INVESTMENT REPORT 2024/25

INNOVATION INTEGRATION AND SIMPLIFICATION IN EUROPE

European Investment Bank | Group

Chapter 5

Innovation in a shifting global landscape

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Investment Report 2024/2025: Innovation, integration and simplification in Europe

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About the Economics Department
The mission of the EIB Economics Department is to provide economic analyses and studies to support the Bank in its operations and in the definition of its positioning, strategy and policy. The department and its team of economists is headed by Debora Revoltella, director of economics.

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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 Europe's ability to marshal the investment needed for the green transition and to support innovation. The report draws extensively on the results of the annual EIB Investment Survey (EIBIS) and the EIB Municipalities Survey, combining internal EIB analysis with contributions from leading experts in the field.

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Chapter 5

Innovation in a shifting global landscape

The global innovation landscape is changing rapidly. To enhance the competitiveness of European firms, Europe must invest more in cutting-edge innovation, improve the diffusion of innovation, increase the resilience of supply chains and reduce strategic dependencies in critical sectors. Against a global backdrop of persistent disruptions and heightened systemic uncertainty, the ability of the European economy to adjust and transform will be dependent on a supportive operating environment.

The European Union is at the forefront of clean technology, but lags behind the United States and China in digital innovation. This creates major dependencies on digital platforms and other technologies (such as artificial intelligence) developed by non-EU providers. Relatively high energy costs and the fragmentation of the internal market are also putting the competitiveness of EU businesses under pressure. A successful green 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.

The European Union is committed to a model of economic security that focuses on diversification and innovation while also retaining the benefits of trade. To increase its resilience, Europe needs to reduce the risks of dependencies in critical raw materials and key strategic inputs imported by EU firms. This will help encourage investment in diversification and possibly the timely build-up of domestic production capacities for high-tech products in which EU businesses have a comparative advantage, making it easier to position the EU manufacturing sector in an intensely competitive global landscape. Certain industries have the potential to create value and jobs in Europe and contribute decisively to its competitiveness, but this will require policy measures to make the economic environment more efficient, bring down regulatory barriers and strengthen the internal market, ensuring there is an equal playing field across the European Union.

Introduction

Global competitive dynamics are changing fast. Trade remains strong, but the last few years have seen a substantial anti-globalisation backlash, with some countries increasingly implementing inward-looking industrial policies and strong pressure for economic security. The United States has embraced a strategy that supports domestic production via widespread stimulus for re-industrialisation paired with higher tariffs, and the new US administration has left the door open to a new wave of tariffs and levies, which may further alter global trade flows. Over the past two decades, China has positioned itself as a leading global player in key advanced technologies with a strategy that substantially increases its comparative advantage in mid-tech and high-tech sectors, thereby challenging other established players.

The European Union has maintained a more open approach to global trade, and this has proved effective in supporting its economy in the past. In the short term, Europe is still benefiting from its participation in global value chains, the integration of the Central and Eastern European region into international production networks, and a large market. But serious challenges may emerge in the medium term.

This chapter looks at the challenges facing Europe and analyses its global competitive position. It is organised into four sections. The first section assesses the position of the European Union in global research and development investment. The second highlights current trends in the development of new technologies, explores the performance of EU firms that hold patents in green technologies, and discusses the position of the European Union in global technological collaboration networks. The third section discusses investment in resilience to supply chain risks and dependencies in imports, exports and the production of green technologies. The last section presents the policies needed to support innovation in the European Union.

Europe's global research and development position is challenged

Investment in innovation is a key driver of productivity, long-term prosperity and economic growth for advanced economies. 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 (see Chapter 1). This section assesses the position of the European Union in global research and development (R&D).

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

Europe's high number of R&D researchers is evidence of its role as a strong engine for global technological progress, on a par with the United States and China. In 2022, R&D expenditure per capita in the European Union was less than a third of that in the United States but remained higher than in China (Table 1). At the same time, the number of R&D researchers per capita in the European Union was close to the US level, despite only 34% of 25- to 64-year-olds in the European Union having a tertiary education (compared with 50% in the United States).

Table 1
Selected indicators on research output in 2022

	EU	US	China
R&D expenditure (EUR billion)	357.4	876.8	434.9
Population (million)	445.8	333.3	1 425.9
R&D expenditure per inhabitant (EUR)	801.6	2 630.7	305.0
R&D researchers per million inhabitants	4 691.7	4 918.4	1 849.5
Tertiary education (% of 25- to 64-year-olds)	34.2	50.0	18.5
Nature Index (number of publications)	37 991	30 754	24 735
PCT[1] patent applications	53 773	66 785	71 943

Source: *EIB staff calculations based on Eurostat, Organisation for Economic Co-operation and Development (OECD), Nature Index and Patent Cooperation Treaty (PCT) patents (PATSTAT).*

Note: *The Nature Index is based on the number of research papers published in 2022 in 145 natural science and health science journals. Data on R&D researchers in the United States are from 2021. Data on tertiary educational attainment in China are from 2020. Data on PCT patent applications (in collaboration with the Expertise Centre for Research and Development Monitoring (ECOOM) at KU Leuven University) are from 2021.*

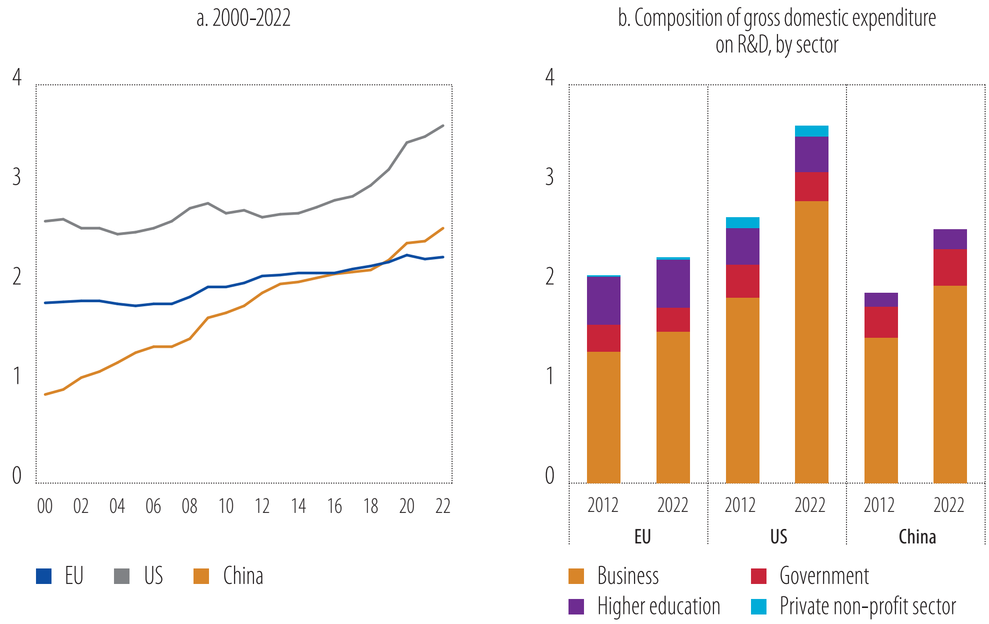
There are more leading natural science and health science publications in the European Union than in the United States and China. However, despite Europe's excellence in scientific research, patent applications under the Patent Cooperation Treaty and total R&D expenditure are lower in the European Union than in the United States and China, showing that the high level of scientific output does not translate sufficiently into innovation and investment in fast-growing key markets, such as pharmaceutical and biotech or digital services.

The European Union sets public and private sector R&D investment goals. The European Commission has acknowledged the crucial role of creating and improving the dissemination of knowledge and technologies. A key policy 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 business 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 is investing less in R&D than the United States or China. The R&D intensity of the European Union was 2.3% of GDP in 2022, compared with 3.6% in the United States and 2.6% in China (Figure 1a). Ten years ago, the R&D intensity was higher in the European Union than in China. The private sector has been driving the rapid increase in gross expenditure on R&D (GERD) in China and the United States over this period (Figure 1b). The failure to meet the 3% target for R&D expenditure is one of the main reasons why the European Union is lagging behind the United States in the development of new technologies (Draghi, 2024). 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.

1 The Patent Cooperation Treaty (PCT) is an international treaty signed by more than 150 countries. It makes it possible to seek patent protection for an invention in many countries simultaneously by filing a single international patent application instead of several separate national or regional patent applications. The granting of patents remains under the control of the national or regional patent offices.

Figure 1
Gross domestic expenditure on R&D (% GDP)



Source: EIB staff calculations based on Eurostat and OECD.
Note: Gross domestic expenditure on R&D (GERD) as a share of GDP. Data on the private non-profit sector are not available for China.

Public funding for R&D in the United States focuses more on defence than in the European Union

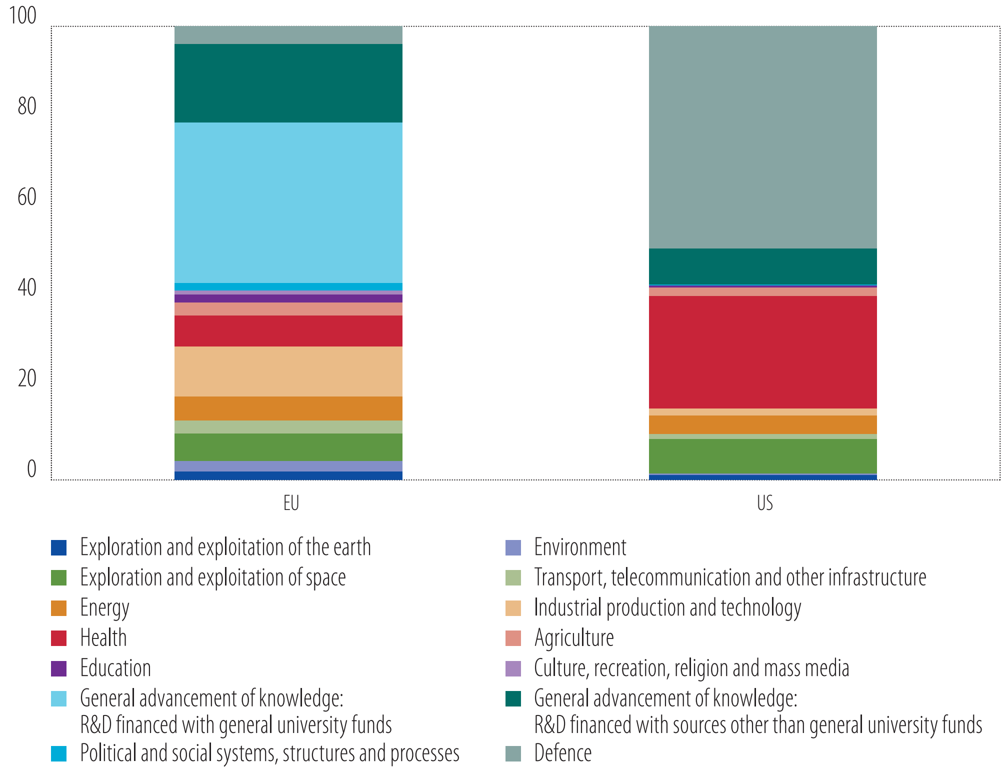
While the business enterprise sector remains the main source of R&D funds in the European Union (1.3% of GDP in 2021), government funding is significant and amounts to 0.68% of GDP. GERD can be broken down not only by sector of performance (Figure 1b), but also by the source of funds (Organisation for Economic Co-operation and Development (OECD), 2015). A non-negligible share of R&D spending is financed by the government in the European Union (0.68% of GDP) and the United States (0.65% of GDP), while this stands at 0.46% of GDP in China.

The European Union and the United States have similar levels of government budgets allocated for R&D, but the United States prioritises defence R&D much more. In the European Union, more than 40% of government budget allocations for R&D (GBARD) goes towards the general advancement of knowledge, industrial production and technology and health (Figure 2).[2] Unlike in the European Union, defence accounts for about half of GBARD in the United States.[3] The European Union's lack of focus on areas related to economic security – including dual-use technologies for civil and defence applications – may be driven by national governments, which account for most government R&D spending. This calls for better coordination of public support for research and innovation among EU countries (Draghi, 2024). The United States also appears to place more of an emphasis on public R&D support for health than the European Union, but this is partially due to differences between the United States and the European Union in the classification of socioeconomic objectives. GBARD for general advancement of knowledge includes R&D related to natural, engineering, medical, agricultural or social sciences as well as humanities – a breakdown not provided at the European level.

2 GBARD can be classified into socioeconomic objectives according to the nomenclature for the analysis and comparison of scientific programmes and budgets (NABS) 2007 classification.
3 A comparison with government funding for R&D in defence in China is difficult due to the lack of reliable data, but various sources suggest that it is high and has increased over time (Nouwens and Béraud-Sudreau, 2020; Tian and Su, 2021; Centrone and Fernandes, 2024).

Figure 2

Socioeconomic objectives of government budget allocations for R&D (in %)**, in 2023**



Source: EIB staff calculations based on Eurostat and OECD.
Note: The numbers are based on government budget allocations for R&D (GBARD) in 2023.

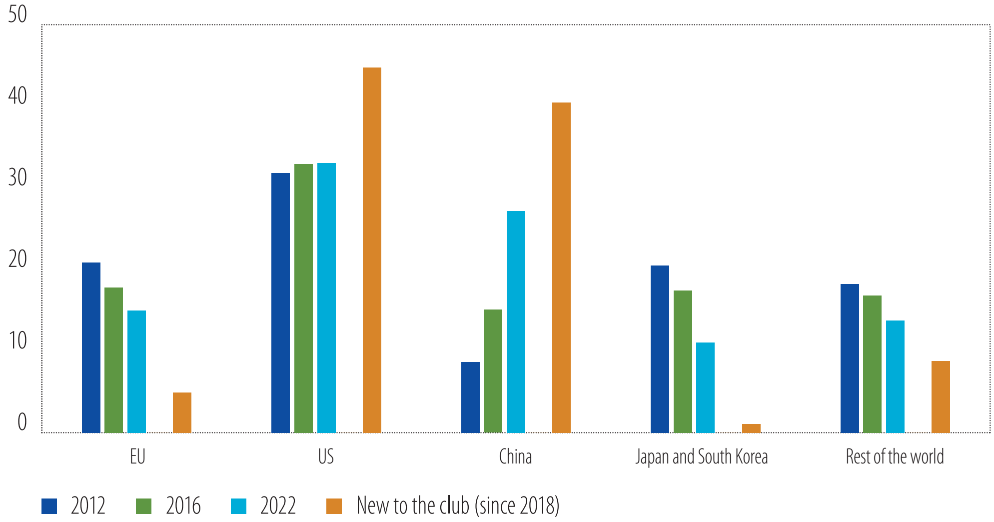
Top European firms are losing ground to other leading global innovators

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 80% of global business R&D expenditure and two-thirds of patent filings in the five largest patent offices (Nindl et al., 2023). 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, but is also significant in mid-tech industries such as the automotive sector. R&D investment and patenting activities are more concentrated among a small number of firms than sales or employment, with these firms having grown bigger over time.

The European Union is a major global player in R&D and innovation, but the share of EU firms among 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 between 2012 and 2022 (Figure 3). This decline is largely attributable to the rise of China, with the number of Chinese companies included in this list rising fast (comprising 40% of firms having joined since 2017). At the same time, the United States remains an innovation leader with the highest number of new entrants to the list, while the number of newly added EU firms is very modest.

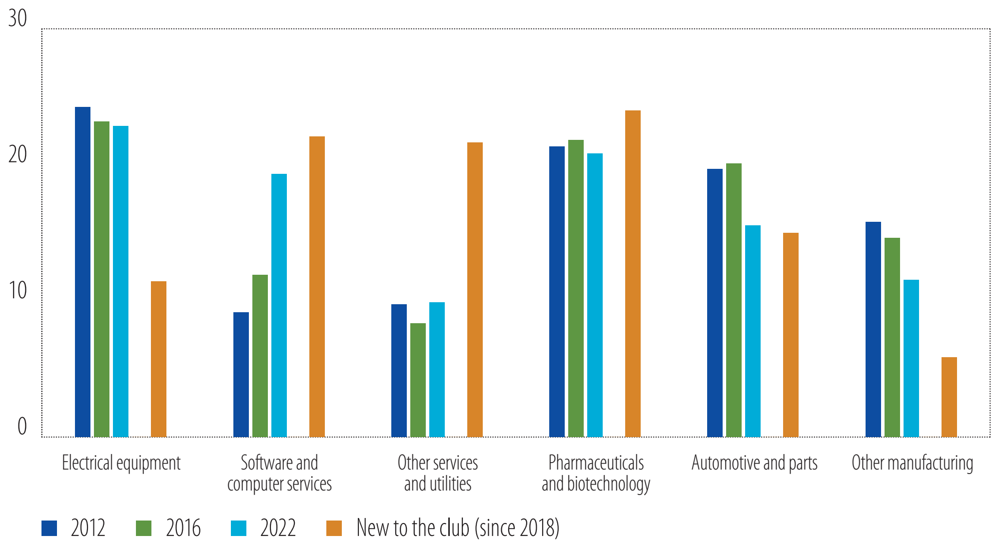
The global R&D landscape has changed rapidly over the past decade as the digital economy has become increasingly important. Electrical equipment and hardware represent 23% of total R&D spending by the top 2 500 companies, followed by pharmaceuticals and biotechnology, which account for 21% (Figure 4). R&D spending by companies selling software and computer services has risen sharply over the past decade, with a share of 19% in 2022 (up from 9% in 2012). At the same time, the automotive industry's share declined to 15% in 2022 (from 20% in 2012). Other manufacturing sectors have seen a similar decline.

Figure 3
Share of top global R&D firms (in %)**, by country or region**



Source: EIB staff calculations based on EU Industrial R&D Investment Scoreboard 2023.

Figure 4
Share of top global R&D firms (% of R&D expenditure)**, by sector**

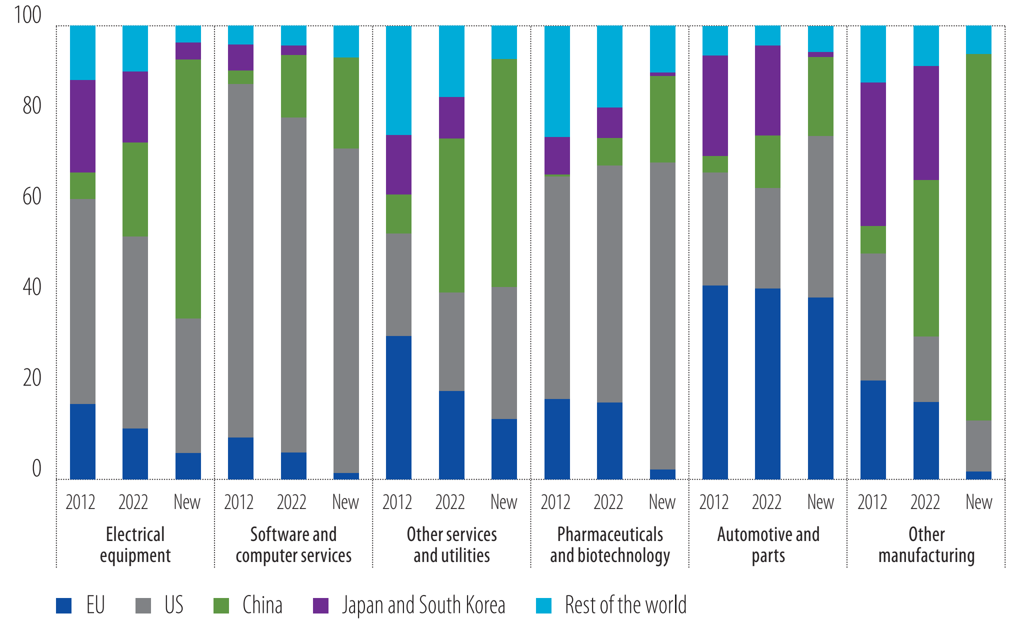


Source: EIB staff calculations based on EU Industrial R&D Investment Scoreboard 2023.
Note: Electrical equipment includes also electronic equipment and technology hardware. Other services and utilities includes fixed line and mobile telecommunications; food and drug retailers; general retailers; industrial 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 multi-utilities; industrial metals and mining; oil and gas producers; oil equipment; services; and distribution. Pharmaceuticals and biotechnology also includes healthcare equipment and services. Automobile and parts also includes aerospace and defence. 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. R&D investment by global leaders represents more than 15% of turnover in these two sectors – significantly higher than for electrical equipment, automotive or other manufacturing industries – reflecting the major investment and ongoing R&D efforts needed to stay competitive. Software and computer services (followed by pharmaceuticals and biotechnology) also have the highest R&D expenditure by companies that are new to the club (firms that have joined the list of R&D global leaders since 2018).

