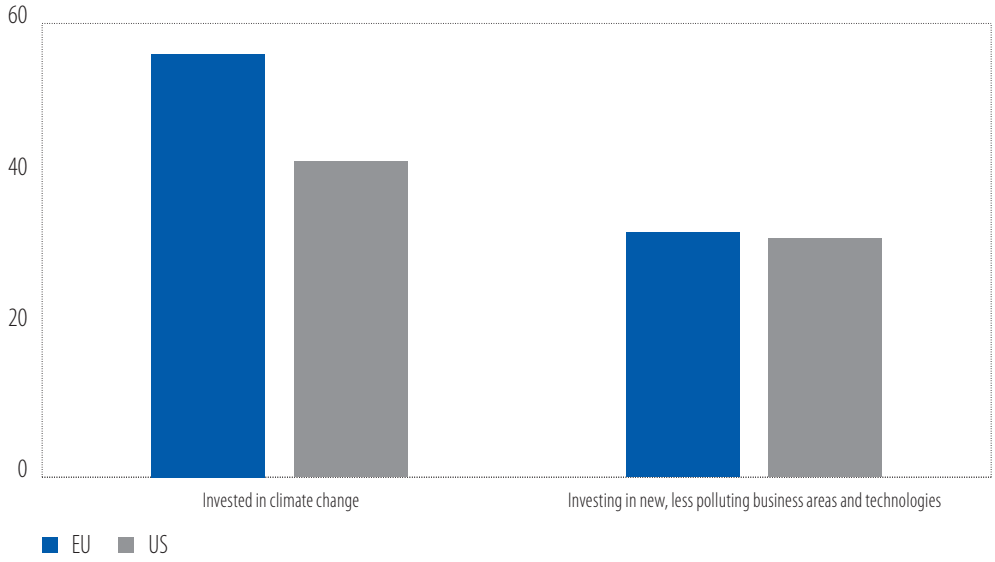
Source: *EIB staff calculations based on EIBIS and ORBIS data.*
Note: *EU firms. The bars show the estimated employment of firms relative to the level of employment in the year just before digital adoption. Only firms that adopt a single digital technology are considered in the estimation. Employment in t+2 is not available for 2020 adopters. Light coloured bars are not significant at the 5% confidence level.*

Adopting green technologies

The European Union has a higher share of firms that invest in tackling the fallout of extreme weather and in helping to reduce carbon emissions than the United States. However, the share of EU and US firms that invest in new, less polluting business areas and technologies is similar (Figure 27). Investing in new green technologies is especially important if the European Union wants to maintain a competitive advantage in this area. The previous section showed that Europe is excelling in patenting green technologies. While this is encouraging, it is critical that firms invest in adopting these new green innovations more broadly.

Figure 27

Investment to tackle the effects of weather events and to help reduce carbon emissions, and investment in new, less polluting business areas and technologies (% of firms)



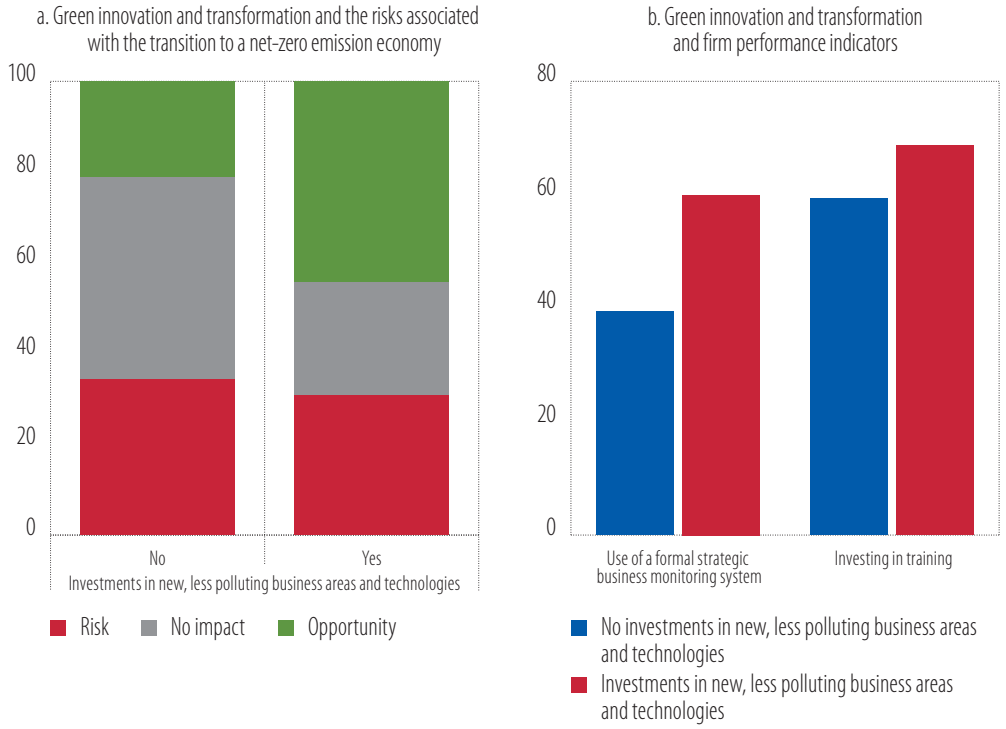
Source: *EIBIS 2023.*
Note: *Firms are weighted by value added.*
Question: *Has your company already made investments to tackle the impacts of weather events and to help reduce carbon emissions? Is your company investing in new, less polluting business areas and technologies to reduce greenhouse gas emissions?*

Firms investing in green innovation and transformation are more likely to see the challenges associated with moving to a net-zero emission economy as an opportunity. Almost half of firms that invest in less polluting business areas and technologies see the transition to stricter climate standards as an opportunity (more than 20 percentage points above firms not making such investments) (Figure 28a). Investing in green innovation also fosters firm performance, resulting in greater use of advanced management practices and more investment in employee training (Figure 28b).

An innovative environment can play a critical role in encouraging firms to invest in innovation and thereby foster economic activity and performance. A wide range of literature highlights the role of knowledge spillovers in innovation by firms and the importance of environments that support innovation (Audretsch et al., 2022; European Commission, 2022a). The intensity of green innovation in a region (as measured by patents in green technologies) can be used as a proxy for the innovative quality of a green ecosystem. Figure 29 shows that significant differences exist in the green innovative intensity of different EU regions and countries.

Figure 28

Green innovation and transformation, transition risks and firm performance (% of firms)



Source: *EIBIS 2023.*
Note: *EU firms. Firms are weighted by value added.*
Question: *Is your company investing in new, less polluting business areas and technologies to reduce greenhouse gas emissions? Thinking about your company, what impact do you expect this transition to stricter climate standards and regulations will have on your company over the next five years? Does your company use a formal strategic business monitoring system that compares the firm's current performance against a series of strategic key performance indicators? In the previous financial year, how much did your business invest in training employees?*

Table 3

Green innovation, regional green innovation and firm productivity

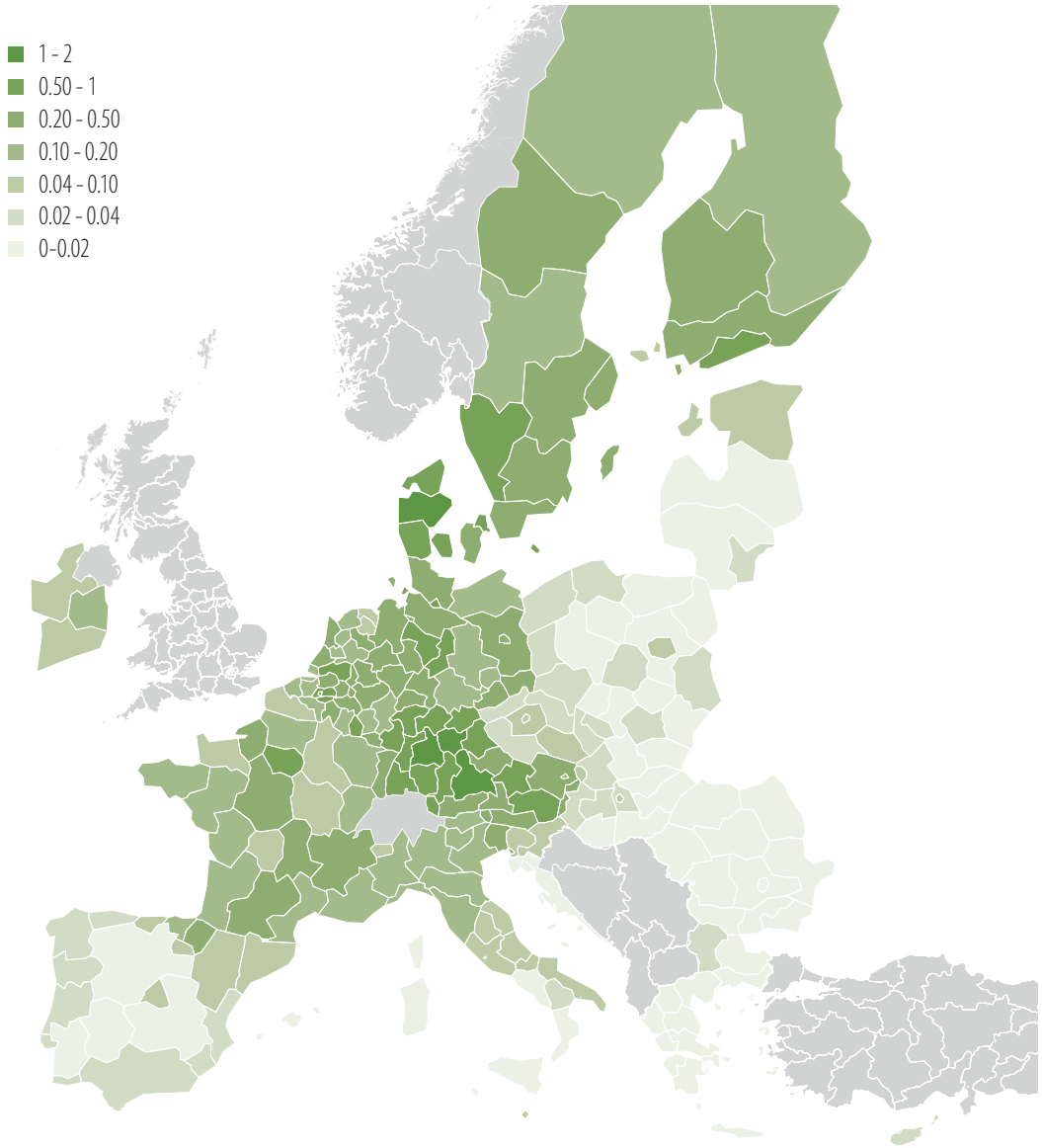
Dependent variable	Labour productivity		
Investing in new, less polluting business areas and technologies	0.139***		0.093***
	(0.017)		(0.026)
Region with a high share of green innovation (relative to total population)		0.451***	0.426***
		(0.024)	(0.026)
Invest in green tech x green innovative region			0.083**
			(0.033)
Sample size	23 422	21 469	21 356
R-squared	0.149	0.187	0.189

Source: *EIB staff calculations based on EIBIS 2022-2023 and PATSTAT.*
Note: *EU firms. Labour productivity is expressed in natural logarithms. The ordinary least squares (OLS) regressions control for firm size, country and sector (three groups of EU countries and four macroeconomic sectors). Robust standard errors in parentheses. Statistical significance: *** p-value<0.01, ** p-value<0.05, * p-value<0.1.*

The returns from green innovation and transformation are greater for firms located in regions with a stronger environment for green innovation. Being located in a region with a higher-than-average intensity of green innovation provides additional productivity gains to companies that invest in green innovation and transformation. This is illustrated by the regression output in Table 3. Table 3 also shows that investments in new, less polluting business areas and technologies are associated with higher labour productivity, even without considering the region's level of green innovation. This also holds when assessing the impact of climate change-related investment in general and its impact on productivity. The evidence is well aligned with an emerging body of literature (Stern & Stiglitz, 2023).

Figure 29

Green tech patents (% of total patents in the region)



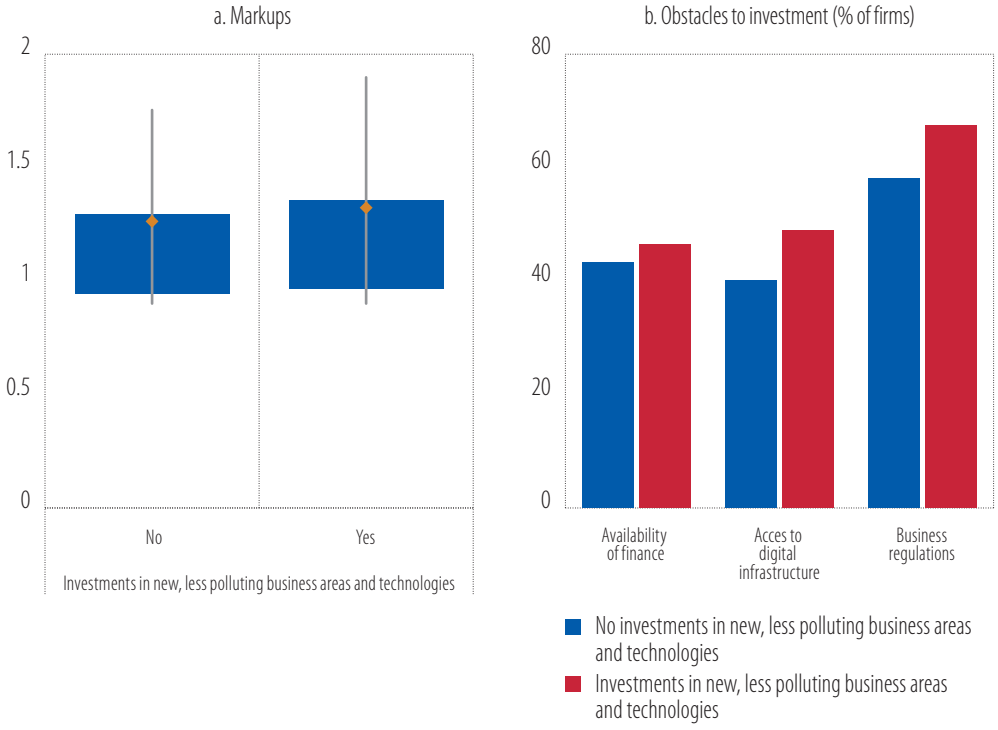
Source: *EIB staff calculations based on PCT patents (PATSTAT), in collaboration with ECOOM and Eurostat.*
Note: *Green tech patents are measured as the cumulative patent from 2011 to 2020. Population is the regional population in 2020, divided by 1 000. The values should thus be interpreted as a ranking, and not interpreted at face value.*

Investment in green innovation and transformation is associated with higher markups. Firms that invest in green innovation and transformation are not only more productive on average, but also tend to have higher markups for their products (Figure 30a). Markups can indicate market power, and they show that investing in green innovation and transformation currently pays for firms. However, it could at the same time indicate that there is too little competition on the markets in which these firms operate. Higher upfront investment costs, especially in new technologies, may also explain the higher markups, meaning that they may not necessarily show a lack of competitive pressure or excessively high market power.

Firms investing in green innovation and transformation report that business regulations are an obstacle to investment. Overall, firms investing in new, less polluting business areas and technologies complain slightly more about almost all obstacles to investments than other firms. The main difference is for business regulations and digital infrastructure, with firms investing in green innovation and transformation complaining almost 10 percentage points more than other firms (Figure 30b). This points to a need for policymakers to alleviate regulatory uncertainty for businesses willing to undertake green investments. Access to digital infrastructure also deserves attention, since the use of digital technologies could play a major role in tackling environmental challenges (Intergovernmental Panel on Climate Change (IPCC), 2022).

Figure 30

Markups and obstacles to investment, by whether a firm invests in new, less polluting business areas and technologies



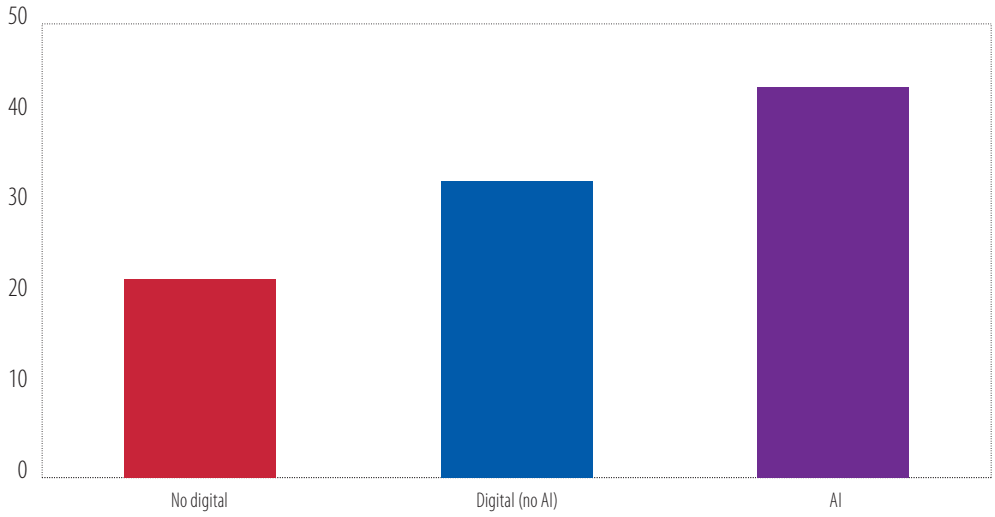
Source: *EIBIS 2023.*

Note: *EU firms. Firms are weighted by value added. In the left panel, the bar represents the range between the markup at the 25th percentile of the distribution (bottom of the bar) and the 75th percentile (top of the bar). The vertical line shows the range between the lowest and the highest value and the diamond shows the mean (average value). Markup calculations are based on the approach of De Loecker et al. (2020). The results on markups also hold in a regression framework controlling for firm size, country and sector (three groups of EU countries and four macroeconomic sectors).*

Question: *Is your company investing in new, less polluting business areas and technologies to reduce greenhouse gas emissions? Thinking about your investment activities, to what extent is each of the following an obstacle? The availability of finance; access to digital infrastructure; availability of adequate transport infrastructure; business regulations (such as licenses, permits, or bankruptcy) and taxation.*

Digital technologies, and especially artificial intelligence, could catalyse green innovation and economic transformation. Firms adopting artificial intelligence are more likely to invest in green innovation and transformation (Figure 31). This suggests that the contribution of digital technologies to a firm's innovation is driven to a large extent by investment in areas of AI applications (Rotman, 2019; Montresor & Vezzani, 2023).

Figure 31
Green innovation and transformation and the use of advanced digital technologies



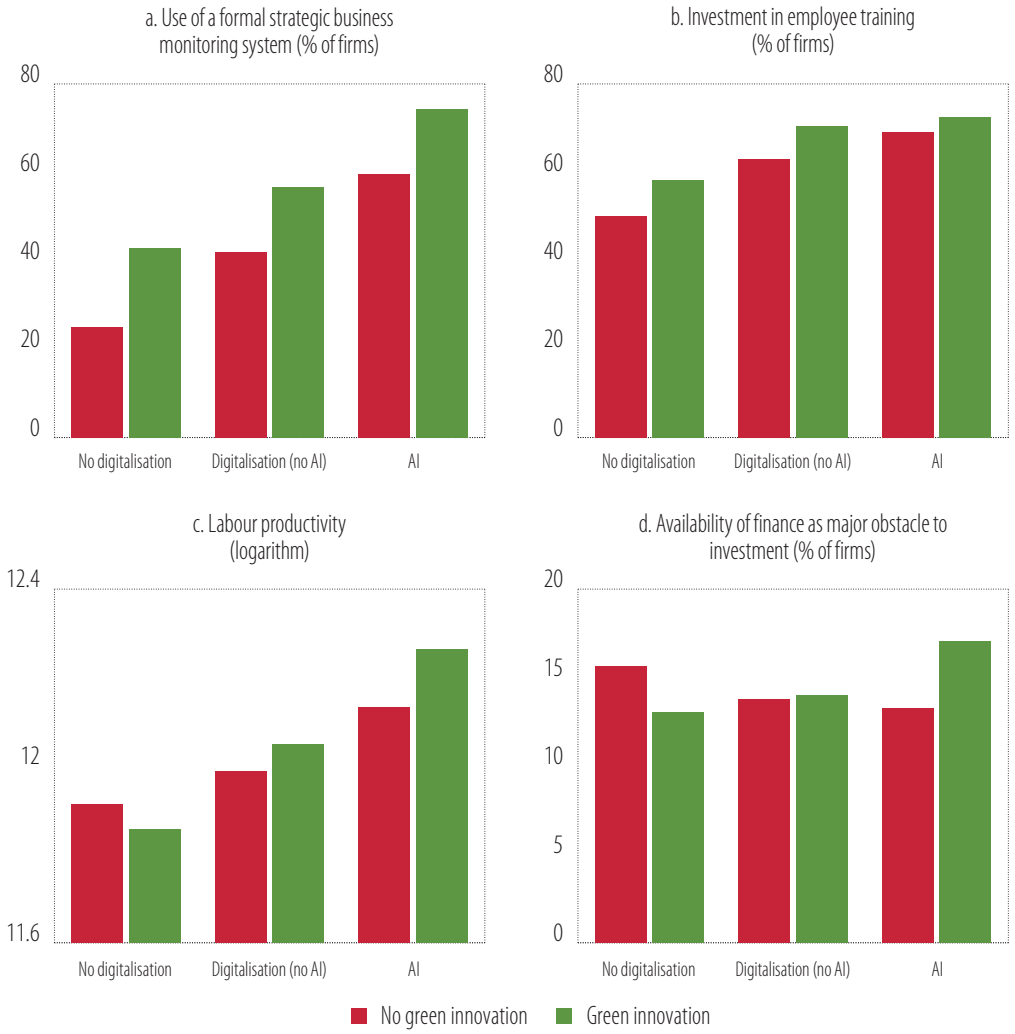
Source: *EIBIS 2023.*
Note: *EU firms. Firms are weighted by value added.*
Question: *Is your company investing in new, less polluting business areas and technologies to reduce greenhouse gas (GHG) emissions? Are advanced digital technologies used within your business? Are Big Data analytics and artificial intelligence used within your business?*

Firms that invest in green innovation and use artificial intelligence tend to perform better. The firms embracing the twin transition by combining artificial intelligence with green innovation are more likely to report the use of strategic business monitoring systems (Figure 32a) and investment in employee training (Figure 32b). This is associated with firm-level output and growth, as these firms also tend to be more productive (Figure 32c). Embracing both digitalisation and green innovation and transformation not only leads to returns for society, but it also seems to pay off for firms.

Firms implementing advanced digital technologies and green innovation and transformation are more likely to report a lack of available finance as a major obstacle to investment (Figure 32d). Given the potential benefits of combining digital and green technologies for structural transformation, it is important for these companies to be able to invest to take full advantage of the twin transition. If problems with the availability of finance are hampering progress in these areas, which are typically plagued by various market failures, then policymakers could have an important role to play in offering solutions.

Figure 32

The impact of green innovation and transformation on firm characteristics and investment



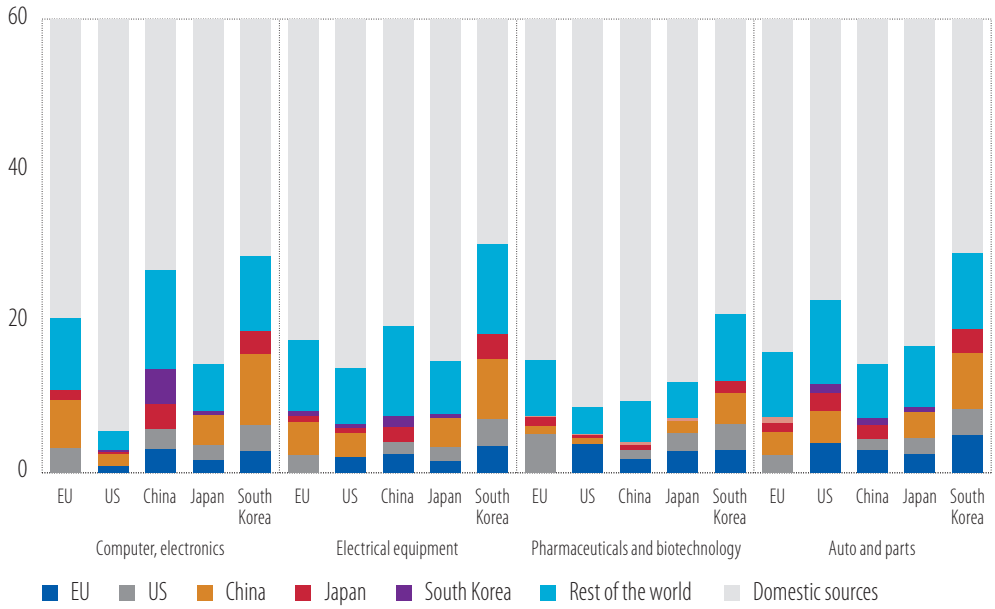
Source: *EIBIS 2023.*
Note: *EU firms. Firms are weighted by value added.*
Question: *Is your company investing in new, less polluting business areas and technologies to reduce greenhouse gas emissions? Are advanced digital technologies used within your business? Are big data analytics and artificial intelligence used within your business? Does your company use a formal strategic business monitoring system that compares the firm's current performance against a series of strategic key performance indicators? In the previous financial year, how much did your business invest in training employees? Thinking about your investment activities, to what extent for each is the availability of finance a major obstacle?*

EU exposure to the global economy

The European Union is well integrated in the global economy, enabling it to carry out some of the production of the goods and services it sells abroad. Over the past three decades, trade liberalisation and advances in digital technologies have allowed firms to reap the benefits of specialisation by producing parts or obtaining resources in different locations and parts of the supply chain (World Trade Organization (WTO), 2019; Alfaro & Chor, 2023). However, recent crises such as the COVID-19 crisis, the war in Ukraine and geopolitical tensions have shown that fragile supply chains can expose firms and countries to trade disruption risks.