The European Union specialises less in software and computer services than the United States or China. The European Union only represents 6% of R&D expenditure by leading software and computer services companies, compared with 74% for the United States and 14% for China (Figure 5). Similarly, the European Union accounts for 11% of R&D expenditure by leading electrical equipment and technological hardware firms, compared with 42% for the United States, 20% for China and 16% for Japan and South Korea. The automotive sector is the only area where the European Union is a major player with a relatively high share of R&D expenditure by new entrants. The dearth of leading innovators in key strategic and fast-growing sectors (such as software and computer services) in the European Union shows that it does not create the right conditions for disruptive innovation. This creates major dependencies on digital platforms and artificial intelligence tools developed by non-EU providers at a time when economic security is an increasing concern.

Figure 5
Share of R&D expenditure in 2012 and 2022 (in %)**, by sector and country or region**



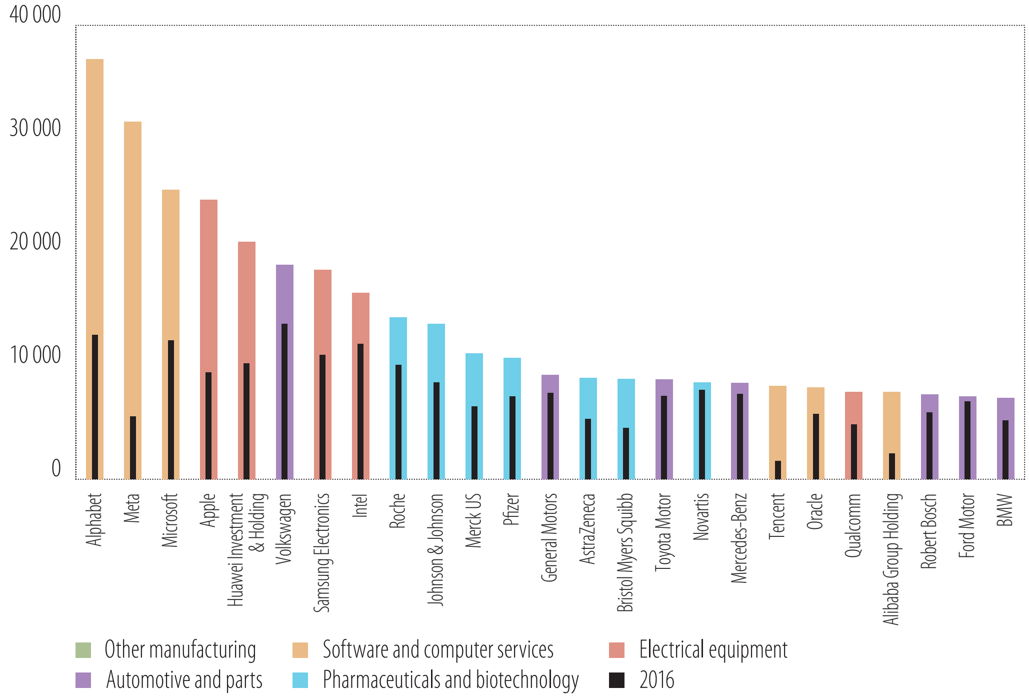
Source: *EIB staff calculations based on EU Industrial R&D Investment Scoreboard 2023.*
Note: *See Figure 4 for the definition of the sectors. "New" refers to firms that entered the list of top global R&D investors after 2017.*

The top four global R&D investors are all US digital companies. With EUR 37 billion spent in 2022, Alphabet (the parent company of Google) was the top global R&D spender, followed by Meta (the conglomerate owning Facebook, Instagram and WhatsApp) and Microsoft (Figure 6). The amounts these three companies spend on R&D every year has increased massively since 2016. The list of the ten largest R&D investors is dominated by US and Asian companies selling software and computer services (Alphabet, Meta and Microsoft) or producing electronic and hardware technology equipment (Apple, Huawei, Samsung and Intel).

The four EU companies among the top 25 global R&D leaders all operate in the automotive sector. Over time, the European Union has developed a key competitive advantage in the automotive sector. Larger in Europe than in China and the United States, this sector has been a key contributor to European research activity, with Volkswagen, Mercedes-Benz, Robert Bosch and BMW holding positions as the top four European R&D performers. However, the EU automotive sector will have to make major investments in innovation and transformation to improve its competitive position and thrive in the transition from the internal combustion engine to battery electric vehicles (McKinsey, 2024). Box A discusses corporate venture capital in the automotive sector, focusing on venture funds controlled by 25 large automotive companies in Europe, the United States, China, Japan and the rest of the world, and their equity participation in innovative startups in different regions.

Figure 6

R&D expenditure by the top 25 global R&D firms in 2022 (EUR million)

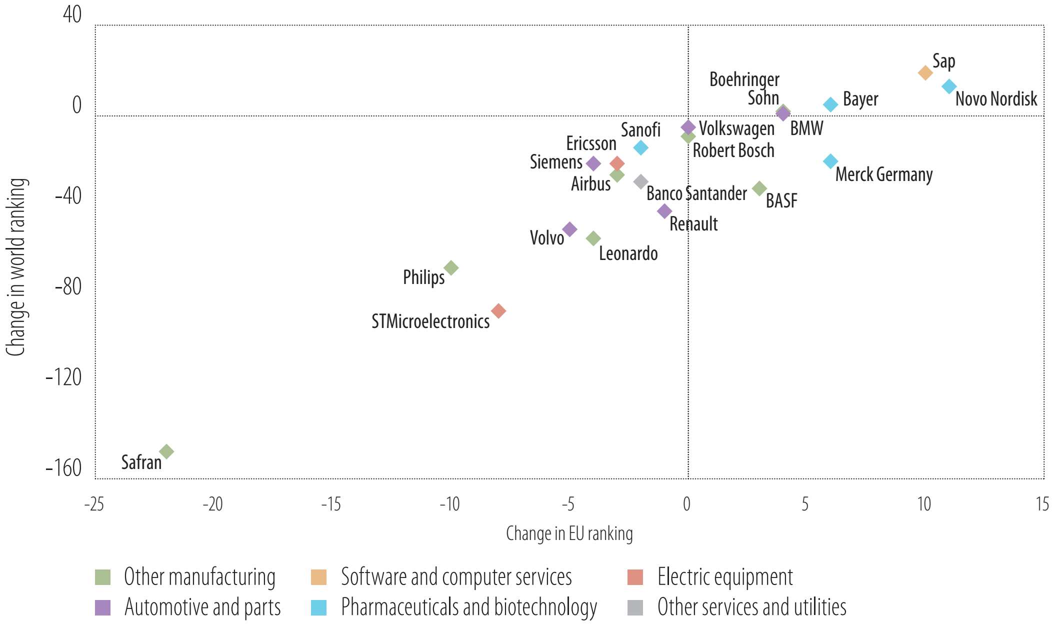


Source: EIB staff calculations based on EU Industrial R&D Investment Scoreboard 2023.
Note: See Figure 4 for the definition of the sectors.

Only a few EU companies increased their relative position in the list of the top global R&D companies from 2012 to 2022. Among the top 25 companies within the European Union, the software company SAP and pharmaceutical companies Novo Nordisk and Bayer are the only firms that improved their position in the global ranking from 2012 to 2022 (Figure 7). Most other top EU R&D companies fell in the global ranking during this period, by an average of 40 places. Europe's R&D landscape has seen shifts in focus over the past decade from other manufacturing sectors (with companies such as Safran and Philips) to software and computer services and pharmaceuticals and biotechnology. Several EU firms are well positioned in pharmaceuticals and biotech and could take advantage of Europe's excellence in scientific research to develop strong ecosystems in this domain.

Figure 7

Change in the ranking of the top 25 EU R&D firms (number of places)**, 2012-2022**



Source: EIB staff calculations based on EU Industrial R&D Investment Scoreboard 2023.
Note: Firms not included in the EU ranking in 2022 due to Brexit: GlaxoSmithKline and AstraZeneca. Firms omitted from the analysis due to mergers: Alcatel into Nokia, Peugeot and Fiat into Stellantis. Telefonica is not shown in the graph due to scaling. Its world rank decreased by more than 200 positions and its EU rank by more than 30 positions. See Figure 4 for the definition of the sectors.

Box A

Corporate venture capital in the automotive sector

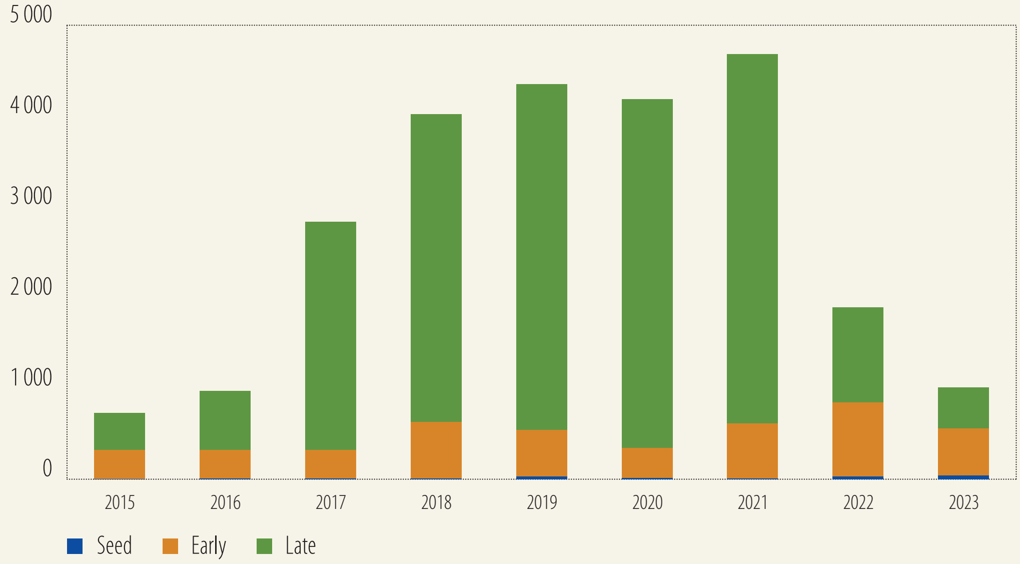
Corporate venture capital (companies buying equity in innovative startups) has become an important way for firms to tap into high-potential, startup-driven innovation (see Chapter 3), allowing for external collaboration and knowledge sharing as well as providing a new source of finance. Corporate venture capital funds now participate in one in four venture capital deals in both Europe and the United States – up from one in ten venture capital deals in 2010 (Hollis, 2024; Chatel, 2023) – while corporate venture capital deal value increased tenfold from 2013 to 2023.

Corporate venture capital investment in innovative startups in the automotive sector (where Europe has always been well represented) has increased markedly in the last decade (Fákó et al., 2024). This funding is concentrated on a handful of companies and is largely focused on late-stage deals (Figures A.1 and A.2).[4]

4 The analysis in this box is restricted to venture capital funds controlled by the five largest automotive companies by R&D investment in Europe, the United States, China, Japan and the rest of the world, based on R&D Scoreboard sector classification, for a total of 25 companies. For more information on the methodology and the sample used, please refer to Fákó et al. (2024). This results in the inclusion of firms like Deere and Caterpillar but, as these have relatively low levels of corporate venture capital, the main messages emerging from the data are not affected. The data set has information on 1 173 venture capital deals financing 827 startups in which one or more of these 25 firms participated from 2010 to 2023. Most of the deals involve multiple investors, though 23% are single investor deals. The amount of financing is disclosed for 945 of the deals, corresponding to 676 startups.

Figure A.1

Total corporate venture capital investment (EUR million) **by the top 25 automotive firms in 2015-2023, by deal type**



Source: *Fákó et al. (2024). Investment data were retrieved from Dealroom.co.*
Note: *The top 25 firms are made up of the top five automotive companies in each of the the following locations: the European Union, the United States, China, Japan and the rest of the world. The companies invest in startups at the seed, early and late stages.*

77% of total corporate venture capital investment went to startups active in areas such as autonomous driving and sensor technology, electric vehicle production (which has a direct link to automotive) and logistics, and mobility (which has an indirect link to automotive). However, a significant amount was invested in startups active in energy (9%), information, communication and technology (7%) and other fields (7%). Most (around 80%) of the corporate venture capital deals in this sample involve two or more investors; the other investors are often private venture capital firms and investors not active in the automotive sector.

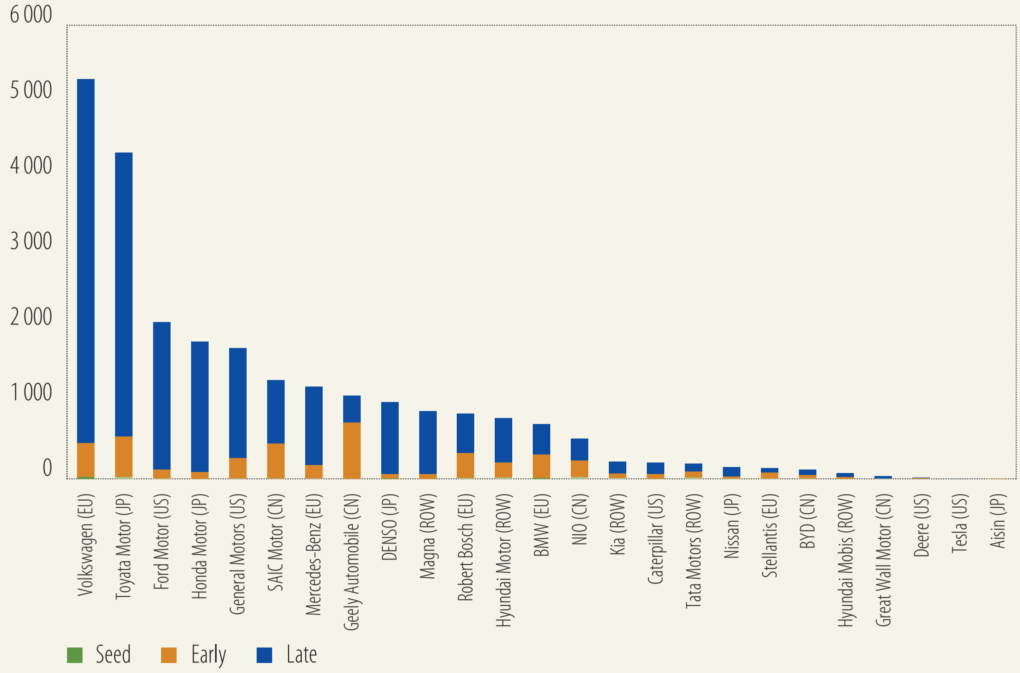
Corporate venture capital activity is mostly located close to the headquarters of parent firms or near large startup ecosystems. This pattern holds for automotive corporate venture capital activity, which is typically handled by offices close to the headquarters of the parent firm (such as Stuttgart, Germany – home to Mercedes-Benz and Porsche; Turin, Italy – Stellantis; or Tokyo and Nagoya, Japan – Toyota). Most also have corporate venture capital offices in locations around the world close to concentrations of talent and venture capital opportunities. For example, Toyota Ventures (Toyota's venture capital arm) was set up in 2017 in San Francisco and had a portfolio of 63 startups, including 51 in North America and just five in Europe.[5] Chinese firm SAIC has also had a venture capital branch in Silicon Valley since 2014, with a portfolio of 24 startups, including 15 in North America, seven in China and two in Europe.[6]

5 Source: Dealroom.co (consulted on 14 June 2024).

6 There are two companies named SAIC: SAIC Venture Capital and SAIC Capital, both registered in Menlo Park, California. Source: Dealroom.co (consulted on 9 September 2024).

Figure A.2

Corporate venture capital investment (EUR million) **by the top 25 automotive firms in 2015-2023, by company**



Source: *Fákó et al. (2024). Investment data were retrieved from Dealroom.co.*
Note: *The top 25 firms are made up of the top five automotive companies in each of the the following locations: the European Union (EU), the United States (US), China (CN), Japan (JP) and the rest of the world (ROW). The companies invest in startups at the seed, early and late stages.*

Most corporate venture capital investment by EU automotive companies goes to the United States, highlighting the less-developed nature of the EU venture capital market for scale-up financing. Figure A.3 shows that United States-based startups are the main beneficiaries of global automotive corporate venture capital investment, with EU, Japanese and rest-of-the-world top automotive firms investing more in United States-based startups than in domestic ones. Chinese and US investors invest mainly at home (Table A.1). On the other hand, startups located in the European Union and Japan (especially) get corporate venture capital funds mainly from domestic firms.

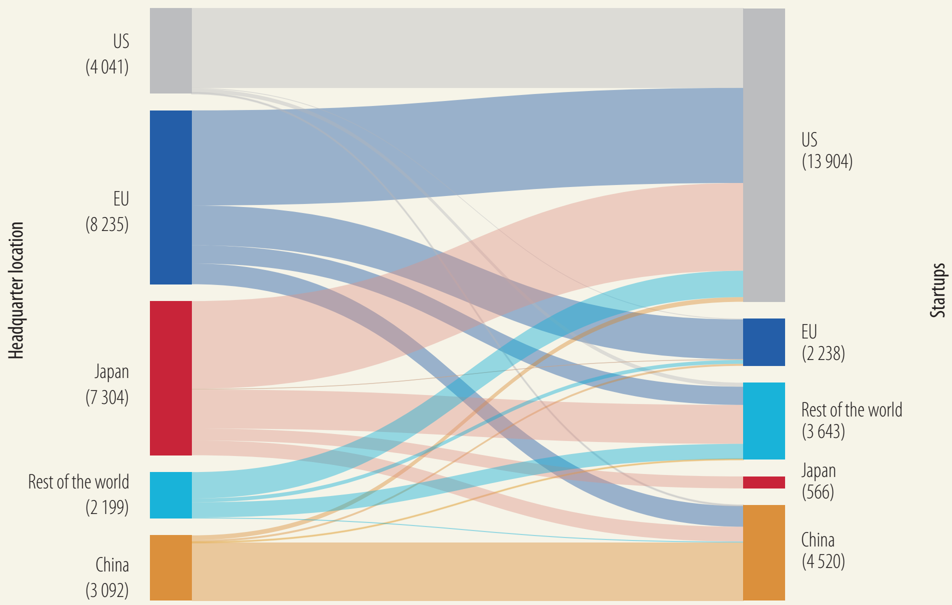
Table A.1

Corporate venture capital investment in domestic startups

Domestic corporate venture capital investment		Domestic origin of startup funding	
EU corporates	23%	EU startups	84%
US corporates	93%	US startups	27%
China corporates	89%	China startups	61%
Japan corporates	8%	Japan startups	100%
Rest-of-the-world corporates	33%	Rest-of-the-world startups	20%

Source: *Fákó et al. (2024). Investment data were retrieved from Dealroom.co.*
Note: *The left column indicates the percentage of domestic corporate venture capital investment by leading automotive companies as a share of their total global investment. The right column shows the percentage of corporate venture capital investment received by startups from leading automotive companies in their own region or country as a share of their total funding.*

Figure A.3
Corporate venture capital investment in startups by top automotive firms (EUR million), **by headquarter location**



Source: Fákó et al. (2024). Investment data were retrieved from Dealroom.co.