Depending on the sector, the European Union imports 15% to 20% of the resources used to create the goods it exports. The remaining resources originate from within the European Union. The European Union is also an important source for its trading partners. For example, in pharmaceuticals and biotechnologies, the United States, China and Japan buy a higher share of resources from the European Union than from other countries (Figure 33).

Figure 33
Value added by foreign sources in the exports of selected countries (in %)**, by sector**



Source: *EIB staff calculations based on OECD Trade in value added 2022.*
Note: *Calculations based on Belotti et al. (2021).*

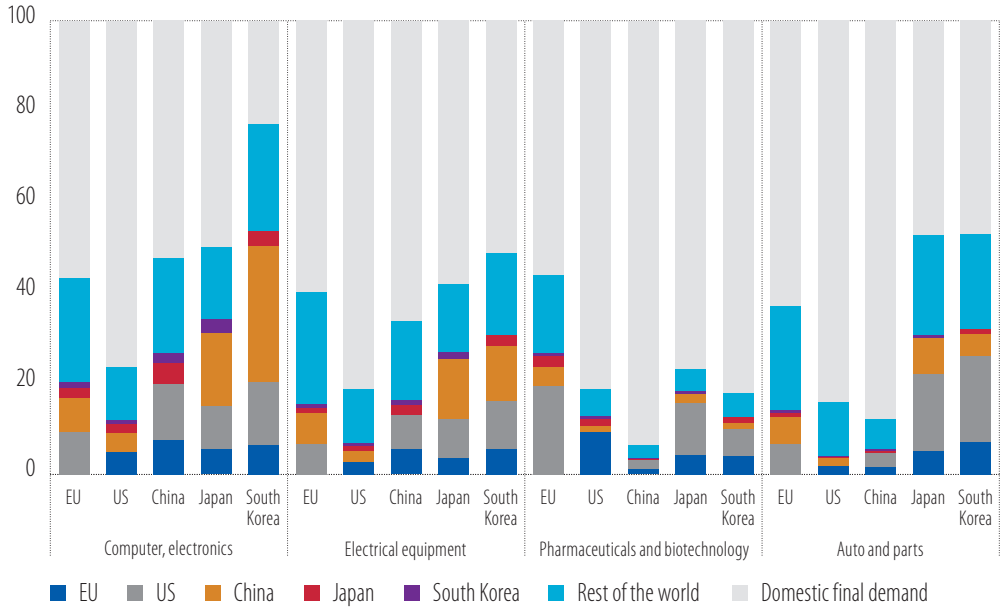
The United States and China are significant markets for the final products and services exported by the European Union. Other countries (including Switzerland and the United Kingdom, for example) are also important trading partners for the European Union. Close to 40% of EU products and services are consumed abroad, while the remainder are sold within the European Union (Figure 34). This share is lower in the United States (around 20%), reflecting the importance of the domestic market for the US economy.

The majority of EU firms have faced obstacles related to their supply chains in recent years, but the challenges differ depending on the sector. Access to commodities or raw materials was cited as an obstacle by 32% of EU firms, while disruptions of logistics and transport were mentioned by 29% of them. Access to raw materials is more likely to be an obstacle for firms in manufacturing. Machinery and transport equipment and computer, electronics and electrical equipment are the two sectors most affected by semiconductor and microchip shortages (Figure 35). Compared to other sectors, firms in the chemicals and pharmaceuticals industries were also hit particularly hard by logistics and transport disruptions.

Importing firms often respond to supply chain obstacles by building stocks and expanding inventories. This is the case even in service industries, where inventories and stocks do not play as significant a role as they do in manufacturing. For most industries, the second most common strategy is investing in digital inventory and resource tracking that allows firms to follow goods through the supply chain. For other industries, such as chemicals and pharmaceuticals and machinery and transport equipment, trade diversification (increasing or diversifying the number of countries from which firms import their resources) is the second most common way companies ensured adequate supplies (Figure 36).

Figure 34

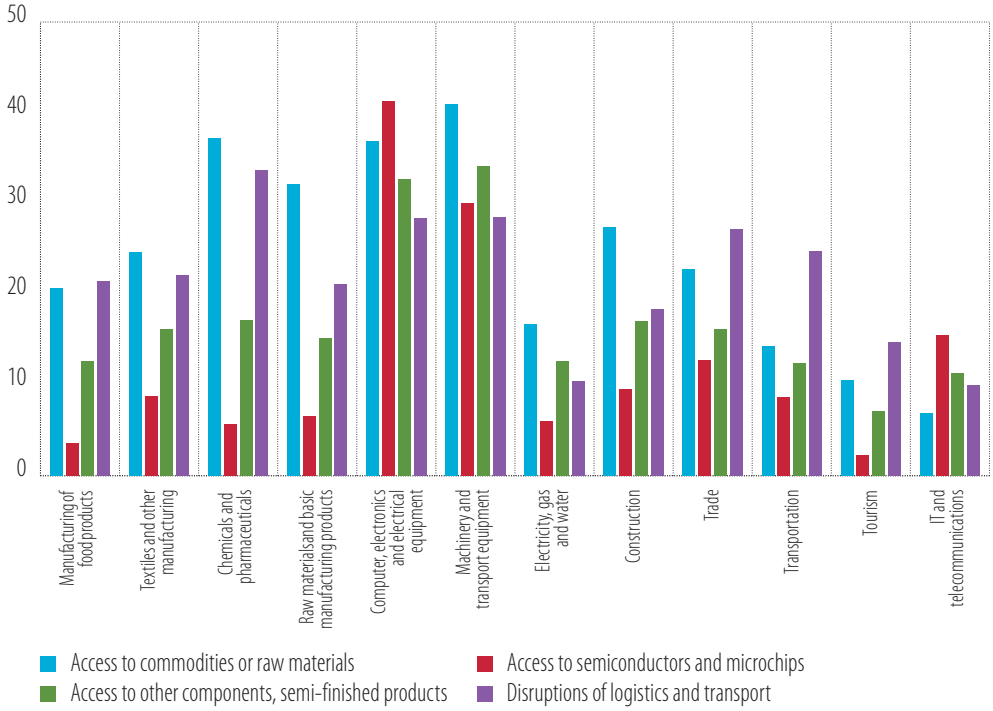
Location of the final demand for the production of selected countries (in %)**, by sector**



Source: *EIB staff calculations based on OECD Trade in Value Added 2022.*
Note: *Calculations based on Belotti et al. (2021).*

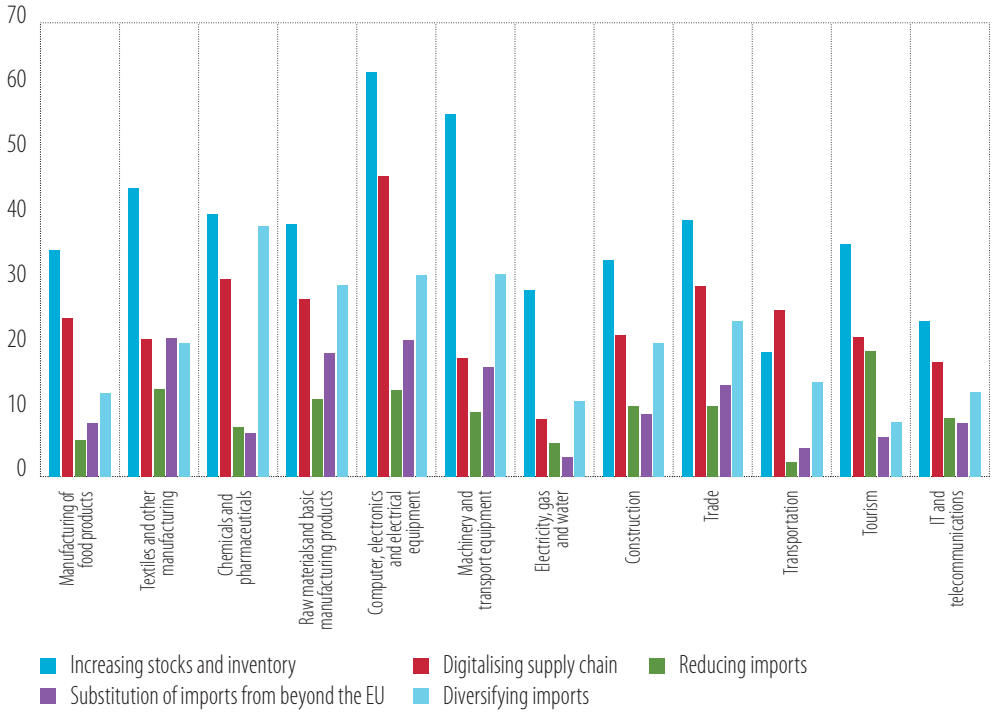
Figure 35

Major obstacles to supply chains (% of firms)



Source: *EIBIS 2023.*
Note: *EU firms. Firms are weighted by value added.*
Question: *Since the beginning of 2022, were any of the following an obstacle to your business's activities?*

Figure 36
Changes in the strategy to source inputs (% of importing firms)



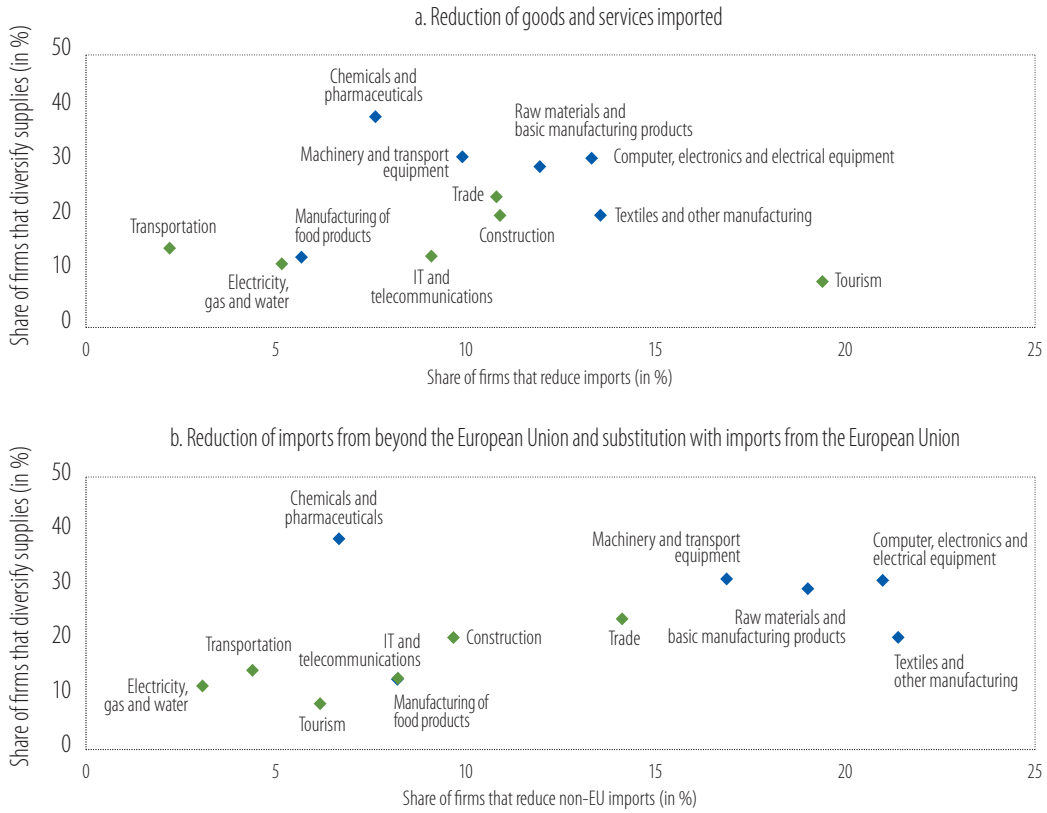
Source: *EIBIS 2023.*
Note: *EU importing firms. Firms are weighted by value added.*
Question: *Since the beginning of 2022, has your company made or are you planning to make any of the following changes to your sourcing strategy?*

Most EU firms are more likely to prioritise the diversification of their supplies than reduce the share of goods and services imported from abroad. Changing sources and import partners can be more difficult and takes more time than stockpiling or improving efficiency by investing in digital inventory and resource tracking. Overall, EU companies remain open to world trade and only one in ten EU importers has responded by reducing imports. At the same time, about one in five EU importers is diversifying their supply chain. These strategies may be key to improving the competitiveness and ensuring the long-term resilience of EU industries.

Diversification and import substitution strategies vary widely by sector. Firms in manufacturing are more exposed to trade than firms in other sectors and are more likely to make adjustments to their sourcing strategy. For example, firms in machinery and transport equipment, computer, electronics and electrical equipment, and textiles and other manufacturing are among those most likely to diversify import partners and reduce imports at the same time (Figure 37). These same sectors are also moving away from partners beyond the European Union to favour those within the European Union. In contrast, firms in food production are less likely respond to supply chain disruptions by either reducing imports or adopting strategies to diversify supplies. While firms in the chemicals and pharmaceuticals sector are more likely to diversify their imports for all trade partners, they are less likely to reduce imports or find trade partners within the European Union to substitute segments of their supply chain that depend on non-EU partners.

Figure 37

Responses to supply chain disruption (% of importing firms)



Source: *EIBIS 2023.*
Note: *EU importing firms. Firms are weighted by value added. Blue diamonds indicate manufacturing sectors (tradeables) and in green diamonds indicate other sectors.*

Table 4

Digital firms' response to supply chain disruptions

	Increasing stocks and inventory	Digitalising supply chain	Reducing imports	Substituting non-EU imports with EU imports	Diversifying trade partners
Digital firms	6.338***	12.29***	1.840**	2.755***	8.727***
	(1.282)	(1.103)	(0.796)	(0.951)	(1.159)
Sample size	6 076	6 076	6 076	6 076	6 076
R-squared	0.067	0.069	0.030	0.051	0.055

Source: *EIB staff calculations based on EIBIS 2023.*
Note: *Importing firms in EU members. The coefficient values express percentage point difference in the probability of taking action for digital vs. non-digital firms. The ordinary least squares (OLS) regressions control country and the 12 sectors. Robust standard errors in parentheses. Statistical significance: *** p-value<0.01, ** p-value<0.05, * p-value<0.1.*

Firms that use advanced digital technologies, such as artificial intelligence, are also more likely to actively manage supply chain shocks. On the one hand, digital firms are more likely to report that trade disruptions have affected their business activities since the beginning of 2022. In particular, firms using digital technologies are more likely than their non-digital peers to consider disruptions related to logistics and transport, access to semiconductors and microchips, and access to other components, semi-finished products, services or equipment to be a major obstacle to their activities. On the other hand,

digital firms are more likely to act to counter the adverse effects of trade disruptions and make changes to their sourcing strategy, to increase stocks and inventories, to invest in digital inventory and resource tracking, and to diversify or increase the number of countries from which they import (Table 4). These findings suggest that digitalisation can increase resilience and the ability to adapt to large, unexpected economic or trade shocks.

The role of policy

The green and digital transition will require major investment in research and innovation. Investment is vital for economic resilience, sustained and sustainable growth and delivering on the European Green Deal. It must also be accompanied by reforms and regulations that create the right incentives for businesses to fully contribute to the structural transformation (European Commission, 2022b; OECD, 2023).

The European Union may be leading the way in clean technology, but it is not well positioned in digital innovation compared to the United States and China. Global uncertainty, an economic downturn and tightening financing conditions may have further adverse effects on investment in innovation activities, especially those that are ground-breaking (Aghion et al., 2012). This may also hamper the structural investment required in areas where Europe needs to maintain or step up its competitiveness.

In the European Union, highly innovative firms tend to suffer from a lack of suitable finance, which becomes particularly severe as companies grow. The financing gap of high-growth companies is associated with a domestic market that is more resistant to disruptive innovation than the United States and lacks the appropriate instruments, scale, risk appetite and skills. The recent tightening of financing conditions has exacerbated these problems and affected scale-up companies disproportionately. The public sector has recognised the need to intervene in the startup and scale-up market. In this context, EU instruments are being put in place, which should ensure a level playing field across the single market. At the same time, many countries are working to consolidate their finances, and EU resources are limited. That means that incentives and direct support will have to become more targeted.

Direct policies such as targeted R&D grants can be useful to foster innovation in certain technology domains that have not yet reached cost competitiveness. Policies are needed to help bridge the gap between R&D and the offering of new products on the market, especially for early-stage technologies and smaller firms (Howell, 2017; European Commission, 2022a). Furthermore, the complementary nature of different technologies (for example, through the combination of green innovation with artificial intelligence) may hold greater potential for breakthrough innovations.

The way in which instruments to support R&D and innovation are deployed matters. While R&D grants have a positive impact on innovation, a selection problem could emerge given that the funding agency must choose the best-suited projects. Conversely, R&D tax credit programmes do not have the same selection problem, but mostly target profitable companies, which often excludes smaller and especially younger firms (Czarnitzki & Giebel, 2021). In addition, tax credits do not necessarily incentivise firms to invest in technologies that are further from the market, since they are most likely prioritise the projects that are most profitable in the short run (Cervantes et al., 2023). Equity incentives, venture capital, tax breaks or public loan guarantees may more effectively address obstacles to investment in R&D and innovation, especially for younger and smaller companies. Finally, carbon pricing, often called the backbone of the EU decarbonisation strategy, pushes the development and deployment of technologies. It also provides a revenue source to the government, which can be used to further support innovation.

Given the size of the financing gap for innovation in the European Union, public support needs to be highly targeted and effectively catalyse private finance. It should focus on early support to kickstart new risky technologies and the patient capital needed to scale up large new projects and invest in key enabling infrastructure. Deepening the EU single market and advancing the capital markets union remain key priorities, as they would provide the market scale and depth needed for firms to take advantage of

growth opportunities. A strategy to reduce barriers to investment and integrate capital markets would further crowd in private investment and support entrepreneurs.

Policymakers must also address the potential detrimental effects new technologies may have on the economy, the labour market and inequality. For example, despite the potential productivity gains and sizeable risks of not keeping up with advanced digital technologies, digitalisation may have a negative impact on unemployment and inequality. New digital technologies tend to reinforce the need for skilled workers (although recent evidence finds that artificial intelligence can have larger productivity gains for low-skilled workers (Brynjolfsson et al., 2023)). These issues will need to be closely monitored, as they have implications for policies aiming to retrain low-skilled workers lacking the digital literacy needed in the labour market (see Box C for a discussion of employee training and lack of skilled staff). Addressing the lack of digital skills (especially in small EU firms) and ensuring younger generations are digitally literate will be crucial.

Bringing down barriers to investment and fostering an innovation-enhancing environment could provide powerful momentum for change. It is important to address direct obstacles to investment (such as a lack of access to external finance) and structural barriers in the operating environment (such as regulatory barriers or difficulties in accessing the necessary infrastructure). In addition, the EU market's highly fragmented nature may further complicate cooperation on and the dissemination of innovations. Preserving a competitive environment goes hand in hand with reinforcing the EU single market and a level playing field across the European Union.

The European Union will have to make a judicious compromise between maintaining openness while being challenged by increasing geopolitical risks. While it is crucial for the European Union to coordinate better within its borders, there are trade-offs on how it should position itself in the global landscape. On the one hand, the current technological developments required for a successful green transition closely depend on global cooperation and knowledge exchange. On the other hand, the European Union should ensure it remains a competitive player.

Box C

Skills for a changing environment

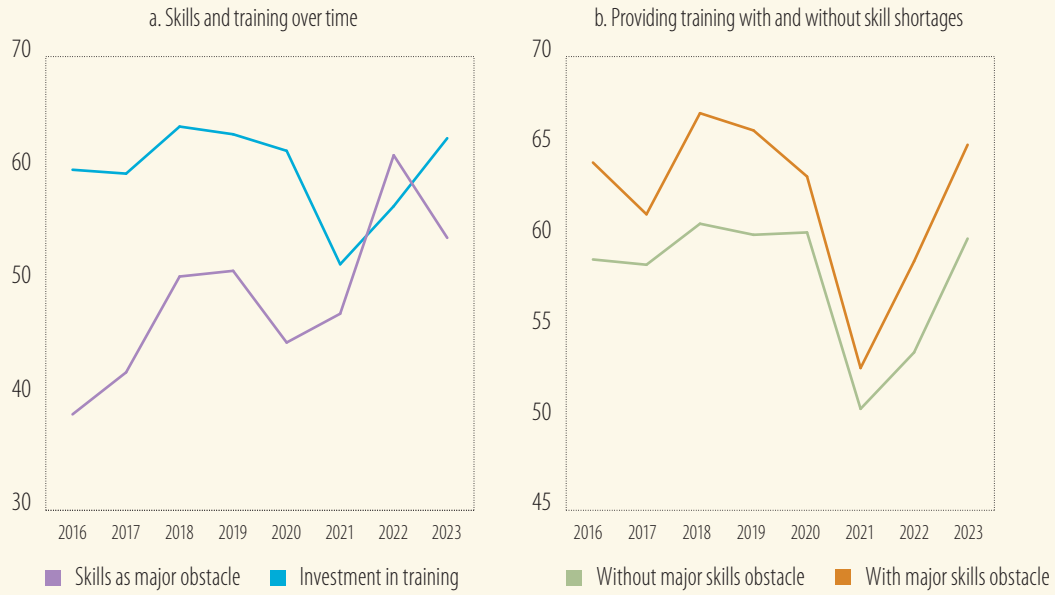
A rapidly changing work environment requires an equally rapid shift in skills. A skilled workforce that can swiftly adapt to a changing needs is incredibly important for Europe's transition to a greener, more digital and more resilient economy. At the same time, EU labour markets have become historically tight, resulting in persistent skill shortages for firms. Effective training of workers and the improvement of their skills are key to addressing these challenges and maintaining companies' performance and profitability in the future.

European firms increasingly suffer from a shortage of skilled staff but tend not to train sufficiently. Over time, the share of EU firms reporting a lack of staff with the right skills as a major barrier to investment has increased to 54% in 2023, from about 38% in 2016 (Figure C.1a). However, training provided, in terms of the percentage of firms and average amount invested, remained relatively constant. This encompasses the recovery period following the COVID-19 crisis, which brought training back to pre-pandemic levels. However, of the firms reporting a significant shortage of skilled staff, only a marginally higher percentage provided training, compared to firms that did not declare skills a major investment barrier (Figure C.1b).[3]

3 These developments are observable independent of firm size.

At the regional level, firms experienced a similar dynamic of skill shortages and training provided. Since the pandemic, the shortage of skilled staff has mainly intensified in Northern and Western Europe and Southern Europe (although at comparatively lower levels), but has receded in Central and Eastern Europe. Investments in training, which were most widespread in Northern and Western Europe (with around 65% of firms on average making these investments since 2016), have not yet fully recovered to pre-pandemic levels across the board. Firms indicating a lack of skilled staff as a major barrier were slower to reinitiate training than firms not reporting skills as a major obstacle.