From 2010 to 2023, the amount of corporate venture capital investment in the United States was 6.21 times larger than in the European Union, which is very similar to the ratio for the total amount of venture capital investment in the respective economies for the same period. Meanwhile, 23% of top EU automotive companies' corporate venture capital stayed within the European Union rather than going to the United States – considerably more than the equivalent share of total corporate venture capital investment (14%, based on European Commission calculations using Pitchbook data).

While this means that corporate venture capital investment by top EU automotive firms shows a certain degree of home bias, it in no way diminishes the urgent need to overcome the overall EU venture capital market's ongoing deficit compared to the United States. Top EU automotive companies invest disproportionately more in the United States than in the European Union, even after controlling for the smaller size of the EU market. This forms part of a broader concern whereby the EU market for disruptive technologies lacks the dynamism and attractiveness of the United States or even China, leading to lower investment.

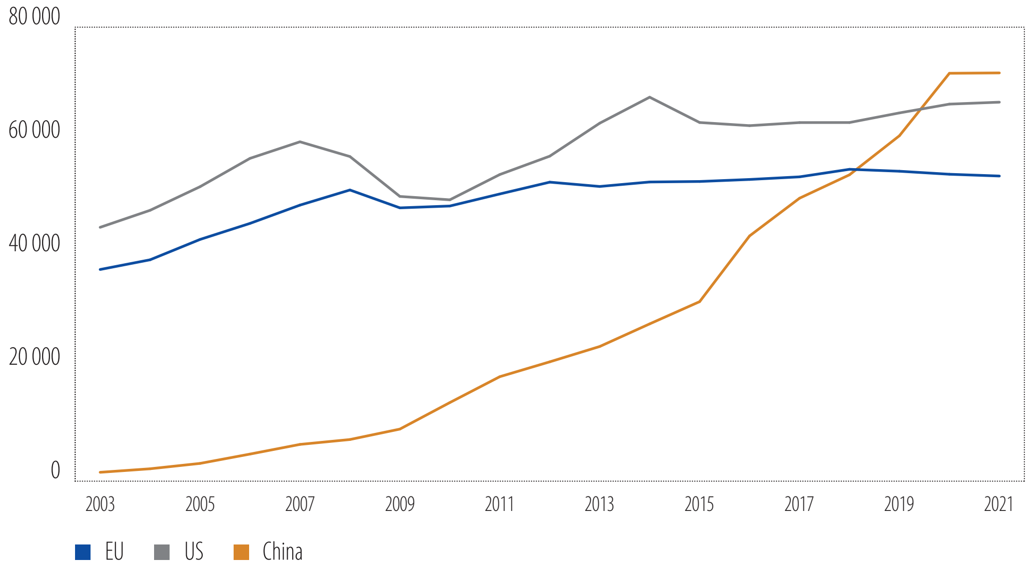
Overall, corporate venture capital is an effective way for companies to develop or procure new technologies. Corporate venture capital investment by leading EU automotive firms is on a par with competitors and is being directed to the technological innovations that are crucial for transforming the sector, such as autonomous driving and sensor technologies.

The European Union is a green pioneer, but weakness in digital technology risks creating potential dependencies

Patents protect novel inventions and technologies used by industry. They are an important part of the innovation process, giving inventors the exclusive rights to their knowledge for a specified period. Patents also 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. This section assesses the position of the European Union in the development of green technologies, biotechnologies and digital technologies.

Figure 8

Patent applications (count)**, 2003-2021**



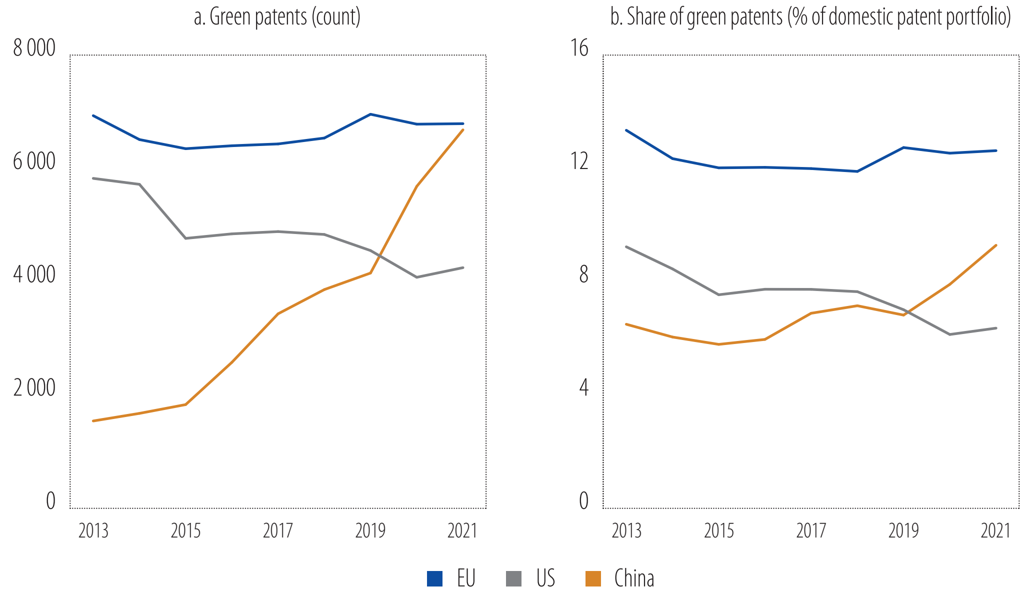
Source: EIB staff calculations based on PCT patents (PATSTAT) in collaboration with ECOOM, KU Leuven.

Patent application numbers show China's surge in the development of new technologies. While the number of new patents under the Patent Cooperation Treaty (PCT) in the European Union and the United States has been relatively stable in recent years, it has been increasing quickly in China (Figure 8). That said, the innovation outlook is very uncertain, with early signs that patent growth may be cooling. The latest insights from the World Intellectual Property Organization's Global Innovation Index 2024 shows an overall decline in the number of PCT patent filings (World Intellectual Property Organization (WIPO), 2024). There are also regional disparities, and while the decline seems to be contained in China, it is for example more pronounced in the United States.

The European Union is a frontrunner in green technologies. Climate is a key focus of EU policy and green tech is a strategic area for the European Union (EIB and European Patent Office (EPO), 2024). The latest data show that the European Union has a similar number of PCT patents in green technologies as China, while the United States has fewer patents in green technologies (Figure 9a). The number of green patents in China has increased very rapidly in recent years. Nevertheless, Europe continues to have a higher share of patents in green technologies than China or the United States, reflecting its relative focus on the development of these technologies (Figure 9b). Moreover, the European Union is much more specialised in the production of clean technologies (see Chapter 1). The strong presence of

European firms in green innovation and production is therefore a source of competitiveness and future resilience for the EU economy.

Figure 9
Green tech patents, 2013-2021



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

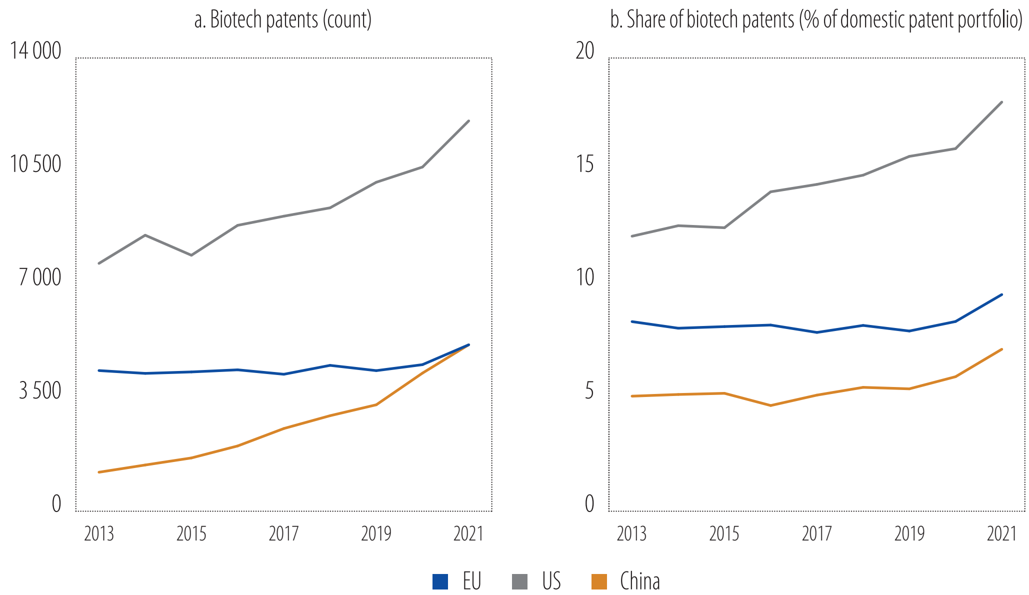
The United States leads in biotechnology patenting, followed by the European Union and China. The number of biotechnology patents has remained relatively stable in the European Union over the past decade, while it has risen in the United States and China (Figure 10). There was an acceleration in the number of biotechnology patents from 2020 to 2021, which may partly reflect the effect of the COVID-19 pandemic on patent filings related to the development of vaccines and treatments (WIPO, 2023). China is catching up with the European Union, reflecting its increased focus on this domain.

Compared to the United States and China, the European Union is not well positioned in digital innovation. The number of patent applications for digital technologies has been growing faster in China than in the United States and the European Union (Figure 11a). The share of digital patents is higher in China and the United States, which indicates that they focus more on digital innovation than the European Union (Figure 11b). If Europe wants to remain globally competitive, it must further strengthen and defend its ability to innovate in digital technologies.

The European Union is falling behind in artificial intelligence innovation. Artificial intelligence is increasingly considered a key digital technology as it has the power to revolutionise industries. It could also help address pressing global challenges, such as climate change, using data-driven solutions. However, the European Union has been trailing the United States and China in this fast-developing area, especially in recent years (Figure 12).[7]

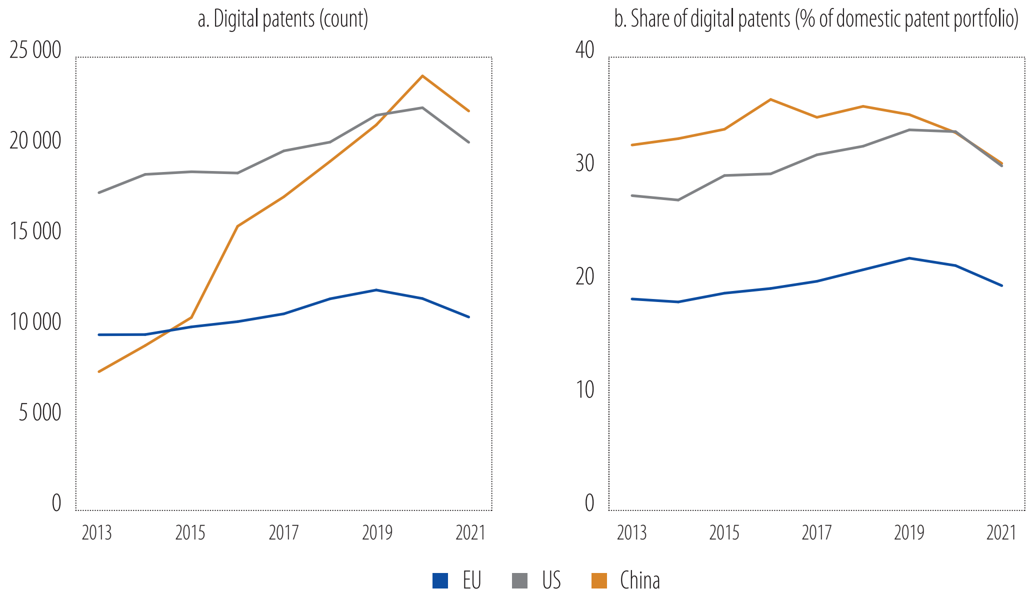
7 The figures do not consider artificial intelligence development that cannot be patented due to being purely software-related, for example. A similar consideration can be made for other technology domains.

Figure 10
Biotech patents, 2013-2021



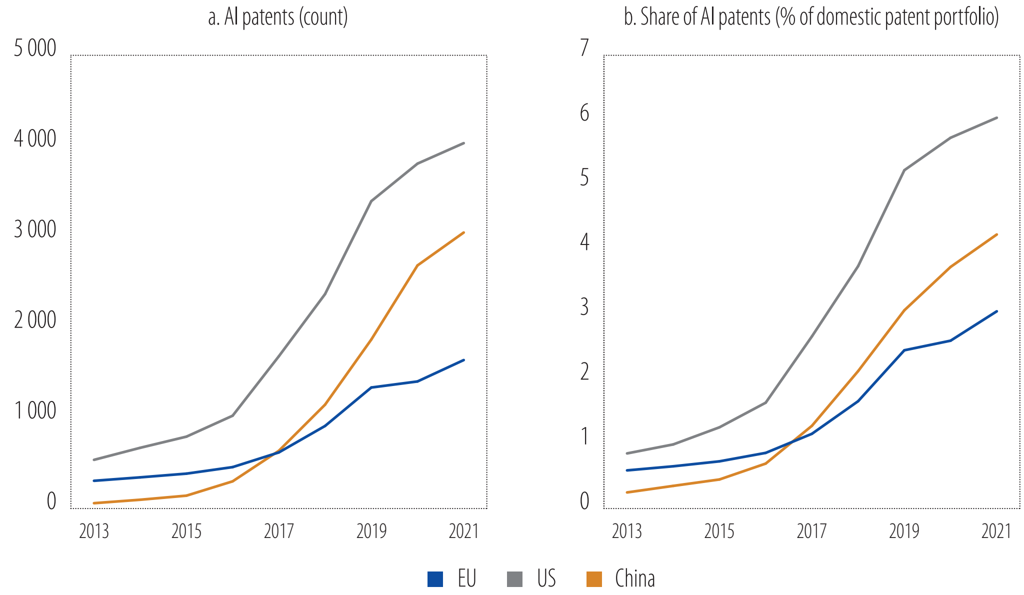
Source: *EIB staff calculations based on PCT patents (PATSTAT) in collaboration with ECOOM, KU Leuven.*
Note: *The patent classification in biotechnology is based on the classification established by KU Leuven. The biotechnology domain is the combination of Fraunhofer technology classes 15 (biotechnology)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

Figure 11
Digital patents, 2013-2021



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

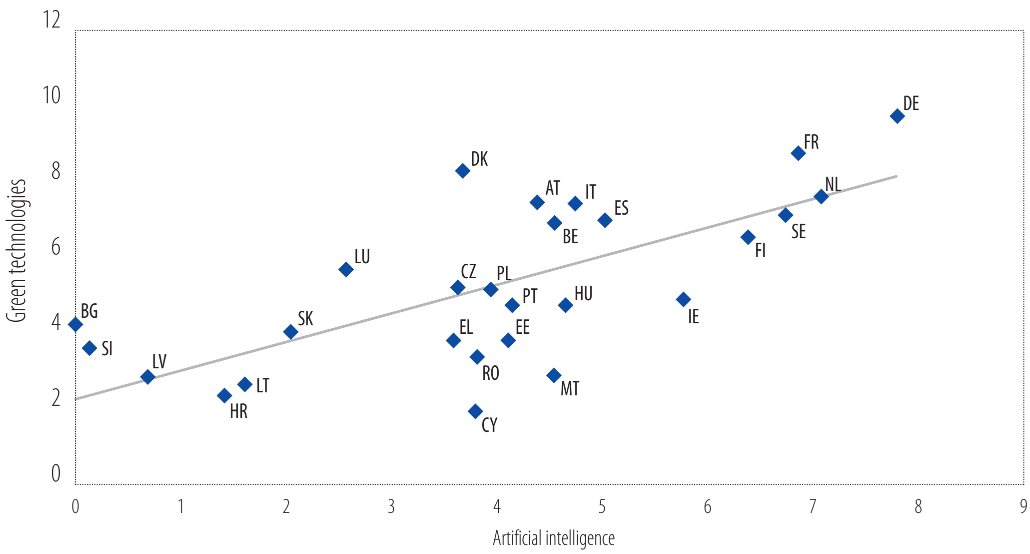
Figure 12
Artificial intelligence patents, 2013-2021



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

Specialisations in green technology and artificial intelligence seem to be mutually supportive in EU countries, particularly in Western and Northern Europe. Green technologies and artificial intelligence-related innovation activities in Europe vary significantly by country. Nevertheless, there seems to be a link between patenting specialisation in these two innovation domains (Figure 13). Combined specialisation could pay off in the future given the growing evidence that artificial intelligence could revolutionise the green transition (Rotman, 2019).

Figure 13
National Breeding Ground indices of AI and green technologies (logarithm)**, 2017-2021**

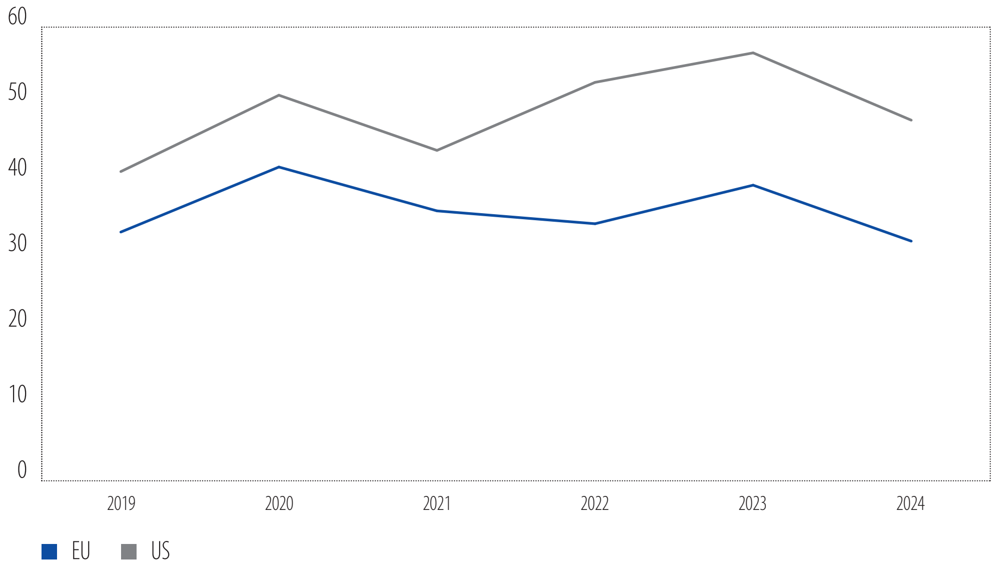


Source: *EIB staff calculations based on PCT patents (PATSTAT) in collaboration with ECOOM, KU Leuven.*
Note: *The National Breeding Ground index (following Leusin et al., 2020) multiplies the revealed technological advantage by the number of patents in each domain in a given country.*

The European Union has a lower share of firms investing in innovation and adopting digital technologies than the United States

Corporate investment in innovation is lower in the European Union than in the United States. The share of EU firms investing to develop or introduce new products, processes or services is lower than in the United States (Figure 14). The gap in innovation between EU and US firms has been widening over time and is broad based, being present in all sectors (including manufacturing) and firm size categories. This evidence from the EIB Investment Survey (EIBIS) confirms the findings of the European Innovation Scoreboard 2024 (European Commission, 2024a) and OECD data, in which the United States scores better than the European Union on several indicators related to R&D and innovation. As suggested in the previous section, the recent slowdown in innovation activities is also apparent in other related measures, such as patent applications (WIPO, 2024).

Figure 14
Investment in innovation (% of firms)

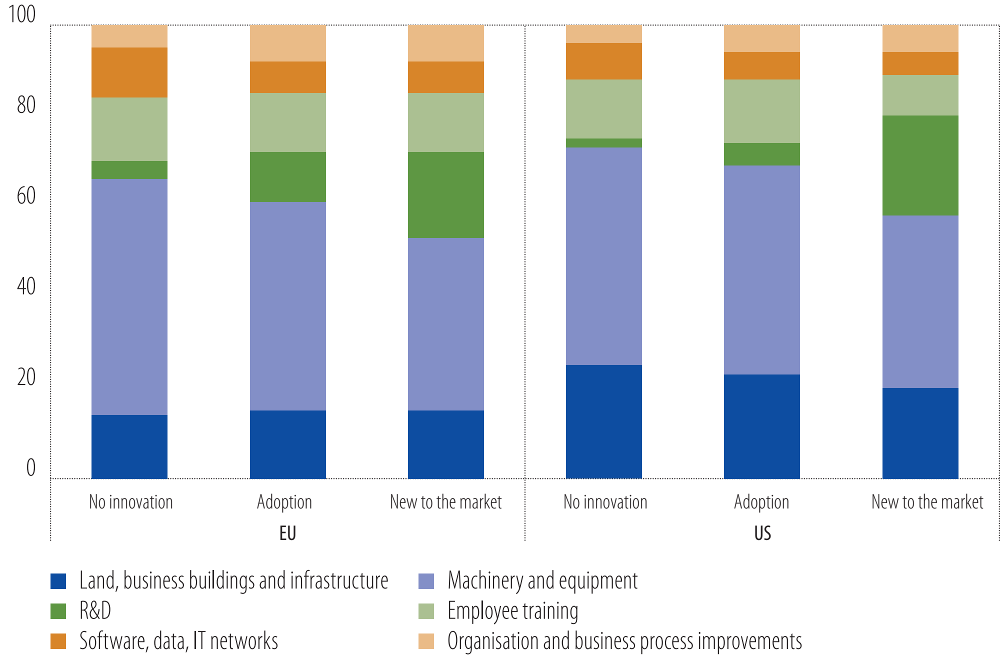


Source: *EIBIS 2019-2024.*
Note: *Firms are weighted by value added.*
Question: *In the previous financial year, did you invest to develop or introduce new products, processes or services?*

Innovation activities are associated with investment in intangible assets. Firms that allocate a greater share of investment to intangible assets (R&D, software and data, training of employees and organisational and business process improvements) tend to innovate more (Figure 15). 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.

The digital adoption gap persists between the United States and the European Union. To strengthen the competitiveness of the European economy, cutting-edge innovation will need to go hand in hand with broader adoption and deployment of technologies. The latest results from the EIBIS show that EU firms are accelerating the adoption of advanced digital technologies: 74% of them adopted these technologies in 2024 (compared with 80% of firms in the United States – Figure 16a). There is a particularly wide digital adoption gap between EU and US firms in services (notably in accommodation and food services), and in other sectors such as manufacturing and infrastructure (especially transportation and storage).

Figure 15
Innovation and investment in intangible assets (% of total investment)



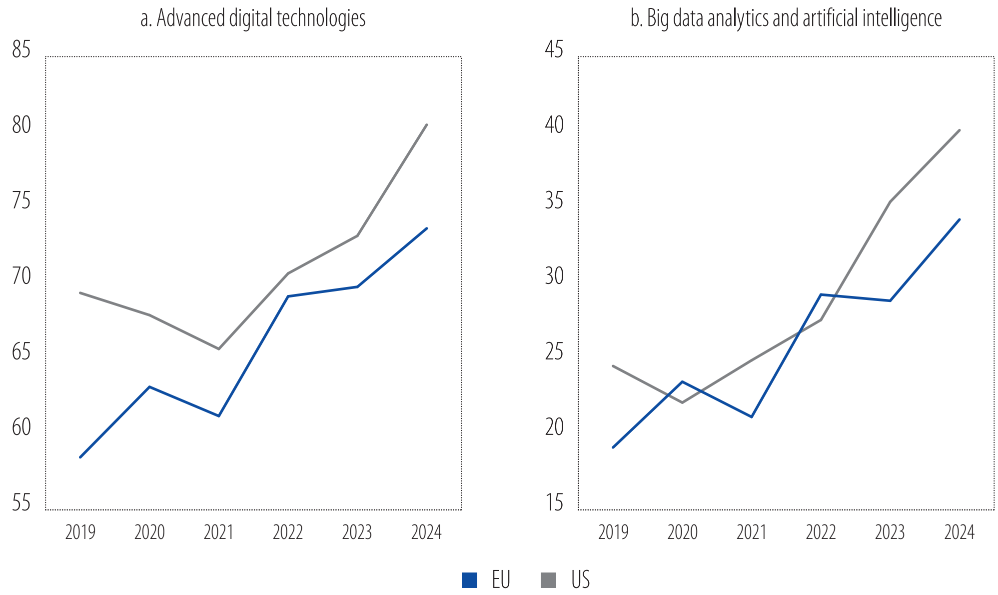
Source: *EIBIS 2024.*
Note: *Firms are weighted by value added.*
Question: *Were the new products, processes or services that you developed or introduced new to the company or new to the country or global market? In the previous financial year, how much did your business invest in each of the following with the intention of maintaining or increasing your company's future earnings?*

To close the gap with US firms, EU firms need to remain vigilant and reinforce the use of artificial intelligence and big data analytics (Figure 16b). Recent developments in generative AI show that it is a key technology with the potential to transform business models (Brynjolfsson et al., 2023).

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 17). This 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; Acemoglu et al., 2022).

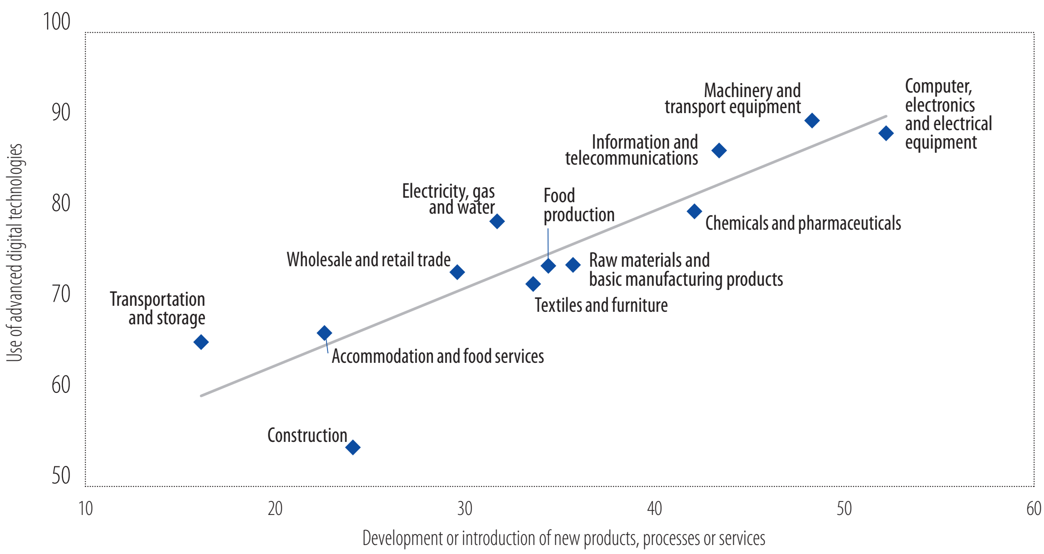
Digital technologies such as internet platforms can offer opportunities for European firms, particularly smaller companies. Box B discusses how these technologies can help small firms respond to changes in demand and reach new customers. However, digital platform service providers are concentrated in specific parts of the globe and are dominated by US companies, while China's market is served by Chinese providers (Figure 5 provides more information on R&D expenditure by the leading innovative companies in software and computer services). European players are significantly smaller, while China has strengthened its position in the global platform market in recent years. Despite its economic size, Europe faces hurdles to scaling and expanding these platforms, such as market fragmentation, a lack of investment in disruptive innovation, and different national regulatory systems, which are characterised by a strong emphasis on data protection and consumer rights (Hosseini, 2023). The major dependencies this creates on digital platforms and other technologies (such as artificial intelligence) developed by non-EU providers come just as economic security considerations are in the spotlight.

Figure 16
Use of advanced digital technologies and artificial intelligence (% of firms)



Source: *EIBIS 2019-2024.*
Note: *Firms are weighted by value added. The question on big data analytics and artificial intelligence was not asked to firms in the construction sector.*
Question: *Are advanced digital technologies used within your business? Are big data analytics and artificial intelligence used within your business?*

Figure 17
Investment in innovation and use of advanced digital technologies (% of firms)



Source: *EIBIS 2024.*
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?*

Box B

Digital platforms help level the playing field for small firms

Multisided platforms facilitate exchanges and interactions between different types of users, such as buyers and sellers, businesses finding suppliers, or workers seeking employment with firms searching for candidates (Rochet and Tirole, 2003; Cennamo and Santaló, 2013; Gu and Zhu, 2021). By reducing the need to travel to a central location, digital platforms reduce transaction costs, alleviating information asymmetry and diminishing coordination costs (Garicano and Kaplan, 2001).

Despite the substantial efficiency gains that platforms can offer, not all firms benefit equally, nor do all firms adopt them (Brynjolfsson et al., 2006). Like all outsourcing decisions, the use of standardised solutions provided by platforms involves a trade-off between fixed and variable costs (Loertscher and Riordan, 2019).

Large firms can adopt customised solutions by making significant fixed investments in physical and human capital, while small firms are unable to sustain such investments. Small firms can obtain standardised products and services on the market through outsourcing. Outsourcing involves higher (market) transaction costs, but recent advances in platform technologies have increased the viability of these high variable cost/low fixed cost solutions.

Moreover, large investments in fixed assets can lead to excess capacity during periods of low demand and high overhead costs. The outsourced platform technology allows small firms to scale production seamlessly, making them resilient to demand fluctuations. This suggests that the value of the platform technology increases with the likelihood of negative demand shocks.

Using EIBIS data, Santaló and Weiss (2024) find significant differences in the effect of digital platforms on firm productivity between smaller and larger firms. The estimates in Table B.1 show that firms that adopt platform technologies tend to have higher labour productivity. However, the effect of platform adoption on firm productivity is greater for smaller firms.[8] This difference is illustrated by the negative coefficient on the interaction between the use of a digital platform and firm size (proxied by the value of fixed assets). The estimates in Table B.2 show that platform adoption is associated with an average increase in labour productivity of 5.1%, but small firms experience a larger increase (about 10.4%) than large firms (-0.01%).

To assess whether platforms allow firms to better adapt to sudden changes in demand, Santaló and Weiss (2024) construct an index of sales variability in the sector in which firms operate using data from Eurostat short-term statistics on monthly sales and turnover in the services and trade sectors. A higher index value means that sales in the sector tend to have higher variability. The index is matched to EIBIS firms at the country and sector level.

Table B.3 reports the results of ordinary least squares (OLS) regressions using the index of sales variability interacted with the use of platforms. They are very close to the results reported in Table B.1. For example, the interaction term of platform and firm size (proxied by the log of fixed assets) is -0.033 in Table B.3, compared to -0.034 in Table B.2. The magnitude of the estimated coefficient on the other explanatory variables are also very similar.

The estimates in Table B.3 also show a positive interaction between the use of platform and sector sales variability. In other words, the use of digital platforms can help mitigate sudden changes in

8 The decision for a firm to adopt digital technologies is likely associated with its inherent productivity, even when accounting for country, sector, year and firm-specific characteristics. See Santaló and Weiss (2024) for estimates using instrumental variables to address potential endogeneity concerns in the relationship between platform adoption and productivity.

demand and this is associated with greater firm productivity. This supports the argument that platforms enable firms to operate with lower fixed production costs.

Table B.1
Effect of digital platforms on firm productivity

Dependent variable: Log labour productivity	
Platform	0.513***
	(0.105)
Platform × log of fixed assets	-0.034***
	(0.007)
Log of fixed assets	0.144***
	(0.006)
Sample size	15 752
R-squared	0.372

Source: *Santaló and Weiss (2024) based on EIBIS 2029-2023.*
Note: *Ordinary least squares (OLS) regression. The regression includes controls for number of employees (four firm size categories), age (less than ten years old), management practices, the interactions of country and sector (NACE 1 digit)[9] and year fixed effects. Robust standard errors in parentheses. Robust standard errors in parentheses. Statistical significance: ***p-value<0.01, **p-value<0.05, *p-value<0.1.*

Table B.2
Effect of digital platforms on firm productivity at different points in the distribution of fixed assets

Dependent variable: Log labour productivity	
Average fixed assets	0.051***
	(0.017)
Small: First quartile of fixed assets	0.104***
	(0.023)
Medium: Median fixed assets	0.054***
	(0.018)
Large: Third quartile of fixed assets	-0.013
	(0.020)

Source: *Santaló and Weiss (2024) based on EIBIS 2019-2023.*
Note: *OLS regression from Table B.1. The regression includes controls for the number of employees (four firm size categories), age (less than ten years old), management practices, the interactions of country and sector (NACE 1 digit) and year fixed effects. Robust standard errors in parentheses. Statistical significance: ***p-value<0.01, **p-value<0.05, *p-value<0.1.*

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

Table B.3
Effect of digital platforms on firm productivity, with an index of sales variability

Dependent variable: Digital platform	
Platform	0.424***
	(0.099)
Platform × log of fixed assets	-0.033***
	(0.007)
Platform × index of sales variability	0.033***
	(0.007)
Log of fixed assets	0.144***
	(0.005)
Index of sales variability	-0.333
	(0.399)
Sample size	15 752
R-squared	0.372

Source: *Santaló and Weiss (2024) based on EIBIS 2019-2023.*
Note: *OLS regression. The regression includes controls for number of employees (four firm size categories), age (less than ten years old), management practices, the interactions of country and sector (NACE 1 digit) as well as year fixed effects. Robust standard errors in parentheses. Statistical significance: ***p-value<0.01, **p-value<0.05, *p-value<0.1.*

Green innovation as an enabler of EU competitiveness

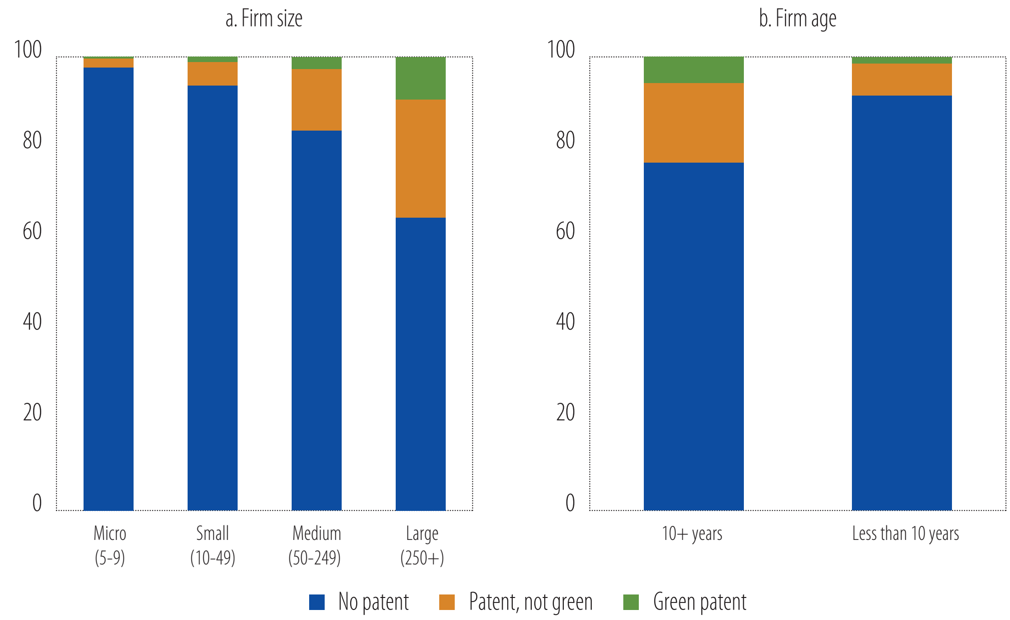
Investment in innovation, especially green technologies, lies at the very heart of EU policy. Innovation benefits society as a whole but it should also sustain the companies investing in these efforts. This section explores the multifaceted relationship between green technologies and firm performance, focusing on innovation output, the green transition, firm productivity and financing conditions by assessing the firm characteristics of patent applicants.[10]

Firms filing patents tend to be larger and older. About 35% of large firms in the EIBIS hold a patent, compared to 6% of small firms (Figure 18). Similarly, firms that have been around for more than ten years are much more likely to have patents than younger firms.

The share of firms with patents and green patents varies widely between sectors. EU firms in the computer, electronics and electrical equipment sector are most likely to hold a green patent, while firms in machinery and transport equipment are most likely to apply for a patent overall (Figure 19). Unsurprisingly, firms in manufacturing are more likely to have patents than firms in other industries. Nevertheless, there are large discrepancies between sectors: Almost half of the firms with patents in the computer, electronics and electrical equipment sector hold at least one green patent. In contrast, in other sectors in manufacturing (such as manufacturing of food, beverages and tobacco), the share of firms with green patents is only slightly more than 10%.