Figure C.1
Aggregate reporting of major skills obstacles and training (% of firms)



Source: *EIBIS 2016-2023.*
Note: *EU firms. Firms are weighted by value added.*

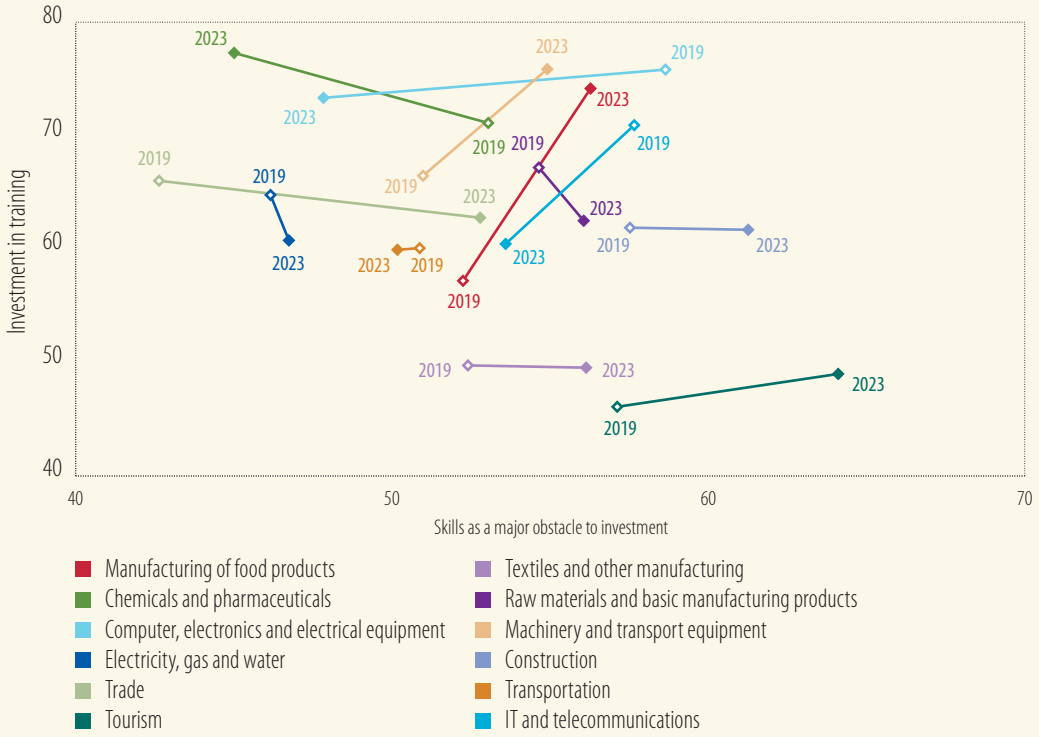
Firms in innovative sectors face the highest skill shortages but also invest more in training on average. The share of firms reporting skill shortages increased by an average of 9 percentage points between 2019 and 2023 (Figure C.2). Sectors found to be the most innovative in using advanced digital technologies (such as IT and telecommunications and manufacture of machinery and transport equipment) seem to face bigger challenges in finding skilled staff and filling open vacancies than other sectors. While firms in these sectors tend to train more on average, they also exhibit the biggest gap in training provided relative to demand for skilled staff. For instance, IT and telecommunications experienced one of the steepest increases in skill scarcity, but also a bigger drop in the share of firms providing training from 2019 to 2023 than any other sector (with a decrease of 10 percentage points). In contrast, firms providing training in machinery and transport equipment during the same period increased by 10 percentage points.

On average, this pattern continues to hold at a regional level and over time, with more innovative sectors reporting a higher prevalence of firms investing in training. This includes sectors like food production and IT and telecommunications in Northern and Western Europe, the manufacturing of machinery and transport equipment in Southern Europe, and (to a lesser extent) food production in Central and Eastern Europe. Firms in other sectors often trimmed their training expenses amid intensifying skill shortages.

While most EU firms face significant challenges in finding skilled staff, firms in more innovative sectors seem to be adapting better to an environment demanding increasingly skilled work. Major discrepancies remain, however, despite investment in training stepping up as firms looked for more skilled workers. All firms need to increase their efforts not only to better train their staff, but also to attract qualified external candidates more easily. Making firms more attractive to external candidates may also require improvements to more structural elements such as flexibility within firms, offering childcare to attract workers, and providing employees with the support they need to engage in training.

Figure C.2

Investment in training and skills as a major barrier to investment (% of firms), **by sector**



Source: *EIBIS 2019 and 2023.*
Note: *EU firms. Firms are weighted by value added.*

Conclusion and policy implications

EU policies increasingly emphasise the need to enhance and preserve the global competitiveness of European firms, with a renewed focus on innovation, the spread of innovation and the resilience of global supply chains, particularly as firms find themselves dependent on critical sectors. The ability of Europe's economy to adjust and transform itself during the green and digital transition will also depend on the support of an effective operating environment.

Europe's position in global innovation is being challenged. While it is at the forefront of clean technologies, the European Union's digital technology performance remains lacklustre compared to the United States and China. It should therefore strengthen its ability to innovate in key strategic technologies.

A successful transition to a more digital and green EU economy will require the widespread uptake of new technologies, as they will drive competitiveness and improve resilience to economic disruption and climate change. While EU firms are catching up with their US peers in the use of digital technologies, they should remain vigilant and invest more, particularly in the adoption of big data analytics and artificial intelligence, which are positively associated with firm performance and job creation and can be a catalyst for green innovation and transformation.

Amid global uncertainty, geopolitical tensions and strategic dependencies, pressure on EU competitiveness may increase. Europe is committed to a model of open strategic autonomy where the benefits of trade remain, but diversification, resilience and innovation are enhanced. Improving the competitiveness of EU firms will also help maintain the efficiency of the economic environment and strengthen the single market, ensuring there is an equal playing field across the European Union.

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Chapter 5

Investing in green transformation

The EU energy market has been grappling with a severe crisis that has affected governments, households and businesses across Europe for the last two years. The crisis demanded urgent solutions to ensure a continuous and stable supply of energy to Europe, but it was also a chance to speed up the transition to a greener and more sustainable economy. The European Union implemented various measures to address the short-term and long-term challenges of the energy crisis, by diversifying energy supply routes, reducing demand and promoting renewable sources. These measures not only helped Europe cope, but also paved the way for the transformation of the energy landscape.

The energy shock affected EU firms more strongly than US firms, but it also motivated companies to invest and transform. In the short term, most EU firms responded to the energy shock by investing in energy efficiency. When looking at overall climate action investment, EU firms remained more committed than US firms, but uncertainty affected their investment decisions, somehow slowing their efforts. The role played by uncertainty underlined once again the relevance of clear policies on the speed and future path of the net-zero transition.

Firms in energy-intensive industries are at a crossroads. The progressive tightening of the EU Emissions Trading System (ETS) is effectively incentivising firms to transform, with decarbonisation going hand in hand with investment and innovation. Decarbonisation leaders and laggards are emerging. Firms seeing opportunities in the net-zero transition process are more likely to invest, innovate and transform. It is important to avoid the creation of a divide between firms actively pursuing net-zero and those less implicated. Decarbonisation depends on clear signals, with energy prices, regulations and uncertainty critical issues for all firms.

Beyond reducing emissions, most European firms also need to adapt to the adverse effects of climate change. However, many lack the awareness, knowledge, skills and incentives to assess and implement suitable and cost-effective adaptation solutions. Firms hurt by extreme weather events are slightly more proactive about investing in adaptation measures. But even those are dismissive of their role in climate adaptation. Finance appears to be crucial for adaptation, as it can help firms overcome barriers like high costs, long payback periods, low returns, high uncertainty and risk aversion. Public funds are crucial in supporting and catalysing firms' investment in adaptation, especially in the most vulnerable regions and sectors, and in helping them overcome barriers and create new markets and opportunities.

Introduction

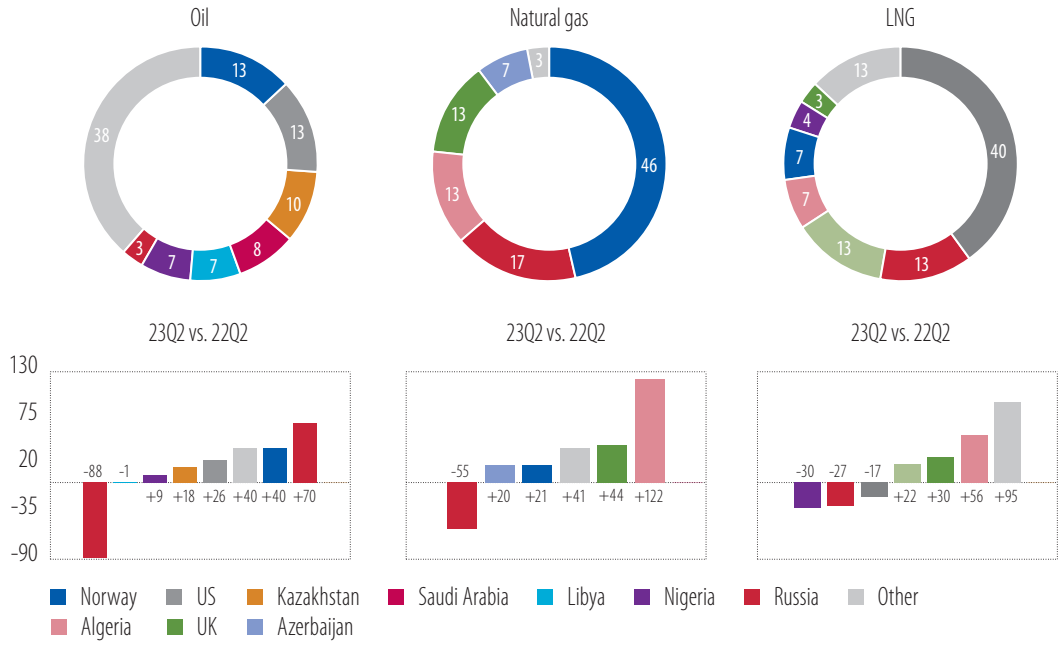
The 2022 energy shock forced a reckoning in the European economy. At first Europe had to deal with potential energy supply shortages and high costs, which it managed reasonably well. However, the shock provoked a rethinking of the EU energy landscape. The European Union revised its energy market and energy mix, and set ambitious climate goals and policies to transition to low-carbon energy in the future while ensuring the security of supply in the meantime. The shock also instigated a push for energy efficiency, for households and companies. However, uncertainty remains high as the economy adjusts to a new equilibrium that encourages energy resilience and sustainability. It will take more than a decade for renewable and alternative resources to stabilise energy prices, despite efforts to diversify the energy mix and increase the production of renewable energy and energy efficiency. In this context, the European Union faces many questions: How are the energy markets transforming? How are EU firms adapting to the new environment? How is competitiveness affected? How are energy-intensive industries adjusting? And how can the economy balance varying demand as it responds to shocks and the challenges of the transition?

This chapter aims to answer these questions. Section one examines how the energy crisis affected the EU energy market and its ongoing transformation. Section two explores the reaction of EU firms to the energy shock and the ongoing adjustments demanded by the green transition. Section three focuses on energy-intensive industries – those most exposed to the energy crisis and the green transition – and examines how they are balancing their emissions reduction and transformation. Box A presents the results of a focused survey on manufacturing firms operating in the Emissions Trading System, to shed light on their decarbonisation strategies. Section four focuses on the role of adaptation in enhancing firms' resilience to climate change and extreme weather events, while section five concludes with policy implications and recommendations for supporting firms in the green transition.

The energy shock has triggered a rethinking of EU energy markets

Russia's invasion of Ukraine, and the EU response, disrupted the supply of Russian oil and gas to the European Union, forcing Europe to diversify its fossil fuel imports. In December 2022, the European Union banned imports of Russian crude oil and refined oil products by sea. Russia had been Europe's main supplier of natural gas, accounting for 40% of total imports before the war. However, Russian gas imports were halved between 2022 and 2023 thanks to various policy measures to restrict imports and reduce consumption. By June 2023, Russia's share of EU oil imports had fallen to 3% and gas to 14% – a decline of 84% for oil and 51% for gas, compared to a year earlier (Figure 1). The European Union turned to liquefied natural gas (LNG) as an alternative to gas transported via pipelines. Although major efforts were made to diversify LNG sources, Russia held a significant (albeit declining) share of the trade, as some EU members could not secure alternate sources. The European Union also moved swifty to maximise the storage of supplies. By November 2023, EU gas storage had reached 90% of its capacity, providing a favourable outlook for the gas supply throughout the winter of 2024.

Figure 1
EU energy imports by supplier in the second quarter of 2023 (in %, top panel) **and change in market share compared to the second quarter of 2022** (in %, bottom panel)



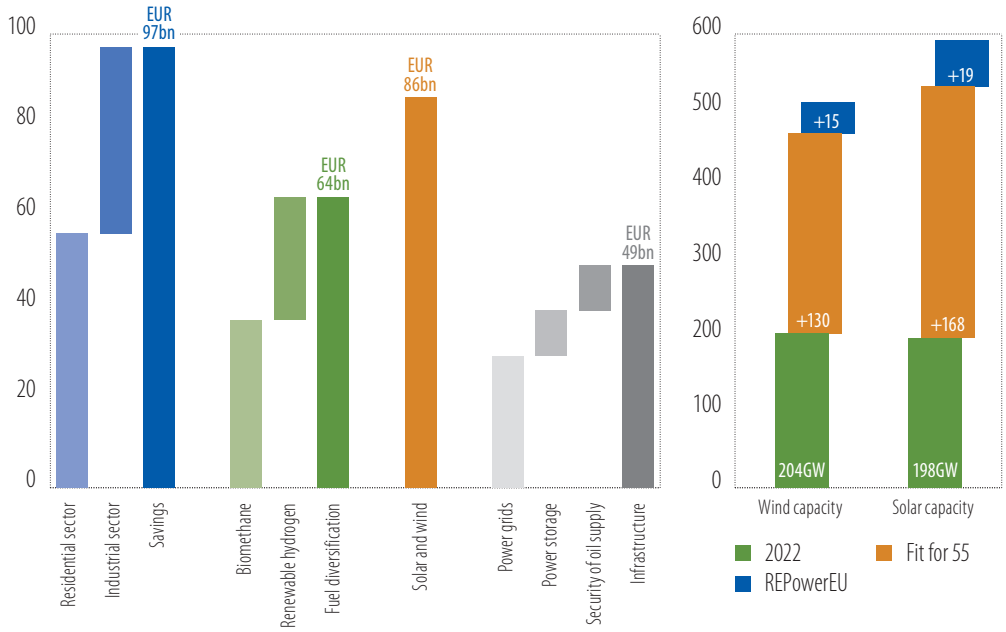
Source: *Eurostat (2023).*
Note: *Shares refer to trade in value and not volume. LNG stands for liquefied natural gas.*

To reduce its dependence on Russian gas by 2027, the European Union adopted the REPowerEU plan, which builds on the European Green Deal and uses the approximately EUR 225 billion Recovery and Resilience Facility as its main source of funding. The REPowerEU plan aims to cut gas demand by 155 billion m^3, which is equal to the amount of gas imported from Russia in 2021. The gas reduction is one-third more than the original goal of the Fit for 55 package, Europe's plan to reduce emissions 55% by 2030, compared to 1990 levels. The REPowerEU plan also sets more ambitious targets for reaching net-zero emissions and introduces various reforms, helping the EU economy to decarbonise (Figure 2). The plan includes almost EUR 100 billion of gas savings for households and industries, along with encouraging behavioural changes and other efforts to reduce demand. It also allocates nearly EUR 50 billion to improving power grid and energy storage infrastructure, emphasising their importance in the transition.

The energy shock prompted European firms and households to act quickly to save energy. Buildings and industries reduced their demand for natural gas the most (Figure 3), thanks to a combination of energy efficiency measures and other actions. Although significant nuclear and hydropower capacity was temporarily unavailable due to maintenance and exceptionally dry weather conditions, this was largely offset by increased production of electricity based primarily on coal and renewable energy.

Figure 2

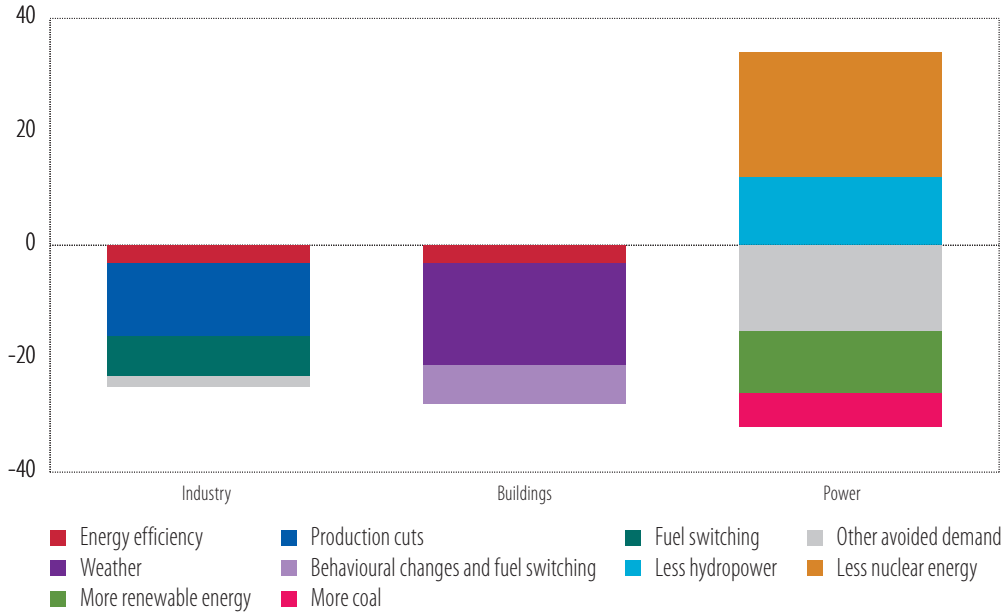
Investment needed to reach 2030 goals for Fit for 55 and REPowerEU (left panel), **and wind and solar capacity targets for 2030** (right panel)



Source: *Directorate-Generale for Energy (2023).*
Note: *Gas savings in the residential sector will be realised through with a wider adoption of energy efficiency measures and heat pumps by 2030. The industrial sector will essentially cut its gas usage with more energy efficient processes and electrification.*

Figure 3

Estimated drivers of change in EU demand for natural gas, by region 2022 vs. 2021

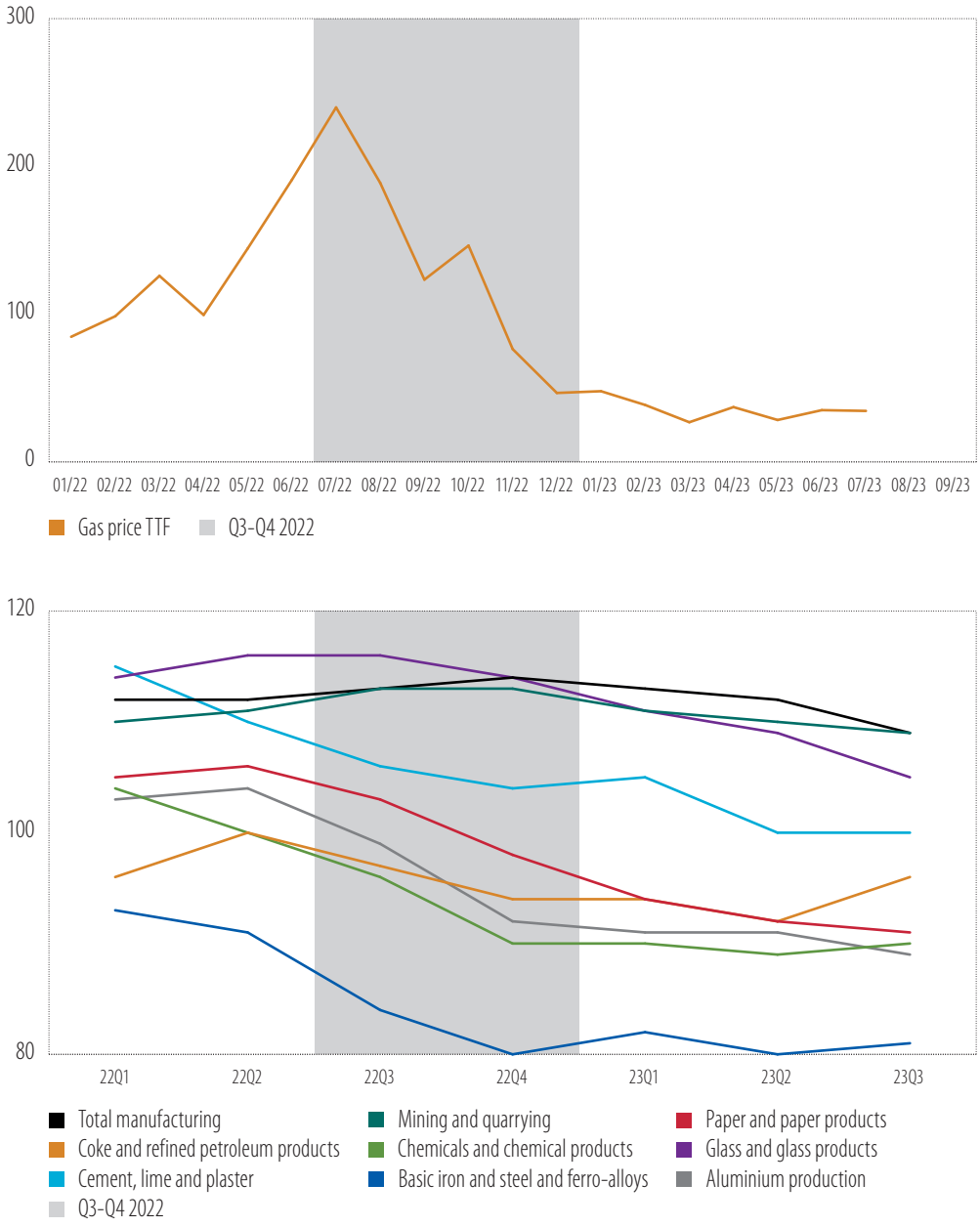


Source: *IEA online commentary (14 Mar 2023), Europe's energy crisis: What factors drove the record fall in natural gas demand in 2022?*

As the energy shock sunk in, industries reacted by rolling out emergency measures, such as scaling back production, and accelerating efforts to save energy. Under pressure from soaring gas and electricity prices – which were compounded by historically high prices for carbon credits under the Emissions Trading System – energy-intensive industries revised their production plans downwards for most of 2022 (Figure 4). By contrast, overall activity in manufacturing was only moderately affected. Primary aluminium production was cut by 12%, crude steel by 10%, paper by 6% and chemicals by 5%. The economic activity of heavy industries levelled off during the first half of 2023, but at a lower rate than before the crisis.

Figure 4

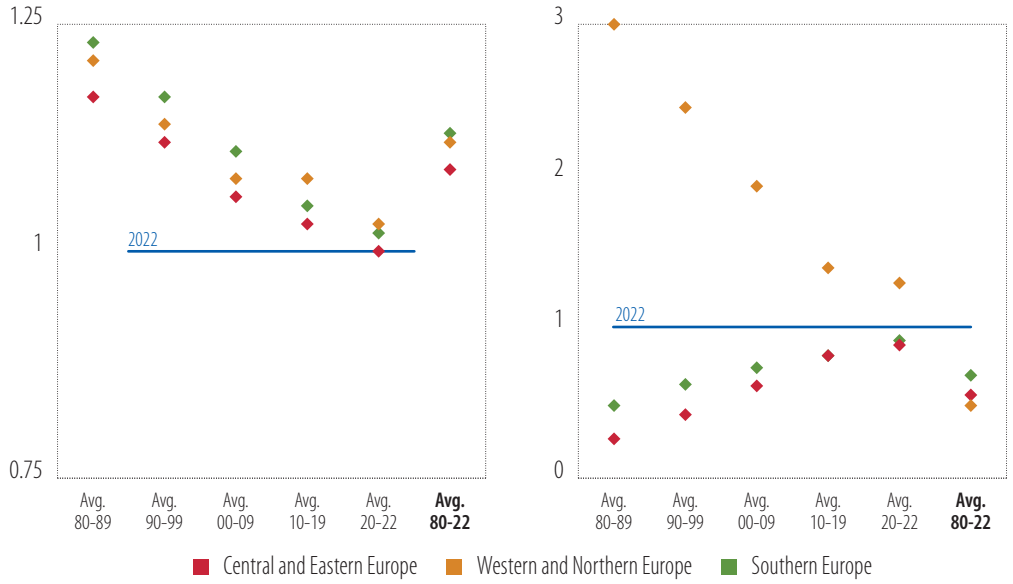
Gas price developments (€ per megawatt hour, top panel) **and activity index** (2015=100, bottom panel) **by industrial sector.**



Source: *Eurostat.*
Note: *Top panel, nautral gas prices come from the Dutch Title Transfer Facility (TTF). Bottom panel, the index of industrial production measures monthly changes in industry output.*

Exceptional weather conditions in 2022 also caused energy demand to fluctuate widely. Weather conditions can disrupt the functioning of energy systems, and they are monitored closely by energy producers, grid operators and regulators alike. In 2022, winter was warmer than usual in Europe, reducing demand for heating to historically low levels. Conversely, the summer of 2022 brought record-high temperatures, which increased cooling needs and partially offset the gas savings achieved during the winter (Figure 5).