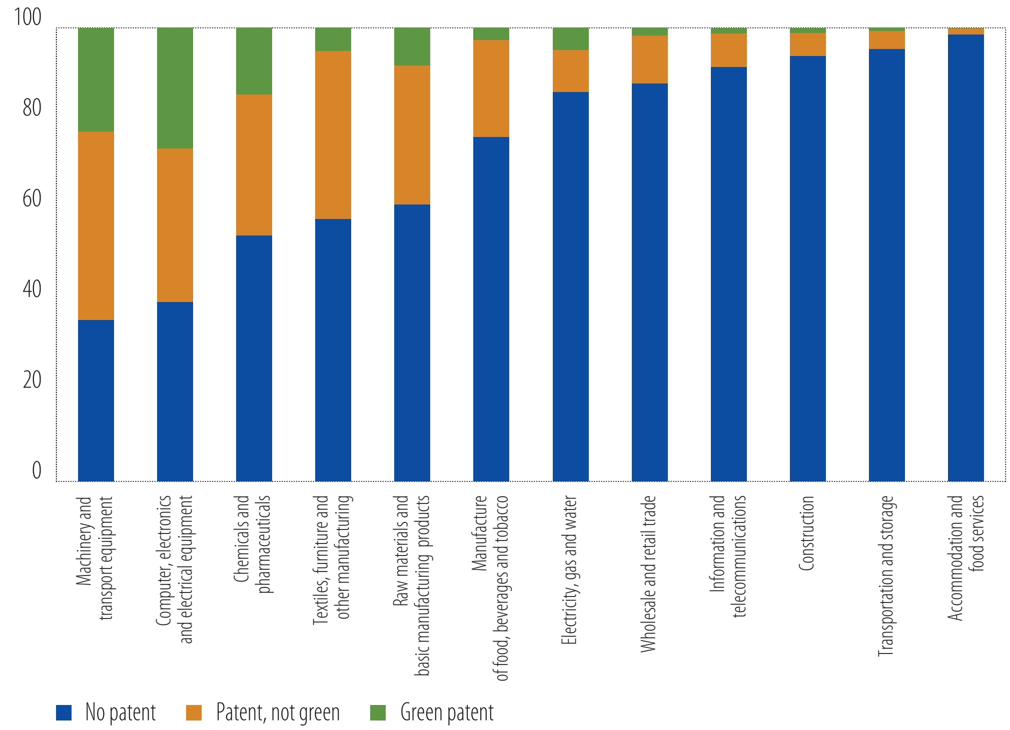
10 Firms in EIBIS waves 2023 and 2024 were matched to Orbis Intellectual Property (IP). In the figures presented in this section, firms with a patent are firms that have applied for at least one patent since 2000, corresponding to about 10% in the EIBIS sample considered. Firms with a green patent are firms that have applied for at least one patent with the Cooperative Patent Classification (CPC) code Y02 ("technologies or applications for mitigation or adaptation against climate change"). This classification overlaps extensively with the classification used in the previous sections.

Figure 18
EU firms with green patents (% of firms)**, by size and age**



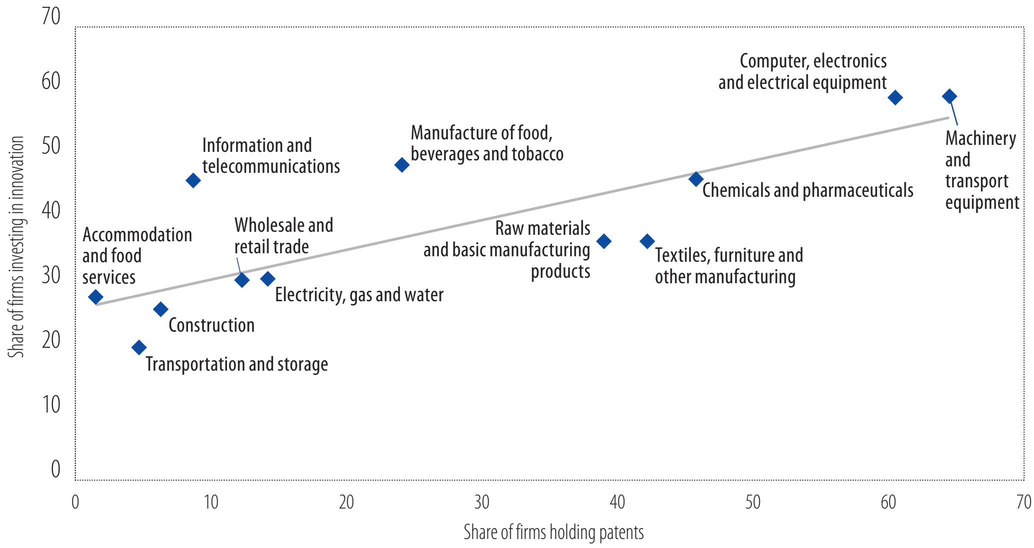
Source: *EIB staff calculations based on EIBIS 2023-2024 and Orbis IP.*
Note: *EU firms. Firms are weighted by value added. See footnote 10 for a description of how patent applicants are defined.*

Figure 19
EU firms with green patents (% of firms)**, by sector**



Source: *EIB staff calculations based on EIBIS 2023-2024 and Orbis IP.*
Note: *EU firms. Firms are weighted by value added. See footnote 10 for a description of how patent applicants are defined.*

Figure 20
Investment in innovation and patent applicants (% of firms)**, by sector**



Source: EIB staff calculations based on EIBIS 2023-2024 and Orbis IP.
Note: EU firms. Firms are weighted by value added. See footnote 10 for a description of how patent applicants are defined.
Question: In the previous financial year, did you invest to develop or introduce new products, processes or services?

Sectors with a greater share of firms holding patents are more likely to invest in innovation. The share of firms reporting investments with the purpose of developing or introducing new products, processes or services is greater in sectors with a larger share of patentees (Figure 20). This confirms that patent protection may indeed be one of the factors encouraging an innovative environment.

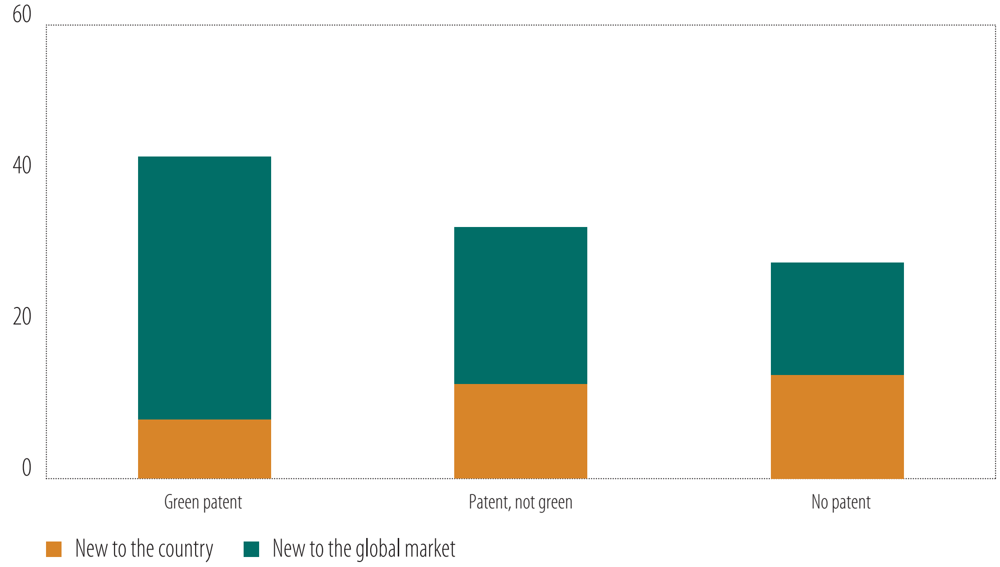
Firms with green patents invest in innovations that are new to the global market. Patentholders are more likely to invest in new products, processes or services in general (Figure 21). But firms holding green patents are nearly 70% more likely to invest in innovations that are new to the global market than firms that hold only patents not related to green technologies (35% vs. 21%, respectively).

Firms with green patents are more likely to see the green transition as an opportunity rather than a risk (Figure 22). This suggests that these companies could gain a competitive edge in the sustainable economy. It is therefore crucial that EU firms reap the benefits of the transition to a greener economy.

Firms that innovate, especially in green technologies, tend to be more productive. Innovation is known to drive economic growth and create a competitive advantage, particularly for firms that hold a green technology patent (Table 2). This suggests that there are substantial productivity gains to be made from engaging in green innovation, which is an area of great strength for Europe.

Figure 21

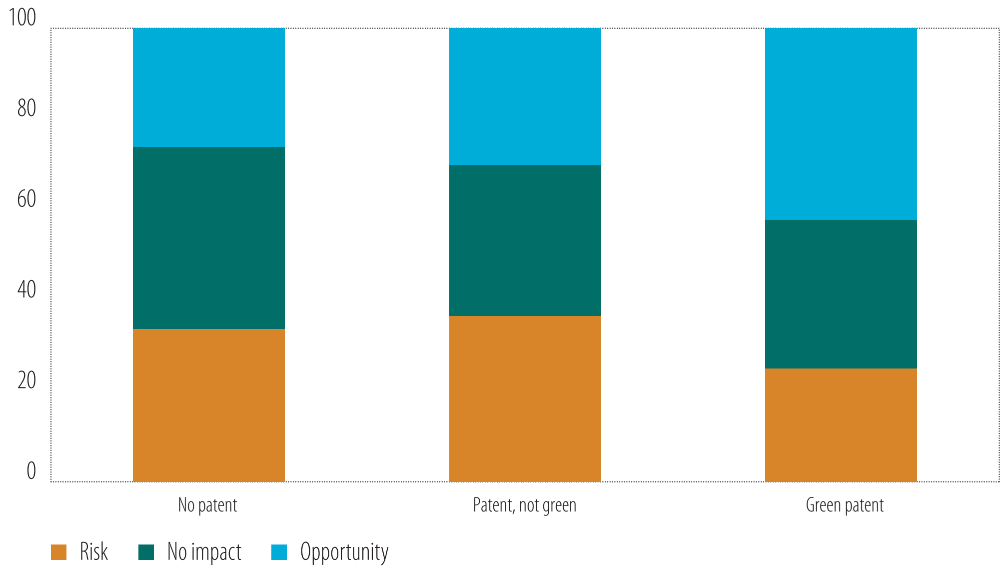
Share of firms investing in innovations that are new to the country or the global market (% of firms)**, by type of patent**



Source: *EIB staff calculations based on EIBIS 2023-2024 and Orbis IP.*
Note: *EU firms. Firms are weighted by value added. See footnote 10 for a description of how patent applicants are defined. The bars do not sum up to 100% because some firms invest in innovation that is only new to the company.*
Question: *Were the new products, processes or services (a) new to the company; (b) new to the country; (c) new to the global market?*

Figure 22

Opportunity and risk associated with the transition to a greener economy (% of firms)**, by type of patent**



Source: *EIB staff calculations based on EIBIS 2023-2024 and Orbis IP.*
Note: *EU firms. Firms are weighted by value added. See footnote 10 for a description of how patent applicants are defined.*
Question: *Thinking about your company, what impact do you expect the transition to stricter climate standards and regulations will have on your company over the next five years?*

Table 2
Green patenting activities and labour productivity

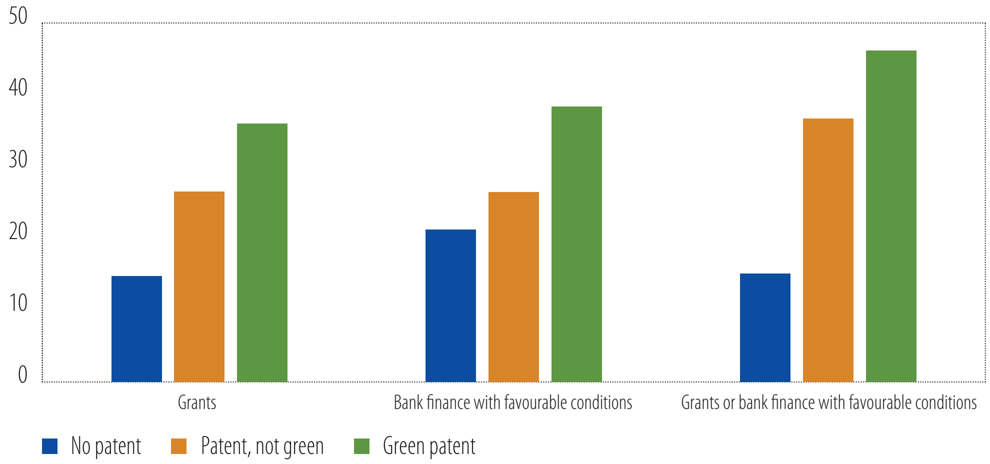
Dependent variable: Log labour productivity	(1)	(2)
Green patent	0.200***	0.232***
	(0.044)	(0.045)
Patent, but not green		0.142***
		(0.022)
Sample size	21 173	21 173
R-squared	0.261	0.262

Source: *EIB staff calculations based on EIBIS 2023-2024 and Orbis IP.*
Note: *EU firms. Labour productivity is expressed in natural logarithms. See footnote 10 for a description of how patent applicants are defined. The OLS regressions control for firm size, country and sector. Robust standard errors in parentheses. Statistical significance: ***p-value<0.01, **p-value<0.05, *p-value<0.1.*

Companies that innovate in green technologies are mostly large firms, meaning that they are not particularly finance constrained or more likely to receive grants. However, they are more likely to receive bank finance with favourable conditions (for example with a subsidised interest rate or a longer grace period, Figure 23). Meanwhile, well-established literature shows that innovators are more exposed to market failures and information asymmetries (Arrow, 1962; Stiglitz and Weiss, 1981) and therefore may find it more difficult to obtain a socially optimal level of financing. However, patent-holding firms are generally large and as such are not necessarily more finance constrained. This makes bank finance with favourable conditions an effective way to support patenting firms.

Finance with favourable conditions, as well as grants or subsidies, are effective when they focus on specific policy objectives. Firms that hold patents, especially green patents, are more likely to receive policy support targeting innovation and digitalisation or the green economy (Figure 24).

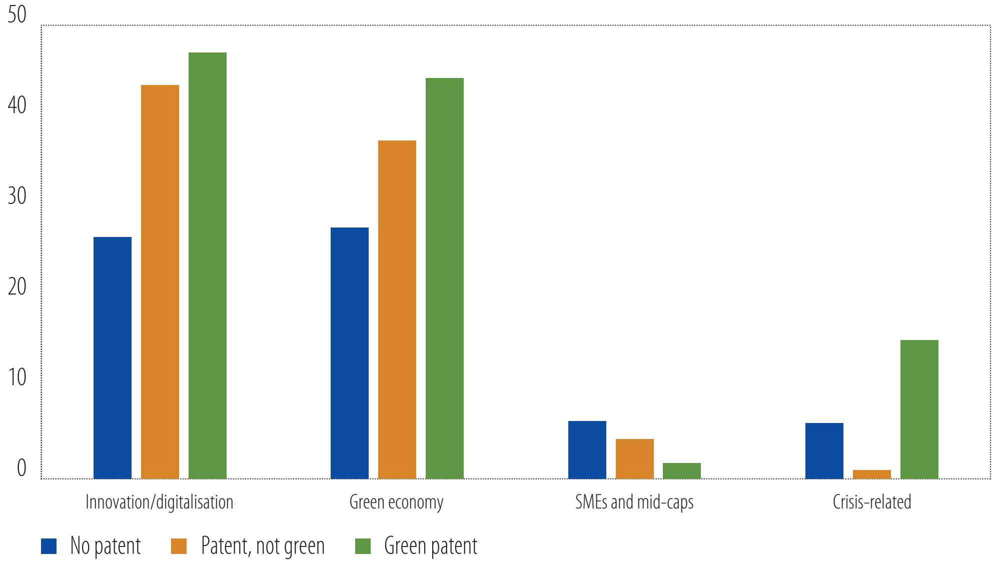
Figure 23
Grants and bank finance with favourable conditions (% of firms using external finance), **by type of patent**



Source: *EIB staff calculations based on EIBIS 2024 and Orbis IP.*
Note: *EU firms using external finance. Firms are weighted by value added. See footnote 10 for a description of how patent applicants are defined.*
Question: *Which of the following types of external finance did you use for your investment activities in the last financial year? Was any of the bank finance you received on concessional terms (e.g., subsidised interest rate, longer grace period to make debt payments)?*

Figure 24

Targeted areas of grants, subsidies or bank finance with favourable conditions (% of firms receiving them)**, by type of patent**



Source: *EIB staff calculations based on EIBIS 2024 and Orbis IP.*
Note: *EU firms receiving grants, subsidies or bank finance with favourable conditions. Firms are weighted by value added. See footnote 10 for a description of how patent applicants are defined.*
Question: *Were any of the grants, subsidies or the bank finance you received on concessional terms, in the last financial year targeted at a specific-area of investment for example innovation, digitalisation, sustainability, energy efficiency, mid-caps etc? And in which, if any, of the following areas was it targeted?*

The European Union is at the centre of global collaboration networks in green technologies

Technological interdependencies between regions contribute to the formation of innovation ecosystems in strategically important domains by facilitating access to knowledge, technology transfer and collaborative R&D activities. The dynamics of interconnection in an open innovation environment are central to European innovation ecosystems (Hervás-Oliver et al., 2021; European Commission, 2024b). Understanding these dynamics is key to fostering European innovation and competitiveness.

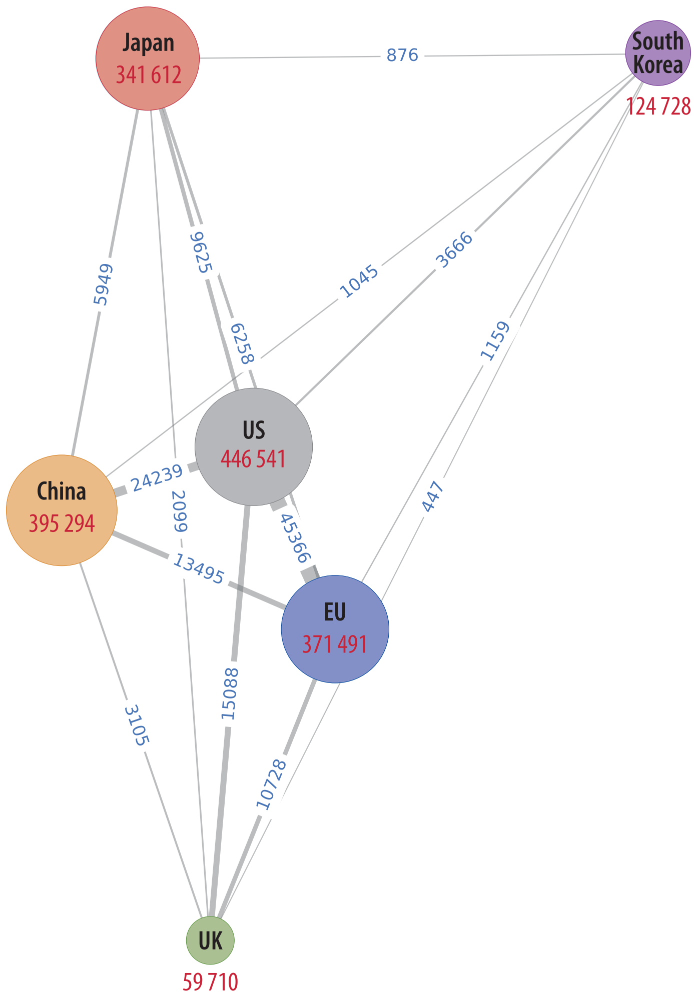
The European Union and the United States are strongly interdependent in all technology domains. Figure 25 illustrates co-patenting networks, a proxy for technology collaboration networks between different regions or countries. The proximity of their respective nodes shows that, overall, the European Union and the United States are very closely linked in the development of new technologies.

China is a key partner in the US-EU hub for digital technologies, but mainly through its collaboration with the United States. Digital technology collaboration networks are driven by the United States, China and the European Union (Figure 26a). However, the United States holds the closest ties with the two regions, with the digital technology connections between the European Union and China being mainly indirect and driven by close collaboration between the United States and China.

The European Union is a central node in green technology collaboration networks and has close ties with the United States. Unlike for digital technologies, there are no close ties between China and the United States or the European Union in green technologies (Figure 26b).