Figure 5
Heating (left panel) **and cooling degree days** (right panel) **in EU regions, decade averages 1980-2022**

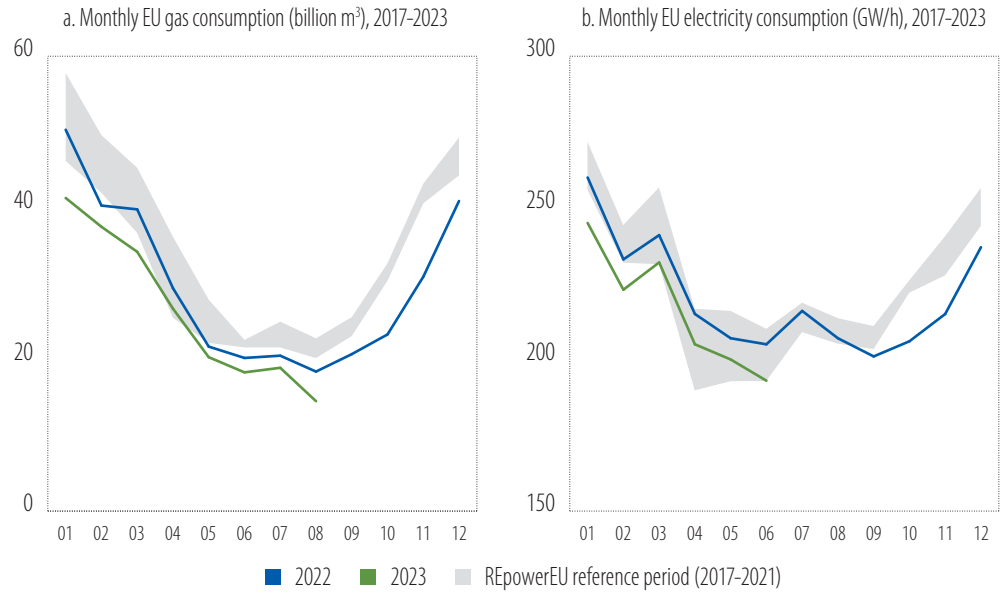


Source: *Eurostat (2023).*
Note: *Heating degree day and cooling degree indices are weather-based technical indices designed to describe the energy required to heat or cool buildings.*

In 2022, the weather was mild and the economy was sluggish, which led to record-low demand for gas, which was 14% less than in 2021. Electricity demand also decreased. Gas demand fell by 19% from August 2022 to January 2023 (Figure 6). For example, the industrial sector used much less gas (one-quarter less), as did the residential sector (one-fifth less) (International Energy Agency (IEA), 2023a). Electricity consumption fell by 3%, the second biggest drop since the global financial crisis of 2008-2009. The impact varied between countries, depending on their economic structures, energy systems and connections with other European networks (Figure 6).

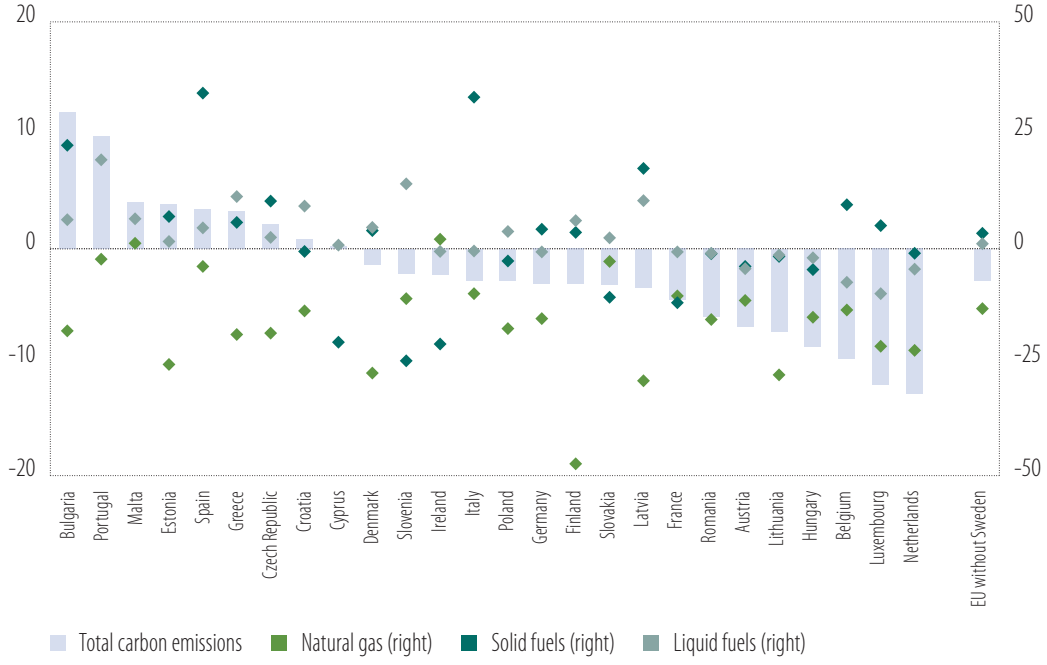
The energy transition in 2022 helped the European Union reduce carbon emissions by 2.8%, thanks mainly to lower gas consumption. This brought the European Union closer to its goal of cutting emissions by 55% by 2030. Seventeen EU countries reduced their net carbon emissions (Figure 7). Some countries, like Bulgaria or Portugal, temporarily used more coal or liquid fuels instead of gas during the first half of 2023, which increased their net emissions. The power sector saw the biggest drop in greenhouse gas emissions (-10% compared to the average of 2017-2021). The manufacturing sector – which was the largest emitter in the European Union, producing 22% of total emissions – experienced a smaller drop of 2%. Early 2023 estimates point to an historical drop in the European Union's carbon emissions, following a marked slowdown in coal-based electricity and overall gas consumption thanks to the breadth of energy saving measures implemented since the start of the energy crisis.

Figure 6
Impact of the energy shock on gas and electricity consumption



Source: *Eurostat (2023).*

Figure 7
Change in annual EU carbon emissions (in %)**, 2021-2022**

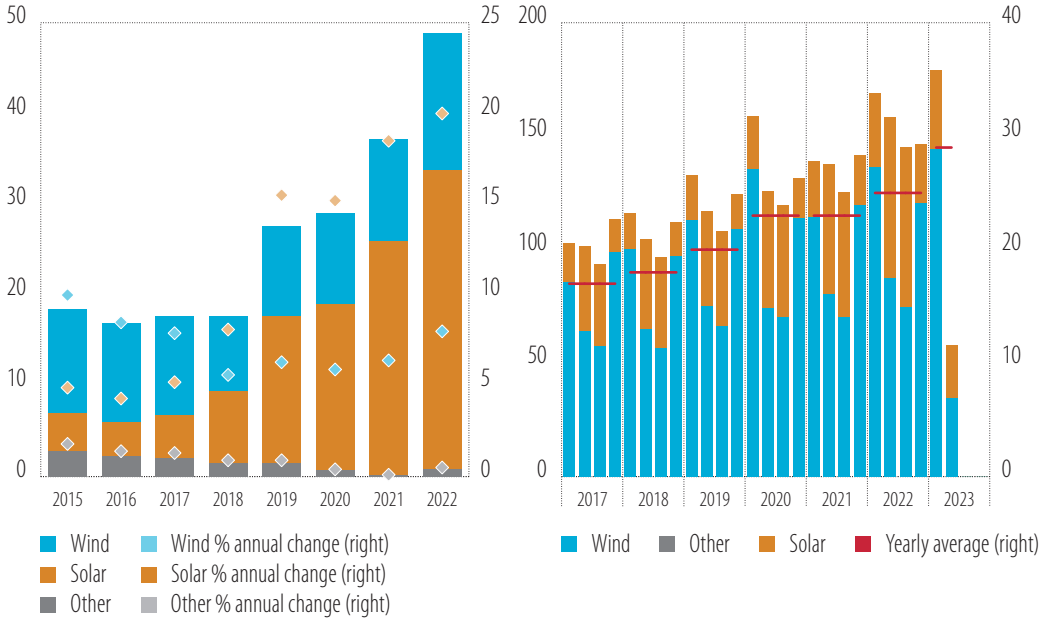


Source: *Eurostat (2023).*
Note: *Solid fuels mostly refer to coal.*

Renewable electricity is the key to decarbonisation, and it has been Europe's main response to the energy shock. It also helped replace the missing Russian fossil fuels in 2022. Solar power grew very fast in 2022, with 20% new capacity, and wind power also increased by 8% (Figure 8). This helped grid operators to manage the crisis. Almost 40% of electricity needs were met by renewable sources, with wind and solar alone accounting for 30% (and producing more electricity than gas). Renewable power also opened new markets for green hydrogen and ammonia, which can be used to decarbonise hard-to-abate sectors. The European Union has a strong supply chain for renewable energy, especially in wind manufacturing, which offers vast opportunities to create skilled jobs and add value.

Figure 8

Installed capacity of renewable electricity (GW, left panel)**, 2015-22, and electricity production from solar and wind power** (TW/h, right panel)**, 2017-2023**

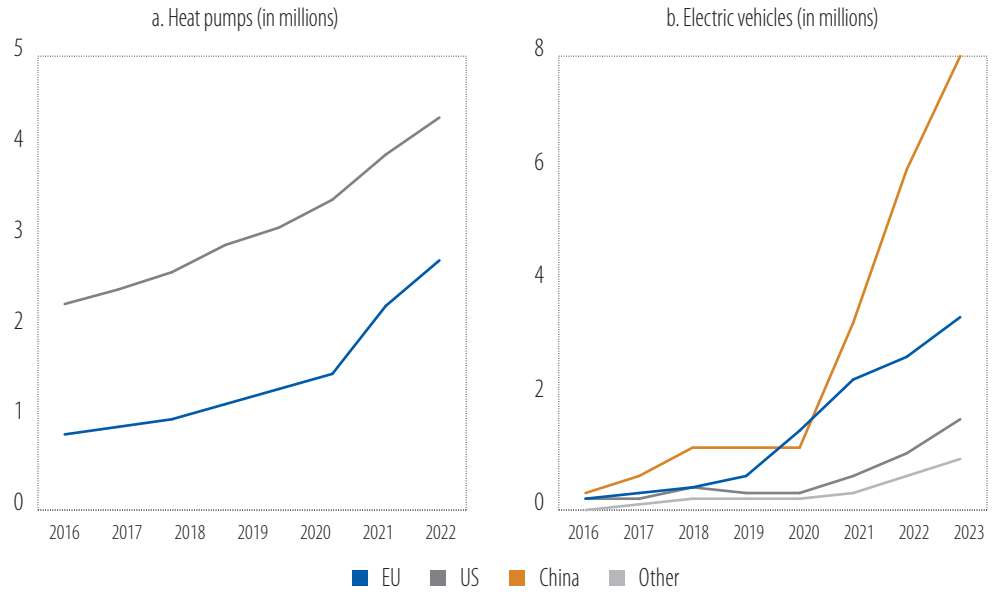


Source: IRENA (2023), Eurostat energy statistics, latest trends from monthly data (2023). The diamonds represent the annual change in renewable energy generation.

Heat pumps, which have a booming manufacturing base in Europe, are among the priority technologies in the REPowerEU plan with the potential to deliver large gas savings. In the residential sector, around 80% of final energy consumption is for space and water heating. Average residential gas prices in 2022 were 80% higher than in the previous five years, and heat pumps – three to four times more efficient than traditional boilers – have become a prime option for residential and industrial end users to reduce energy bills (Figure 9). Thanks to generous public support, the heat pump market is experiencing double-digit growth in Europe, approaching sales of 3 million units per year. REPowerEU targets will prompt a further 10 million hydronic heat pumps to be installed in the next five years, on top of the 20 million units currently in use in Europe.

Electric mobility is also gaining momentum. Electric mobility is now flourishing globally thanks to various support schemes. 20 EU members have incentives in place to stimulate the purchase of electric cars (European Automobile Manufacturers' Association (ACEA), 2023), while others grant tax reductions or exemptions. According to Bruegel and the European Automobile Manufacturers' Association, average support for electric mobility in Europe is equivalent to EUR 6 200 per vehicle (the US Inflation Reduction Act grants a tax credit of EUR 7 100 per vehicle). One-quarter of electric vehicles worldwide, about 3.4 million cars, are sold in the European Union (Figure 9) – far behind China, which captures almost 60% of global sales. The electrification of transport beyond personal mobility is also being supported, through targeted measures like the REPowerEU provisions to strengthen power grids and build up charging networks for electric vehicles.

Figure 9
EU heat pump sales (left panel), **and electric vehicles sales by country** (right panel), **2016-2022**

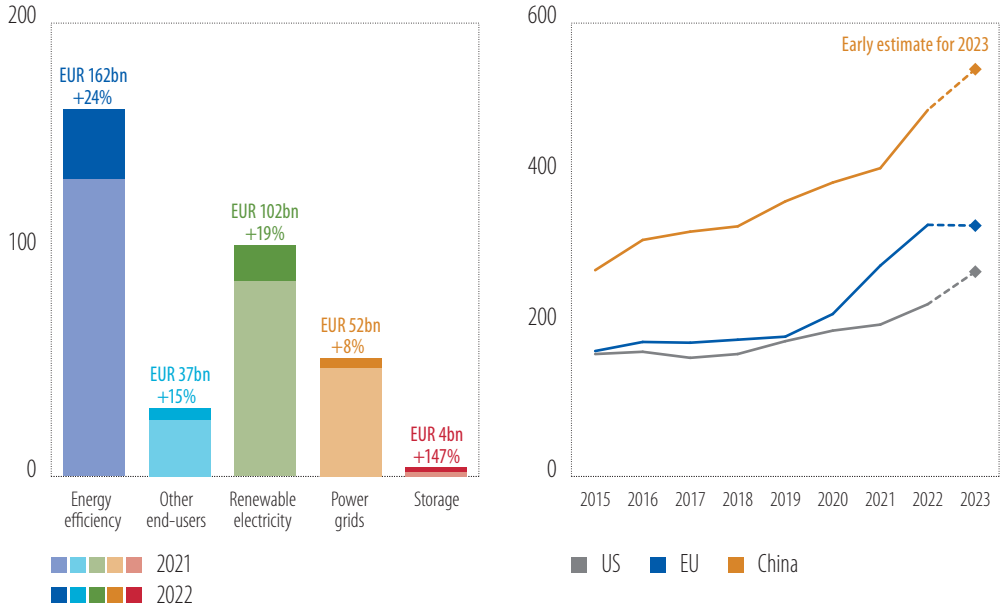


Source: *EIB staff calculations on heat pumps are based on market data from European Heat Pump Association, New York State Energy Research and Development Authority (2023), Bloomberg New Energy Finance (2023) and Eurostat (2023). Electric car sales are based on IEA (2023b) and the European Automobile Manufacturers' Association (2023).*

The Net-Zero Industry Act could provide further impetus to the clean tech manufacturing sector, directing investments towards technologies and know-how that are indispensable to reaching carbon neutrality. This initiative was originally proposed in response to the US Inflation Reduction Act, but it will also reduce EU dependence on imported commodities. The plan includes creating an enabling framework for these technologies, with simplified regulatory and licensing procedures, easier access to markets for green technology developers (including long-term contracts), and measures to align skills with the needs of the green transition. This regulatory toolbox will foster innovative net-zero technologies like heat pumps, solar panels, electrolysers, fuel cells and wind turbines. The proposal also calls for establishing a European financial facility to stimulate the green hydrogen market, the Green Hydrogen Bank, and the creation of more environmentally and socially responsible battery supply chains, in line with the European Critical Raw Materials Act.

Clean energy investments in the European Union kept growing during the energy crisis, despite challenges and uncertainty. As defined by the International Energy Agency, clean energy investments are all energy investments except those directed to unabated fossil fuels. EU clean energy investments reached almost EUR 360 billion in 2022 – twice as much as in 2015 and 20% more than in 2021 (Figure 10). High energy prices motivated people to invest more in energy saving measures (+24%), such as heat pumps, electric vehicles and other efficient equipment. Renewable electricity investments also increased to more than EUR 100 billion and boosted energy storage capacities (+147%). China invested EUR 540 billion in 2022, growing at roughly the same rate as the European Union (+19%). The United States invested just over EUR 250 billion in clean energy (13%), helped by the US Inflation Reduction Act, which was signed in August 2022. Preliminary estimates for 2023 indicate that clean energy investments will rise to more than EUR 1.6 billion globally, roughly two-thirds higher than fossil fuel investments, with investment accelerating in the United States and China. EU investments in clean energy are expected to plateau somewhat as high interest rates put pressure on financing costs and supply chain constraints persist.

Figure 10
EU clean energy investments (EUR billion, left panel)**, by sector 2021-2022, and regional comparison** (EUR billion, right panel)**, 2015-2023**



Source: *EIB staff calculations based on IEA (2023c).*
Note: *Other end-users refers to renewable energy and electrification used in the buildings, transport and industrial sectors. Investments in nuclear energy and clean fuels are included in country totals (right panel).*

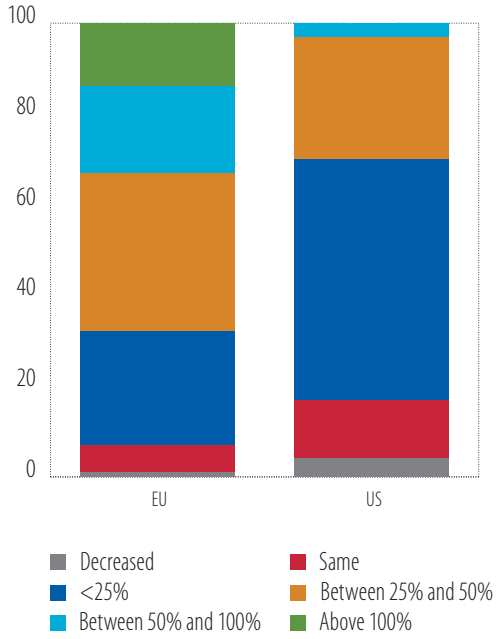
The investment required to meet the objectives of the European Green Deal and REPowerEU is estimated to be about EUR 620 billion per year. The green deal and REPowerEU policies gave a clear signal to investors to speed up the transition and phase out fossil fuels faster. While the data in Figure 10 referred to investment in clean energy technologies alone, the estimated EUR 620 billion needed for investment includes initiatives for the green transition and for addressing climate change, the environment, energy, transport, industry, agriculture and sustainable finance, all of which are closely interlinked (European Commission, 2023).

The energy shock and EU climate policy are pushing firms to transform

Europe felt the reverberations of the energy shock strongly. In the EIB Investment Survey (EIBIS) for 2023, nearly 70% of European firms reported a rise of more than 25% in their energy spending since early 2022, with 20% saying bills rose 50-100% and 14% saying their spending at least doubled (Figure 11). The shock hit Europe particularly hard, since it was heavily dependent on Russian gas imports at the beginning of the crisis and needed to quickly reshuffle its energy mix. By contrast, only 30% of firms in the United States saw their energy bill rise more than 25%.

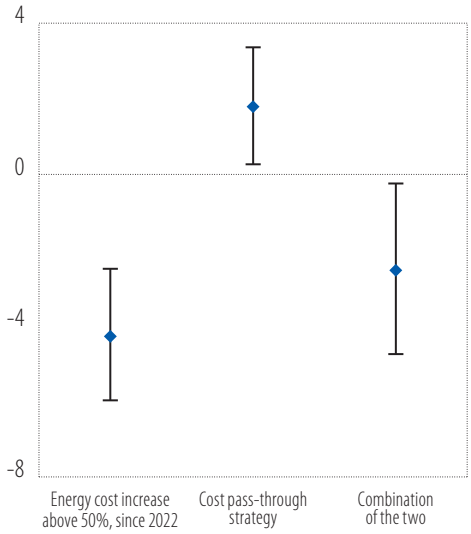
These energy cost hikes clearly affected the competitiveness of European companies. A regression analysis of EIBIS 2023 data shows that a firm's probability of being profitable decreases by more than 4 percentage points if its energy spending increases by at least 50% (Figure 12). However, this effect is reduced by half if the firm had a strategy to pass on the extra cost to its customers. In contrast, firms with a strategy to pass on costs were more likely to be profitable if their energy spending had not increased by more than 50% since 2022.

Figure 11
Spending on energy since the beginning of 2022 (% of firms)



Source: *EIBIS 2023.*
Question: *Since the beginning of 2022, by how much has your company's spending on energy (including gas, electricity, oil) changed on average?*

Figure 12
Marginal effects of energy spending increases on the likelihood of a firm being profitable (in percentage points)

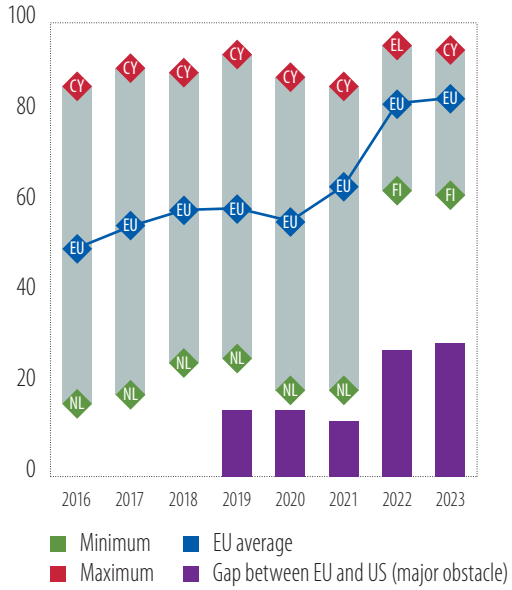


Source: *EIB staff calculations based on the EIBIS 2023.*
Note: *Marginal effects of increased spending on energy vs. no change or a decrease in the probability of being profitable, with and without a strategy to pass on costs to clients, after accounting for country, sector and size effects. The black lines represent 95% confidence intervals.*

The rise in energy spending meant a large share of firms once again cited energy costs as an obstacle to investment. EIBIS 2023 shows that energy costs are a serious hurdle to investment in Europe, with 83% of firms saying it is a barrier, and 53% describing it as a major one. This is 30 percentage points higher than US firms, which illustrates the difference in the impact of the energy crisis across the Atlantic. Concerns about energy costs dampening investment are widespread across European countries and sectors, but they vary in intensity. Nevertheless, the variation among countries and sectors decreased significantly in 2022 and 2023, showing the universal nature of the energy shock for European firms (Figure 13).

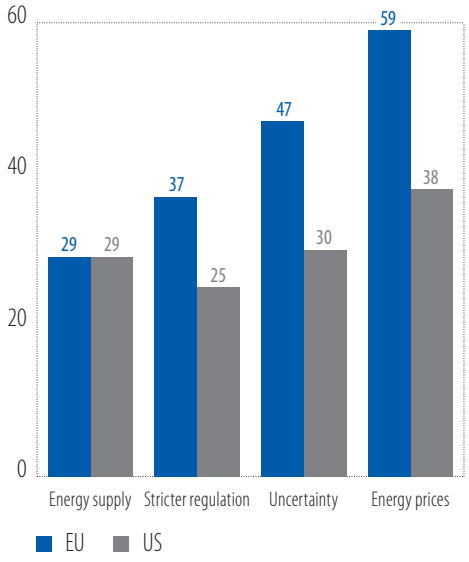
The ongoing energy crisis poses different challenges for firms in the European Union than in the United States, depending on the factors affecting their energy concerns. EIBIS 2023 shows that EU firms are generally more concerned than US firms about various aspects of the energy crisis, including stricter regulation, uncertainty and energy prices (Figure 14). The only exception was concern about energy supply, which was similar in both regions.

Figure 13
Impact of energy cost concerns on investment (% of firms)



Source: *EIBIS 2016-2023.*
Question: *Thinking about your investment activities, to what extent is energy cost a major, minor or not an obstacle?*

Figure 14
Major concerns related to the energy shock (% of firms)



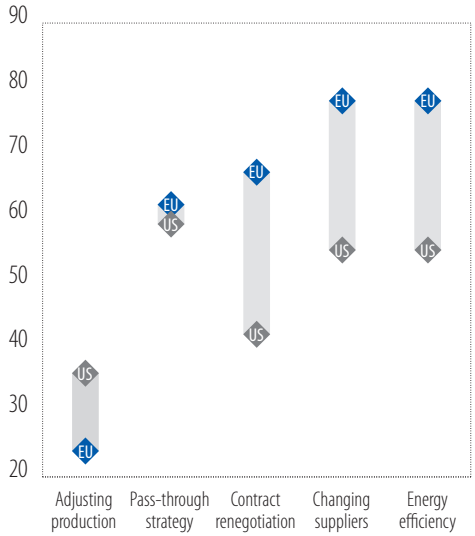
Source: *EIBIS 2023.*
Question: *Thinking about the energy shock, to what extent is your company concerned about …?*

To cope with the energy crisis, EU and US firms have different strategies, with EU firms being generally more reactive. EU firms are more likely to invest in energy savings, change their supplier or contract, and adjust their fuel mix than US firms. According to EIBIS 2023, 78% of EU firms prioritise investment in energy savings, compared with 55% in the United States (Figure 15). Similarly, 67% of EU firms would seek to change their supplier or renegotiate their contract, compared with only 42% of US firms. Moreover, 47% of EU firms would change their fuel mix, whereas only 20% of US firms would consider this option. This suggests that EU firms are more proactive and adaptive in reducing their energy cost and consumption, and in diversifying their energy sources.