Figure 25

Co-patenting networks between different regions for all technologies, 2016-2022

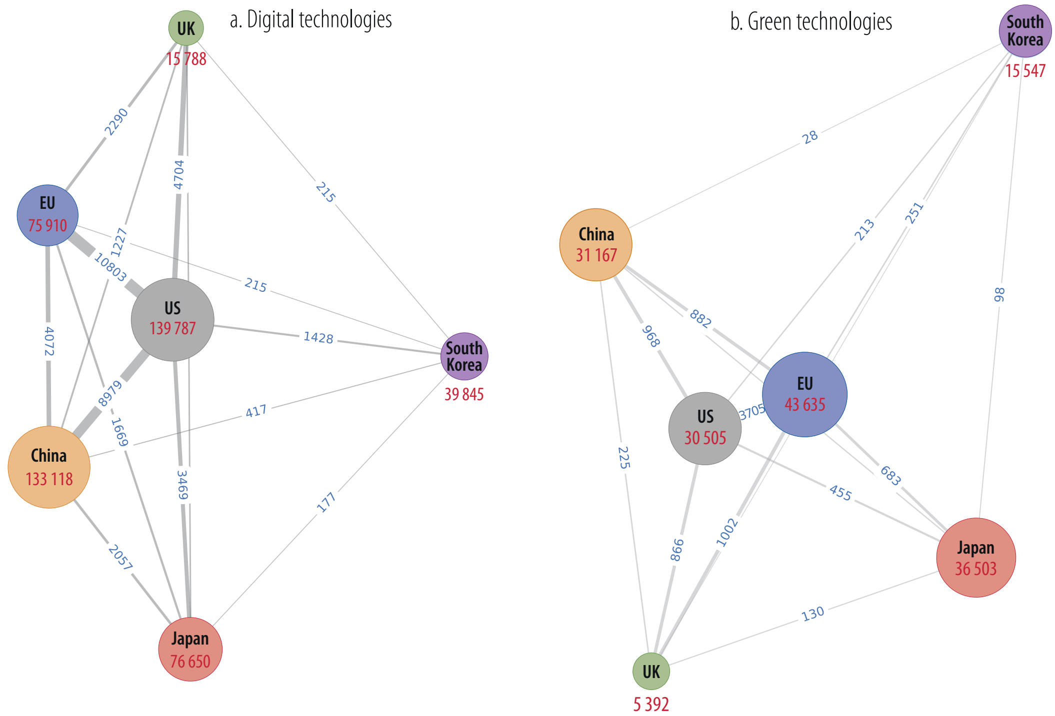


Source: *PCT patents (PATSTAT), calculated by ECOOM, KU Leuven.*
Note: *The illustration is based on co-patents filed with the World Intellectual Property Organization (WIPO) from 2016 to 2022. It depicts co-patenting networks in all technology domains. Each circle (or node) represents a country or region. The size of the node is proportional to the number of patents for the country or region (the number within the nodes). The lines connecting the nodes (edges) represent co-patenting links between the countries or regions. The thickness of the line (which is inversely proportional to the distance between nodes) indicates the strength or volume of the collaboration. A thicker line and nodes that are closer to one another imply more joint patents. The edge labels denote the number of co-patent applications between the connected countries or regions.*

The strongest technology development ties are those between the European Union and the United States. The evidence on collaboration networks can be complemented with the Salton index, which is a metric used to assess the strength of links between entities in a network – in this case, regions and countries. The Salton measure shows that the European Union and the United States are closely linked in all technologies, even when focusing on specific sub-domains such as digital and green technologies (Figure 27). The analysis also shows that the collaboration between the United States and China is stronger than between the European Union and China, and that the collaboration between the United States and China is more prominent for digital technologies than green technologies.

Figure 26

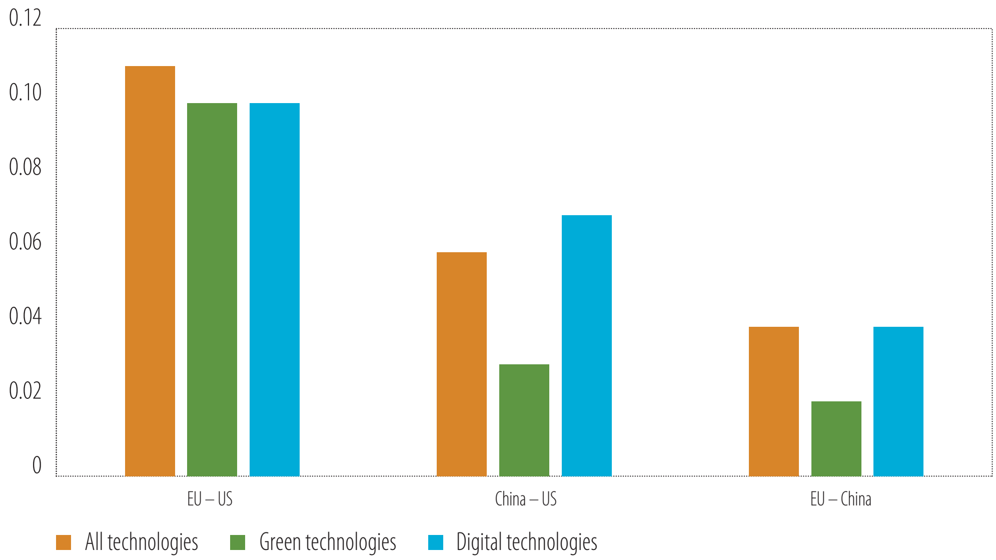
Co-patenting networks between different regions for different technologies, 2016-2022



Source: *PCT patents (PATSTAT), calculated by ECOOM, KU Leuven.*

Note: *The illustration is based on co-patents filed with the WIPO from 2016 to 2022. It depicts co-patenting networks in (a) digital technologies and (b) green technologies. Each circle (or node) represents a country or region. The size of the node is proportional to the number of patents for the country or region (the number within the nodes). The lines connecting the nodes (edges) represent co-patenting links between the countries or regions. The thickness of the line (which is inversely proportional to the distance between nodes) indicates the strength or volume of the collaboration. A thicker line and nodes that are closer to one another imply more joint patents. The edge labels denote the number of co-patent applications between the connected countries or regions.*

Figure 27
Salton index of collaboration for different regions and technologies, 2016-2022



Source: PCT patents (PATSTAT), calculated by ECOOM, KU Leuven.
Note: The Salton measure is calculated by the following formula:

$$r = \frac{r_{ij}}{\sqrt{n_i . n_j}}$$

where the numerator r_{ij} represents the number of co-patents between country i and country j and the denominator is the square root of the product of each country's total number of patents (n_i and n_j). The Salton measure is also known as the cosine similarity measure.

Strong collaboration links can drive global competitiveness and resilience. As highlighted above, investing in innovation is vital for economic growth and competitiveness. Against a prevailing global backdrop of uncertainty, technological networks may prove crucial to maintaining a region's relevance. However, while innovation is central to creating knowledge and value, it must be understood in the broader context of EU participation in global value chains. The next section therefore provides a review of EU trade dependencies and discusses trade in clean technologies.

Investing in resilience to trade disruptions can make Europe more competitive

In recent decades, the European Union has benefited greatly from its in-depth integration into global value chains. However, recent crises – such as the COVID-19 pandemic, shortages of key strategic inputs, rising shipping costs and disrupted routes, Russia's military aggression against Ukraine, the energy crisis and increased geopolitical tensions – have highlighted vulnerabilities in the supply chains of EU companies (EIB and European Commission, 2024). This section assesses how supply chain disruptions affect EU businesses, and which strategies they are setting in motion to bolster resilience.

Supply chain disruptions eased from 2023 to 2024. In 2024, 17% of EU firms reported that access to commodities and raw materials (steel, copper, fossil fuels, lithium, etc.) was a major obstacle to their business activities, down from 36% in 2023 (Figure 28). Similarly, the share of EU firms considering disruptions of logistics and transport to be a major obstacle decreased to 19% in 2024, from 34% in 2023. However, the share of firms reporting compliance with new regulations, standards or certifications as a major obstacle increased to 20% of EU firms in 2024, from 16% in 2023.

Figure 28
Supply chain disruptions (% of firms)

Source: *EIB staff calculations based on EIBIS 2023-2024.*
Note: *EU firms. Firms are weighted by value added. The question on recent changes in customs and tariffs is only asked to traders (importers or exporters).*
Question: *Since the beginning of 2023, were any of the following an obstacle to your business's activities? A major obstacle, a minor obstacle, or not an obstacle at all?*

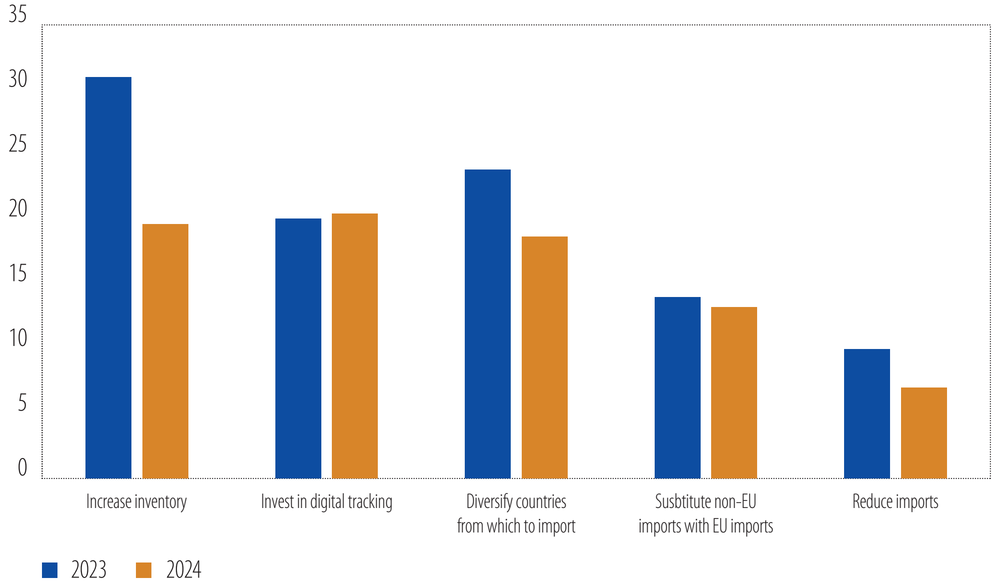
EU companies have demonstrated remarkable agility in addressing recent supply chain disruptions. In 2024, disruptions in logistics and compliance with new regulations led firms to invest in changes to their sourcing strategies, including increasing stocks and inventory, digital input tracking, and diversifying the countries they import from (Figure 29). The share of firms reporting that they will withdraw from trade and reduce imports is relatively small, suggesting that EU firms perceive trade disruptions to be temporary. However, they are likely to resort to other measures if barriers to trade become more structural or more acute.

Innovative and digital firms are more heavily affected by supply chain disruptions but are also more likely to invest in resilience to trade risks. These firms are more likely than other firms to report that trade disruptions have been a major obstacle to business activities since the beginning of 2023 (Figure 30a). However, of the firms reporting a major trade-related obstacle, innovative and digital firms are much more likely to change their sourcing strategies, for example by investing in digital input tracking (Figure 30b).

Policy support helps finance-constrained firms address trade disruptions and invest in resilience. Finance-constrained firms suffer more from trade disruptions and are less able to respond effectively, as the absence of financial buffers is likely to prevent investment measures to address risk. However, policy support can make a difference for firms that seek external finance. In fact, those receiving grants or bank finance with favourable conditions are more likely to report changes to their sourcing strategies. This effect is particularly significant for firms that receive grants and are finance constrained, as reflected in the positive estimated coefficient on the interaction term in the regression results reported in Table 3.

Figure 29

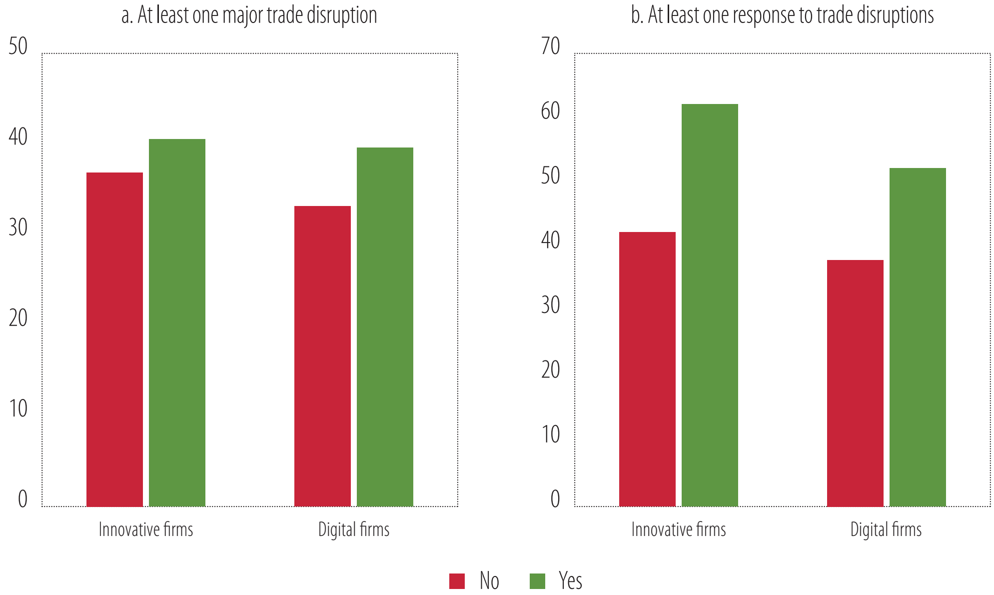
Response to trade disruptions (% of firms)



Source: *EIB staff calculations based on EIBIS 2023-2024.*
Note: *EU firms. Firms are weighted by value added. The questions on diversifying trade partners and reducing imports are only posed to importers. The question on substituting non-EU imports with EU products or services is only posed to firms importing from beyond the European Union.*
Question: *Since the beginning of 2023, has your company made any of the following changes to your sourcing strategy, or are you planning to make any of these changes this year?*

Figure 30

Supply chain disruptions and response to trade disruptions (% of firms)



Source: *EIB staff calculations based on EIBIS 2024.*
Note: *EU firms. Firms are weighted by value added. See notes to Figure 29 and 30 for details on the questions. See notes to Figure 28 and 29 for details on the questions on trade disruptions.*
Question: *In the previous financial year, did you invest to develop or introduce new products, processes or services? Are advanced digital technologies used within your business?*

Table 3
Grants, finance constraints and responses to trade disruptions

Dependent variable: Responding to trade disruptions	
Grants or bank finance with favourable conditions	0.032**
	(0.016)
Finance constrained	0.055
	(0.043)
Grants × finance constrained	**0.145***
	(0.075)
Any major trade disruption	0.168***
	(0.016)
Sample size	4 041
R-squared	0.126

Source: EIB staff calculations based on EIBIS 2024.
*Note: EU firms that use external finance. The OLS regression controls for firm size, firm age, country and sector. Robust standard errors in parentheses. Statistical significance: ***p-value<0.01, **p-value<0.05, *p-value<0.1.*

Understanding dependencies in critical raw materials is key to economic security

Europe's competitiveness and economic security depend on supply chain resilience. This resilience requires a reliable supply of the raw materials and key products crucial to the growth of the EU economy. Many of these goods are imported, however, and trade dependencies may put economic security at risk. As some of these imported goods are not widely available, diversification across multiple suppliers is difficult and therefore does not mitigate the risk of supply chain distress. Box C estimates that about 5% of all imported products in the European Union can be classified as vulnerable to trade dependencies but shows that some imports could potentially be substituted with production within the single market.

Critical raw materials are of great importance to the EU economy and display substantial supply risk. They are also key enablers of the EU green and digital transition, and some are crucial for economic security and the resilience of key sectors such as defence and aerospace. Critical raw materials must not be seen individually, but rather as part of a wider supply that encompasses extraction and processing. Demand for these materials is expected to grow exponentially. The European Commission used the Critical Raw Materials Act to establish a regulatory framework and identify a list of 34 critical raw materials, 16 of which are also considered strategic raw materials (Table 4).

Table 4
List of strategic raw materials (2023)

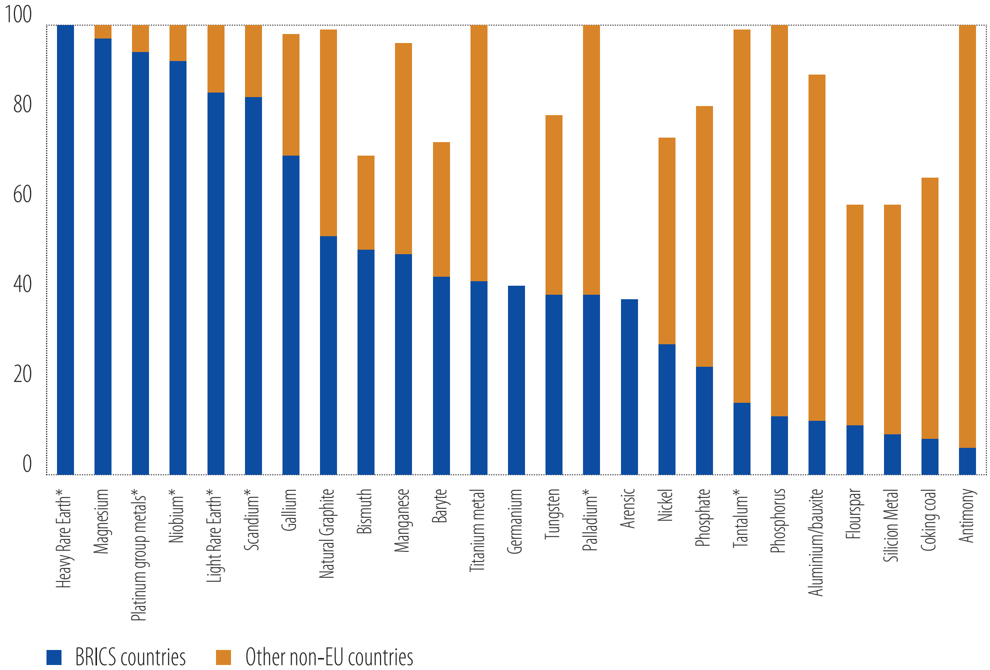
Bismuth	Gallium	Manganese - battery grade	Rare earth elements for magnets
Boron - metallurgy grade	Germanium	Natural graphite - battery grade	Silicon metal
Cobalt	Lithium - battery grade	Nickel - battery grade	Titanium metal
Copper	Magnesium metal	Platinum group metals	Tungsten

Source: RMIS - Critical, strategic and advanced materials. The list of strategic raw materials is defined by Article 3 and Annex 1 in European Commission (2023a).

The supply of many critical raw materials is highly concentrated in specific geographic areas. The European Union's industry and economy are reliant on international markets to provide access to raw materials, since they are produced and supplied by third countries. Although certain critical raw materials are produced in the European Union, in many cases Europe is highly dependent on imports from non-EU countries (especially Brazil, Russia, India, China and South Africa) (Figure 31). The risks associated with production concentration are compounded by low substitution. This not only highlights the competitive advantages that the countries with these raw materials (such as China) hold in developing key technologies and enhancing them, but also exposes the geopolitical risk embedded in the supply chains involving raw materials that could emerge when diplomatic relations become tense. Europe should not only ensure the supply of critical raw materials, but also increase investment in recycling (including of old batteries) and substituting technologies to enable the use of other materials.