However, EU and US firms are equally likely to pass on the additional energy cost to their customers. EIBIS 2023 shows that 62% of EU firms and 59% of US firms plan to pass additional energy costs on to their customers, which increases the probability that they will remain profitable (Figure 15). This is especially true for EU firms in sectors that are most affected by the transition to a low-carbon economy, as 80% are willing to pass on higher energy costs. EIBIS 2023 indicates, however, that only 24% of EU firms and 36% of US firms are thinking of stopping or reducing the production of certain goods and services because high energy costs have made them less profitable. This indicates that most firms are trying to maintain their output and market share despite high costs.

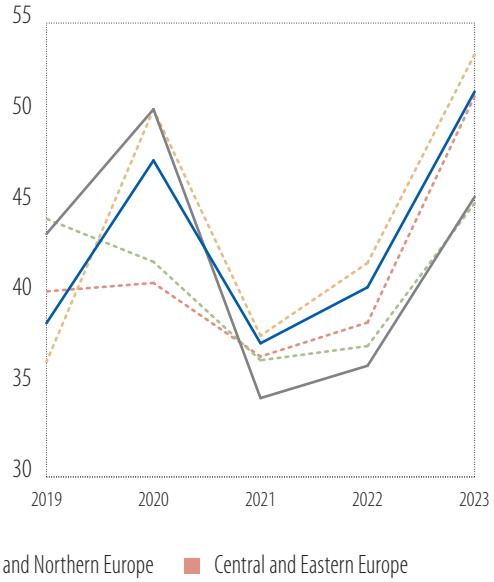
Energy efficiency investment made a strong comeback as the energy crisis pushed firms to look for ways to reduce costs and improve competitiveness. The share of firms that invested in energy efficiency in the European Union rose to 51% in 2022 from 40% in 2021 (Figure 16), surpassing the United States (45%). This trend played out across sectors and firm sizes, but varied by country. In 2023 the share of EU corporate investment budget devoted to energy efficiency was 12% on average, which matched the EIBIS 2022. It was higher than in the United States (8%).

Figure 15
Strategies for dealing with the energy shock
(% of firms)



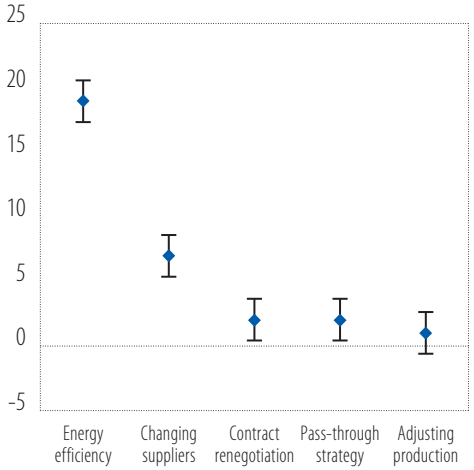
Source: *EIBIS 2023.*
Question: *Which, if any of the following, are your priorities/strategies to deal with the recent developments in the energy market?*

Figure 16
Investing in energy efficiency
(% of firms)



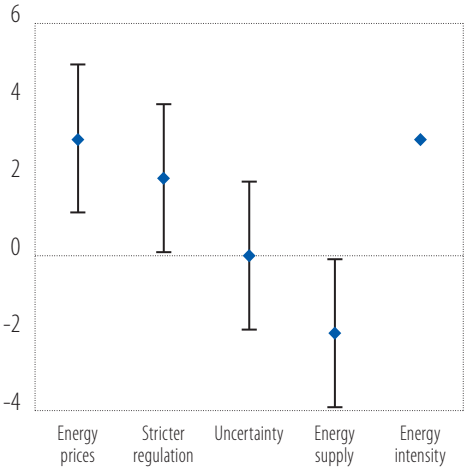
Source: *EIBIS 2019-2023 .*
Question: *What proportion of the total investment in the last financial year was primarily for measures to improve energy efficiency in your organisation?*

Figure 17
Likelihood of firms investing in energy efficiency (in percentage points), **based on the strategies they adopted to deal with the energy crisis**



Source: *EIB staff calculations based on the EIBIS 2023.*
Note: *Marginal effects of various strategies on the probability of investing in energy efficiency, after accounting for country, sector and size effects. The black lines represent 95% confidence intervals.*

Figure 18
Likelihood of firms investing in energy efficiency (in percentage points), **based on their concerns about the energy crisis**

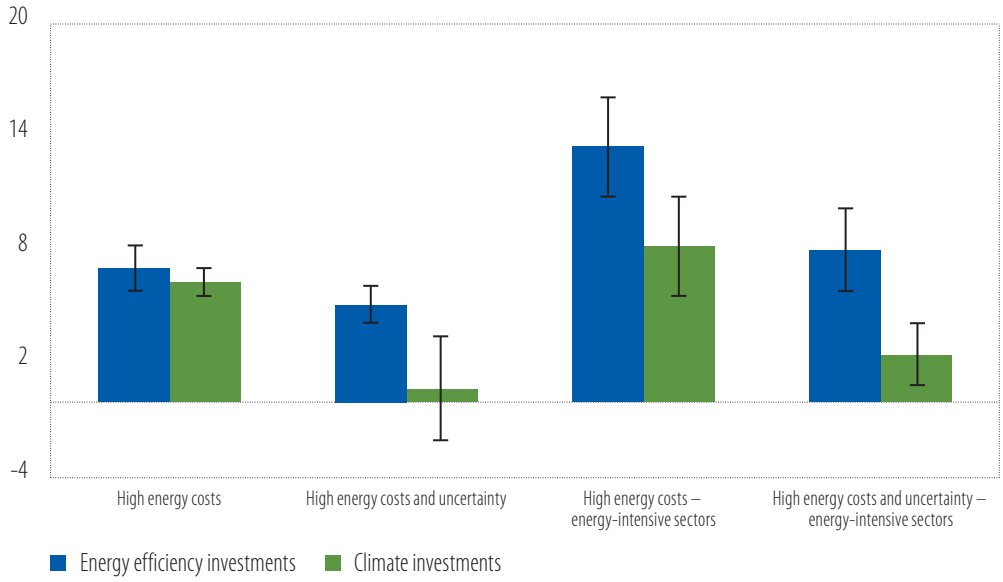


Source: *EIB staff calculations based on the EIBIS 2023.*
Note: *Marginal effects of various concerns related to the energy shock on the probability of investing in energy efficiency, after accounting for country, sector and size effects. The black lines represent 95% confidence intervals.*

Firms that were willing to transform invested more in energy efficiency, as did companies with a longer-term outlook. Among European firms, those that had a long-term vision and wanted to reduce their energy costs and environmental impact were more likely to invest than those that had a short-term focus and tried to cope with the energy crisis by passing the costs onto consumers or by reducing production (Figure 17). Similarly, firms concerned about energy prices, tightening regulation or their own energy intensity were more proactive in investing in energy efficiency, while firms concerned about uncertainty or energy supply were less proactive (Figure 18).

Figure 19

Effects of higher energy costs and uncertainty on the likelihood of investing in climate action and energy efficiency (in percentage points)**, by energy intensity**



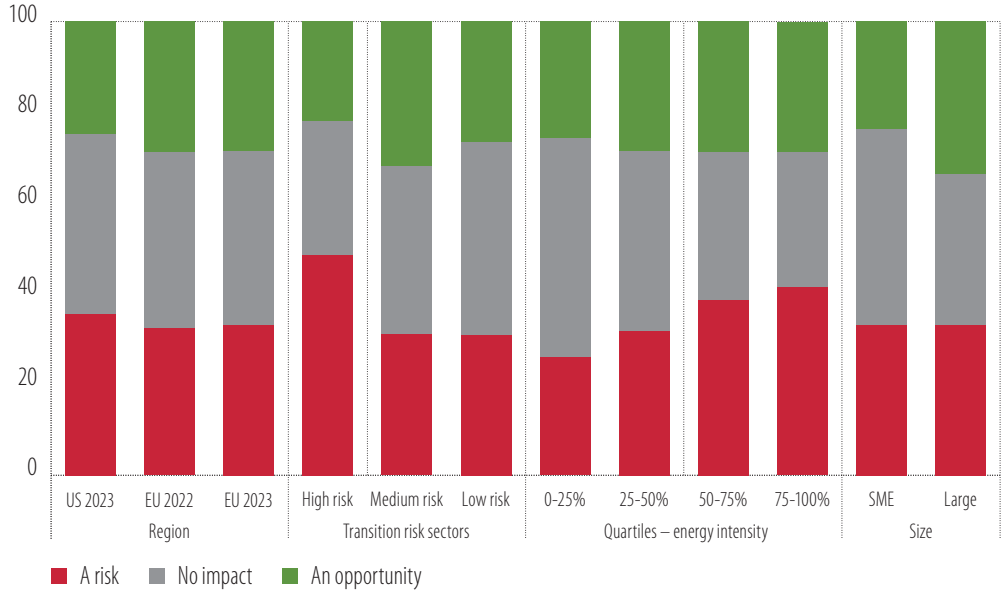
Source: *EIB staff calculations.*
Note: *Marginal effects of major energy cost concerns and uncertainty on the probability of investing in energy efficiency or in climate action, by energy intensity, after accounting for country, sector and size effects. The black lines represent 95% confidence intervals. For more information see Kalantzis et al. (2024).*

Firms chose to invest more in energy efficiency than other types of climate measures when they faced sudden increases in energy prices. The empirical analysis (Figure 19) reveals how energy costs and uncertainty affect firms' decisions to invest in energy efficiency and climate action. Higher energy costs stimulate investment in energy efficiency and climate action. But when energy cost concerns are combined with concerns about uncertainty, firms prioritise investment in energy efficiency. Remarkably, however, this result does not hold for firms in energy-intensive industries. Those firms continue to invest in energy efficiency and climate measures when uncertainty is paired with high energy costs.

The energy shock and the climate emergency are two interrelated issues that firms must tackle simultaneously. The energy crisis, caused by rising demand for fossil fuels and a limited supply of renewable sources, is a hurdle for companies trying to deal with climate change. However, it is not the only difficulty they face. Companies also must deal with the risks and opportunities arising from the transition to a green economy, such as changing consumer preferences, regulatory pressures, technological innovations and competitive pressures.

Figure 20

Impact of the energy transition on firms (in %) **by region, sectors, energy intensity and size**

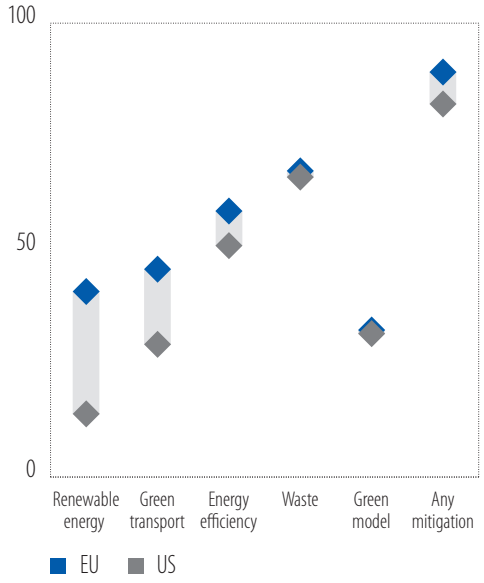


Source: *EIBIS 2023.*
Note: *Sectors with transition risks were determined using codes from the Nomenclature of Economic Activities (NACE), the European statistical classification of economic activities. The quartiles are based on energy spending per employee.*
Question: *What impact do you expect this transition to stricter climate standards and regulations will have on your company over the next five years?*

The transition to a low-carbon economy is not only a challenge, but also an opportunity for firms to gain a competitive edge in their industry. However, not all firms see it that way. EU firms are less concerned about the transition's negative impact (25%) than US firms (36%), and they are slightly more prone to see opportunities related to it (33% for EU firms vs. 29% for US firms). Differences also exist across Europe. Firms in industries that are highly exposed to the energy transition tend to see it as a threat (Figure 20), while firms in low-risk sectors think the transition will not affect them. Firms in sectors with mid-size risks have mixed views. Energy-intensive firms are more likely to see the transition as a risk than an opportunity, and fewer of them expect to come through the transition unaffected. Small and medium firms tend to be equally as concerned as large firms, but they are less likely to see the transition as an opportunity.

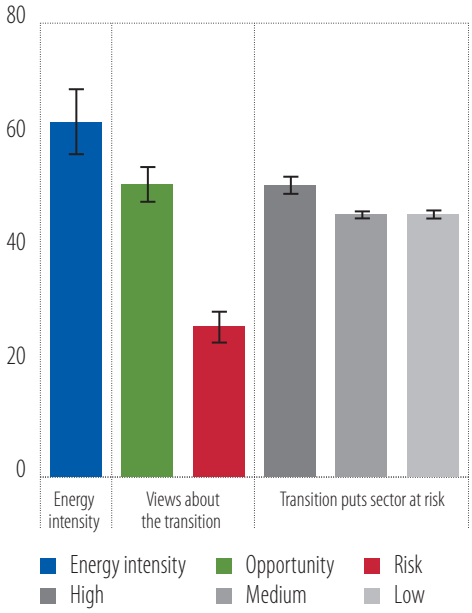
EU firms are ahead of US firms in reducing their carbon footprint, but there is room for improvement. The EIBIS shows that almost 90% of EU firms have taken action to reduce their greenhouse gas emissions, compared with 82% of US firms (Figure 21). EU firms invest mainly in energy efficiency (59% vs. 51% of US firms), and waste minimisation and recycling (67% vs. 66%). EU firms are well ahead of their US counterparts in investing in renewable energy (41% vs. 14%) and green transport (46% vs. 29%). These figures suggest that EU firms are aware of the urgency and importance of addressing climate change and are taking concrete steps to reduce their environmental impact. The results also imply that EU firms are more proactive than US firms in pursuing green investments and strategies.

Figure 21
Acting to reduce greenhouse gas emissions (% of firms)



Source: *EIBIS 2023.*
Question: *Which of the following applies to your company regarding investments to tackle the impacts of weather events and to help reduce carbon emissions?*

Figure 22
Probability of investing in new green products and services (in %), **by transition risks**



Source: *EIB staff calculations.*
Note: *Marginal effects of the probability of investing in green products and services by transition risk sector classification (EIB's risk classification), energy intensity, and views on the energy transition impacts, after taking into account country, sector and size effects. The black lines represent 95% confidence intervals.*

Many EU firms are changing their business model in response to climate change risks. Diving deeper into the data, regression analysis (Figure 22) shows that energy-intensive firms are more likely to consider changing their production and business models to favour less polluting activities. Similarly, firms that operate in sectors that are highly exposed to the transition have more incentives to invest in green products and services to mitigate these risks and seize new opportunities.

A key factor that influences firms' willingness to invest in green products and services is whether they perceive the green transition as a risk or an opportunity. Firms that expect to benefit from the transition (meaning that they expect higher demand, lower costs, an improving reputation or better innovation) are more likely to invest in green products and services. By contrast, firms that view the transition negatively (expecting to suffer from lower profitability, more cumbersome regulation, a worsening reputation or disruption to their innovation) are less likely to invest in transformation. Remarkably, both groups are more likely to invest than firms that expect no impact.

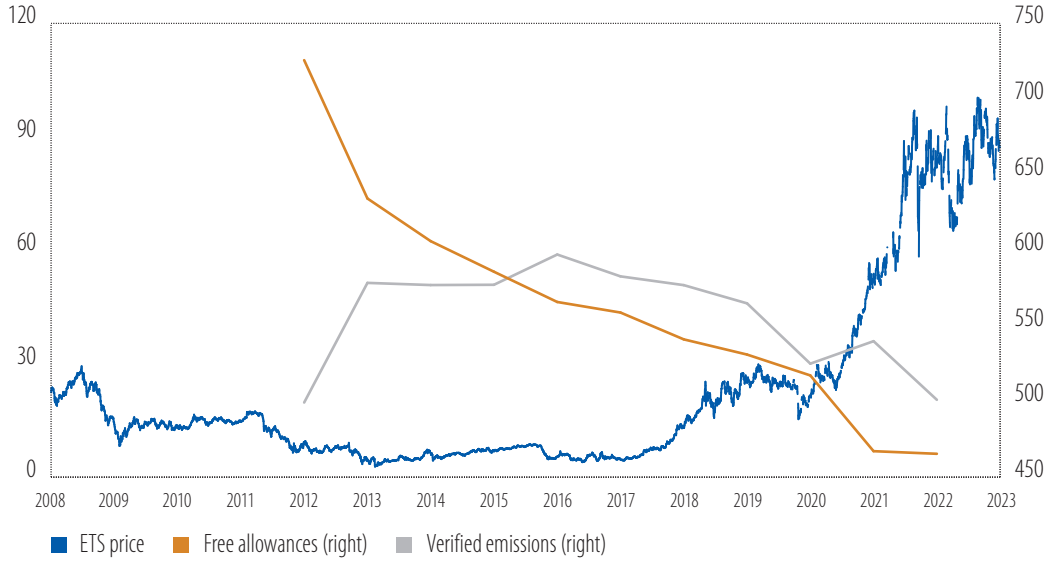
Energy-intensive industries are forging a greener path, but challenges persist

At the EU level, recent evolutions in the energy market and in climate policies have led emission-intensive industries to a crossroads. On one hand, they must adapt to the changing climate and energy landscape, as the European Union aims to become the first climate-neutral continent by 2050, which requires cutting its emissions by more than half by 2030. On the other hand, businesses must cope with rising costs and competition, as the energy crisis and stricter climate regulations put pressure on their profit margins and market share. Firms' ability to adjust to the green transition is neither straightforward nor uniform, as the transition is creating difficulties and opportunities for EU manufacturing.

The European Union is implementing a raft of policies and instruments to decarbonise its economy. One of these is the EU Emissions Trading System (ETS), which is the world's largest carbon market. The trading system includes more than 14 500 installations in the power sector and energy-intensive industries that cover almost 40% of the European Union's total greenhouse gas emissions. The system sets a cap on total emissions allowed by the regulated industries and installations, and it allows market players to trade emission allowances within the cap. The cap is reduced every year, creating a scarcity of allowances. That scarcity determines the price for emissions and outlines the future environment in which manufacturing firms must thrive (Figure 23).

Figure 23

ETS emission prices (left axis: €/tCO_2) **and verified emissions and free emission allowances** (right axis: tCO_2)

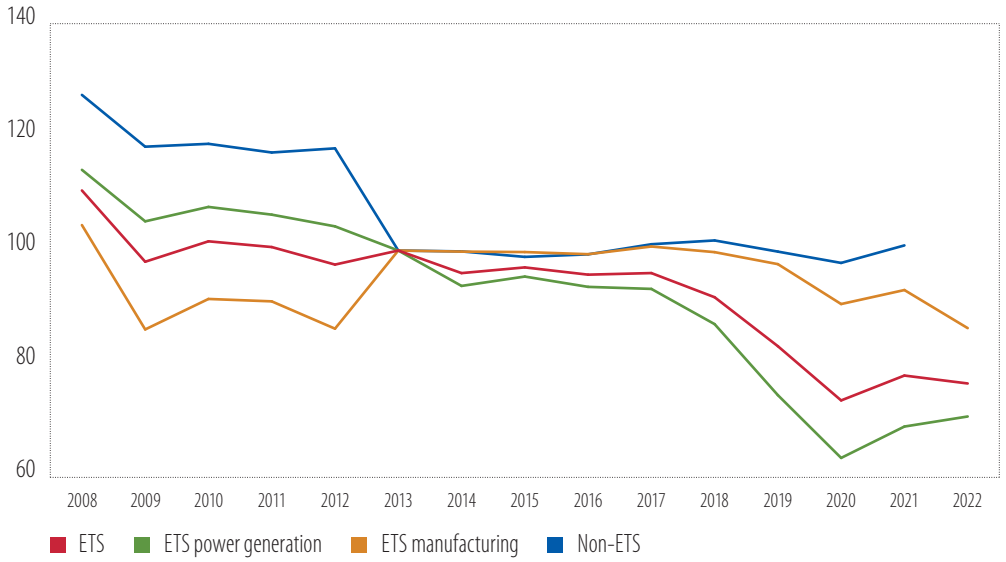


Source: *EU Transaction Log, Bloomberg and Eurostat.*

In operation since 2005, the Emissions Trading System has gone through four phases of development, with changes in scope, emission caps and allocation rules.[1] Since the system was first set up, the regulated sectors have reduced emissions significantly (Figure 24). The power generation sector has mainly driven the reductions, cutting greenhouse gas emissions 30% from 2013 to 2022, thanks to the increasing use of renewable energy and less carbon-intensive fossil fuels. But the manufacturing sector has made less progress (15% reduction for the same period), with many firms still highly reliant on carbon-emitting fossil fuels.

1 In the first phase (2005-2008), allowances were given for free and covered only power generators and energy-intensive industries. In the second phase (2008-2012), allowances were reduced by 6.5% compared to 2005 and Iceland, Liechtenstein and Norway joined the scheme. In phase three (2013-2020) and four (2020-2030), the cap on allowances become even stricter (annual reduction of 1.74% in phase three and 2.2% in phase four), and more sectors and gases were covered (including aviation, petrochemicals and aluminium), while the allocation of free credits was adjusted, based on actual production levels.

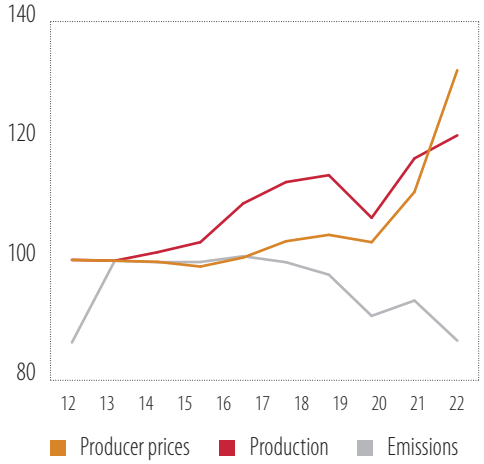
Figure 24
Emissions (an index, 2013=100)**, by sector**



Source: *EU Transaction Log, Bloomberg, Eurostat.*

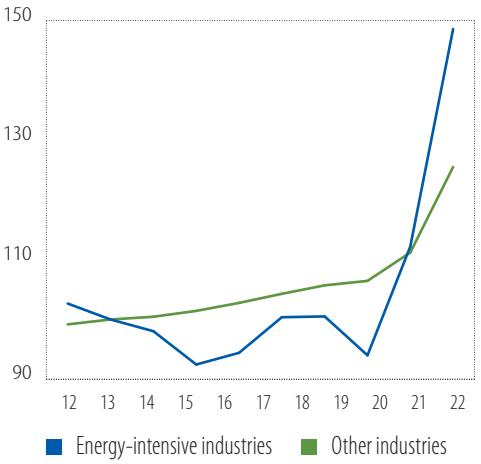
Climate regulation is getting stricter, and the Emissions Trading System is undergoing a major reform to align with the European Union's 2030 climate target. As part of the Fit for 55 package – which aims to align the EU climate and energy policies with the 2030 target of reducing emissions 55% compared to 1990 levels – the European Commission presented a legislative proposal to review the trading system in July 2021. The proposal includes several measures to strengthen the system, such as faster reduction the emission cap from 2.2% to 4.2%, extending the scope of the system to include new sectors like maritime transport and buildings, creating a separate trading system for road transport and heating fuels, and phasing out the allocation of free allowances for most sectors by 2030.

Figure 25
Producer prices, production and emissions in EU manufacturing (an index, 2013=100)



Source: *Eurostat.*

Figure 26
Production prices in energy-intensive manufacturing sectors (an index, 2013=100)



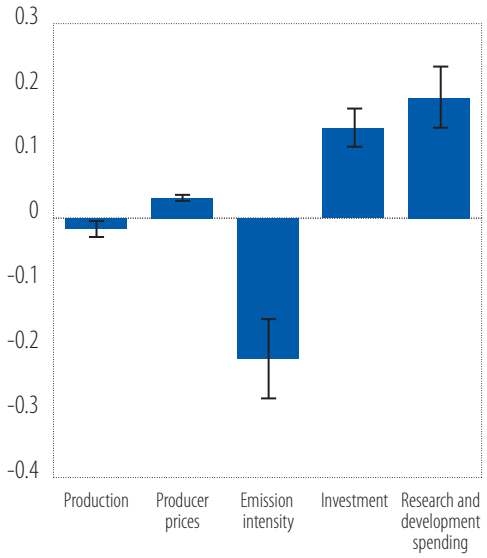
Source: *Eurostat.*
Note: *Energy-intensive industries cover the following sectors: Food, pulp and paper, basic chemicals, refining, iron and steel, non-ferrous metals, nonmetallic minerals.*

On top of the tightening of the market for emission allowances, the energy crisis has intensified the cost pressures faced by EU firms. In 2022, the producer price index jumped nearly 30% annually, but production increased by a meagre 3% (Figure 25). While inflation has fuelled costs, the 54% increase in carbon prices from 2021 to 2022 and an 83% rise in energy costs in the same period also contributed significantly. Cost pressures are exemplified by energy-intensive industries, where production prices surged nearly two times more than in other industries (Figure 26). These developments have raised concerns about the competitiveness and profitability of EU manufacturing firms, especially those highly exposed to international trade and those more likely to shift production or consumption to regions with less strict climate policies (known as carbon leakage).

Tighter carbon markets bring benefits and challenges for industries that are highly dependent on energy or are high emitting. On the positive side, tighter carbon markets help reduce emissions and prod the European Union to meet its climate goals (Figure 27). However, these gains come with economic costs, and steepness of those costs depend on how well the regulated sectors can adapt and innovate. By placing a cap on carbon emissions and limiting the trading of allowances, the Emissions Trading System influences markets through price and supply. Its impact is explored below with a panel regression model that explores developments from 2012 to 2022, after controlling for factors like labour, energy costs and value added.

Figure 27

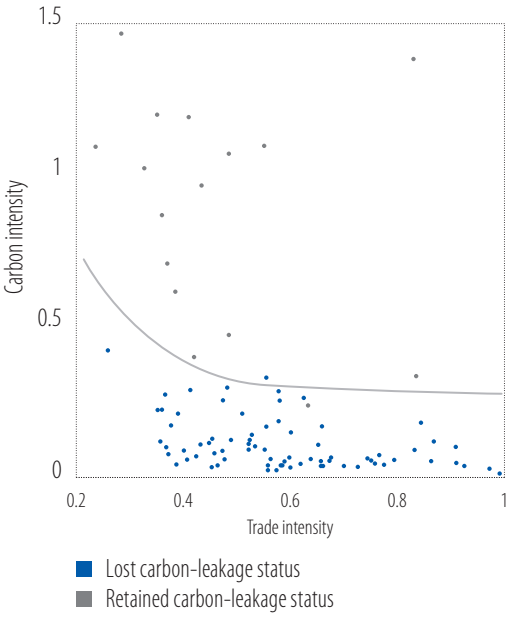
Impact of ETS prices on firms' strategies (a coefficient)



Source: *EIB staff calculations.*
Note: *The coefficients have been estimated based on panel regressions (2012-2022), taking into account sectorial and country effects, as well as control variables such as value added at factor cost, share of labour and energy prices. The black lines represent 95% confidence intervals. For more details see Hattemer and Kalantzis (2024).*

Figure 28

Changes in the allocation of free allowances (indexes)



Source: *EIB staff calculations.*
Note: *The figure below shows the changes in the allocation of free allowances for different sectors under the EU Emissions Trading System from Phase III (2013-2020) to Phase IV (2021-2030). The free allowances are granted to sectors that are exposed to a significant risk of carbon leakage, which means that they may relocate their production to countries with less stringent climate policies. The blue dots represent sectors that lost their eligibility for free allowances in Phase IV, while the grey dots represent sectors that retained their eligibility for free allowances in Phase IV. For more details see Hattemer and Kalantzis (2024).*

Higher prices for emission allowances have a small impact on producer prices and production, but a larger impact on emission intensity. A 1% increase in the ETS price is associated with less than a 0.03% increase in producer prices, and a similarly small decrease in production. This means that only a small fraction of emission costs is passed through to consumers, and that firms slightly reduce output (Figure 27). By contrast, the same price increase results in a decrease of over 0.2% in emission intensity, which is robust and statistically significant. This implies that the ETS price effectively encourages the manufacturing sector to reduce greenhouse gas emissions per unit of output.

Higher ETS prices create an incentive for firms to invest in low-carbon or carbon-neutral technologies, which can lower their production costs and enhance their long-term competitiveness. However, the relationship between carbon price and investment is not simple, as it depends on many other factors, such as market structure, technological advancements, regulatory interventions and external shocks. Despite this complexity, a clear trend emerges from the panel data analysis. A 1% increase in the price of carbon allowances corresponds to a 0.14% increase in net investments or 0.18% increase in research and development (R&D) spending. These findings confirm that investment and R&D are key ways in which the system influences the environmental performance of the manufacturing sector.

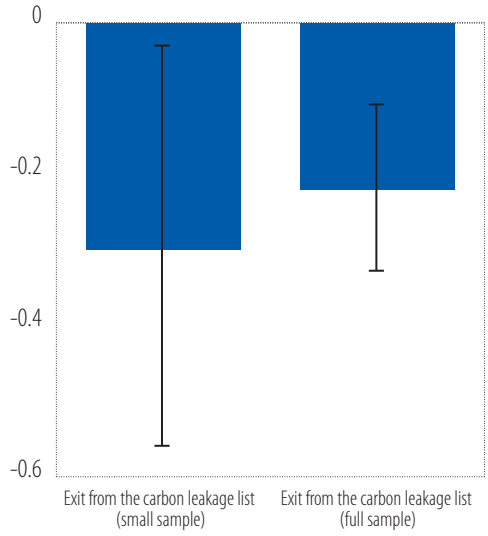
Figure 29

Effects of losing the carbon-leakage status on emission intensity

Source: *EIB staff calculations.*
Note: *The red line represents the moment at which some sectors lost their free emissions allowances.*

Figure 30

Change in the emissions intensity of firms that lost their carbon-leakage status vs. those that retained it (in %)



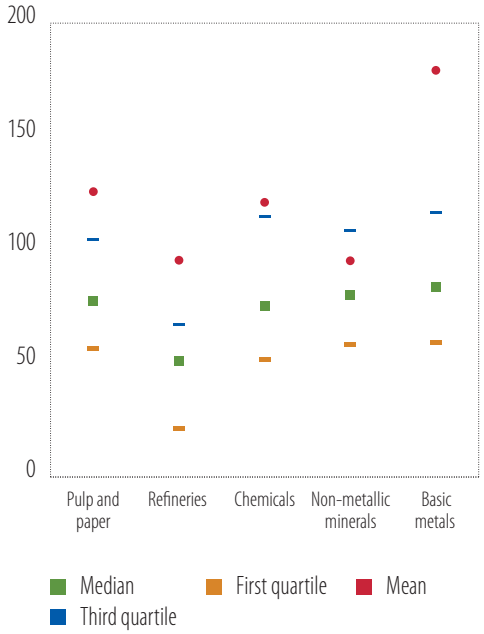
Source: *EIB staff calculations.*
Note: *The small sample excludes sectors with very high carbon intensity in Figure 28. For more details see Hattemer and Kalantzis (2024). The black lines represent 95% confidence intervals.*

Cutting the quantity of emission allowances provided for free also encourages firms to lower their emission intensity. Sectors at risk of carbon leakage used to receive free emission allowances to offset the risk of firms' relocating production to countries or regions with less stringent climate regulations. This practice was reduced in Phase IV of the system (Figure 28) as the allocation criteria became stricter. As a result, sectors that exported more but had lower carbon intensity were excluded from the list (blue dots). The impact of this change is measured by comparing the average emission intensity of sectors that lost their carbon leakage status (and received fewer free allowances) and sectors that remained on the list (and continued to receive free allowances), taking into account sector-specific factors like labour share, energy prices and value added (Figure 29). The results indicate that firms stripped of their carbon leakage status decreased their emission intensity by 20% more than firms that retained their status (Figure 30).

Nevertheless, high emissions remain a source of concern for many firms in energy-intensive industries. With the exception of refineries, more than 25% of firms in each of the other product categories increased their emission intensity from 2013 to 2020 (Figure 31). A few firms even saw their emission intensity increase substantially – such that average changes in intensity exceeded the median and even the third quartile of the distribution. These firms constitute potential pockets of vulnerability, as they will be particularly exposed to more ambitious climate objectives and further competitiveness pressures resulting from higher carbon prices.

Figure 31

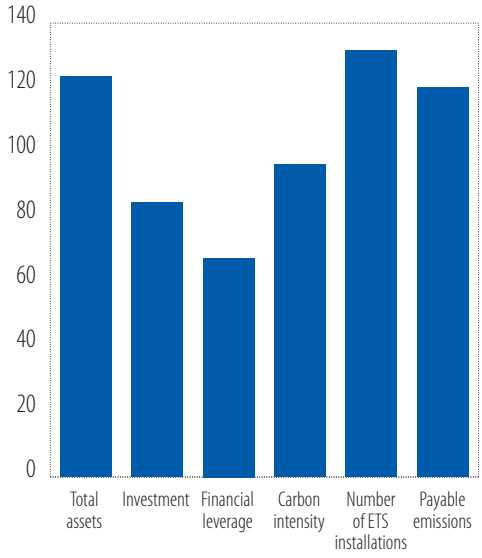
Distribution of changes in firms' carbon intensity (carbon intensity index, 2013=100), **by sector**



Source: *EIB staff calculations.*
Note: *The squares represent the median for each sector, the bars the first and third quartiles of the distribution and the dots the mean. Investment is represented in relation to the index. Product sectors are based on EU ETS installation-level sectors and are assigned to firms based on the installations which constitute the majority emissions.*

Figure 32

Differences in the characteristics of firms lagging in decarbonisation vs. the sector average (average=100)



Source: *EIB staff calculations.*
Note: *Average statistics calculated on a sample of EU ETS manufacturing firms from 2013 to 2020. Decarbonisation laggards are defined as 25% of firms with the lowest reduction in carbon intensity from 2020 to 2013 in each of the product sectors. Financial leverage is defined as the sum of short-term loans and long-term debt compared to total assets. Payable emissions describe the share of verified emissions for which a firm has to buy credit. Numbers are standardised such that 100 describes the average for all manufacturing firms in the period.*

Firms that have made the least progress in reducing their emission intensity appear to be structurally different than the average manufacturing firm. Decarbonisation laggards are defined as the bottom 25% of firms in each sector based on the reduction in their emission intensity from 2013 to 2020. Descriptive statistics show that decarbonisation laggards are typically larger, invest less and rely less on external finance than the average manufacturing firm covered by the Emissions Trading System (Figure 32).

Access to long-term financing is correlated with a reduction in a firm's emission intensity. We examine the relationship between external finance and emission intensity, controlling for firm financial characteristics and the exposure to the Emissions Trading System, as well as fixed effects for firms, countries, sectors and years. While financial leverage is only weakly correlated with emission intensity, the relationship becomes negative and significant for external debt with a maturity of more than 12 months (Figure 33). At the firm level, a 1 percentage point increase in the long-term debt-to-asset ratio is associated with 0.2% lower emission intensity over time. This means that emission-intensive firms use long-term finance to decarbonise.

Figure 33

Relationship between firms' leverage and carbon intensity (a coefficient)

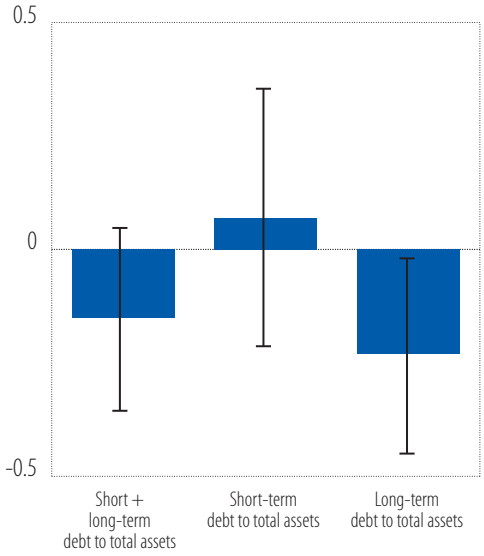
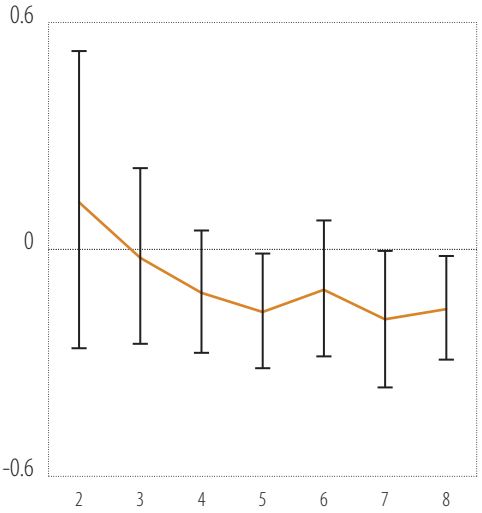


Figure 34

Relationship between firms' leverage and carbon intensity (a coefficient)**, by deciles of the carbon intensity of firms covered by the ETS**



Source: *EIB staff calculations.*

Note: *The right panel looks at the relationship between firms' financial leverage and their carbon intensity, depending on where the they fall in the distribution of the carbon intensity of firms covered by the Emissions Trading System. Regression results use the firm-level fixed effects panel model, regressing real carbon intensity (in log) on financial leverage and its components (loans and long-term debt scaled by total assets). The model controls for the changes in tangible fixed assets, returns on assets, taxes paid, cash ratio, total assets (in log), firm's age, and number of installations reported under the EU ETS and the amount of free allowances granted under the regulation. All explanatory variables are lagged by one year. The model takes into account firm-level and country-sector-year fixed effects, and clusters the standard errors at the firm level. The estimation sample covers 2008-2020. The black lines represent 95% confidence intervals. For more details see Wolski (2024).*

The time to accelerate decarbonisation for emission intensive industries is now. Emission-intensive firms are more dependent on long-term finance. After controlling for fixed effects for country, sector and year, regression results show that the negative relationship between long-term debt and emission intensity is significant only for companies located in the highest emission intensity deciles (Figure 34). This suggests that high-emitting firms depend on long-term finance to decarbonise. Long-term finance might become scarce for high-emitting industries, however. Financial institutions are progressively starting to price in the cost of climate risk, which means that financing costs will increase substantially for these firms.

Box A

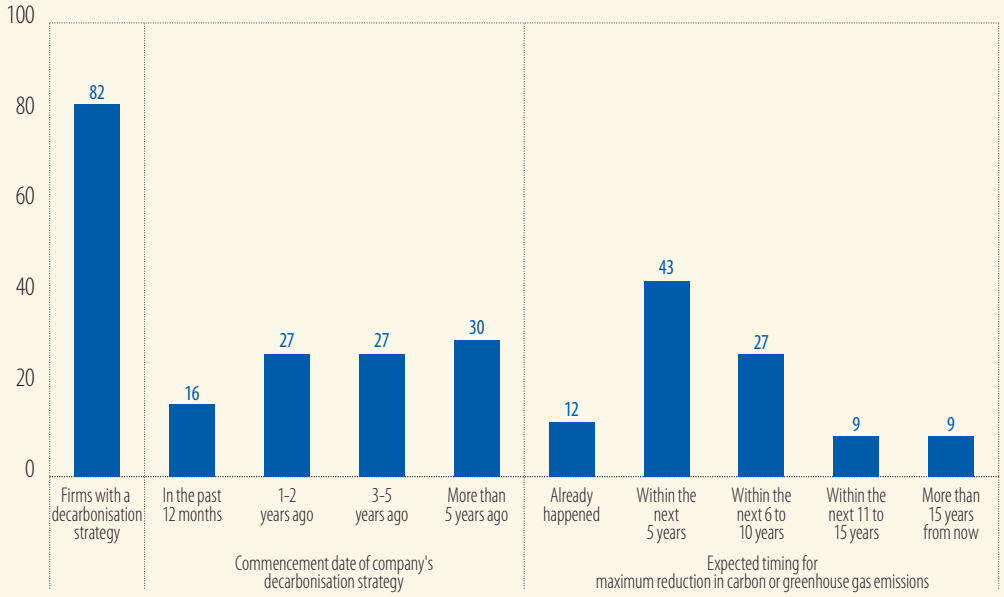
Manufacturing firms in the EU Emissions Trading System – what makes the leaders stand out from the rest?

This box explores how EU firms in manufacturing sectors subject to the Emissions Trading System (ETS) approach decarbonisation. It investigates what sets emissions reduction leaders apart from those that lag behind, and what motivates or hinders them. The analysis leverages data derived from a 2023 EIB special survey of 373 EU manufacturing firms[2] that had at least one installation, namely a stationary technical unit subject to the trading system in 2022.[3] These firms are, by nature, energy-intensive and face the greatest transition challenges, but are also more aware of those challenges.

Responses show that 82% of ETS manufacturing firms in the survey had a decarbonisation strategy in place in 2023. The majority of firms began their decarbonisation strategy before 2020 but the rest have been catching up quickly (Figure A.1). Looking at firms' decarbonisation plans, only 12% say they have already reached their decarbonisation peak. Most are focusing on the 2030 targets and on aligning their activities with the Paris Agreement. Some 18% report that they do not expect their decarbonisation efforts to have the most impact within the next ten years.

Figure A.1

Presence and impact of a decarbonisation strategy for firms covered by the Emissions Trading System (% of firms)



Source: *EIBIS 2023 add-on module on manufacturing firms covered by the Emissions Trading System (ETS).*
Question: *1. Does your company have a decarbonisation strategy? 2. If yes, when did you first implement a decarbonisation strategy for your company? 3. When thinking about the decarbonisation strategy of your company, when do you expect to achieve the biggest reduction in your carbon or greenhouse gas emissions?*

2 The questionnaire was designed in cooperation with the European University Institute. The European University Institute input is part of the LIFE COASE project, co-financed by the EU Life Programme.

3 For more information on the ETS survey, see the Data Annex.

Manufacturing firms operating in the system were asked to assess their decarbonisation efforts compared to their peers. About 30% described themselves as ahead of their peers (firms that are "ahead," or leaders), 10% as behind ("laggards" or behind) and 60% as in line with other firms (Figure A.2). Figure A.2 also presents the leaders and laggards by sector. Pulp and paper and refineries tend to have a slightly higher incidence of laggards. The chemical sector has a higher share of firms considering themselves ahead.

Cross-checking this self-assessment with hard data on emissions, firms appear to have a relatively strong awareness and ability to measure their decarbonisation progress. The self-reported status tends to match the real carbon intensity trends for each group, measured by the ratio of emissions to value added in the last decade (Figure A.3). Specifically, the median carbon intensity has steadily dropped by nearly 20% from 2013 to 2019 among the leaders, and by only 5% among the laggards.

Figure A.2
Firms' reported decarbonisation status (in %)

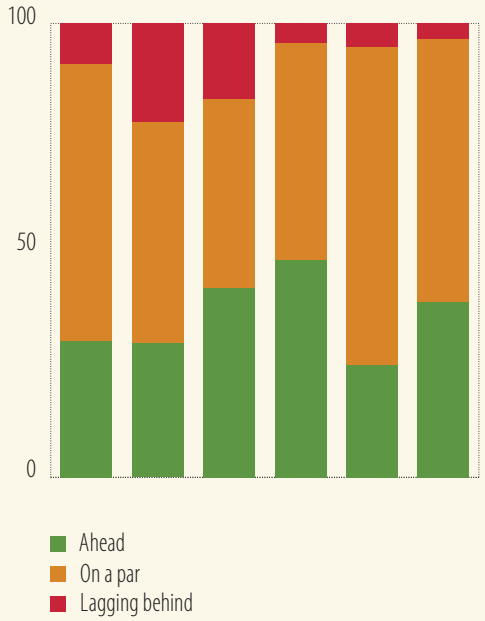
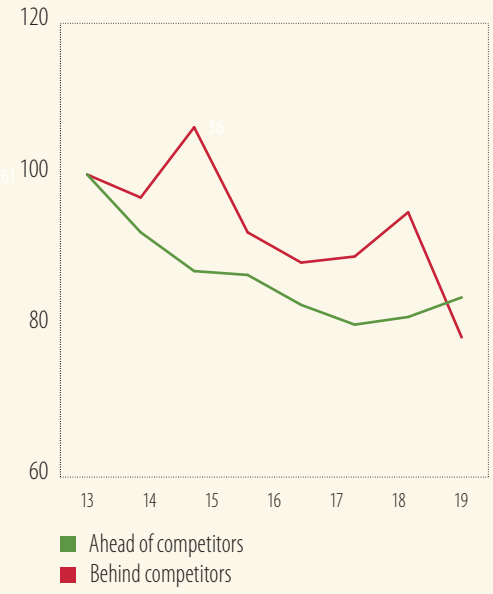


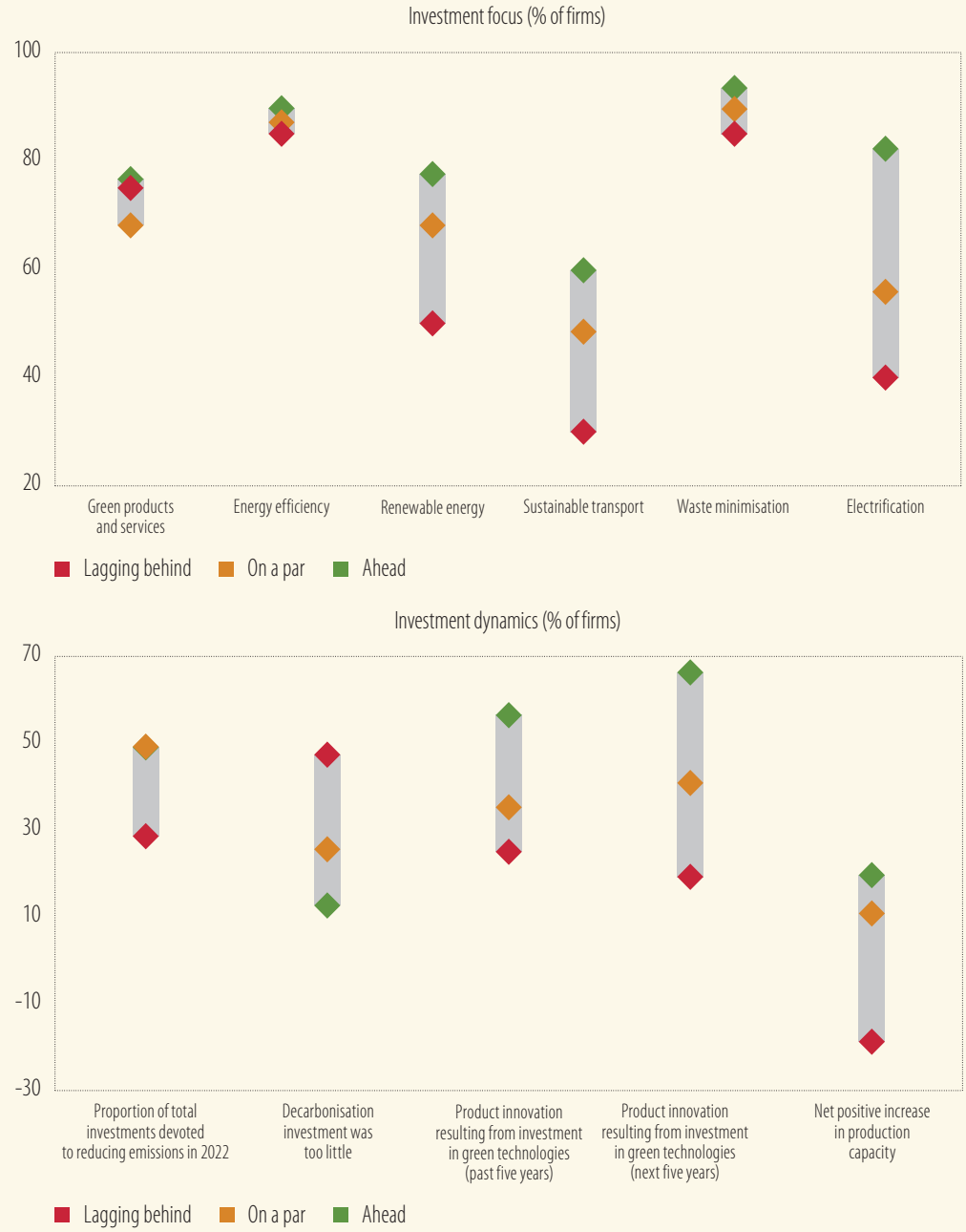
Figure A.3
Carbon intensity of firms that say they are ahead or behind on decarbonisation (an index, 2013=100)



Source: *EIBIS 2023 add-on module on manufacturing firms covered by the ETS.*
Note: *In Figure A.3, the two groups of firms are based on 2023 ETS survey, and they are fixed across the years. The median is calculated using the firm-level decarbonisation index (2013=100) for specific years. Data constraints make it impossible to control for the business cycle, therefore 2020 was left out to avoid anomalies caused by the COVID-19 pandemic.*

Having a decarbonisation strategy is a basic but essential step for any firm that wants to be ahead in decarbonisation. All leaders have a decarbonisation strategy in place, unlike 38% of laggards and 22% of those on a par with their peers. A decarbonisation strategy can help a firm to set clear goals, identify opportunities, allocate resources, monitor progress, and communicate visions and actions to shareholders and others. Leaders also embarked on their strategies earlier (41% started more than five years ago) and, for almost 20% of them, the peak in emissions reduction has already been achieved.