Figure 31

Sources of EU imports of selected critical raw materials (in %)



Source: *EIB staff calculations based on European Commission (2023b).*
Note: *BRICS countries include Brazil, Russia, India, China and South Africa. The EU import share of the materials marked with asterisks was estimated on the basis of the BRICS share of global production. The bars do not all add up to 100% because some critical raw materials are sourced domestically or imported from EU countries.*

Box C

A review of EU trade dependencies

Global value chains are complex networks that manage the production and distribution of goods, linking multiple buyers and suppliers across various stages of supply chains. Over the past three decades, global value chains have undergone hyper-globalisation, resulting in highly dispersed geographical production. This fragmentation has increased trade gains and risk sharing for countries, firms and consumers (Antràs and Chor, 2022; Backus et al., 1992). Simultaneously, it has led to a large concentration of production at certain stages, making economies and firms vulnerable to local supply shocks that can propagate to downstream industries (Boehm et al., 2019; Bonadio et al., 2021; Di Giovanni et al., 2024). Such trade dependencies, as underscored by the COVID-19 pandemic and the Russia-Ukraine conflict, can lead to supply chain disruptions and shortages of critical goods (European Commission, 2020; Baldwin and Freeman, 2022; Thoenig, 2023; Mejean and Rousseaux, 2024).

Countries are facing a trade-off between the benefits of global value chains and the need to increase resilience to risks stemming from trade dependencies. The European Union and the United States have recently implemented resilience policies (such as the European Chips Act or the 2021 Executive Order on America's Supply Chains) to mitigate these risks through diversification and local production. Given this trade-off, such policies are essential, especially considering firms' potential underinvestment in resilience because of network and information externalities. The challenge of these policies also lies in correctly identifying vulnerabilities, isolating the risk the policies aim to address and balancing the costs of resilience with traditional trade benefits.[11]

This box identifies trade vulnerabilities imported by the European Union at a product level and cross references them to understand potential risks arising from their position within global value chains, geographical origins and specific sectors. Identification is performed by applying a first set of criteria based on European Commission (2021), where a product is vulnerable if it simultaneously meets criteria for (i) high import concentration, (ii) the significance of extra-EU imports, and (iii) no substitutability of these imports with EU exports. An additional set of criteria based on Mejean and Rousseaux (2024) selects vulnerabilities where a product (iv) is mainly reliant on extra-EU imports to meet domestic demand (absorption) and (v) has very low potential to substitute suppliers.[12]

The inclusion of more criteria identifies fewer but more acute vulnerabilities. Out of the 5 381 products imported by the European Union during the period before the financial crisis, 272 are characterised by high import concentration, the significance of imports coming from beyond the European Union and a lack of domestic exports that can be substituted (Figure C.1). Restricting the analysis to products mainly reliant on extra-EU imports to meet domestic demand reduces vulnerabilities to 125, while adding criterion (v) isolates 29 products with extremely low potential for supplier substitution.

While trade dependencies have increased over time, the difference between the products identified by the two methodologies remains relatively stable. Between 40% and 54% of the vulnerabilities identified have EU production that mainly satisfies domestic demand, and once criterion (iv) has been added, 77% to 80% can easily be substituted by using different suppliers. While acute vulnerabilities represent only a tiny fraction of total EU trade volumes (from 0.19% to 1.01% depending on the period and after applying all five criteria), these products pose significant risks to European value chains.

Vulnerabilities tend to persist over time. While trade dependencies can change over time, 41% of dependencies identified before the global financial crisis persisted directly after the crisis, and 35% remained after that (after applying all five criteria). The COVID-19 pandemic marked a turning point in the number of dependencies, regardless of the methodology.

The more upstream a product is in the global value chain (for example raw materials or intermediate inputs at the early stages of the production process within a supply chain), the larger its potential

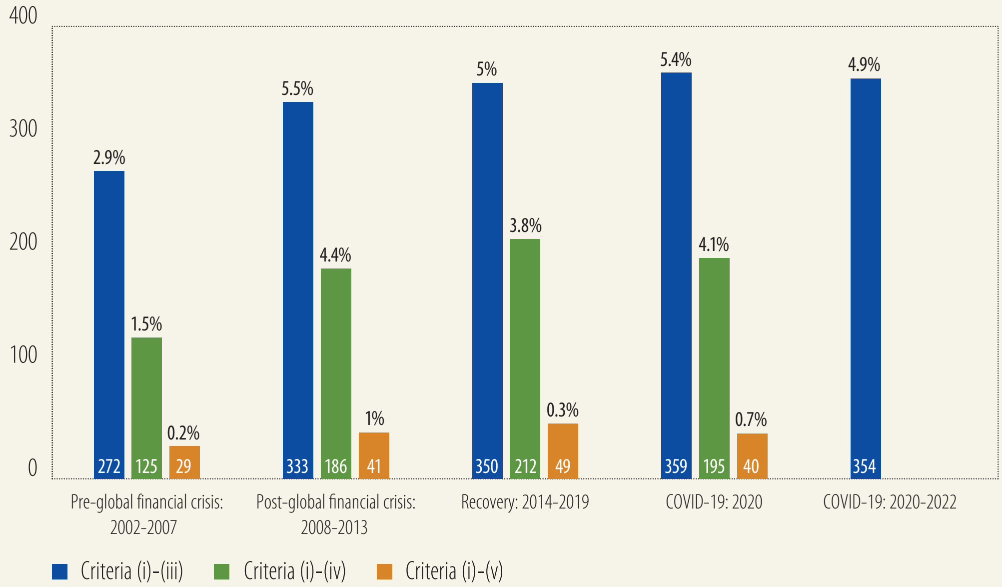
11 Several methodologies have emerged following the COVID-19 pandemic, including those by the French Treasury (Bonneau and Nakaa, 2020), the French Council of Economic Advisors (Jaravel and Mejean, 2021), the European Commission (2021), the CESifo (Baur and Flach, 2022) and Mejean and Rousseaux (2024).

12 The five criteria are applied to EU commodity trade from 2002 to 2022, covering pre/post-global financial crisis, recovery and COVID-19 periods using the CEPII-BACI dataset (Gaulier et al. 2010), covering worldwide trade flows of over 5 000 products at the detailed HS 6-digit level. Criteria (iv) and (v) incorporate, at the same product level, manufacturing output from the Eurostat Prodcom dataset and the relationship stickiness measure of Martin et al. (2023).

impact. However, a downstream product can also cause significant damage if it is central to the production of essential goods (Baur and Flach, 2022). As stressed in Mejean and Rousseaux (2024), some 30% of vulnerable products are consumer goods imported from China. Shortages of these items can hurt consumers and specific firms, but they tend to affect production less. Conversely, supply shocks in the most upstream parts of global value chains (especially through intermediate goods that enter the value chains at early stages) can propagate to downstream industries, adjacent supply chains and consumers. Figure C.2 displays the share of products according to how far upstream they are in the value chain – or how many production stages are needed before a product is ready for final consumption (Antràs et al., 2012). The riskiest vulnerabilities are located more than three production stages away from the final consumer. Despite a slight decrease over time, these products represent 49% of the vulnerabilities identified by the five criteria (on average and across all periods).

Figure C.1

EU trade dependencies over time (% of imports and number of products)**, by methodology**



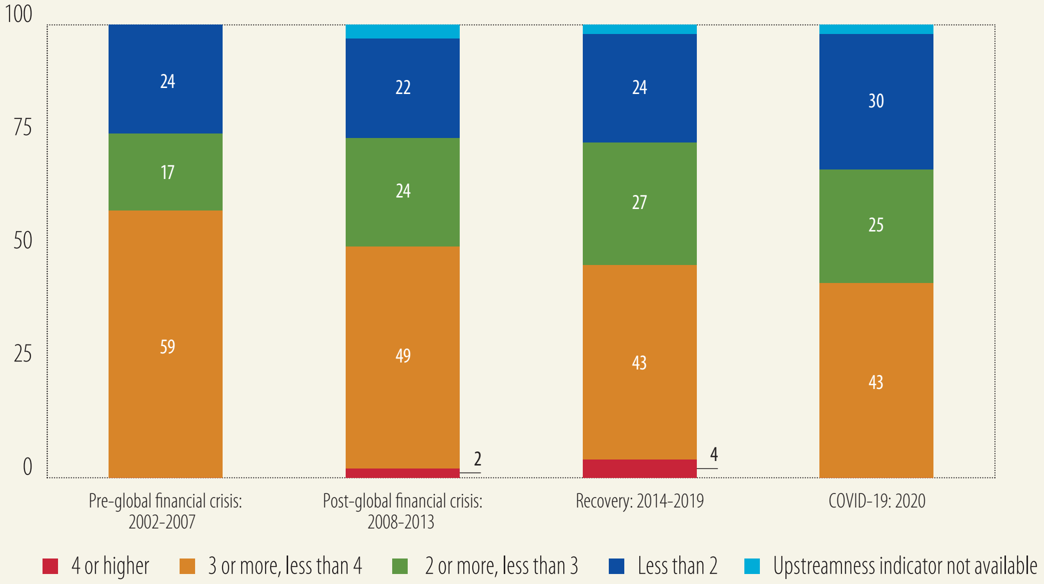
Source: *CEPII-BACI data over 2002-2022 and Eurostat Prodcom over 2002-2020.*
Note: *The total number of products imported by the European Union for each period is 5 381 except for the period following the global financial crisis (2008-2013), when it is 5 379. The products are classified as UN Harmonised System 6-digit (HS6). Criteria (i-iii) follow European Commission (2021), Criteria (iv-v) follow Mejean and Rousseaux (2024).*

Trade dependencies are increasingly associated with Chinese exports. Against a backdrop of rising geopolitical tensions, the concentration of a large share of global production in China poses a significant risk. Political instability (such as the US-China trade war that started in 2018 or issues in the sourcing of cobalt in the Democratic Republic of the Congo) imposes heavy costs on reliant economies. The share of China in EU import vulnerabilities is rising, while the shares of the United States and the rest of the world have dropped by 3 to 10 percentage points (Figure C.3). Overall, China's share is higher for products that are not readily produced in the European Union.

Most vulnerabilities and risks are concentrated in the chemicals, ceramics and metals sectors. The imported products identified by the European Commission's three criteria are mainly produced in manufacturing sectors, and nearly all appear when applying all five criteria (Figure C.4). When products with the lowest levels of substitution with EU production and between suppliers are isolated, the shares of the chemicals, ceramics and metals sectors are particularly high.

Figure C.2

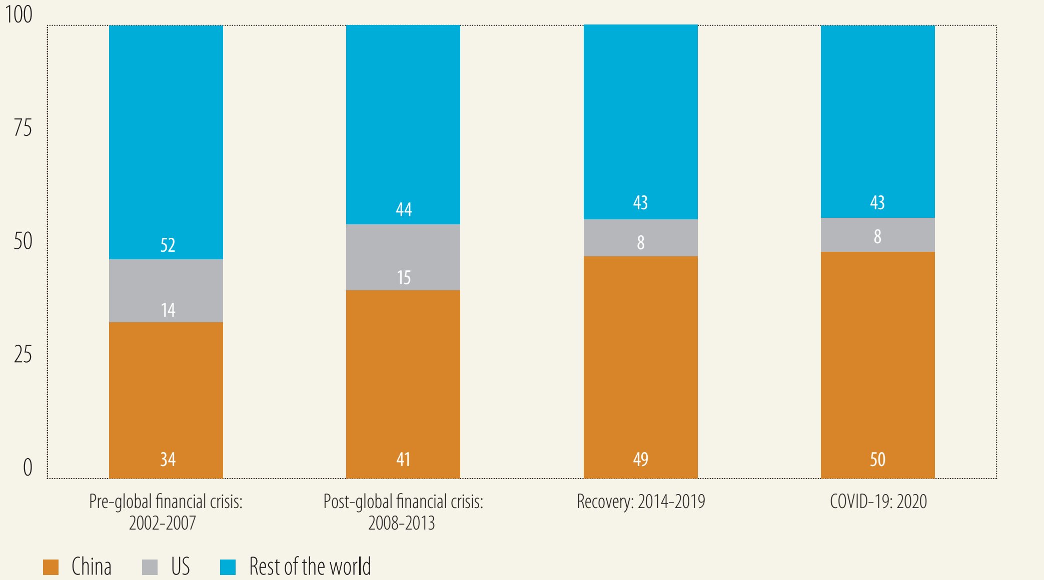
Upstreamness of EU trade dependencies for the five criteria methodology (% of products)



Source: *CEPII-BACI data over 2002-2022 and Eurostat Prodcom over 2002-2020.*
Note: *The total number of products imported by the European Union for each period is 5 381 except for the period following the global financial crisis (2008-2013), when it is 5 379. The upstreamness indicator value shows the approximate number of production stages before a good reaches its final consumer. An upstreamness value of 1 corresponds to a product ready for immediate consumption and an upstreamness value of 4 indicates that there are four remaining stages before the product reaches the consumer. The products are defined at UN Harmonised System 6-digit (HS6), and vulnerability criteria follow Mejean and Rousseaux (2024).*

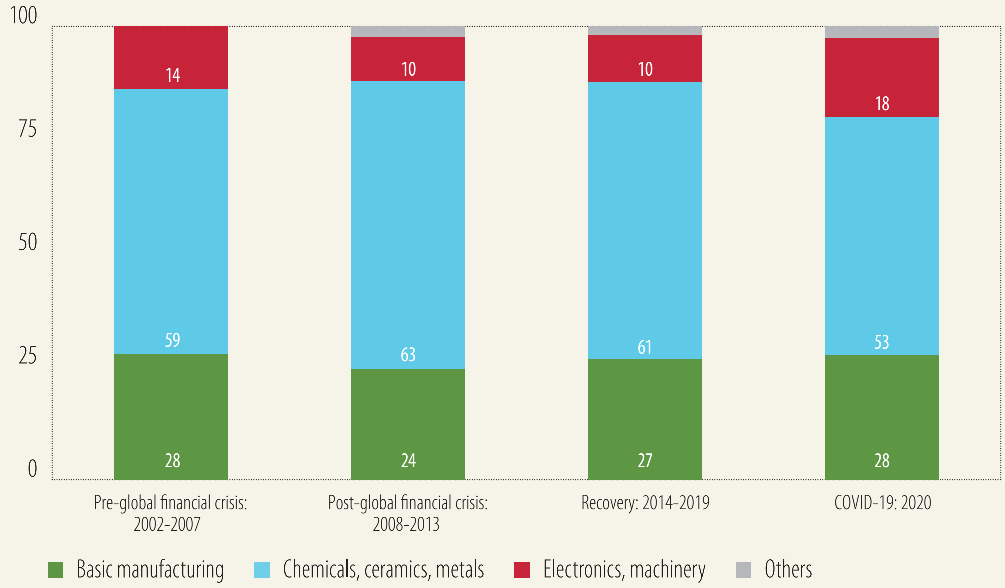
Figure C.3

Main origin of EU trade dependencies for the five criteria methodology (% of products)



Source: *CEPII-BACI data and Eurostat Prodcom over 2002-2020.*
Note: *The total of vulnerable products (HS6) imported by the European Union for each period respectively is 29, 41, 49 and 40, as calculated using the five criteria of the HS methodology (Mejean and Rousseaux, 2024).*

Figure C.4
EU trade dependencies (% of products)**, by sector**



Source: CEPII-BACI data and Eurostat Prodcom over 2002-2020.
Note: The total of vulnerable products (HS6) imported by the European Union for each period respectively is 29, 41, 49 and 40, as calculated using the five criteria of the HS methodology (Mejean and Rousseaux, 2024). Basic manufacturing (NACE 2: 10 to 18, 31 to 32); chemicals, ceramics, metals (NACE 2: 19 to 25); and electronics, machinery (NACE 2: 26 to 30).

Incorporating how countries substitute goods after an economic shock, and the impact that has on trade vulnerability, enhances our understanding of weaknesses and sources of resilience. It highlights the need for policies that target specific dependencies on products not easily substituted within the European Union and supplier diversification. Such targeted policies must consider the risks posed by these products to determine their nature and intensity. Dependencies in sectors like electronics and machinery mostly originate from China, but these products are close to the end consumer, limiting the risk of propagation through supply chains. Conversely, while dependencies in the chemicals, ceramics and metals sectors are less reliant on China, they come into play very early in global value chains, posing significant supply chain risks for the European Union and importing firms. Evaluating additional risks driven by these dependencies is crucial for the EU economy.

The debate on the need for and form of policy intervention contrasts enhanced resilience and diversification with more active industrial policies. However, intervention might be costly and subject to imperfect information and network effects. Real-time information sharing, assessing and sharing firms' indirect exposure,[13] and industry coordination between different stages of global value chains could mitigate the risks.

13 Firms can be exposed to risks unknowingly through indirect exposure, which is non-negligible in the European Union according to available data (Mejean and Rousseaux, 2024).

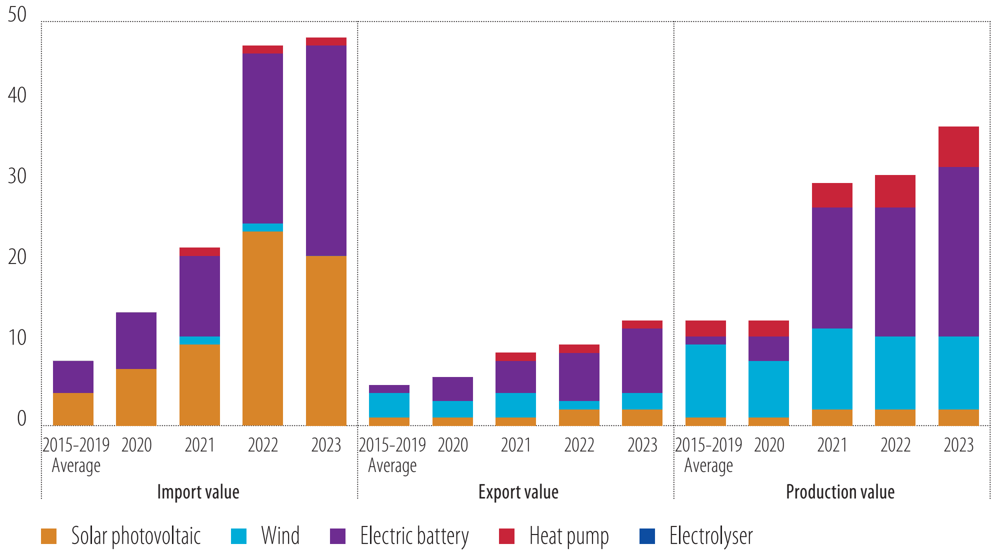
Securing supplies of green technologies for the European Union

Clean technology innovation and manufacturing is critical to Europe's competitiveness. As discussed in Chapter 1, the European Union holds a competitive advantage in green innovation and production. It performs strongly in cleantech products and is also a key market for their deployment. However, Europe has struggled to remain globally competitive in some green technologies in recent years, with China becoming a significant player in the sector. The role of China as a major producer of various cleantech products has pushed prices down substantially, facilitating a wider rollout of Chinese products. At the same time, concerns regarding oversupply by Chinese producers and non-competitive practices have emerged, opening the debate on potential response policies.