Figure A.4
Firms' investment focus and dynamics



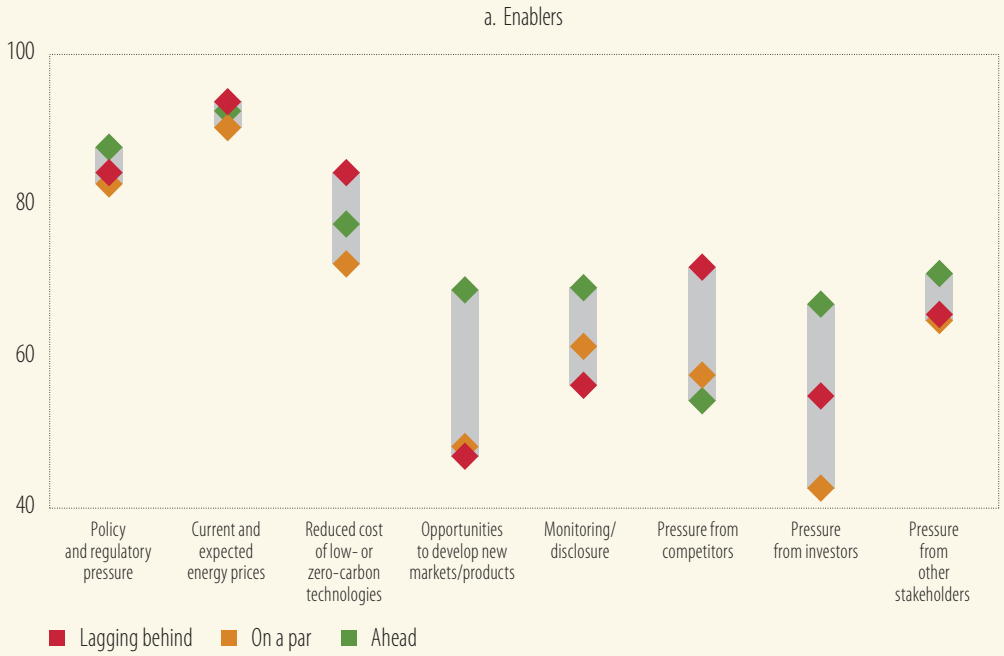
Source: *EIBIS 2023 add-on module on manufacturing firms covered by the ETS.*
Question: *Question: 1. Is your company investing in or implementing any of the following to reduce carbon or greenhouse gas emissions? 2. Thinking about the total investment of your company in 2022, what proportion of your total investment was devoted to reducing greenhouse gas emissions? 3. Looking back at your decarbonisation investment over the last five years, was it too much, too little, or about the right amount to ensure the success of your decarbonisation strategy? 4. And thinking about your company's decarbonisation strategy, compared to five years ago, has your company's total production capacity significantly changed as a result of the construction, shutdown, purchase or sale of production plants? 5. You mentioned investment in technologies to reduce greenhouse gas emissions in the EU. Did this involve any product innovation?*

Firms that invest more in decarbonisation tend to perform better in reducing their carbon footprint and their emission intensity. Leaders invested 50% of their total investment budget in decarbonisation, outperforming laggards, which invested only 30%. Nearly half of laggards admitted that they underinvested in decarbonisation, while only 13% of leaders said so (Figure A.4).

Firms that are frontrunners in decarbonisation are very active in product innovation. Among the firms that invested in technologies to reduce greenhouse gas emissions in the last five years, 75% of the laggards did not focus on product innovation, while almost 60% of the leaders did. Similarly, 66% of leaders plan to innovate in decarbonisation in the next five years, while only 19% of laggards have such plans. Product innovation helps firms stand out from the competition and meet changing customer needs and preferences. It also helps them to access new markets and opportunities and stay competitive in the long run.

Firms' decarbonisation efforts are closely linked to the prospects they see in the future. Leaders, the ones cutting emissions the most, are more likely to have seen an increase in production than a contraction (24% vs. 5%) (Figure A.4). Laggards, the ones cutting emissions intensity the least, are much more likely to have seen production capacity contract rather than increase (34% vs. 16%). In parallel, all firms show little appetite for shifting production to new plants outside the European Union, to regions with less strict environmental regulations. Less than 5% consider shifting production to be a major or minor part of their strategy. This suggests that carbon leakage, or moving production offshore, is not a widespread practice among ETS firms.

Figure A.5
Enabling factors and obstacles to climate investments (% of firms)



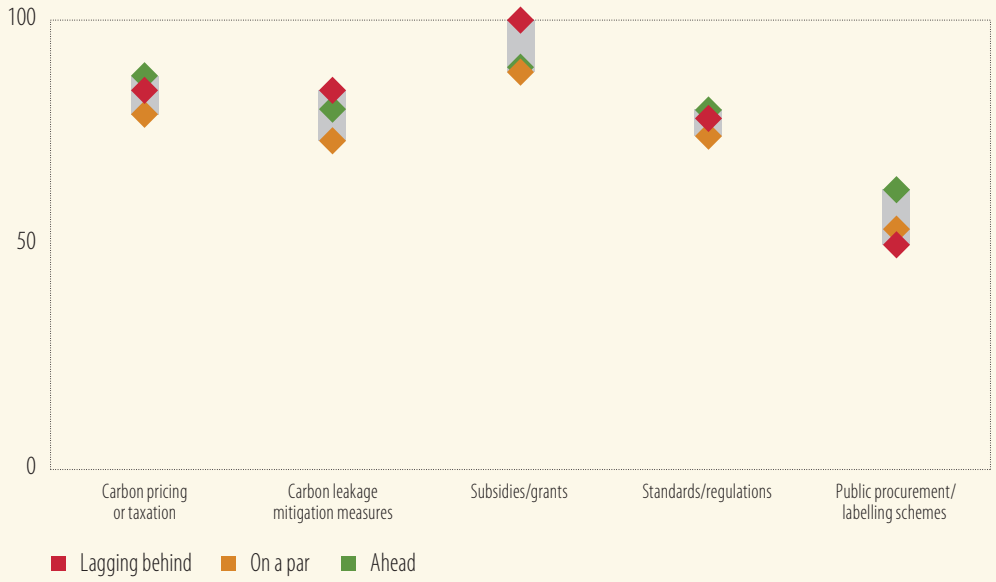
Source: *EIBIS 2023 add-on module on manufacturing firms covered by the ETS.*
Question: *1. When thinking about decarbonisation, how important, if at all, are each of the following to encourage you to undertake or accelerate action to tackle climate change? 2. To what extent, if at all, is each of the following an obstacle to investing in green technologies and processes?*

All firms see the political and regulatory framework, along with energy prices, as key drivers of their decarbonisation efforts (Figure A.5). Laggards cite high costs for low-carbon technologies as an obstacle and pressure from competitors as a stimulus for transformation. They also show lower sensitivity to monitoring and disclosure requirements and to pressure from investors. Combining these findings suggests that laggards' delay could be motivated by a gap in technological advancement. Leaders are more sensitive to reporting and disclosure rules (69%), and to pressure from investors (67%) and stakeholders (71%). They are also much more likely to be motivated by business opportunities from creating new markets or products (69%).

For all groups, the major barriers to decarbonisation are uncertainty about future energy and carbon costs, and uncertainty about regulation and taxation. These concerns affect the incentive to decarbonise for frontrunners (who might anticipate investment, expecting more stringent net-zero conditions and requirements) and laggards (who might hope for delays in such requirements). Thus, uncertainty reduces incentives to invest for both groups of firms (Figure A.5). The majority (around 90%) are likely to see high financing costs as constraints. Firms that are slower to decarbonise tend to cite long payback periods (88%) and technology-related challenges (88%) as obstacles, whereas those that feel they are ahead tend to be more concerned about the lack of skilled labour (80%).

Finally, the survey asked ETS manufacturing firms about policy initiatives that could support their decarbonisation efforts and general decarbonisation investment (Figure A.6). Leaders preferred market and legal incentives, such as carbon pricing (88%), green public procurement (62%) and standards (80%). Laggards, who are behind in the green transition, preferred subsidies (100%) and measures to prevent carbon leakage (84%). This suggests that leaders favour of policies that reward their efforts and create new business opportunities in the net-zero economy, whereas laggards are in favour of policies that reduce the costs of adjusting to net zero and protect them from international competition.

Figure A.6
Policy initiatives that would encourage investment (% of firms)



Source: *EIBIS 2023 add-on module on manufacturing firms covered by the ETS.*
Question: *How likely or unlikely are each of the following policies to encourage your company to invest in green technologies and processes?*

To sum up, the decarbonisation challenges of manufacturing firms covered by the Emissions Trading System vary depending on the sector and the availability of suitable technologies. However, some common features can be identified. Decarbonisation leaders are firms that see the net-zero transition as a business opportunity and invest more in it. They are more innovative, more responsive to investor pressure and more transparent about their decarbonisation efforts. They are also more likely to expand or maintain their production capacity. Decarbonisation laggards are firms that face technological constraints and invest less in the transition. They are more likely to believe they are not doing enough and to anticipate a decline in production. Measures that could accelerate decarbonisation differ for the two groups of firms. Leaders are in favour of more market opportunities and clear policy guidance for the net-zero economy. Laggards, however, seem to delay their transformation and to make it conditional on direct support.

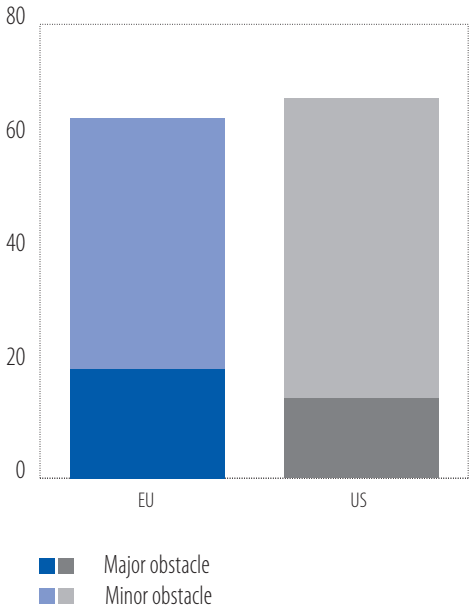
Firms favour mitigation over adaptation measures, creating a gap in climate resilience

Climate change is not just a global environmental issue, but also a business challenge. EU firms must adapt to the fallout of climate change, on top of reducing their emissions. Many companies are facing extreme weather events, such as droughts, heat stress and floods, which affect their operations and profitability. These events can disrupt the supply chain, reduce the productivity of labour and resources, and damage business infrastructure and assets. They also increase the need for external finance (Benincasa et al., 2023). This section explores how European companies are responding to these physical climate risks and the strategies they are adopting to enhance their resilience and competitiveness.

While climate change poses serious risks to EU firms, few of them are taking sufficient measures to adapt. According to EIBIS 2023 data, 63% of firms in the European Union and 67% in the United States

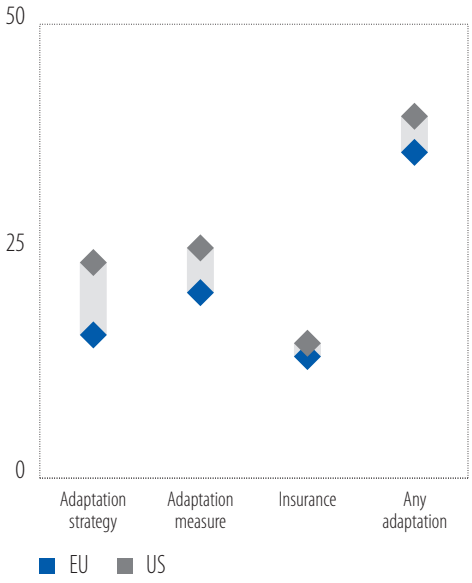
say they are at risk from climate change (Figure 35), up by at least 6 percentage points compared to the previous survey wave. However, only 36% of EU firms have taken any action (strategy, investment or buying insurance) to deal with physical risks (Figure 36). Moreover, there is a large gap in insurance coverage, as only 13% of firms in Europe have bought an insurance policy against climate risks. Only 17% of firms already facing climate risks are insured.

Figure 35
Firms (in %) **affected by physical climate risks**



Source: *EIBIS 2023.*
Question: *Thinking about climate change and the related changes in weather patterns, would you say these weather events currently have an impact on your business?*

Figure 36
Firms (in %) **investing in specific adaptation measures**

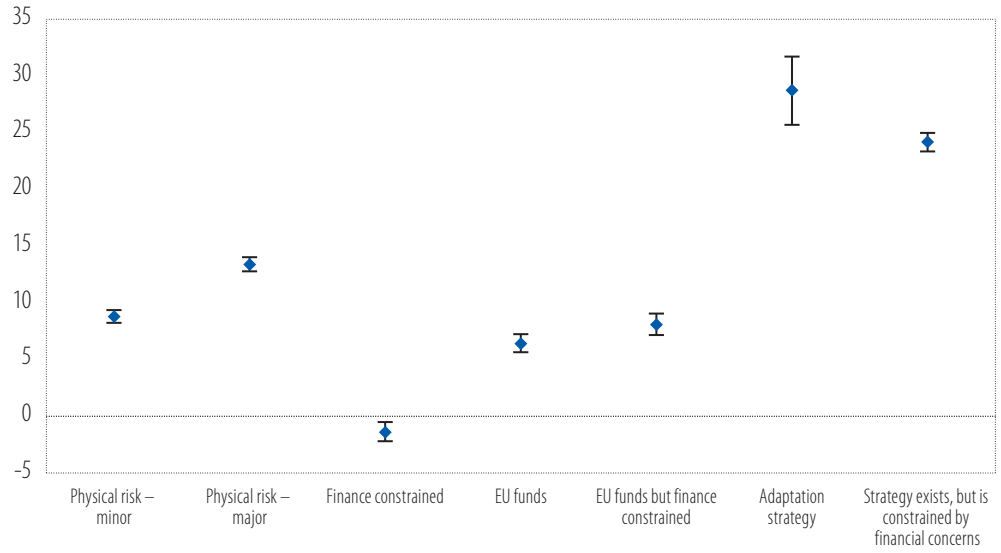


Source: *EIBIS 2023.*
Question: *Has your company developed or invested in any of the following measures to build resilience to the physical risks to your company caused by climate change?*

Adapting to physical climate risks is not an easy task for companies. They face several challenges that may hinder their efforts (Li, 2022). These include the difficulty of estimating the long-term impacts of climate change, which are not well captured by historical data; the complexity and costliness of adapting to multiple and diverse climate risk drivers; the tendency to prioritise short-term goals over the long-term benefits of adaptation; and the attempt to shift the burden of adaptation to other players, such as governments. There is also the chance firms will not take the necessary steps to protect themselves against climate risks, as they expect government to intervene.

Firms are implementing different types of adaptation measures to cope with climate change risks. Some of those measures are active and include changing operational or business strategies, while others are passive, such as insurance or relocation. According to EIBIS 2023 data, EU firms tend to prefer active adaptation measures (especially operational ones) over passive measures. Several factors may explain this. First, operational measures, such as improving water efficiency or installing cooling systems, are easier and faster to implement than business strategies, such as changing product lines or entering new markets. Second, operational measures are less costly and risky than business strategies, which may require significant investments and changes in the business model. Third, operational measures can be more easily justified to stakeholders, such as customers, employees or investors, as they demonstrate the firm's commitment to sustainability and resilience. Therefore, firms may opt for active adaptation measures that are more feasible and beneficial than passive ones.

Figure 37
Factors influencing the probability of investing in adaptation measures (in percentage points)



Source: *EIB staff calculations.*
Note: *Marginal effects of the probability of investing in adaptation measures, after taking into account country, sector and size effects. The black lines represent 95% confidence intervals.*

Firms' investment in adaptation measures depends on how they perceive and respond to the physical climate risks they face, and on access to finance. EIBIS data show that companies invest more in adaptation when they are exposed to higher climate risks that affect their own business (Figure 37). Finance is also crucial for this investment – but it is often scarce, uneven and insufficient to meet the growing needs and costs of adaptation. The European Investment Bank (2021) estimates that annual adaptation needs in Europe range from EUR 35 billion to EUR 500 billion, while only EUR 70 billion was allocated to adaptation through EU structural and investment funds from 2014 to 2021. In addition, EIBIS analysis shows that finance-constrained firms are less likely to adopt an adaptation strategy or take measures (passive or active) to protect themselves from climate change. Furthermore, even if they have an adaptation strategy, the likelihood that they will invest in adaptation measures decreases when they face finance constraints.

Public funds play a vital role in catalysing investment in adaptation by companies, especially in the most vulnerable regions and sectors. EIBIS analysis confirms that European firms are more likely to invest in adaptation when a higher share of EU funds within the country is earmarked for adaptation purposes (Figure 37). These funds help companies adapt either by providing direct financial incentives or by creating a framework for adaptation. Such a framework ultimately sets standards and guidelines, integrates climate risks and adaptation solutions into economic and development policies, and supports capacity-building, knowledge-sharing and research.

Geographical characteristics also shape firms' climate investments. EIBIS 2023 shows clear regional clusters of firms that are investing in adaptation and mitigation. In some regions firms are less active, while in others clusters of active firms exist. Interestingly some spillover effects, such as firms exposed to demonstrations of climate projects and presented with opportunities to learn from their peers, could help to encourage climate investments. To this end, the geographical dimension of firms' climate investments should be considered when designing EU policies and programmes. Box B gives more detail on how regional spillover effects influence firms' decisions to invest in climate adaptation and mitigation measures.

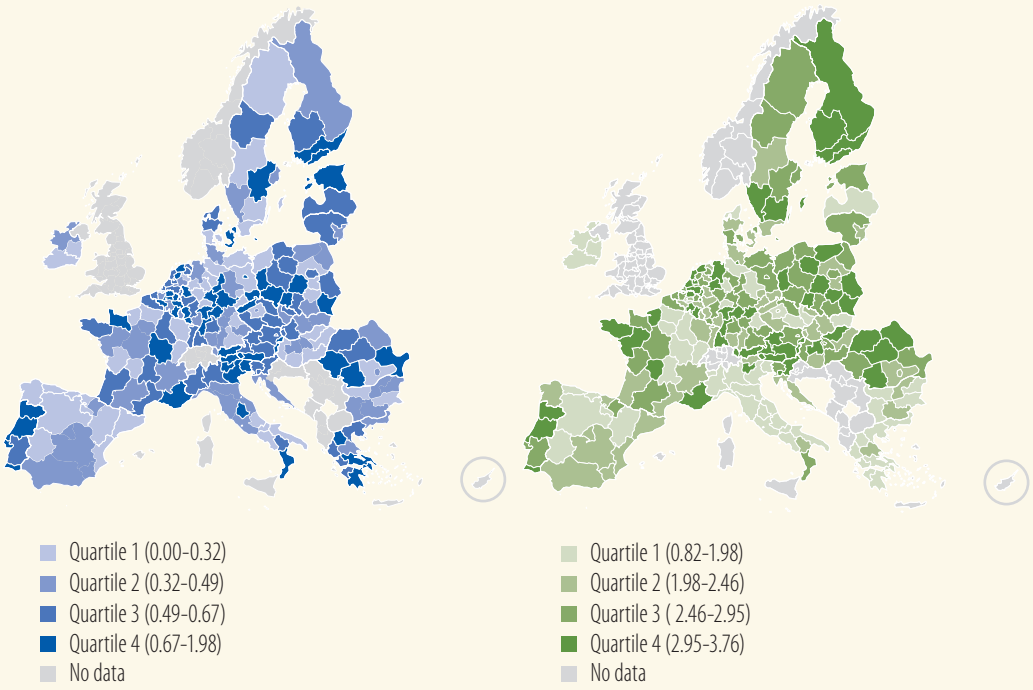
Box B

How regional spillovers shape firms' climate investments in Europe

Climate action depends in part on awareness and local conditions. This box explores how spillover effects from firms' climate actions in one specific region can influence firms in neighbouring regions. Spillover effects can create a positive or negative environment for investment, depending on whether they benefit or harm other firms. They can also generate network effects, where the impact of a specific climate action increases with the number of adopters. For example, if more firms invest in renewable energy, they may create economies of scale and reduce costs for others. Furthermore, regional spillover effects can foster learning and innovation as firms share knowledge and best practices with each other. Because they can amplify or hinder firms' adoption of climate-friendly practices, policymakers should take regional spillover effects into account when drafting climate laws or regulations.

Figure B.1

Average number of adaptation (left) **and mitigation** (right) **measures adopted by firms, by NUTS 2 region and distribution quartile**



Source: *EIBIS 2023.*

Question: *1) Has your company developed or invested in any of the following measures to build resilience to the physical risks to your company caused by climate change? 2) Is your company investing or implementing any of the following to reduce greenhouse gas emissions?*

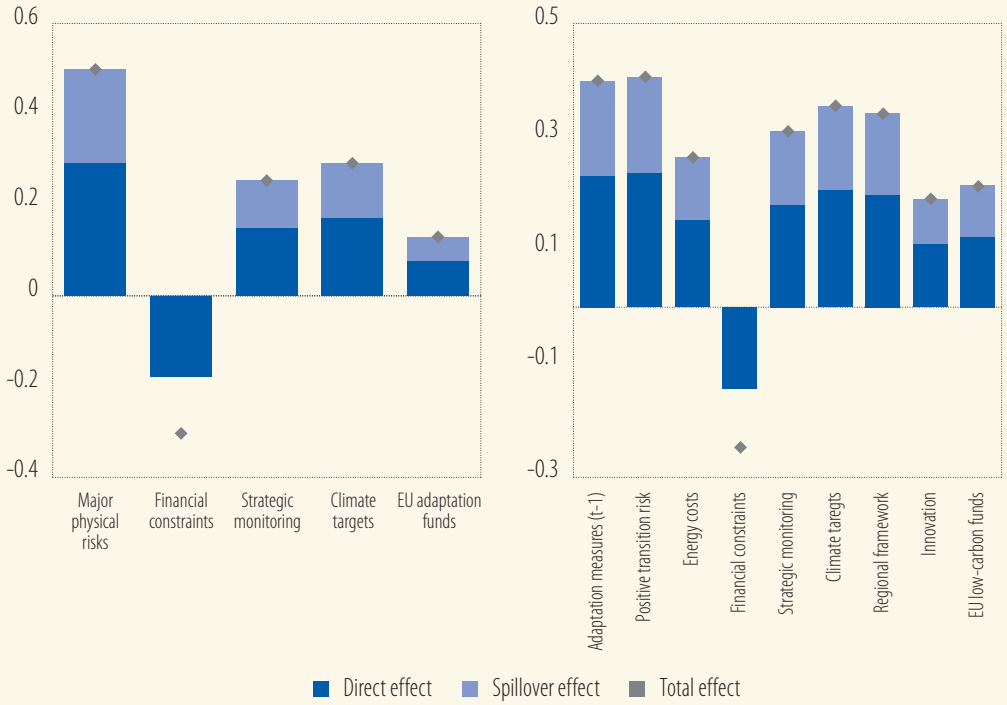
Figure B.1 shows clusters of firms that are more or less active in addressing climate change. These spillover effects are the focus of this study, which investigates whether adopting more climate change measures in one region translates to a higher rate of adoption of similar measures in neighbouring regions. Our analysis based on spatial techniques confirmed the existence of spatial dependence in the adoption of climate measures among EU regions at the NUTS 2 level,[4] underscoring that firms in

4 NUTS refers to the Nomenclature of Territorial Units for Statistics, or La nomenclature des unités territoriales statistiques (NUTS) in French. It is used to reference the administrative divisions of countries for statistical purposes.

one region affect climate action in another region. Furthermore, the magnitude of these spillover effects depends on the type of measure, with mitigation measures influencing firms slightly more than adaptation measures.

Figure B.2

Direct, indirect and total effects of various factors on the number of adaptation (left) **and mitigation** (right) **measures adopted** (a coefficient)



Source: *EIB staff calculations.*

Note: *The graphs show the direct, indirect and total effects of different factors on firms' climate investments, based on spatial autoregressive (SAR) models. The left chart shows the impact on the average number of adaptation measures per region (NUTS 2), and the right chart on the average number of mitigation measures. The charts only show the factors that are significant at 90% or more. The models account for the spatial dependence in the data, as indicated by the Morans' I and Lagrange Multiplier tests. For more details see Casati and Kalantzis (2024).*

In particular, the spatial analysis (Figure B.2) reveals some other interesting patterns and insights.

- Firms' own strategies (strategic monitoring or setting climate targets) affect neighbours' decisions to invest in climate adaptation and mitigation. A decision to set and monitor greenhouse gas targets influences local investment in adaptation and mitigation, but also generates positive spillover effects, amplifying environmental investment across regions. This is particularly true in interconnected regional markets where firms keenly observe their peers' strategies. On the other hand, financial constraints negatively influence local investment, but their spillover effect is negligible in neighbouring regions.
- Regional characteristics also shape climate investment and spill over to neighbouring regions. For instance, improved local conditions (measured by the Basic Sub-Index of the Regional Competitiveness Index, which aggregates information on macroeconomic status, institutions, infrastructure, health conditions and basic education) and a higher level of innovation (captured by R&D expenditures in the business sector) can create a conducive environment for regional climate investments, with positive effects for neighbouring regions.

- Deploying EU funds at the regional level for adaptation or mitigation encourages firms to adopt more climate measures. This trend also spreads beyond the immediate recipients, with firms in neighbouring regions prompted to keep pace and align themselves with emerging climate standards.
- Importantly, the results revealed an interesting interplay between adaptation and mitigation when promoting climate action among firms. Firms that have adaptation strategies in place are more likely to implement mitigation measures (although not vice versa). This synergy also extends to neighbouring regions, amplifying the collective response to climate change. These findings have important implications for public policies. The synergies and benefits that exist between adaptation and mitigation measures should be maximised, keeping in mind the trade-offs and conflicts that may arise between them.

Conclusion and policy implications

The global energy crisis was a wake-up call for Europe to rethink its energy system and accelerate the green transition. The crisis required urgent solutions to ensure security of supply and stability, but it also increased pressure on the European Union to achieve its climate goals and transition to a low-carbon economy. In addition, the crisis exposed the significant challenges and uncertainty plaguing EU firms, especially in energy-intensive industries, which had to cope with higher energy and borrowing costs and decreased competitiveness.

The energy crisis has increased the urgency and the opportunity for EU firms to invest in energy efficiency. However, energy efficiency alone is not enough to achieve the ambitious climate goals of the European Union and the world. Firms must adopt a holistic approach that integrates mitigation and adaptation measures, as well as innovation and the transformation of business models. There is a clear divergence among EU firms in their readiness and willingness to change, depending on their perception of the risks and opportunities associated with the green transition. Firms that see opportunities in the net-zero transition invest more to achieve it, while those concerned about the risk invest less. A large group of firms is still unaware of the consequences, and they are not investing for the transition.

Energy-intensive firms covered by the Emissions Trading System play a key role in the green transition. The analysis shows how the trading system influences businesses' efforts to decarbonise. It finds that stricter emissions requirements and a reduction in the number of free emission allowances is pushing firms to decarbonise faster. At the same time, energy-intensive firms seem to rely heavily on long-term finance to decarbonise. Funds for the green transition may become harder to find for energy intensive industries and more costly as financial markets progressively price in climate risks.

There is a wide variation in the performance of firms covered by the Emissions Trading System in reducing their carbon footprint, resulting in a clear distinction between leaders and laggards. Firms that see opportunity in the net-zero transition are more likely to invest and innovate, and they are transforming faster. This difference in perception might create a divide between decarbonisation leaders and the laggards – a divide that risks becoming entrenched. Overall, decarbonisation relies on clear market signals. Uncertainty over energy prices or regulation are a drag on the decarbonisation efforts of all firms. Interestingly, when looking at what motivates firms to transform, decarbonisation leaders are seizing market opportunities, while laggards are calling for more protection, subsidies or grants.

The European Union has a leading role in climate action, and it has set high standards and policies for firms to follow. However, there is still a gap between policy objectives and actions taken by firms, especially for adaptation. Therefore, EU firms continue to focus more on climate mitigation than on adaptation, implying that they are relying on government to ensure that infrastructure can resist the impact of climate change.

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Data annex

The availability and quality of the data on investment are critical to supporting effective policymaking. 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 runs a survey on corporate investment and investment finance and has created a database on patents broken down by activity, based on patent data counted using the European Patent Office's PATSTAT database. This annex outlines these datasets and provides references to detailed methodological notes.

EIB Investment Survey

General module

The EIB carries out an annual survey of firms in the European Union (EIBIS General Module) with the aim of monitoring investment and investment finance activities and capturing potential barriers to investment. The survey covers approximately 12 000 companies across the European Union and slightly more than 800 firms in the United States since 2019. It is administered by telephone (in the local language) and takes an average of 25 minutes to complete. The first wave of the survey took place in 2016 and the survey completed its eighth wave in 2023, with interviews held between April and July 2023.

Using a stratified sampling methodology, the EIBIS General Module is representative of all 27 Member States of the European Union and the United States. It is representative of four firm size classes (micro, small, medium and large) and four sector groupings (manufacturing, services, construction and infrastructure) within the individual countries.

Firms have to have a minimum of five employees to be interviewed, with full-time and part-time employees counted as one and employees working less than 12 hours per week excluded. Eligible respondents are employees in senior positions with responsibility for investment decisions.

The survey 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 (see EIBIS-Orbis matched dataset below). Approximately 40% of the companies interviewed in each wave are companies that have already taken part in the survey in the previous wave.

The EIBIS General Module complements pre-existing information on investment activities in the European Union. It adds a firm-level dimension to the macroeconomic data available and thus facilitates a more fine-grained analysis of firm investment patterns. It also adds to existing firm-level surveys at a national level by providing full comparability of results across countries. The survey complements the European Commission investment survey by asking a much wider set of qualitative and quantitative questions on firm investment activities. It rounds out the European Central Bank/European Commission SAFE survey by focusing on the link between firm investment and investment finance decisions.

Table 1
EIBIS at a glance

27	EU Member States are all consistently represented by the survey – more specifically, non-financial enterprises with at least five employees and belonging to NACE categories C to J.
4	industry groupings and size classes determine the representativeness of the data within almost every member country.
12 030	firms in the European Union participated in the last wave of the survey.
802	US firms participated in the last wave of the survey.
44%	of all firms participating in the last wave responded in at least two consecutive waves.
80%	of firms surveyed in 2023 agreed to be contacted again for next year's survey.

The EIBIS is a very powerful instrument built according to the highest scientific standards. To guarantee top quality, every step of the survey process is executed and closely monitored by experts in the field. All steps – sampling and weighting, questionnaire development and translation, the fieldwork, and quality control and data processing – are also subject to strict controls and validation. More information on these technical aspects can be found in the technical report produced by the market research company conducting the survey (Ipsos MORI, 2020). Table 1 presents key numbers about EIBIS.

All aggregated data using the EIBIS General Module in this report are weighted by value added to reflect the contribution of different firms to economic output more closely. The aggregate survey data and a detailed account of the survey methodology are available on www.eib.org/eibis.

Representativeness of the general module

The EIB Investment Survey is designed to be representative for the European Union and the United States at a country level and for most countries at a country-industry-group and country-size-class level.

In an EIB working paper (Brutscher et al., 2020), we assessed the data quality of the EIBIS in three steps. First, we benchmarked the sampling frame from which all survey respondents are drawn, the Bureau van Dijk Orbis database, against official statistics to see how well our sampling frame captures the relevant business population.

Second, we compared the final EIBIS sample against firms drawn at random from the same sampling frame and compared statistics constructed from the financial information included in that sampling frame. The purpose of this exercise was to assess whether and to what extent firms' willingness or unwillingness to participate in the survey may have led to a selection bias.

Last, we compared aggregate statistics calculated from the final EIBIS sample to corresponding statistics from Eurostat and the Organisation for Economic Co-operation and Development (OECD). In addition, we compared statistics based on financial information calculated from the EIBIS to the counterpart data obtained from the CompNet database. This purpose of this exercise was to evaluate both the level and dynamics of the financial information calculated from firm-level data.

Overall, the results from all three steps are very positive. First, the assessment of the sampling frame (a comparison of the Bureau van Dijk Orbis dataset with the Eurostat Structural Business Statistics (SBS) for the European Union and the United Kingdom [1] for the relevant sector/size classes) showed coverage ratios (number of firms in Orbis/number of firms in the SBS database) between 75% and 100% for the majority of countries. The ratio is between 50% and 75% in a few countries, and in only four – Cyprus, Greece, Luxembourg and Poland – does the coverage ratio fall below 50%. [2]

1 For the United States, the statistics were compiled from the US Census Bureau and the Bureau of Economic Analysis.

2 An important driver of the positive coverage ratio is that the EIBIS samples firms with five or more employees. Coverage ratios tend to be higher for larger firms, so excluding the smallest firms from sampling significantly boosts coverage.

The sampling frame must cover a high percentage of the population of interest for the EIBIS survey results to reflect what is happening in the non-financial corporate sector in the European Union. However, this condition alone is not sufficient because, like any other survey, the EIBIS runs the risk of selection bias if there are systematic differences between firms that are willing to participate in the survey and firms that are not.

Secondly, to test whether (and if so, to what extent) the EIBIS sample is subject to such selection issues, we compared the distribution of a set of financial ratios in the final EIBIS sample against those of five samples drawn at random from the same sampling frame. The financial ratios were calculated using information in Orbis. The idea was that statistically identical distributions between the EIBIS sample and the random samples would provide evidence that selection bias does not pose a major issue for representativeness and vice versa.

Using a Kolmogorov-Smirnov approach to compare the two samples, we find that for almost all countries, the percentage of variables for which the null hypothesis of equal distribution in the EIBIS and random samples is rejected is very low, suggesting a high degree of resemblance between EIBIS and the random sample.[3] In other words, comparing the final EIBIS sample with a series of random samples from the same sampling frame provides little evidence of sampling bias in our data.

Finally, a comparison of the financial information from Orbis for firms in the final EIBIS sample to CompNet data also suggests good coverage of both EIBIS and Orbis information. The CompNet data are based on a distributed micro-data approach. Relevant data are extracted from often-confidential firm-level datasets available within national central banks or national statistical institutes and aggregated so that the confidentiality of firm data is preserved. The outcome of CompNet is a wide range of indicators at the country-sector-size-class level.

To assess the final EIBIS sample; we reproduced the same country-sector-size-class level indicators using the Orbis information for firms in the EIBIS (where possible) and compared them to those in the CompNet dataset. What we found is a very close match between the two datasets, with the financial variables in the EIBIS and the CompNet database showing very similar trends.

More information on both the general module and the add-on module in the EIB Investment Survey is available upon request by email to eibis@eib.org.

EIB Municipality Survey 2022

In 2022, the EIB Municipality Survey polled 750 municipalities in the European Union on their infrastructure investment activities and associated barriers.

The survey was administered by telephone (in the local language) among mayors, treasurers and/or municipalities' chief civil engineers. It took a median average of 20 minutes to complete. Fieldwork took place between June and August 2022. As part of the survey, 750 municipalities were interviewed in all 27 Member States.

The sample frame from which municipalities were randomly selected was a comprehensive list of European municipalities. All larger municipalities were eligible to be included in the exercise.

Regional and European Union-wide figures are weighted based on the urban population in each country to take size differences into account.

3 The Kolmogorov-Smirnov (KS) test is a nonparametric statistical test for the equality of probability distribution between two samples. Unlike a t-test, KS does not just compare the means of a variable, but also tests the null hypothesis that two samples are drawn from the same distribution by quantifying the distance between the empirical distribution functions of two samples. It therefore compares the shapes of the two distributions and evaluates whether the vertical differences between them are statistically significant.

EIB ETS Survey 2023

In 2023, the annual EIB Investment Survey polled 373 firms in the European Union on their decarbonisation strategies, the main drivers of and obstacles to decarbonisation, and the perception of decarbonisation progress achieved.

The survey was administered as a special add-on module of the annual EIB Investment Survey (EIB). The survey data were merged with the Emissions Trading System (ETS) emission data and firms' financial statements from Orbis.

The survey was administered by telephone (in the local language) among firm owners, finance managers, finance directors or heads of accounts, chief financial officers (CFOs) and chief executive officers (CEOs). Fieldwork took place between June and September 2023. As part of the survey, 373 firms from 23 EU countries were interviewed.

The sample frame from which firms were randomly selected was a comprehensive list of European firms that participate in the ETS market and owned at least one ETS installation in 2022. Only manufacturing firms were eligible to be included in the exercise.

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 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 according to a 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%.

The matched dataset complements the cross-sectional perspective of the EIBIS with time series information starting in 2000. Custom panel datasets used in several analyses in this report were constructed thanks to this dataset.

Patent data

Patents grant the applicant exclusive rights to produce or use a specific new device, apparatus or process for a limited period. More specifically, the legal protection gives patent-holders the exclusive right to make, use, sell or import the patented invention for a set period of time, usually 20 years from the filing date, in the country or countries covered.

By providing protection and exclusivity, a patent encourages investment in research and the subsequent innovative work that will put inventions to practical use. By providing temporary exclusive rights to intellectual property, patents give their holders a competitive advantage. Patents can also be licensed or used to help create or finance a spin-off company. Patent-holders, therefore, can derive value from patents even if they are unable to manufacture the product (as is the case of universities, for instance).

A patent filing contains a wealth of technical information that can be useful for follow-up inventions. In addition, the elaborate and well-structured information stored in patent documents facilitates systematic and objective quantitative analyses that can provide insights into technological progress. Indicators based on patent statistics are widely used to assess the inventive and innovative performance of a country or a region. As such, patents reflect a country's inventive activity and its capacity to use and develop knowledge for potential economic gain.

In addition to containing technical details about the innovation in question, patent applications also disclose material on prior inventions, such as any other relevant patents. While patent statistics can be used to measure innovation, statistics on patent citations can be used to assess the spread of knowledge and technology.

Nevertheless, some caveats exist for patent-based indicators. First of all, the propensity to patent varies by technological domain and country. Second, not all innovations are patented (for reasons of secrecy, for example), and not all patented inventions are innovative or even marketable products. Obtaining a patent does not necessarily mean the patented technology is important or has any commercial value. The value of patents varies widely. Last, some patent activity stems from strategic behaviour (such as blocking out or scaring off potential competitors) rather than innovative and valuable R&D efforts.

PATSTAT

The patent data used in this chapter are sourced from PATSTAT (Worldwide PATent STATistical Database). PATSTAT is a patent statistics database held by the European Patent Office (EPO) and developed in cooperation with the World Intellectual Property Organisation (WIPO), the Organisation for Economic Co-operation and Development (OECD) and Eurostat.

PATSTAT was founded in 2006 and concentrates on raw data, leaving it up to licensed users to create indicators. PATSTAT's raw patent data are collected from more than 100 regional and national patent offices worldwide, including the most important and largest offices such as the EPO, the United States Patent and Trademark Office (USPTO), the WIPO, the Japanese Patent Office (JPO) and the Chinese Patent Office (SIPO).

PATSTAT is a relational database: more than 20 related tables contain information on relevant dates (filing, publication, grant, etc.), applicants and inventors, technological domains, references to prior art, etc. The database is updated twice a year, in the spring and autumn. The data sourced for this report were produced in collaboration with the Centre for Research and Development Monitoring (ECOOM) in Belgium.

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Glossary of terms and acronyms

3D printing	Also known as additive manufacturing. Variety of processes in which material is joined or solidified under computer control to create a three-dimensional object, with material being added together (such as liquid molecules or powder grains being fused together), typically layer by layer.
Adaptation	Addresses the risks posed by climate change rather than the underlying causes (as in "climate change adaptation").
AI	Artificial intelligence. A system's ability to correctly interpret external data, to learn from such data, and to use such learning to achieve specific goals and tasks through flexible adaptation.
AMECO	The annual macroeconomic database of the European Commission's Directorate-General for Economic and Financial Affairs.
Augmented (or virtual) reality	Presentation of information integrated with real-world objects, using a head-mounted display.
Automation	Substitution of human labour with work performed by machines, to achieve higher quality and quantity of output at lower costs.
Big data	Extremely large data sets that may be analysed computationally to reveal patterns, trends and associations, especially relating to human behaviour and interactions.
Biotech	Biotechnology. The manipulation of living organisms or their components to produce useful, usually commercial products.
BLS	Bank lending survey. The euro area bank lending survey provides information on bank lending conditions in the euro area. It supplements existing statistics with information on the supply of, and demand for, loans to enterprises and households. The BLS provides input for monetary and economic assessments carried out by the Governing Council of the European Central Bank (ECB), which feed into the monetary policy decision-making process.
bn	Billion (1 000 million).
BNEF	Bloomberg New Energy Finance.
Bureau van Dijk's Orbis database	Database of private and listed company information from around the world that includes, among others, companies' financial accounts, ownership structures and mergers and acquisitions activity.
Business angel	An individual who provides capital for startups, usually in exchange for convertible debt or ownership equity.
CEE	Central and Eastern Europe, including Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.
Carbon capture and storage	A group of technologies that can remove almost 100% of the carbon dioxide from large-scale point sources of carbon, such as energy-intensive industries (like steel, cement and refining) and fossil fuel power.
Circular economy	A systemic approach to economic development designed to benefit businesses, society and the environment. In contrast to the "take-make-waste" linear model, a circular economy is regenerative by design, and aims to gradually uncouple growth from the consumption of finite resources.

Climate change adaptation	Describes measures to deal with the impact of changing weather patterns or extreme weather events.
Climate change mitigation	Describes measures to address the underlying causes of climate change.
Cohesion regions	Regions are grouped based on the 2021-2027 cohesion policy. Transition regions and less developed regions, together referred to as cohesion priority regions, have more extensive options for co-financing. More developed regions, also referred to as non-cohesion (priority) regions, have more limited options for co-financing.
Depreciation	A reduction in the value of an asset over time, due in particular to wear and tear; a decrease in the value of a currency relative to other currencies.
Digital	A firm is identified as having adopted an advanced digital technology if at least one digital technology specific to its sector was implemented in parts of the business and/or if the entire business is organised around at least one digital technology.
Disposable income	The amount of money that can be spent after current personal taxes. Refers to income from wages and salaries, self-employed income, income from unincorporated enterprises, social benefits, etc., after taking into account net interest and dividends received and the payment of taxes and social contributions.
Drones	Powered, unmanned aerial vehicles that can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or non-lethal payload.
EBA	European Banking Authority.
ECB	European Central Bank.
EIB	European Investment Bank.
EIBIS	EIB Investment Survey.
EIF	European Investment Fund.
Energy intensity	Energy consumption divided by activity, such as energy/GDP.
EPO	European Patent Office.
ESAF	EIF SME Access to Finance index, a composite indicator that summarises the state of SME financing for each of the EU Member States and covers different aspects of SME access to finance.
ESIF	European Structural and Investment Funds. These are the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund.
European Green Deal	A set of policy initiatives by the European Commission with the overarching aim of making the European Union climate neutral by 2050.
European Union	The 27 Member States of the European Union (taken as a whole when used for data comparison with other groups).
Eurostat	The statistical office of the European Union.

External finance	In the EIB Investment Survey, this consists of: bank loans, excluding subsidised bank loans, overdrafts and other credit lines; other terms of bank finance, including overdrafts and other credit lines; newly issued bonds; newly issued equity, including quoted or unquoted shares; leasing or hire purchase; factoring/invoice discounting; loans from family/friends/business partners; grants (financial support or subsidies from regional or national government); and funding provided by the public sector.
FDI	Foreign direct investment.
Finance constrained	In the EIB Investment Survey, a firm is considered finance constrained if it was : (i) rejected when seeking any external financing for an investment; (ii) quantity constrained (dissatisfied with the terms and the amount received from the latest request for external financing); (iii) price constrained (the firm did not apply because it thought the conditions of external financing would be too expensive); or (iv) discouraged from seeking any external financing (the firm did not apply because it thought the application would be turned down).
GDP	Gross domestic product. The total value of goods produced and services provided in a country over one year.
GFCF	Gross fixed capital formation. The net increase in physical assets (investment minus disposals) within the measurement period. It does not account for the consumption (depreciation) of fixed capital, and also does not include land purchases. It is a component of the expenditure approach to calculating GDP.
Global financial crisis	Referring to the worldwide financial crisis of 2007-2008.
Human capital	The knowledge, skills, competencies and other attributes embodied in individuals or groups of individuals acquired during their lives and used to produce goods, services or ideas in market circumstances.
IEA	International Energy Agency.
IMF	International Monetary Fund.
Infrastructure	As defined for the EIB Infrastructure Database, infrastructure includes the following sectors for macroanalysis
Infrastructure sector	Based on the NACE classification of economic activities, this includes firms in groups D and E (utilities), group H (transportation and storage) and group J (information and communication).
Institutional sectors	The general government, corporations and households are the three institutional sectors in this report.
Intangible investment	In the EIB Investment Survey, intangible investment consists of investment in research and development (including the acquisition of intellectual property); software, data, IT networks and website activities; employee training; and improvements to organisation and business processes (including restructuring and streamlining).
Intellectual property products	In the European System of Accounts, intellectual property products include fixed assets (intended to be used for more than one year) such as findings from research and development, or from mineral exploration and evaluation; computer software and databases; or entertainment and literary or artistic originals.

Internal finance	In the EIB Investment Survey, internal finance consists of internal funds or retained earnings (such as cash or profits).
IPCC	Intergovernmental Panel on Climate Change.
IRENA	International Renewable Energy Agency.
Large companies	Firms with at least 250 employees.
Low-carbon economy	An economy based on low-carbon power sources (not based on fossil fuels).
Mark-up	The ratio of the cost of a good or service to its selling price, expressed as a percentage of the cost.
Medium-sized firms	Firms with between 50 and 250 employees.
Micro firms	Firms with less than ten employees.
MWh	Megawatt hour.
NACE	"Nomenclature statistique des activités économiques dans la Communauté européenne" (Statistical Classification of Economic Activities in the European Community). The industry standard classification system used in the European Union.
Non-digital	Firms that have not yet implemented (or have not heard of) any of four sector-specific advanced digital technologies from recent years (see also "Digital").
NUTS	"Nomenclature des unités territoriales statistiques" (Nomenclature of territorial units for statistics). A hierarchical system for dividing up the economic territory of the European Union.
OECD	Organisation for Economic Co-operation and Development.
Patent	Documents issued by an authorised agency, granting exclusive right to the applicant to produce or use a specific new device, apparatus or process for a limited period. The protection conferred by a patent gives its owner the right to exclude others from making, using, selling, offering for sale or importing the patented invention for the term of the patent (usually 20 years from the filing date) in the country or countries concerned by the protection.
PATSTAT	EPO Worldwide Patent Statistical Database. Contains bibliographical data relating to more than 100 million patent documents from leading industrialised and developing countries.
Pandemic emergency purchase programme	A non-standard monetary policy measure initiated by the European Central Bank in March 2020 in response to the COVID-19 outbreak. It is a temporary asset purchase programme of private and public sector securities.
PCT	Patent Cooperation Treaty. Provides a unified procedure for filing patent applications to protect inventions in each of its contracting states.
Percentile	A value on a scale of 100, used to compare scores in a data set. For example, scores in the 50th percentile of a set are higher than 49% of the other scores in that set.
Physical risks	Typically defined as risks arising from the physical effects of climate change and environmental degradation. They can be categorised either as acute (if they arise from climate and weather-related events and acute destruction of the environment) or chronic (if they arise from progressive shifts in climate and weather patterns or a gradual loss of ecosystem services).

Platform technologies	Technologies that connect customers with businesses, or customers with other customers.
PPP	Refers either to: (i) public-private partnership or (ii) purchasing power parity.
Private equity	A form of equity investment in private companies not listed on the stock exchange.
Production processes	Processes related to actual production, such as those performed by machinery and equipment.
Public sector purchase programme	The programme under which the ECB purchases bonds issued by governments, international organisations, multilateral development banks and recognised agencies. One of the ECB's asset purchase programmes.
R&D	Research and development.
Recovery plan for Europe	A European Union economic recovery package, boosted by the NextGenerationEU fund, to support Member States adversely impacted by the COVID-19 pandemic.
RRF (Recovery and Resilience Facility)	A large grant and loan facility offered by the European Union to Member States. Part of the recovery plan for Europe.
SAFE	Survey on Access to Finance for Enterprises. A survey on the access to finance of small and medium-sized enterprises conducted by the ECB and the European Commission.
SE	Southern Europe, including Cyprus, Greece, Italy, Malta, Portugal and Spain.
Securitisation	The conversion of an asset, especially a loan, into marketable securities, typically in order to raise cash by selling it to other investors.
Services sector	Based on the NACE classification of economic activities, this includes firms in group G (wholesale and retail trade) and group I (accommodation and food service activities).
Small firms	Firms with between 10 and 49 employees.
Smart grids	Electricity supply networks that use digital communications technology to detect and react to local changes in usage.
SMEs	Small and medium-sized enterprises. Firms with fewer than 250 employees.
SME securitisation	Transactions backed by SME loans, leases and other products.
Sovereign debt crisis	Also known as the European sovereign debt crisis. A multiyear debt crisis in the European Union that began in 2009.
Special purpose vehicle	A subsidiary company with an asset/ liability structure and legal status that makes its obligations secure, even if the parent company goes bankrupt.
Tangible investment	As defined in the EIB Investment Survey, tangible investment includes investment in land, business buildings and infrastructure, or machinery and equipment, for example.
Total factor productivity	The efficiency in combining production factors to create added value.

Transition risks	Risks that arise from the potential for loss resulting from a shift towards a lower-carbon economy, driven by policy, regulations, low-carbon technology advancement, consumer sentiment and preferences, and liability risks, impacting the value of certain assets.
UK	United Kingdom.
US (or USA)	United States of America.
Venture capital	A type of private equity focused on startup companies with high growth potential.
WNE	Western and Northern Europe, including Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, the Netherlands and Sweden.

INVESTMENT REPORT 2023/2024

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