The value of cleantech imports has more than doubled since 2021, reaching almost EUR 50 billion in 2023. Accounting for about 50% of the cost of an electric car, electric batteries represent half of total cleantech imports to the European Union (Figure 32). The steep rise in spending on imported batteries offsets the slight dip in imports of solar photovoltaic cells, signalling overcapacity in the Chinese market (International Energy Agency (IEA), 2024). In contrast, EU exports of cleantech rose much more gradually and stood just above EUR 10 billion in 2023. The bulk of EU clean technology production remains largely directed to covering domestic needs, with 57% of production value stemming from battery assembly.

Figure 32

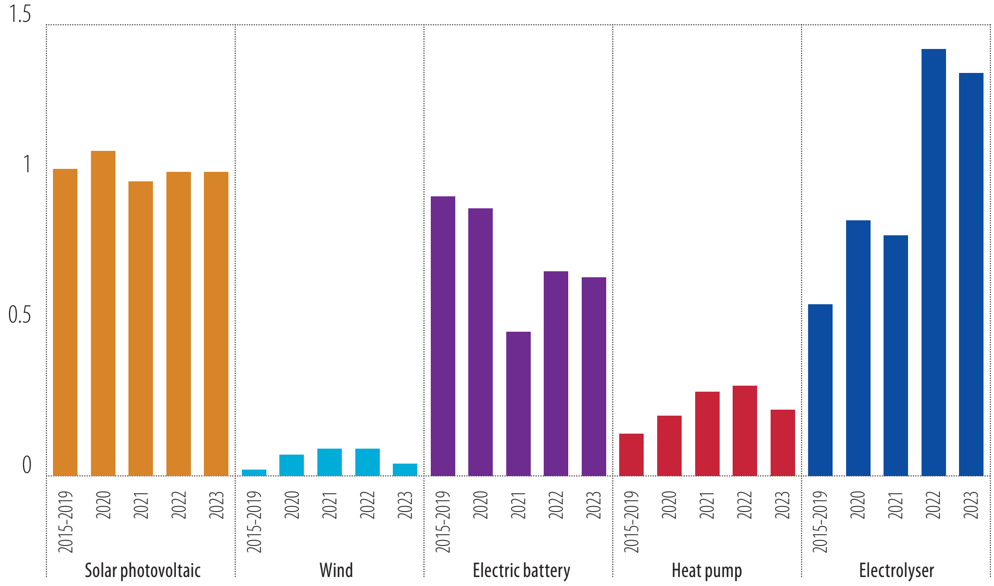
Exports, imports and production of clean technologies in the European Union (EUR billion)



Source: *EIB staff calculations based on Eurostat PRODCOM (2024).*
Note: *The analysis rests on the following cleantech components: heat pumps other than air conditioning machines for heat pumps (PRODCOM code 28.25.13.80); photosensitive semiconductor devices, solar cells, photodiodes, phototransistors for solar photovoltaic (PRODCOM code 26.11.22.40); wind turbines - generating sets, wind-powered (PRODCOM code 28.11.24.00); lithium-ion accumulators for electric batteries (PRODCOM codes 27.20.23.50 and 27.20.23.00); machines and apparatus for electroplating, electrolysis or electrophoresis for electrolysers (PRODCOM code 28.49.12.83).*

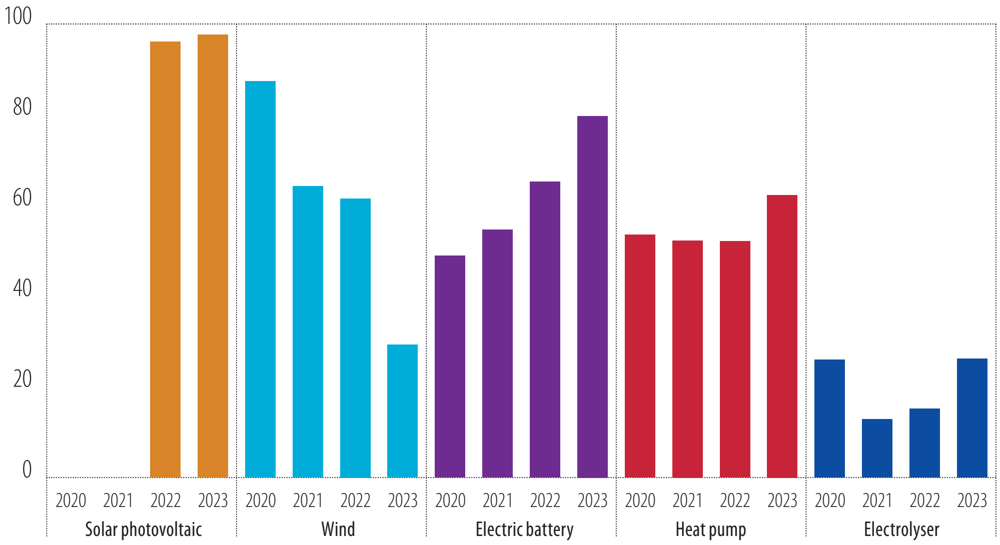
The European Union does not have a comparative advantage in the manufacturing of some of the more mature clean technologies, such as solar photovoltaic cells. The bulk of the European Union's need for solar photovoltaic cells is already met with imported products, with the ratio of import to domestic use for these products lying close to 100% (Figure 33). According to the International Energy Agency, ramping up the manufacturing of solar photovoltaic cells on European soil would result in a 35% increase in costs, compounded by limited access to lithium ore (IEA, 2022). This suggests that there is a need for policies securing a resilient supply, but casts doubt on the true value added of production independence strategies for mature technologies.

Figure 33
Ratio of imports to domestic use of clean technologies in the European Union



Source: *EIB staff calculations based on Eurostat PRODCOM (2024).*
Note: *The ratio is calculated as Imports / (Production – Exports + Imports) based on Figure 32.*

Figure 34
China's share of imports of clean technologies to the European Union (in %)



Source: *EIB staff calculations based on Eurostat COMEXT (2024).*
Note: *The analysis is based on the HS 2022 nomenclature. Solar photovoltaic is classified as HS 6-digit codes 854142 and 854143 (solar photovoltaic statistics are not available before 2022, since solar and photovoltaics were not separable from LED lights in the HS classification system before 2022). Wind is classified as HS 50231; electric batteries as HS 850760 (lithium ion accumulators); heat pumps as HS 841581 and HS 841861; and electrolysers as HS 854330.*

At the same time, investment in less mature clean technologies could create value and jobs in Europe and contribute decisively to the long-term competitiveness of European industries, while making it possible to take advantage of spillover effects. EU manufacturers still hold a competitive position in wind turbines and heat pumps – making up more than half of global exports – while the European Union's dependence on imports in this area is still modest. Although import dependency is high for electrolysers, the market is less mature and import competition is low, including for imports from China (Figure 34). The share of EU countries in global exports of electrolysers is even comparable to or higher than that of China. This indicates that cleantech segments with more room for innovation and positive spillovers as well as higher margins for producers may offer better prospects for positioning the EU manufacturing sector at a time of intense global competition.

The role of policy

In a fast-changing global landscape, the nexus between trade, economic security and competitiveness is increasingly taking centre stage in EU policy (Draghi, 2024). Relatively high energy costs and the fragmentation of the internal market are also putting the competitiveness of EU businesses under pressure. The European Union needs to invest more in cutting-edge innovation, improve the diffusion of innovation, increase the resilience of supply chains and reduce strategic dependencies in critical sectors.

The ability of the European economy to transform and adjust to the new global order will depend on a supportive operating environment. Global uncertainty, an economic downturn and tight financing conditions can adversely affect investment in innovation activities (Aghion et al., 2012), especially for those breaking new ground, as innovation's uncertain nature exacerbates information asymmetry. This may hamper the structural investment required in areas where Europe needs to maintain or step up its competitiveness. Investment in innovation must be accompanied by reforms and regulations that create the right incentives for businesses to fully contribute to the structural transformation (OECD, 2023; Draghi, 2024).

Highly innovative firms in the European Union tend to suffer from a lack of suitable finance, which becomes particularly severe as companies grow. The gap in financing innovation stems from a European market that is more resistant to disruptive innovation than the United States and lacks the appropriate instruments, scale, risk appetite and skills (EIB, 2024). The public sector has recognised the need to intervene to support innovation in Europe, and EU instruments are being put in place to ensure a level playing field across the single market. At the same time, many countries are working to consolidate their finances, and resources at the EU level are limited. That means that incentives and direct support will have to become more targeted.

Different instruments such as equity incentives, venture capital and bank finance with favourable conditions can complement each other to foster investment in R&D and innovation. As discussed above, firms that innovate in green technologies are more likely to receive bank finance with favourable conditions (Figure 23). In addition, innovators (and especially firms that have developed green technologies) are more likely to receive grants or bank finance with favourable conditions targeting investments in innovation and digitalisation or the green economy (Figure 24).

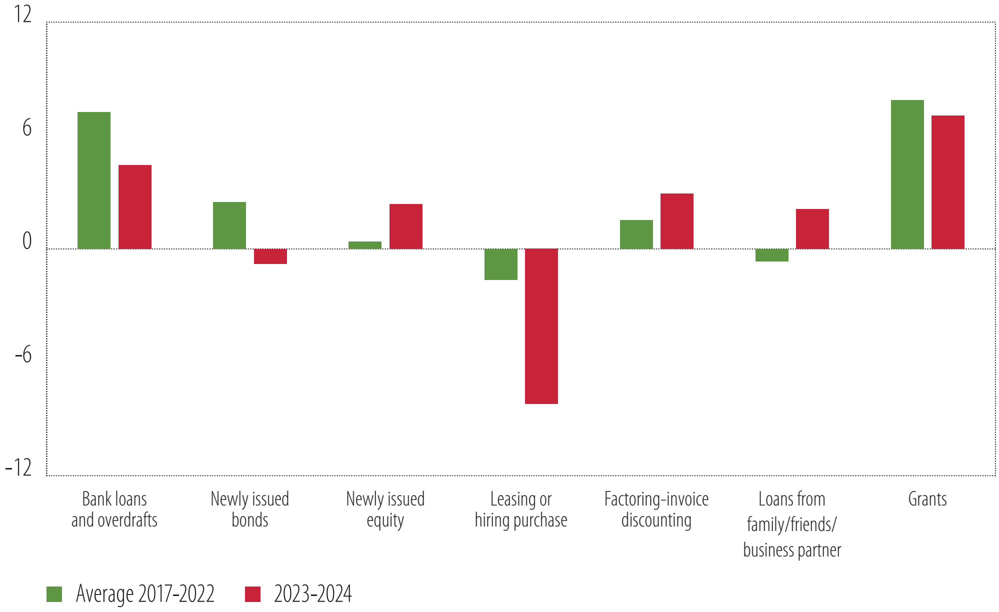
Targeted instruments play a crucial role in addressing obstacles to investment in R&D and innovation. Targeted R&D grants can promote innovation in certain technology domains that are still in an early stage, especially for smaller and younger firms (Howell, 2017; European Commission, 2024b). However, while R&D grants are generally considered to have a positive impact on innovation, funding agencies may have difficulties choosing the best-suited projects. Conversely, R&D tax credit programmes do not have the same selection problem, but mostly target profitable companies, often excluding smaller and especially younger firms with potential and in need of support (Czarnitzki and

Giebel, 2024). Tax credits do not necessarily incentivise firms to invest in technologies that are further from the market since companies are most likely to prioritise the projects that are most profitable in the short term (Cervantes et al., 2023).

Equity plays a more important role for successful innovators than for firms that are neither innovative nor profitable, but EU equity markets remain underdeveloped. When using external finance, successful innovators and struggling firms tend to rely mainly on bank loans and overdrafts.[14] Interestingly, innovative and highly profitable firms are more likely to have issued new equity since 2023 than struggling firms (Figure 35). Equity funding is crucial in the funding journey of scale-ups, but EU markets lag behind those of the United States (EIB, 2024).

Figure 35

Difference in the use of financial instruments between innovative and highly profitable firms and struggling firms (in percentage points)

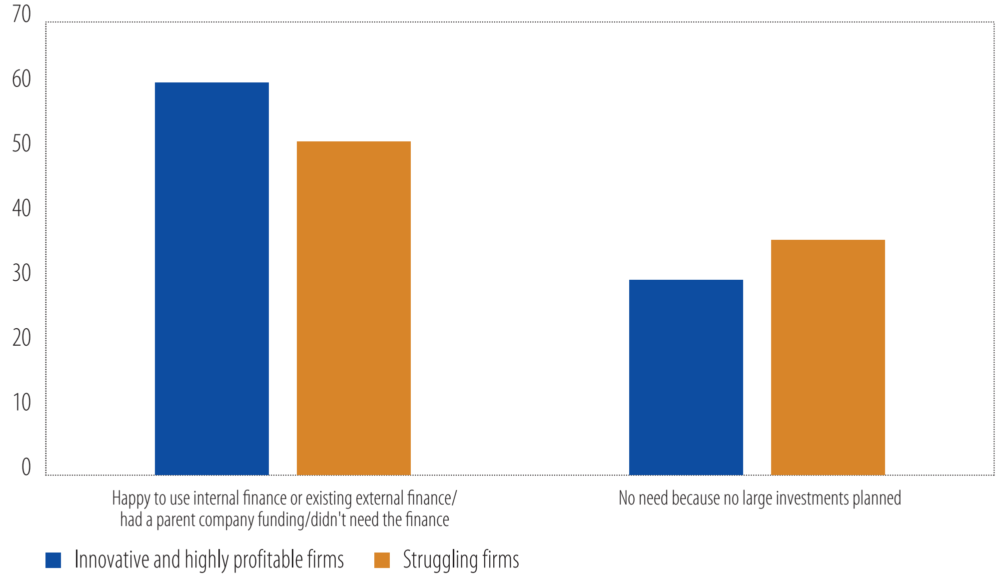


Source: *EIB staff calculations based on EIBIS 2017-2024.*
Note: *EU firms. Firms are weighted by value added. The difference is calculated by subtracting the level of highly innovative and profitable firms from the level of struggling firms for each period. A negative amount means that the share of struggling firms using a specific financial instrument is higher than the share of innovative and profitable peers using that same financial instrument. See footnote 14 for the definition of innovative and highly profitable firms and struggling firms.*

Internal financing may still provide some leeway for successful innovators, but the amount of leeway provided depends on how long these buffers last. Most innovative and highly profitable firms report that the main reason for not looking to finance investment externally is that they did not need outside help (Figure 36), potentially due to stronger internal financing buffers or pre-existing external finance. At the other end of the spectrum, struggling firms also cite that they are happy to use internal finance or existing external finance as the main reason, but are more likely than successful innovators to report that they did not apply for external finance because they did not plan to make a large investment.

14 An innovative and highly profitable firm is defined as a firm that reports profit margins over 10% and that invests in the development or introduction of new products, processes or services. A struggling firm is defined as a firm that reports a loss or breakeven and that does not invest in innovation.

Figure 36
Main reasons not to ask for external finance (% of firms that did not apply)



Source: *EIB staff calculations based on EIBIS 2023-2024.*
Note: *EU firms. Firms are weighted by value added. See footnote 14 for the definition of innovative and highly profitable firms and struggling firms.*
Question: *What was your main reason for not applying for external finance for your investment activities?*

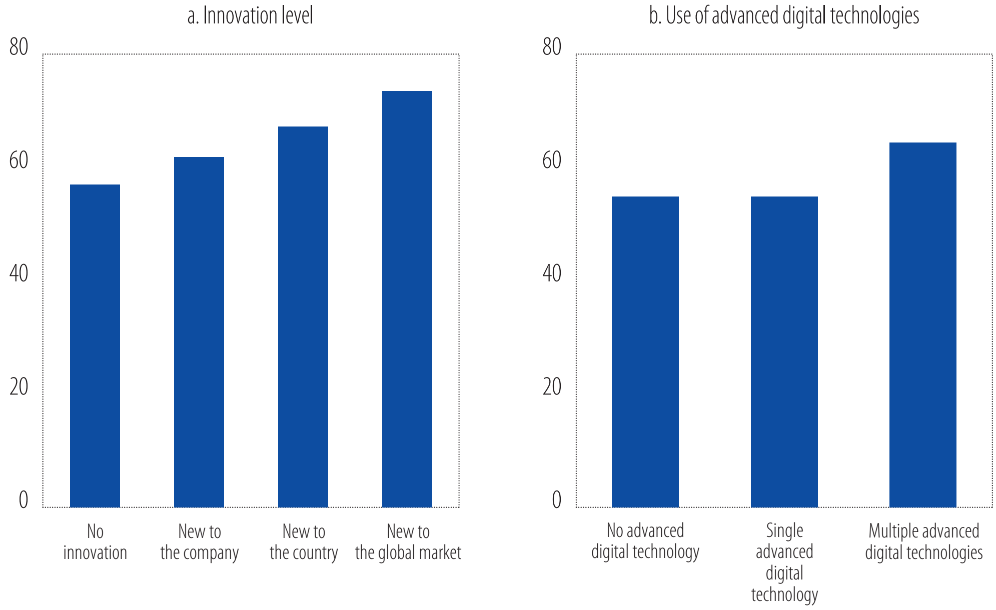
Given the size of the innovation financing gap in the European Union, public sector support must be highly targeted and effectively catalyse private finance. It should focus on early support to kick-start new, risky technologies and the patient capital needed to scale up new projects and invest in key enabling infrastructure. Expanding the EU single market and advancing the capital markets union are key priorities, as they would provide the market scale and depth needed for firms to take advantage of growth opportunities (Letta, 2024). A strategy to reduce barriers to investment and integrate capital markets would further crowd in private investment and foster the creation of an innovation-enhancing environment.

Regulatory differences between EU countries tend to have a stronger impact on innovative and digital firms, highlighting a need to streamline and strengthen the single market. More innovative or digital firms are more likely to report that their main product or service must comply with varying regulatory requirements, standards or consumer protection rules in different EU countries (Figure 37).[15] This resonates with recent findings from the International Monetary Fund (IMF, 2024) showing that, despite substantial progress, trade barriers within the European Union remain significant.

15 Part of this correlation could also be driven by the fact that more innovative and digital firms (which also tend to be larger companies) are more likely to be exposed to a larger number of export markets.

Figure 37

Exporters reporting that they have to comply with different regulations across EU countries (in %), by innovation level and use of advanced digital technologies



Source: *EIBIS 2024.*
Note: *EU exporters. Firms are weighted by value added.*
Question: *Does your main product or service have to comply with differentiated regulatory requirements, standards or consumer protection rules across EU member states. 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?*

Conclusion and policy implications

To enhance the global competitiveness of European firms, Europe must invest more in cutting-edge innovation, improve the diffusion of innovation, increase the resilience of supply chains and reduce strategic dependencies in critical sectors. The European Union is at the forefront of clean technology, but lags behind the United States and China in digital innovation. This creates major dependencies on digital platforms and other technologies (such as artificial intelligence) developed outside the European Union. Relatively high energy costs and the fragmentation of the internal market are also putting the competitiveness of EU businesses under pressure. A successful green 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.

To increase resilience, the European Union needs to reduce its dependency on imports of critical raw materials and products that are strategic to EU businesses. This will help encourage investment in diversification and possibly encourage the build-up of domestic production for high-tech products in which EU businesses have a comparative advantage. This will improve the position of EU manufacturing in an intensely competitive global market. Certain industries have the potential to boost value and create jobs in Europe and contribute decisively to its competitiveness, but this will require policy measures to make the economic environment more efficient, bring down regulatory barriers and strengthen the internal market, ensuring there is an equal playing field across the European Union.

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